

# Servitization and solution provision of manufacturing companies

A contingency theoretical analysis

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Max Finne

# Servitization and solution provision of manufacturing companies

A contingency theoretical analysis

**Max Finne**

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**Abstract**

Manufacturers in developed countries are struggling to find ways for a competitive edge against their peers from countries with lower cost levels. Servitization has been suggested as one possible way to achieve this aim: the manufacturer increases the proportion of services in the offering and eventually can become a solution provider. Accordingly, understanding central aspects of servitization and solution provision has become a must for many manufacturers, and the amount of academic research around these phenomena has been increasing. This dissertation sees servitization research currently at the typical early phase in which the strategy is praised as a best practice (cf. Sousa and Voss, 2008), one which would be applicable irrespective of the context.

This dissertation applies a more critical view on servitization and solution provision and attempts to systematically study their contextuality. The research design is a combination of analysing existing research literature and empirical company cases. The analysis of the contextuality proceeds from higher-level considerations of the effects of operational environment on companies' servitization to the more detailed focus on individual companies' actions regarding solution provision, which are affected by network position. The findings provide novel insights into how six different aspects of operational environment either encourage or inhibit servitization of companies within an industry. These environmental factors are the density of servitized manufacturers, the effects of other competing populations, resource availability, institutional linkages, technological innovation, and legislation and policies. In addition, the findings shed light on the particularities of suppliers' and integrators' development actions regarding their solution provision. Further, supplier companies' transformation toward solution provision is identified to be requiring forming ways to cooperate with the integrator companies to reach customers. In addition, contradictory development paths of manufacturing companies are analysed, where the firms transition away from solution provision. These transition paths are labelled 'reversed servitization'.

**Keywords** Servitization, solution provision, contingency theory, service infusion, industrial service, product-service

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**Tekijä**

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**Väitöskirjan nimi**Teollisuusyritysten palvelullistuminen ja ratkaisupalvelujen tarjoaminen:  
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Kehittyneiden talouksien laitevalmistajat etsivät jatkuvasti keinoja, joilla taistella matalamman kustannustason kilpailijoita vastaan. Palvelullistumista on ehdotettu yhdeksi mahdolliseksi ratkaisuksi tähän: laitevalmistaja lisää uusia palveluita tarjoamaansa ja saattaa päätyä ratkaisupalvelujen tarjoajaksi. Siten palvelullistumisen ja ratkaisupalvelujen ymmärtämisestä on tullut välttämätöntä useille laitevalmistajille. Samalla näitä ilmiöitä koskevan akateemisen tutkimuksen määrä lisääntyy nopeasti. Palvelullistumista koskeva tutkimus on nähdäkseen parhaillaan tyypillisessä varhaisessa vaiheessa, jossa palvelullistumisstrategiaa ylistetään parhaana käytäntönä (vrt. Sousa and Voss, 2008), jota suositellaan yrityksille riippumatta niiden yksilöllisestä tilanteesta.

Tässä väitöskirjatutkimuksessa sovelletaan kriittistä näkemystä palvelullistumiseen ja ratkaisupalveluihin sekä pyritään järjestelmällisesti tarkastelemaan näiden ilmiöiden tilannesidonaisuutta. Tutkimusote yhdistelee olemassa olevan tieteellisen kirjallisuuden ja empiiristen yritystapausten analysointia. Työssä analysoidaan ensin ylätasoin toimintaympäristön vaikutuksia tietyn teollisuudenalan yritysten palvelullistumiseen. Yksityiskohtaisemmassa analyysissä tarkastellaan yritysten ratkaisupalveluiden kehittämiseksi tehtyjen toimenpiteiden riippuvuutta yrityksen asemasta toimitusverkostossa. Löydökset luovat uutta ymmärrystä, kuinka kuusi toimintaympäristön tekijää joko edesauttavat tai estävät tietyn teollisuudenalan yritysten palvelullistumista. Nämä tekijät ovat palvelullistuneiden yritysten tiheys teollisuudenalalla, muut kilpailevat populaatiot, resurssien saatavuus, siteet instituutioihin, teknologiset innovaatiot sekä lainsäädäntö ja määräykset. Ratkaisupalveluita tarjoavien yritysten ja näiden alihankkijoiden kehittämistoimenpiteiden tunnustetaan myös eroavan selkeästi toisistaan. Alihankkijoiden palvelullistumisen havaitaan vaativan yhteistyötapojen muodostamista ratkaisupalveluja integroivien yritysten kanssa, jotta alihankkijat tavoittavat loppuasiakkaat. Lisäksi analysoidaan kirjallisuudessa esitetyille vastakkaisia kehityspolkuja, joissa yritykset siirtyvät pois ratkaisupalvelujen tarjoamisesta. Nämä kehityspolut nimetään 'käänteiseksi palvelullistumiseksi'.

**Avainsanat** palvelullistuminen, ratkaisupalvelut, kontingenssiteoria, teollisuuden palvelut, tuotepalvelut**ISBN (painettu)** 978-952-60-5721-7**ISBN (pdf)** 978-952-60-5720-0**ISSN-L** 1799-4934**ISSN (painettu)** 1799-4934**ISSN (pdf)** 1799-4942**Julkaisupaikka** Helsinki**Painopaikka** Helsinki**Vuosi** 2014**Sivumäärä** 236**urn** <http://urn.fi/URN:ISBN:978-952-60-5720-0>



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## LIST OF PUBLICATIONS

*The dissertation consists of a summary and the following four original papers:*

- Paper 1. Turunen, T., Finne, M., (accepted for publication). The organizational environment's impact on the servitization of manufacturers. *European Management Journal*. 30 p.
- Paper 2. Finne, M., Brax, S., Holmström, J., 2013. Reversed servitization paths: A case analysis of two manufacturers. *Service Business: An International Journal*, Vol. 7 Iss. 4, pp. 513–537.
- Paper 3. Finne, M., Turunen, T., Eloranta, V., (under review). Striving for Network Power: The Perspective of Solution Integrators and Suppliers. 46 p.
- An earlier version of the paper was presented at the Academy of Management 73rd Annual Meeting, 9–13 August 2013, Orlando, U.S.
- Paper 4. Finne, M., Holmström, J., 2013. A manufacturer moving upstream: Triadic collaboration for service delivery. *Supply Chain Management: An International Journal*, Vol. 18 Iss. 1, pp. 21–33.

## CONTRIBUTIONS IN THE ORIGINAL PAPERS

- Paper 1. The initial idea, research design, literature review, theoretical reasoning and writing were a joint effort by both authors, where both contributed equally in each phase.
- Paper 2. The paper is based on Holmström's initial idea, but Finne had the main responsibility for other parts of the work. Brax contributed to writing and to formulating theoretical implications. Finne carried the main responsibility for research design, gathering the data for both cases, carrying out analyses, formulating theoretical implications and writing the paper.
- Paper 3. The initial idea, research design, analyses, theoretical reasoning and writing were a joint effort by all authors. The primary responsibilities of the case studies were divided as follows: Finne carried the main responsibility for data gathering and analysis regarding TechAssemblies and TechProjects, Turunen for ComCo, ProsCo and MinCo, and Eloranta for RoofCo. Finne had the main responsibility in formulating the theoretical implications and writing in the final phase.

Paper 4. Finne had the main responsibility for the research design, data gathering, analyses, formulation of theoretical implications, and writing. Holmström provided supporting contributions in all phases but analyses.

The dissertation work used external service providers to transcribe the interviews and proofread the paper manuscripts when submitted for journal review.

Table 1. Key terms of the dissertation, their explanation and operationalisation.

<b>Term used</b>	<b>Explanation</b>	<b>Operationalisation in the dissertation</b>
Organisational response	Chosen strategies and related actions when companies implement the strategies to cope with the demands of the context (Thompson, 1967; Sousa and Voss, 2008).	Two different levels in the empirical analysis: response content and response implementation (see below).
Response content	The chosen strategy for coping with the demands of the context: <i>what</i> the company does on a higher level (Thompson, 1967; Sousa and Voss, 2008).	Manufacturer's offering's position in the Oliva and Kallenberg's (2003) product-service continuum. Particular focus is on servitization (see below).
Response implementation	The actions taken to put the strategy at work: <i>how</i> the company behaves on a more detailed level (Bozarth and McDermott, 1998).	The focus of manufacturer's actions in relation to solution provision, especially regarding the relationships, interdependencies and power relationships in the network.
Servitization	The process of adding services into goods-based offerings (Oliva and Kallenberg, 2003) and thereby transitioning toward solution provision.	Transition in the Oliva and Kallenberg's (2003) product-service continuum toward increasing service dominance and thereby changing response content.
Solution provision	Delivering integrated offerings consisting of service, goods and technology components, in order to operate and maintain systems to solve customer problems (Davies and Brady, 2000; Davies et al., 2007).	The operations of a company positioned at the service end of the Oliva and Kallenberg's (2003) product-service continuum, which are networked in nature and where different actors are highly interdependent.
Context	The situational characteristics usually outside of management's control, or requiring at least substantial effort and a long time span to be changed (Sousa and Voss, 2008).	Two different perspectives in the empirical analysis: industry and network context (see below).

Industry context	The operational environment where the manufacturers provide their customers with relatively similar offerings and are dependent on the same resources (Hannan and Freeman, 1989).	A geographical market where populations of manufacturing companies provide relatively similar goods, but whose degree of participation in services can differ (see Operational environment below.)
Network context	Social network in which the company operates, consisting of actors and ties between the actors (Borgatti and Halgin, 2011).	The empirical analysis considers service triads as core components of the network and sees solution network position (see below) as defining the network context.
Operational environment	Social, economic and political system in which organisations perform (Hannan and Freeman, 1989).	The factors affecting companies' survival within the industry, but outside of the direct control of the focal company.
Solution network position	The company's position in the solution provision network, especially its relative distance from the customer of the network.	In the empirical analysis network position is operationalised as either integrator, or supplier of integrators in the triad.
Fit	The selection approach applied in this dissertation perceives fit as a congruence between context and response (Drazin and van de Ven, 1985), without explicitly considering the effects on company performance (Venkatram, 1989). This follows the natural selection argument of an evolutionary process, in which the survival of only the best performing companies is guaranteed (Drazin and van de Ven, 1985), ensuring their fit.	This dissertation focuses on external instead of internal fit (Bozarth and McDermott, 1998), which means that the focus is the relationship between context and response. The companies studied have been in business for decades and are recognised for their well-performing service operations, which ensures the fit between their responses and contexts.
Selection approach to contingency theory	A specific approach to contingency theory, considered useful for exploring the relationships between context and responses (Sousa and Voss, 2008; see also above).	Context-response relationships are explored through two perspectives in the empirical analyses: (a) industry context—response content and (b) network context—response implementation.



# 1. Introduction

## 1.1 Overview

Both scholars and practitioners have been intrigued by the question of whether manufacturers in countries with high cost levels should transition toward solution provision to respond to competition from low-cost countries. How does the context of operations affect the suitability of such strategies? Among industrial equipment providers, these kinds of questions have directed increasing attention toward the search for new ways to increase customer value. Moving closer to customers and increasing the proportion of services have been presented as ways to achieve these goals (Wise and Baumgartner, 1999; Oliva and Kallenberg, 2003; Baines et al., 2009a). Such manufacturers' transition toward *solution provision* has been termed *servitization* (Vandermerwe and Rada, 1988). Other terms such as service infusion/business in the manufacturing industries have been used to refer to this phenomenon, but herein, the term 'servitization' is used for brevity. There is increasing impetus to understand why and how the transition toward solution provision is carried out (Mathieu, 2001a; Baines et al., 2009b; Kowalkowski et al., 2011a; Salonen, 2011), and to understand the attached managerial challenges (Auramo and Ala-Risku, 2005; Gebauer et al., 2010a; Raddats and Burton, 2011; Gebauer et al., 2012) and the financial implications (Gebauer et al., 2005; Fang et al., 2008; Neely, 2008; Eggert et al., 2011; Kohtamäki et al., 2013a&b; Visnjic and van Looy, 2013).

Most literature presents servitization as a strategic move through which manufacturers can gain competitive advantage (e.g., Vandermerwe and Rada, 1988; Baines et al., 2009a&b; Salonen, 2011). Such claims are usually only based on anecdotal evidence. However, research with particular focus on the implications of servitization on companies' profitability (Gebauer et al., 2005; Ceci and Masini, 2011; Eggert et al., 2011; Visnjic and van Looy, 2013) and market value (Fang et al., 2008) have indicated that the transition toward solution provision sometimes has negative implications on the financial indicators, which somewhat contradicts the claimed

benefits of servitization strategy. Accordingly, Gebauer and his colleagues (Gebauer et al., 2005) introduced the concept of ‘service paradox in manufacturing companies’ to describe the situation where increasing proportion of services in the offering leads to higher costs without higher returns. The abovementioned studies focusing on the profitability of servitization also indicate that the context in which the manufacturer operates could have clear implications as to the suitability of servitization as a strategic move. It might be even that some of the challenges in realising the suggested financial benefits of servitization could be explained through effects from the context. For clarity, this dissertation does not study financial effects of servitization; rather it focuses on the contextuality. Namely, to date we have not been able to reach a clear understanding on how the context of manufacturers’ operations can affect its solution provision or the attached transition (i.e., servitization). Achieving this would be significant in possibly enabling predicting the suitability of such a strategy for different manufacturers, based on their contexts of operations. This is the knowledge gap that this dissertation will address.

This dissertation aims to contribute to the discussions of servitization and solution provision by analysing the role of the context in affecting these phenomena. While servitization refers to a transition, *solution provision* is the usually intended result of such a transition. Namely, manufacturers operating as solution providers offer their customers integrated packages of goods, technology and various kinds of services (Davies and Brady, 2000; Davies, 2004; Davies et al., 2006, 2007; Brax and Jonsson, 2009). Some forerunners have researched the linkages between service strategies and organisational design (Gebauer et al., 2010a), service strategy and operational environment (Neu and Brown, 2005; Windahl and Lakemond, 2006; Gebauer and Fleisch, 2007; Gebauer, 2008; Gebauer et al., 2010b; Ceci and Masini, 2011; Kowalkowski et al., 2011b) and operational environment and service needs (Pawar et al., 2009). Despite these insightful studies, the contextuality of solution provision and servitization still requires more explicit analysis to reveal its true nature.

Contingency theory is used in operations management to study how situational factors affect the suitability of different strategies and management practices. The basic contingency argument states that the performance outcomes of certain practices depend on the context of operations (Donaldson, 2001). Organisations are also viewed as dynamically changing their strategies and structures as a response to altering contexts, in order to maintain the fit between context and organisational response (Drazin and van de Ven, 1985; Venkatram, 1989; Donaldson, 2001; Sousa and Voss, 2008). This dissertation finds that the

controversy between the claimed benefits of servitization strategy and the actual observed effects could partly be explained via a contingency theoretical analysis. Therefore, in this dissertation contingency theory is applied as a higher-level theory to study the interplay between operational contexts and manufacturers' servitization as well as solution provision. Accordingly, using a contingency theoretical perspective (Lawrence and Lorsch, 1967; Thompson, 1967; Donaldson, 2001) this dissertation argues that the suitability of a servitization strategy for a manufacturer will depend on the context of its operations. Thereby, the objective of this dissertation is as follows.

**Research objective :**

*To analyze the effects of the context on manufacturers' servitized offerings and the responses servitizing manufacturers can take depending on their contexts.*

**1.2 Research questions**

The broader research objective is explored here in two different perspectives: the *context* is operationalised in the industry perspective as *operational environment* and in the network perspective as *supply network position* (see Figure 1 below for the key constructs, their relationships, and operationalisations). Research questions 1 and 2 cover the first perspective, while research questions 3 and 4 focus on the latter perspective (see Figures 2 and 3 below for the role of different research questions in the whole dissertation). The two perspectives are needed to study the effects of both of these two contextual elements, which are central regarding servitization and solution provision. These perspectives complement each other by allowing different viewpoints on the interplay between the context and the responses; the first one provides an overall view while the latter adds more details to the picture. In addition, research questions 1 and 2 contribute to the understanding of environmental effects on the servitized offerings of manufacturer. This dissertation argues that there are certain environmental characteristics (Hannan and Freeman, 1984, 1989) that are typical of each industry and that affect greatly how servitization as a transition takes place among the manufacturers within the particular industry. On the other hand, research questions 3 and 4 cover the responses of the servitizing manufacturer. Namely, the supply network position that an individual manufacturer occupies has major implications on how it is able to participate in solution provision and to servitize,

because customer input is necessary to industrial service production (Sampson, 2000; Sampson and Froehle; 2006), typically requiring more direct customer contact.

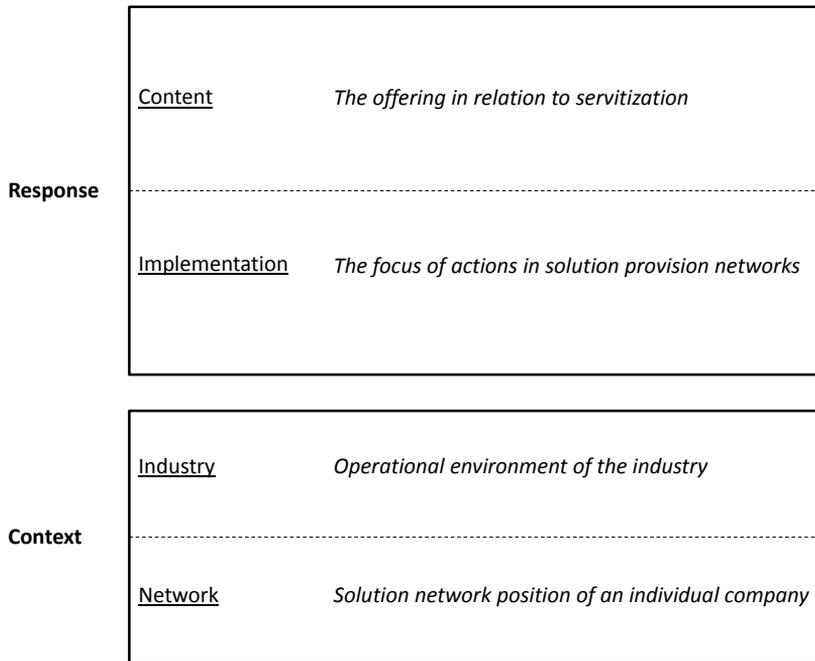


Figure 1. Illustration of the key constructs and their operationalisation.

The first perspective on the interplay between the context and organisational responses considers the context, namely the operational environment (see Figure 2 below for the key constructs and research questions in the industry perspective). This perspective analyses the industry-level environmental effects on the contents of the manufacturers' responses: the changes in the environment are reflected in changing offerings of manufacturers. This dissertation argues that contextual variables related to the operational environment, such as regulation (Dobrev, 1999, 2001) and competitive situation (Hannan and Carroll, 1992; Carroll and Harrison, 1994; Carroll and Hannan, 2004), determine to a great extent how far in their servitization attempts companies should go and determine whether even withdrawing from solution provision or from all service operations would be advisable in certain contexts to maintain the fit with environmental demands. Accordingly, the first research question is:

**Research question 1:**

*What contextual variables in industry-specific operational environment affect the servitization of manufacturers?*

The role of the environment is analysed conceptually by studying the effects of the environmental variables on servitization. This is carried out using organisational ecology (Hannan and Freeman, 1984, 1989) as a theoretical lens. This analysis is done on an industry-level in order to systematically evaluate the environmental influences, which is also compatible with organisational ecology theory. A conceptual model is developed based on the effects of six different environmental factors.

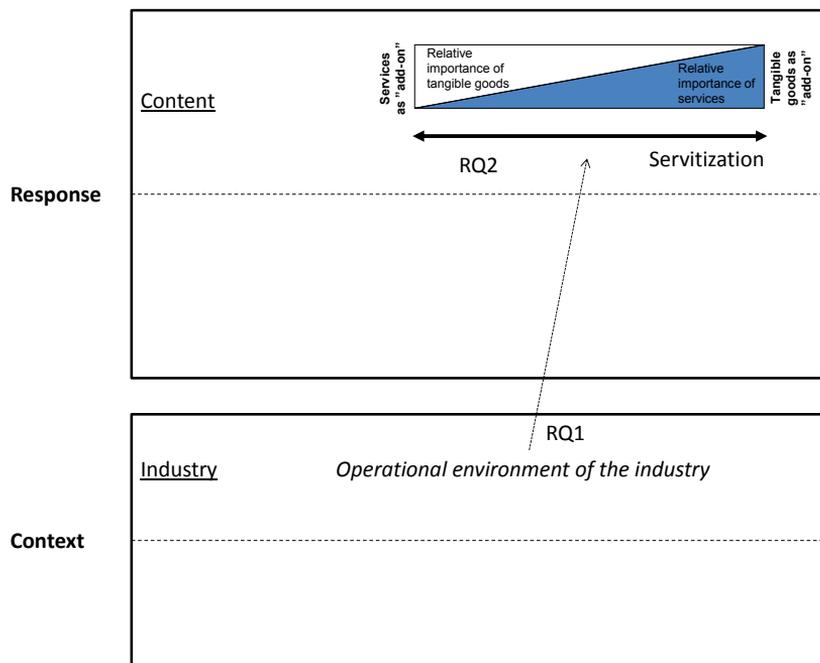


Figure 2. Industry perspective: key constructs, their relationships and targets of research questions.

The conceptual model also predicts the existence of a variety of companies' transition paths related to servitization, not all of which are acknowledged by previous research. Current literature mostly presents servitization as a forward transition from offering only goods with accompanying spare parts and warranty, toward providing solutions (e.g., Vandermerwe and Rada, 1988; Oliva and Kallenberg, 2003; Baines et al., 2009a) and applying to manufacturers irrespective of the context. Accordingly, there is a need to

clearly study how the transition is perceived in literature (see subsection 2.2.1) and whether development paths can be empirically identified, which are contrary to those presented in previous research. Hence, the second research question is formulated as follows.

**Research question 2:**

*Are there alternative transition paths related to servitization than those identified in previous research?*

Research question 2 is explored through a case study of two manufacturing companies. Both of these undergoing interesting development paths, are analysed, one empirically and the other based on secondary data. The analysis of both companies starts from the market introduction of a novel, high-technology product and continues throughout the development paths. The aim is to test the predictions of the conceptual model, based on the existence of alternative transition paths. Especially in the empirical case, the company's abilities to provide services are affected, not only by operational environment, but also by its changed network position, as it has become a supplier of integrators.

This dissertation's second perspective analyses companies' responses, namely the manufacturers' solution provision related actions that depend on their network positions (see Figure 3 below for the key constructs and research questions in the network perspective). These are studied as response implementation: the way companies take action to modify their operations in alignment with demands from the network environment. This perspective is divided to two parts: the dependence of companies' development actions on network position (research question 3) and servitization in supplier position (research question 4).

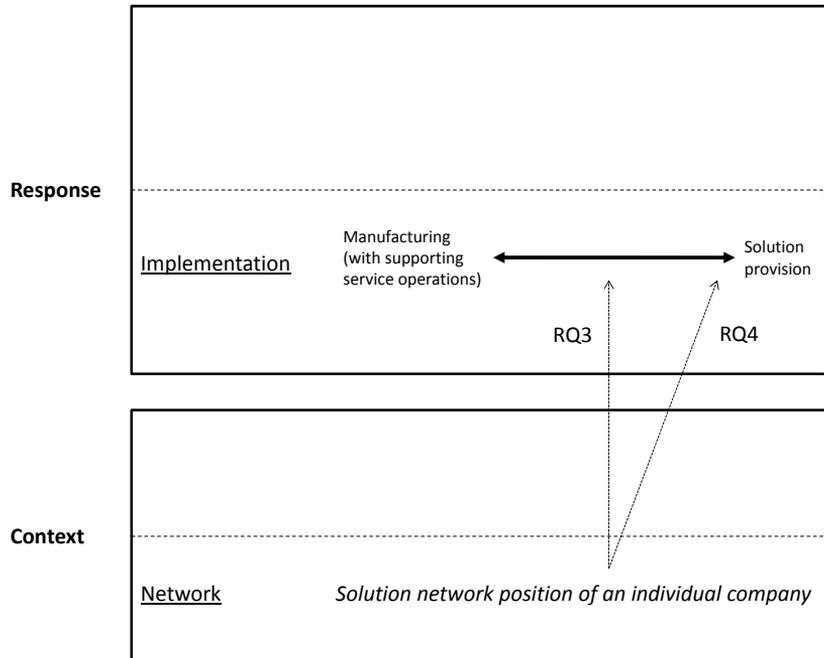


Figure 3. Network perspective: Key constructs, their relationships and targets of research questions.

Service providing manufacturers need to be able to adjust their operations to networked open systems, which most industrial services essentially are, due to the need for significant customer input in the production process (Sampson, 2000; Mathieu, 2001a; Sampson and Froehle, 2006). A manufacturer's relative distance from the customer of solution provision network seems to be a major influence on the firm's actions and in relation to solution provision. Servitization literature argues that manufacturers should operate close to customers (Wise and Baumgartner, 1999; Oliva and Kallenberg, 2003; Baines et al., 2009a), integrating goods and services from different suppliers (Davies and Brady, 2000; Davies, 2004; Brady et al., 2005b; Brax and Jonsson, 2009) and also integrating themselves with customers (Mathieu, 2001a). On the other hand, suppliers further away from customers would be expected to focus more on providing goods, since they lack contact with customers (cf. Sampson, 2000; Sampson and Froehle, 2006). Therefore, the decision was made to explore more explicitly the link between network position and actions regarding solution provision. Thus, the first research question of the network perspective is as follows.

**Research question 3:**

*How do manufacturers' development actions regarding solution provision depend on their network position?*

Research question 3 is explored through empirical analyses of six different solution provision networks. The focus is the solution integrators and their suppliers participating in these triadic networks and especially development actions regarding solution provision. This dissertation uses the findings from this multiple case study to explain the focal company's actions as response to its solution network position, either as supplier or integrator.

A specific and under-explored challenge regarding servitization is faced by supplier companies. Namely, solution provision usually takes place in networks, because the versatile capabilities required to manufacture technology products *and* simultaneously offer services are seldom possessed by any single company (Davies, 2003; Brady et al., 2005b). These solution networks are by their nature triadic (Wu and Choi, 2005; Choi and Wu, 2009b) because of the required direct customer contact between the supplier and customer. A possible lack of such a relationship would pose significant challenges to a supplier company aiming to transition to solution provision. However, understanding of how supplier companies can servitize is rather limited, due to the prevailing focus on integrator companies in previous studies. Thereby, the second research question of the network perspective is as follows.

**Research question 4:**

*How can a manufacturer servitize when operating as a supplier of integrators?*

Research question 4 is explored through an empirical case study of a global manufacturer trying to increase and improve its service operations. The manufacturer has ended up in a supplier position and lost contact to most of the customers who use its products. The customer contacts are controlled in this setting by intermediaries operating between the suppliers and customers. The aim is to devise a solution that will enable the manufacturer to offer services effectively in such a situation. The case study shows how transformation of individual companies toward solution provision can take place in such situations.

### 1.3 Scope and delimitations

This study focuses on the interplay between the operational context and manufacturers' servitization as well as solution provision, where servitization is a transition toward providing solutions. Contingency theory is selected for the main theoretical perspective for the study. The background for this research is drawn from literature streams focusing on the organisational responses (servitization and integrated solutions), on the one hand, and streams describing the context (organisational ecology and service triads), on the other hand. Other streams, such as product-service systems and service-dominant logic of marketing, are not key sources of theoretical insights, although they have a close relationship to the studied phenomena.

The empirical research of this dissertation has been carried out in the context of large multinational/global manufacturing companies. In addition, the companies in the samples manufacture industrial goods that are installed at customer sites. The empirical research has applied case study methodology to offer deep understanding of the phenomena in their natural contexts, but the tradeoff is that, inevitably, case studies do not provide much room for direct generalizations outside the empirical context. Therefore, the applicability of the findings to other contexts, such as SMEs (small- and medium-sized enterprises; see Gebauer et al. 2010b; Kowalkowski et al. 2013), should be tested in further studies before making judgments on this. In addition, manufacturers providing input-to-process offerings (Storbacka et al., 2013) in industrial settings are out of this dissertation's scope, as are pure service providers offering no tangible goods. While contingency theory is applied as the higher-level theory, organisational ecology in the analysis of operational environments and service triads (social network analysis) in the analysis of network position, the intention here is not to contribute directly to these theoretical streams. The theoretical contributions are to operations management (OM) and service operations management in particular.

This dissertation applies selection approach to contingency theory (see subsection 2.1), where the performance implications of fit are not focused but implicitly controlled. Therefore, explicit inferences can be drawn neither from aligning the responses with contexts, nor from systemic effects of groups of contingency and response variables. Selection approach focuses on studying the relationship between the context and organisational responses (Drazin and van de Ven, 1985). The context refers to the situational characteristics of a company's operations while the responses

are the chosen strategies and related actions when companies respond to the demands of the context. Selection approach does not explicitly consider the performance effects, because an evolutionary process is seen to guarantee the survival of only the fittest companies.

The dissertation aims to carry out both higher-level and more detailed analysis of the interplay between the context and companies' responses to acquire rich new knowledge on both the context and the responses. Accordingly, the focus is on operational environment as the context affecting servitization on an industry level, and on the other hand, on implementation of organisational responses that are affected by solution network position (see Table 2 below). Accordingly, the former analysis defines context variables as dependent and controls for companies' responses, while the latter does the opposite, viewing companies' response implementation as dependent and controlling for context variables. Thus, out of scope are analyses on organisational responses to different industry-level environments as well as detailed analysis on different kinds of networks affecting companies' solution provision.

Table 2. The applied focuses and perspectives.

	<b>Industry perspective</b>	<b>Network perspective</b>
Response	<i>Controlled variables:</i> offerings related to <u>servitization</u>	<i>Measured variables:</i> actions related to <u>solution provision</u>
Context	<i>Measured variables:</i> factors in <u>organisational environment</u>	<i>Controlled variables:</i> <u>supply network position</u>

Contributions of contingency theory are in general achieved by (a) identifying the contingency variables, (b) grouping context based on contingency variables, (c) determining the organisational responses to the context (Sousa and Voss, 2008). This dissertation aims to contribute through all of those: the industry perspective through (a) and (b) by identifying context variables in the operational environment and offering a basis to group different industries based on these variables, while the network perspective contributes mostly through (c), studying companies' actions in relation to solution provision as implementation of

organisational responses to different solution network positions (see Figure 1 in the beginning of subsection 1.2).

This summary of the dissertation is structured to five parts. The first part is the introduction at hand. The second part summarises the relevant literature and theories to position the research and to offer the reader an understanding on the body of knowledge and where the contributions are intended. The literature streams studying the responses are servitization regarding the industry perspective and solution provision (in other words, integrated solutions) regarding the network perspective. This dissertation is intended to contribute primarily to these literature streams. The theoretical lenses used in the analyses are organisational ecology for the industry perspective and service triads (social network analysis) for the network perspective. The third part presents the research design: the division to different Papers and the applied methods. The fourth part reviews the findings and contributions from the four original research Papers presented in the appendices. The fifth part concludes this summary by discussing the implications of the research, both to theory and practice, as well as presenting the limitations and avenues for further research. The structure in the research design part deviates from the structure in the other parts: the former is structured with the aim of providing transparency to how the research process evolved logically. All of the other parts are structured thematically, mainly around the research questions.

## **2. Literature: Contingencies between organisational responses and context**

This section will analyse literature on contingency theory and thereafter present background for the studied companies' responses and related contexts by discussing existing work on these topics. The rationale for discussing the responses before the contexts is to provide a logical structure, presenting first the phenomena under study and thereafter the theoretical lenses through which the interplay between the phenomena and contexts are viewed. The responses are explored by reviewing literature on servitization and solution provision phenomena, while contexts are explored by reviewing theoretical literatures on organisational ecology and service triads.

### **2.1 The context in operations management: A contingency theoretical perspective**

Much research in operations management has concentrated on different kinds of management practices. The research has typically gone through a life cycle in which certain practices (e.g., lean, Kanban coordination) are first praised as best practices with potential benefits irrespective of the context, and only through time the context of these practices receives more research attention (Thompson, 1967; Sousa and Voss, 2008). This thesis applies contingency theory's selection approach (Venkatram, 1989; Sousa and Voss, 2008) in the analysis (for selection approach, see later part of this subsection). It studies investment goods manufacturers' application of servitization strategy and actions regarding solution provision and makes a serious attempt to systematically studying the contextuality of servitization and solution provision. The chosen strategy and the way it is applied depending on context is referred here using the term *response* (e.g., Thompson, 1967; Bozarth and McDermott, 1998; Sousa and Voss, 2008).

The first attempt to systematically analyse the effects of the context on managing organisations was the deployment of open-system insights in organisation studies (March and Simon, 1958). Contingency theory (Lawrence and Lorsch, 1967; Thompson, 1967) was then built on these insights. While Thompson (1967), as one of the earliest contingency researchers, considered mostly companies' *responses*, meaning the ways they adapt to different contexts, other contemporary researchers studied how varied *contexts* give rise to different kinds of organisations. Namely, organisational structures were explained to emerge as a result of the employed technology (Woodward, 1958), or environmental change (Burns and Stalker, 1961) and complexity (Lawrence and Lorsch, 1967). Galbraith (1973) argued that organisational forms are responses to different needs of processing information. Pfeffer and Salancik (1978) on their part emphasised the role of other organisations and institutions in shaping the context. Thompson (1967) proposed that all organisations are open to environmental influences, that they have to adapt to these environments through changing structures, and that the degree to which organisations' subunits are open to environments differs.

In general, contingency theory states that the *performance outcomes* of a certain *organisational response* depend on the *context* of operations (Donaldson, 2001). Further, the focus of the theory has been on organisations changing their structures and strategies for maintaining fit with contextual variables (Drazin and van de Ven, 1985; Venkatram, 1989; Donaldson, 2001). In addition to describing the context and its effects, Thompson (1967) contributed significantly by explaining the mechanisms and strategies (i.e., responses) that organisations employ to adapt to different contexts. Accordingly, contingency theory involves three types of variables: contingency, response and performance variables. *Contingency variables* define the situational characteristics that are usually outside the management's control, or at least affect these requires substantial effort and a long time span (Sousa and Voss, 2008). *Response variables* describe the actions taken by the organisation in response to the contingency variables (Thompson, 1967; Sousa and Voss, 2008). *Performance variables* are the measures of effectiveness, which can be used to evaluate the fit between response and contextual variables (Sousa and Voss, 2008).

Recently, contingency theory has been applied in various operations management studies (see Sousa and Voss, 2008), much more so in topics outside the scope of this dissertation (e.g. Flynn et al., 2010; Wong et al., 2011; Droge et al., 2012; Kohtamäki et al., 2012; Sirén et al., 2012; Zhang et al., 2012; Helkiö and Tenhiälä, 2013). In the field of servitization and solution provision, the applications of contingency theory are rather scarce

among published studies. Therefore, the review here also covers studies with links to these phenomena, not all of them focused particularly on servitization or solution provision. The focus in previous studies has been on the relationship between service strategies or capabilities and organisational design (Gebauer et al., 2010a), market environment (Neu and Brown, 2005; Gebauer and Fleisch, 2007; Gebauer, 2008; Gebauer et al., 2010b; Ceci and Masini, 2011), and network relationships (Windahl and Lakemond, 2006), as well as on the dependence of organizational design for services on internal and external aspects (Kowalkowski et al. 2011b).

Servitization and solution provision related studies have operationalised contingencies in three different manners. First, in their quantitative studies Ceci and Masini (2011) as well as Gebauer (2008) studied how the alignment between responses and context leads to improved performance, and operationalised all of these variables based on literature and in detailed manners. The former studied integrated solution provision by IT (information technology) providers and operationalised responses as the company's capabilities, such as hardware manufacturing and infrastructure, software development, consulting, and systems integration. They found evidence suggesting that differences in strategy-environment fit can explain performance differences among IT solution providers, and that four different strategy-environment configurations existed. They operationalised context as the heterogeneity in the market, including the range of products and services, as well as heterogeneity in the industries, in the size of clients and projects, and in the value of projects. Performance implications were measured against revenues per employee and project, degree of goal achievement, and customer satisfaction. Gebauer (2008) viewed company responses as strategic alternatives along five axes: cost leadership, product differentiation, service differentiation, service marketing differentiation, and service offering. He operationalised context as external environment, including competitive intensity in product and service fields, market growth, customer's price sensitivity, and customer's strategic options for operating the product. Further, he measured performance against overall company profitability, direct service profitability, share of service revenue, customer relationship, and customer loyalty. The two other groups consist of qualitative studies, where the contingencies and related variables are first operationalised on a rather high level and the main contributions are to provide more detailed operationalisations. The research design here follows a similar logic as the following qualitative studies, regarding operationalising contingencies.

Second, Windahl and Lakemond (2006), Gebauer and Fleisch (2007), as well as Gebauer et al. (2010a) carried out multi case studies measuring the

implications of contingencies on performance by focusing on customer's process performance, overall profitability, and annual sales. The two latter studies focused only on internal alignment among behavioural processes, managerial motivation, service business investments, and service revenue; as well as service strategy and organizational design. Windahl and Lakemond (2006) viewed the company responses as the development of integrated solutions and identified six contextual factors that affect it: network position and horizon, the strength of relationships, solution's impact on internal activities and on customer's core processes, and external determinants. In relation to the network context, they found that a company's position as the integrator with a direct relationship to the customer improves its ability to develop integrated solutions. In addition, strong ties either directly with the customer or indirectly through another company to the customer would improve the focal company's solution development actions by strengthening its abilities to influence the customer.

Third, Neu and Brown (2005), Gebauer et al. (2010b), and Kowalkowski et al. (2011) focused only on the alignment between responses and context, while performance implications were not directly considered. They all reached rich findings on company responses to different environments. Neu and Brown (2005) operationalised responses as actions on five different areas: strategy, human resources, structure, measurement and rewards, and processes. Their findings describe the details of these actions in response to external environment that varies along three axes simple–complex, stable–dynamics, and tame–hostile. Gebauer et al. (2010b) viewed responses as strategy formation and implementation, and context as position in the value chain and external environment. They identified four different situations where the focal company acts as a supplier or OEM and sells either directly to customers or through distributors. In addition, they described responses to these situations, where the emphasis is on service strategy formation and implementation differs. Kowalkowski et al. (2011b) studied how organizational arrangements for service provision depend on internal and external factors. They found out that companies utilize internal, hybrid, or external organizational arrangements to deliver services depending on company, offering, and market related factors. Here the organizational arrangements represent responses, while the context is divided to internal (company and offering related factors) and external context (market related factors).

There are three possible ways to study the contingencies and organisational fit: selection, interaction and system approaches (Drazin and van de Ven, 1985). The selection approach focuses on the relationship

between context and response variables, without considering how this affects performance (cf. Neu and Brown, 2005; Gebauer et al., 2010b; and Kowalkowski et al., 2011). Interaction approach studies context-response pairs affecting performance (cf. Ceci and Masini, 2011). The system approach applies a systemic point of view by simultaneously addressing several contingencies, responses and performance variables (cf. Gebauer, 2008). This dissertation applies the selection approach that is also consistent with Venkatram's (1989) 'matching' form of fit. This approach has been considered potentially useful for the purpose of exploring important relationships between context and responses (Venkatram, 1989; Sousa and Voss, 2008), which is also the goal here. The selection approach perceives fit as a congruence between context and response (Drazin and van de Ven, 1985). Its focus is on their relationships without explicitly considering the effects on the performance (Venkatram, 1989). According to the natural selection argument, an evolutionary process guarantees that only best-performing companies can survive (Drazin and van de Ven, 1985), and therefore the analysis can concentrate on the interplay between the context and responses.

The research design of this dissertation follows similar logic as previous qualitative servitization and solution provision studies by utilizing rather high level initial operationalisations (see subsection 1.2) and aiming to contribute through findings providing more details to these operationalisations (see subsection 5.1). The focus is divided between contingency and response variables in two perspectives. The industry perspective studies the context of operational environment through organisational ecology theory, viewing the implications of the context on companies' responses (Thompson, 1967; Sousa and Voss, 2008). The responses are operationalised as the offerings in relation to servitization strategy. Contingency variables on their part define the operational environment. The network perspective focuses on manufacturers' operations as response implementation (Bozarth and McDermott, 1998). These are viewed to be depending on the network position context as either supplier or integrator. Accordingly, response variables here refer to the way the manufacturer takes action regarding solution provision, while contingency variables are operationalised as the position in solution provision network.

Servitization and solution provision literatures lack detailed considerations on how the context of operations affects manufacturers' choices to servitize and provide solutions. The next subsection will consider servitization and solution provision as manufacturers' responses to different contexts and analyse the viewpoints of existing literatures.

## **2.2 Organisational responses: Servitization and solution provision**

As mentioned earlier, this dissertation studies the interplay between the context and responses which are here analysed through two perspectives: industry and network. The industry perspective provides more of an overall view, while network perspective focuses on companies' implementation of responses to different contexts and thereby provides a more detailed picture. In the industry perspective, the response contents are operationalised as applications of servitization strategy, whereas the network perspective focuses on response implementation: operations in solution provision networks. The next subsection will review literature on responses according to this categorisation.

### **2.2.1 Servitization as a transition**

Current servitization literature views contingencies in servitization mainly by explaining manufacturers' rationale for carrying out the transition. Namely, the reasons to servitize can be divided into three categories: economic potential of service business, customer requirements and differentiation from competitors. First, sales margins for services are *assumed* to be higher and/or their revenue streams assumed to be more stable than those of products (Anderson et al., 1997; Oliva and Kallenberg 2003; Auramo and Ala-Risku 2005; Cohen et al. 2006). Second, customer needs for broader offerings including services are argued to be increasing due to customers' growing concentration on core competencies (Oliva and Kallenberg, 2003). Third, companies use services as a means of differentiating themselves from competitors, based on the view that services are difficult to imitate, thereby offering a way to escape the typical problems of mature businesses (Wise and Baumgartner, 1999; Shepherd and Ahmed, 2000; Davies et al., 2006; Davies, 2003). However, this dissertation aims to systematically study the interplay between the context and servitization, and therefore the context is divided into organisational environment and position in the solution provision network. The literature on the latter is summarised in subsection 2.3. In this subsection, the focus is studying how servitization literature views the transition.

Examples of servitized manufacturers are abundant, many can be found in the aircraft and in the lift building industries. Power-by-the-hour is a well-known servitized concept developed by Rolls-Royce, where the idea was to deliver customers operational hours instead of ownership of aircraft engines. The Finnish lift and elevator company KONE has been an often cited benchmark of successfully servitized manufacturer, with nearly half (46% in 2013; KONE, 2013) of the total revenue being created by maintenance and modernization services. These companies have been deeply involved with providing industrial services since decades. More recently there has been also increasing academic research emerging around the phenomenon; with especially strong focus during the past few years (see Figure 4 below).

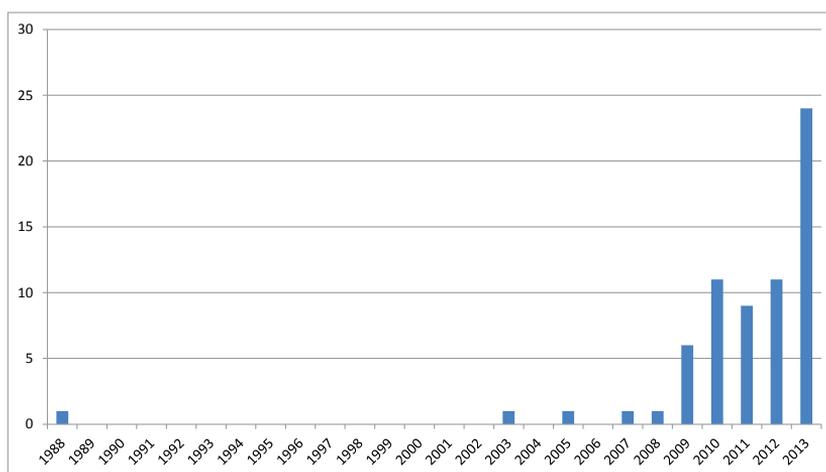


Figure 4. The number of journal articles on servitization has been increasing.<sup>1</sup>

<sup>1</sup> To illustrate how the volume of research on servitization has been developing, I conducted a search in Scopus, which is one of the largest databases for peer-reviewed academic literature. The search was carried out using the search string "TITLE-ABS-KEY(servitization) OR TITLE-ABS-KEY(servitisation) OR TITLE-ABS-KEY("service infusion")) AND PUBYEAR < 2014". So, the focus was on those papers referring to the phenomenon in their title, abstract, or keywords, and published latest during the year 2013. The initial search yielded 236 papers, of which I removed conference papers, editorials, book chapters, conference reviews, letters, and notes, which left 153 articles. Almost half of those were from disciplines that clearly are out of scope regarding industrial services, such as medicine, nursing, pharmacology, toxicology and pharmaceuticals. After cleaning those, 80 articles were left, whose contents were reviewed. Out of these articles, 11 were identified to focus on other services with no direct link to industrial services, two had not gone through a double blind review process, and one was written in Spanish. This left altogether 66 articles to the final sample presented in Figure 4.

In order to reach an explicit understanding of literature views on the direction and nature of the transition in servitization, a systematic literature review was carried out. The focus was to identify how the transition is viewed as taking place along manufacturers' changing offerings, namely, what kinds of phases (at least the starting and ending phases) the transition is seen to involve. Accordingly, the focus was on the content of the organisational response, which here refers to the offering's position in the Oliva and Kallenberg's (2003) product-service continuum. The final sample totalled 31 articles<sup>2</sup> (see Table 3 below). Next, the findings from the review will be summarised.

The systematic review recognised the dominant assumption of the transition, which was labeled forward-unidirectional. It means that companies are assumed to be transitioning or extending their offering's position on the continuum toward more service-focused positions (e.g., Löfberg et al., 2010). This is often described through the product-service continuum (see Figure 5 below), in which the company's position is determined by the relative contents of the offering. The literature observes companies moving toward increasing service dominance. The transition is argued to be directed from manufacturing and possible maintenance services to relationship-related services, in which manufacturers support clients' actions with or without a direct link to their physical product. The forerunning fully servitized manufacturers are seen as providing solutions, thereby blurring the line between goods and services (Davies, 2003; Allmendinger and Lombreglia, 2005).

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<sup>2</sup> Multiple combinations of keywords were tested in ABI/INFORM (ProQuest), Academic Search Elite and Business Source Complete (EBSCO), Emerald Journals, IEEE/IEE, JSTOR, SAGE, Science Direct (Elsevier), and SpringerLink databases. In comparing different databases, it was recognized that results varied greatly. Aiming at both good coverage and a manageable number of good quality articles, ISI was chosen, because citation indexing is generally considered as a way to measure academic quality, and ISI lists all indexed journals from other databases. The chosen search string provided the most condensed set of relevant articles (N=39):

Topic=(servitization) OR Topic=(servitisation) OR Topic=("service infusion") OR opic=(service strateg\*) AND Topic=(manufact\*)  
Refined by: Topic=(transition) AND Web of Science Categories=(MANAGEMENT OR BUSINESS ) AND Document Types=( ARTICLE )  
Timespan=All Years. Databases=SCI-EXPANDED, SSCI, CPCI-SSH  
Date of retrieval = September 2012

It was noted that six highly relevant articles were absent. Therefore broader keywords were tried; the results were less focused but still lacked these studies, which were therefore manually included in the sample: Vandermerwe and Rada (1988) introduced the term servitization. Mathieu (2001a) made the distinction between product oriented and customer supporting services. Davies (2003) noted that while manufacturers extend downstream, service providers extend upstream. Baines et al. (2009a) provided a systematic literature review of servitization. Geum et al. (2011) developed a road map for the practical execution of servitization. Turunen (2011) described the more versatile ways to achieve servitization.

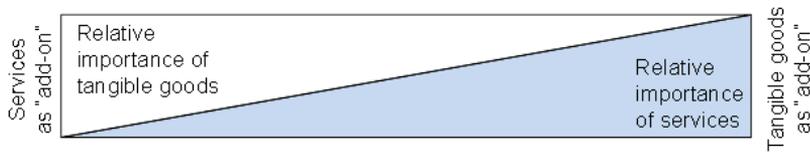


Figure 5. Product–service continuum (modified from Oliva and Kallenberg 2003).

Table 3. Systematic analysis of the literature concerning transition between goods- and services-based business models.

Study's view on servitization	Study	Method and data	Transition explored / explained by
<b>Forward- unidirectional transition view</b>	Vandermerwe and Rada (1988)	Conceptual	Pressures to establish and maintain customer relationships and to defend market positions
	Mathieu (2001a)	Single-case study	Product-oriented or customer-supporting service approach
	Oliva and Kallenberg (2003)	Multi-case study	Strategic intent and deliberate development activities
	Allmendinger and Lombreglia (2005)	Conceptual with illustrative cases	Search for profitability, differentiation and locking-in customers drives companies not only to services, but to smart services as well
	Baines et al. (2009a)	Literature review	Higher value business activities and differentiation
	Gremyr et al. (2010)	Multi-case study	Competition is driving companies to seek new ways to create value
	Kindström (2010)	Multi-case study	Business model aspects and innovation activities
	Geum et al. (2011)	Conceptual with illustrative cases	Innovative business models and technological developments foster the integration of products and services
	Kowalkowski (2011)	Comparative case study	Roles of service function entities and their interdependencies
	Salonen (2011)	Comparative case study	Cultural reorientation of dominant logic and external and internal efficiency
Paiola et al. (2012)	Multi-case study	Dynamic capabilities and operational capabilities	
<b>Forward- unidirectional transition, also risks / obstacles identified</b>	Bjurklo et al. (2009)	Single-case study	Competition is driving manufacturers to service provision
	Gebauer et al. (2010a)	Survey	Manufacturers are changing mindsets toward customer-centricity and value co-creation, which drive servitization
	Raja et al.	Single-case	Competition is forcing

	(2010)	study	manufacturers to seek new ways to grow and improve profitability
	Raddats and Burton (2011)	Multi-case study	Organisational alignment of service strategy with structure
	Ulag and Reinartz (2011)	Comparative case study	Specific service capabilities and resources associated with hybrid offerings
	Gebauer et al. (2012)	Literature review	Organisational culture and capabilities; organisational arrangements
<b>Forward-unidirectional extension</b>	Neu and Brown (2005)	Single-case study	Fit between market complexity and firm strategy, structure, processes, measurement and rewards and people
	Gebauer et al. (2010b)	Multi-case study	Position in value chain, component supplier role and conditions in external environment
	Holmström et al. (2010)	Conceptual	Visibility to customer's demand chain as critical enabler
	Brown et al. (2011)	Conceptual	Perceived similarity between parent brand and brand extension
	Eggert et al. (2011)	Survey	Product innovation activity explaining performance in different service strategies
	Kowalkowski et al. (2011a)	Comparative case study	Key service components, management of central and local organisations, balancing exploration and exploitation
	Kowalkowski et al. (2011b)	Multi-case study	Firm-specific, offering-specific and market-specific factors in channel selection
	Lightfoot and Gebauer (2011)	Multi-case study	Determinants of innovation supporting service strategy
	Nordin et al. (2011)	Conceptual	Customisation, bundling, range of offerings; operational and strategic risk
<b>Forward- and backward-unidirectional transitions</b>	Davies (2003)	Multi-case study	Manufacturing firms extend downstream with services; service firms extend upstream to systems integration and product supply
<b>Forward transition / extension, also some empirical findings on regressive turns</b>	Fang et al. (2008)	Survey	Leverage of knowledge and resources, increased customer loyalty, loss of strategic focus and organisational conflict
	Matthyssens and Vandenbempt (2010)	Multi-case study	The fit of a chosen strategy, in terms of added customer value and customisation, capabilities and other contingencies
	Turunen (2011)	Single-case study	Increasing user-orientation forces companies to find faster and versatile ways to achieve servitization
	Kowalkowski et al. (2012)	Single-case study	Disjointed incrementalism, bounded rationality, path-dependencies and exploration

There are two main types of assumptions in the prevalent literature on the nature of the servitization process: the offering transitioning on the product–service continuum away from the original position (e.g. Oliva and Kallenberg, 2003; Gremyr et al., 2010; Kindström, 2010), or extending the offering to a wider coverage on the continuum (e.g. Neu and Brown, 2005; Gebauer et al., 2010b; Kowalkowski et al., 2011b). Both views are useful in the analysis of servitization processes. Clearly, studies differ in how explicitly they address the nature of the transition, and some require more subjective interpretation in order to be grouped.

Studies in the ‘forward unidirectional’ categories (in total, 26 out of the total sample of 31) typically discuss the transition either conceptually or through empirical evidence and in varying levels of detail. These studies typify successful approaches to implementing service strategy (e.g., Brown et al., 2011; Lightfoot and Gebauer, 2011; Nordin et al., 2011), discuss how to organise service operations efficiently (e.g., Neu and Brown, 2005; Kowalkowski, 2011; Kowalkowski et al., 2011b; Raddats and Burton, 2011) or identify essential capabilities required to pursue servitization successfully, noting that the lack of capabilities is likely to complicate the transition (e.g., Bjurklo et al., 2009; Paiola et al., 2012). Also, the financial impact of servitization has been studied (Fang et al., 2008; Eggert et al., 2011). The level of detail in these studies varies greatly: Sometimes the focus is on enabling factors, and the gradual development of transition is not investigated (e.g., Ulaga and Reinartz, 2011), whereas in some studies the focus is on modeling trajectories (Salonen, 2011).

Only five of the empirical studies in the sample (the ones furthest down in the Table 3) demonstrated other types of views on transitions of the offering than forward unidirectional. Fang et al. (2008) identified circumstances where servitization negatively affects company value: when critical mass of service sales is not reached, services are not related to manufacturer’s core business, and available service resources are very few. Davies (2003) acknowledged backward transition, as in the case of service firms moving upstream toward solution integration. However, this did not cover manufacturers. Matthyssens and Vandenbempt (2010) described a case in which one of the five case manufacturers withdrew its servitization strategy. The focus of the study was still on forward transition, and this identified step backward was not exploited to build any theory; the article reported the company as repositioning for a new servitization attempt. This dissertation argues that Matthyssens and Vandenbempt (2010) actually reported a case of reversed servitization, as the company moved forward and backward on the continuum.

Kowalkowski et al. (2012) and Turunen (2011) take a more conscious approach against purely unidirectional view. Kowalkowski et al. (2012) argue that while the transition appears unidirectional in the long-term at the aggregate level of analysis, their case study reveals incremental, agile and less straightforward micro-level processes in implementing the servitization. They report two small backward steps in the implemented service strategies. This dissertation considers these steps as interruptions at the macro-level forward transition; after the incremental drawbacks the company continued moving toward increasing service dominance. Turunen (2011) argues that the servitization process can be versatile, driven by increasing user-orientation. Her empirical case describes a manufacturer starting the process through a merger with a knowledge-intensive business service provider. Thereby, the manufacturer introduces more advanced services to its offerings before offering product-related services. However, the direction of the transition is toward services in Turunen's (2011) case. To summarise, the literature's view on the transition is limited, and the possibility of servitized manufacturer's continued transition away from services, i.e., reversed servitization, is not explicitly addressed.

### **2.2.2 Supplier and integrator companies in solution provision**

Whereas in the previous subsection the focus was on analysing the contents of organisational responses (i.e., companies' offerings), here the focus is on response implementation: the actions of companies regarding solution provision. Especially the interdependencies between different parties are emphasised, because this is characteristic of solution provision networks that require customer input to the production process. Further, the interdependencies between parties link directly to relational power in the network and different kinds of resources the actors possess, which are also discussed here.

Servitizing manufacturing companies can take the role of solution integrators in the network when they start concentrating on solving customer problems with customised solutions (Davies and Brady, 2000; Davies et al., 2006; Davies et al., 2007; Brax and Jonsson, 2009). On the other hand, some manufacturers become suppliers of solution integrators. Solution integration can mean, for example, integrating various types of machinery, power appliances, software, and services to be able to offer the customer what is required to install, operate and maintain a whole production line, instead of delivering products and services in separate transactions. The shift toward service operations requires manufacturers

operating as integrators to focus on their networking and relationship capabilities (Brax, 2005; Prakash, 2011). This requirement applies particularly to manufacturers of investment goods, because offering services for goods with longer life cycles necessitates closer partnerships with customers and emphasises openness, trust and long-term commitment (Johnsen et al., 2009). Such integrators have to rely on a number of suppliers of technologies, subassemblies and services, which makes solution business highly networked by nature (Davies, 2003; Brady et al., 2005b; Davies et al., 2006; Tuli et al., 2007). However, in these analyses most solution provision and servitization studies have focused on the integrator and the service provision targeted toward its customers. Because of the dyadic integrator-customer focus of the literature, the importance of the supplier's involvement in service delivery has remained under-explored.

Providers of integrated solutions may also utilise suppliers in service provision to support the subsystem. For example, Brax and Jonsson (2009) described the reliance of a solution integrator on its software supplier in improving the efficiency of its industrial service operations. To improve the overall efficiency of the company's service operations, their case company was dependent on a software supplier that further developed a software platform and increased the automation of laborious tasks. Davies et al. (2007) found that complex investment goods manufacturers transitioning into solution integration have to acquire new relationship capabilities and skills for managing the networks of suppliers. Accordingly, solution integrators carry the total responsibility of the projects delivered and focus on improving their partnering competence, while relying more heavily on networks of specialised service suppliers to deliver components of the total system (Davies, 2004).

Suppliers of subsystems also need to develop new relationship-oriented skills (Galbraith, 2002) in order to operate effectively in solution networks controlled by integrators and other intermediaries. The task is challenging and requires an understanding of the processes of not only different solution integrators but also of end users. The level of trust between supplier and integrator also affects the type of skills required because solution integrators operate and maintain the systems delivered and coordinate the supply of services from suppliers (Davies et al., 2006; Johnsen et al., 2009). Based on market requirements and customer needs, key suppliers of services or products need to develop the capability of supporting the integrator effectively and operating at different levels of cooperation with the integrators and end users. The relationship between

the subsystem supplier and end users is central to the supplier's abilities to provide services (Sampson, 2000; Sampson and Froehle, 2006).

The power relationships among different actors are central to their operations in solution provision networks. According to an evolutionary-ecological perspective, competition between companies is essentially competition over scarce resources (e.g., Pfeffer and Salancik, 1978; Hannan and Freeman, 1989; Barney, 1991). In solution business, a single company rarely possesses all the resources and capabilities required for offering a complete solution. In addition, companies specialise to build on their core competencies and to increase their efficiency—for example, in delivering a certain subassembly (Jarillo, 1988) or knowledge-intensive component (Brax and Jonsson, 2009). Therefore, companies need to rely on shared resources and capabilities. Because the companies without access to a key resource are dependent on the parties controlling the access, the latter have a power advantage compared to the former (Pfeffer and Salancik, 1978).

Due to the numerous and crucial relationships in solution networks, current solution provision literature generally considers the position closest to the end customers—the integrator—to have the most strategic power because it has access to the customer's purchasing power and information of customer processes (e.g., Davies et al., 2000; Brax and Jonsson, 2009). Those resources are seen as necessities for success. Therefore, by striving for close collaboration with customers and thereby acquiring detailed information of their needs, solutions integrators can try to achieve power, especially toward their suppliers having less possibilities of getting the access to such information (Cox, 2001b; Ala-Risku, 2009). The integrators can reach possibly an even more powerful position if they manage to create a situation where the access to end customers is critical and where they have tight control over these relationships, which is often the case with providers of complex solutions (Davies and Brady, 2000; Brady et al., 2005a; Tuli et al., 2007; Brax and Jonsson, 2009). This necessitates developing project management skills and relationship capabilities to carry full responsibility of the solution and to manage the dependencies both downstream and upstream (Davies, 2003; Davies et al., 2007; Håkansson et al., 2009).

However, the literature also acknowledges that the suppliers can improve their power by investing in developing their own valuable organisational power sources. These include, among others, product and/or process technology, accumulated experience on the required maintenance actions and product brand (Pfeffer and Salancik, 1978; Thorelli 1986; Cox, 2001a&b). Suppliers of key technologies for solutions can aim to achieve an advantageous position in relation to integrators (Pfeffer and Salancik, 1978;

Thorelli, 1986; Chang et al., 2012) by developing their technology's value provided to integrators and customers, as well as its substitutability compared to technologies from competing suppliers.

Although the servitization and solution provision literatures present moving to solution provision as a suitable way to achieve competitive advantage, it also acknowledges that this type of operations imply major challenges. Neely's (2008) findings suggest that larger firms find it especially difficult to achieve the financial benefits of transitioning to solutions (see also Gebauer and Friedli, 2005). Gebauer et al. (2005) refer to the phenomenon of increased service offerings and higher costs without higher returns as the 'service paradox in manufacturing companies'. On the other hand, Eggert et al. (2011) studied the effect of service provision on companies with different levels of product innovation activity. They found mixed results regarding the effect of increasing service provision on profitability. Flaws in managerial actions and strategic decision-making are thought to produce challenges of realising the financial benefits of solution provision (Gebauer et al., 2005). Some indication exists that the extent of service provision would need to overcome a breakeven point to generate profitable service business (see Kohtamäki et al., 2013b; Visnjic and van Looy, 2013) and that network capabilities and social capital could contribute to the predictability (Kohtamäki et al., 2013a&b). However, more research is needed in order to gain a thorough understanding of how the context affects servitization and operations in solution provision networks (Brax and Jonsson, 2009).

### **2.3 Contexts: Operational environment and network position**

The companies' context is divided here into two parts, as were the responses. Namely, the industry perspective concerns finding the environmental variables affecting servitization. Here the analysis is aimed at providing an overall view, while the network perspective focuses on the responses individual companies take to different contexts. Next the literature will be reviewed on these two perspectives on the context, starting with industry. In addition, the chosen theoretical lenses of organisational ecology (industry perspective) and service triads (network perspective) will be discussed.

### **2.3.1 Operational environment as the context of servitization**

Studies on the alignment of manufacturers' service strategies with different environments have been infrequent, and few researchers have considered the business environment as a factor that impacts strategy selection. Here the contexts are focused as affecting the offerings of manufacturers. As forerunners, Gebauer and his colleagues studied the service strategy–environment fit (Gebauer and Fleisch, 2007; Gebauer, 2008) and the fit between the identified strategies and organisational design (Gebauer et al., 2010a). Recently, Gebauer et al. (2010b) explored the linkages between service strategies and combinations of value chain position and business environment. Pawar et al. (2009) developed an operations strategy framework for delivering product-service systems in which the operational environment affects the servitized manufacturer by modifying customer requirements. In addition, Neu and Brown (2005) explored the factors that enable manufacturers' successful service provision, and explored how manufacturers align their strategies in complex markets.

Because the aim here is to identify environmental variables affecting the servitization of all manufacturers operating in the same environment, there is a need to abandon the focal-company point of view and to analyse the phenomenon at the industry-level and in specific environments. This dissertation agrees with McKelvey and Aldrich's (1983) notion that explanations of behaviour on an individual-organisation level can be decoupled from those on a population level. Therefore, both network and industry perspectives are applied in the analyses of this dissertation. In the industry perspective, the focus is environmental influences on servitization of an industry, a topic that has not yet received enough attention. The purpose is not to claim that transformation is only a result of environmental demands, but that strategic and managerial decision-making has a strong impact on the process, which is especially prevalent at the individual company-level. On the other hand, this dissertation argues that servitization at the industry-level is driven by a selection-and-replacement process induced by the operational environment.

Three different streams of organisational theories were considered as potential sources for the analyses of the operational environment. First, some behavioural theories, such as contingency theory, claim that a course of action in an organisation is dependent upon the internal as well as external situation of the company (Burns and Stalker, 1961; Drazin and Van de Ven, 1985; Gresov, 1989; Donaldson, 2001). The unit of analysis in behavioural theories is usually a single organisation; however, the intention

in the analysis of operational environment is to grasp the reasons behind servitization at the industry-level. Second, institutional theory emphasises the deeper and more resilient aspects of social structure and seeks to find cognitive and cultural explanations for organisational phenomena (DiMaggio and Powell, 1983). Organisational legitimacy is seen as being earned through isomorphism, which constitutes structural and procedural dimensions (Meyer and Rowan, 1977; DiMaggio and Powell, 1983). Third, ecological studies usually have a large-scale longitudinal focus, which this dissertation considers to be very dominant in the servitization phenomenon taking place across industries and countries over longer time periods (Schmenner, 2009). Another strength of organisational ecology (Hannan and Freeman, 1984, 1989) in relation to the analysis is the combinative approach that takes into account both the institutional factors and the ecological view—that is, competition. Therefore, organisational ecology was considered to best serve the purpose.

Organisational ecology (Hannan and Freeman, 1989) is a theory that builds general ecological and evolutionary models of change in populations of organisations. The goal of this standpoint is to understand the forces that shape the strategies and structures of organisations over long time periods. The work of Hannan and Freeman (1984, 1989) builds on the notion that organisations do not seem to have unitary, stable preference structures or simple mechanisms in terms of changing conditions. The so-called focal-organisation view does not take into consideration that the success or failure of any tactic or strategy for dealing with an environmental problem presumably depends on the tactics and strategies adopted by other similar organisations in the system (Hannan and Freeman, 1989). As servitization has been gaining popularity in a variety of industries in different geographical areas (Neely, 2008; Szász and Demeter, 2011), a consideration of populations may be useful.

The ecology of organisations relates to an understanding of how social conditions affect the rates at which new organisations and new organisational forms arise, the rates at which organisations change forms, and the rates at which organisations and forms fade out (Hannan and Freeman, 1989). Organisational ecology looks at the social, economic and political systems in which organisations perform, and at the dynamics within and across organisational populations (Hannan and Freeman, 1989). The societal impact on the ecology of organisations determines the capacity of a society to respond to uncertain future changes (Hannan and Freeman, 1989). Recognising the different organisational forms that firms can pursue is especially relevant in an uncertain environment. It is noteworthy that although the theory states that most fit organisational forms will be selected

due to environmental pressures, individual organisations might choose very different paths from others (McKelvey and Aldrich, 1983).

To summarise, the selection toward organisational ecology theory was based on three criteria. First, the aim was to identify the reasons for different ways of servitizing, which necessitated abandoning the focal-company point of view and moving toward analysis of a group of organisations. Second, the purpose was to study how the operational environment impacts servitization attempts. Third, there was considered a need for a theory that would consider large-scale changes taking place over longer periods of time. For clarification of how organisational ecology relates to servitization in the analysis, the key concepts of organisational ecology, servitization and their relationships to each other are presented in Tables 4 and 5 below. The tables are tightly linked, and they should help readers with different backgrounds to understand the cross-disciplinary argumentation.

Table 4. Key concepts used in servitization literature related to organisational ecology.

<b>Term used</b>	<b>Explanation</b>	<b>Meaning in analysis combining organisational ecology and servitization</b>
Servitization	The process of adding services into goods-based offerings (Oliva and Kallenberg, 2003).	Changing organisational form: non-servitized → servitized.
Servitized offering	The offering consisting of both goods and goods-related services (Baines et al., 2009b).	A dimension of the specific organisational form defining the focal population.
Servitized manufacturer	Manufacturer with a servitized offering and the following characteristics: 1) Offers services that are clearly defined as service concepts; i.e., they can be purchased separately, like goods. 2) Earns returns on services; i.e., service business is liable for part of the total returns. 3) Has allocated human resources for service development and delivery.	An organisation having the servitized organisational form (as defined to the left).
Servitized population	The group of servitized manufacturers operating in a specific industry in a given geographical area, having servitized offerings and the above-defined three characteristics.	The focal population, consisting of organisations that all have a similar type of organisational form.
Service company	Company whose offering consists only of services, without goods (Fließ and Kleinaltenkamp, 2004).	A member of the rival population.
End-user's service operations	End-user's sub-organisation carrying out maintenance of the end-user's equipment (Oliva and Kallenberg, 2003).	A member of another rival population.

Table 5. Key concepts used in organisational ecology literature related to servitization.

<b>Term used</b>	<b>Explanation</b>	<b>Meaning in analysis combining organisational ecology and servitization</b>
Organisational form	Organisation's configuration committing it to a specific environmental dependence. Dimensions of organisational form: its stated goals, forms of authority, core technology and marketing strategy (Hannan and Freeman, 1984).	Defines whether a manufacturer is servitized or not (see explanation for servitized manufacturer in Table 4).
Organisational population	Group of organisations with the same organisational form (Hannan and Freeman, 1989).	Servitized manufacturers operating in an industry of a country as the focal population.
Entry rate	Speed of organisations joining the population (Carroll and Hannan, 2004).	The factor measuring the flow of organisations into the servitized population.
Exit rate	Speed of organisations leaving the population (Carroll and Hannan, 2004).	The factor measuring the flow of organisations out of the servitized population.
Population density	The number of organisations in a population. Indicates the intensity of competition within the population (Hannan and Carroll, 1992.)	The number of companies within the servitized population.
Resources	Used as inputs of an organisation's activities to generate outputs. Resources include capital, commitment of potential members of organisations, entrepreneurial skills, technological knowledge, legitimacy and consumer wealth (Stinchcombe, 1965).	Resources of servitized manufacturers include commitment of organisation members to service business (Gebauer and Friedli, 2005), technological knowledge and machinery for maintenance and repair of equipment (Lightfoot et al., 2011), skilled personnel for these functions, installed base information and legitimacy of the manufacturer's service operations.

Institutional linkages	Direct ties that organisations have to the resources and legitimacy conferring institutions of their environment. (Baum and Oliver, 1991).	Relevant linkages for servitized manufacturers include those with industry associations, the educational system, labour unions and the financing system.
Technology	Tools, devices, techniques and knowledge used by the organisation, in addition to inputs, in order to generate outputs (Rosenberg, 1972).	Key technologies for servitized manufacturers include maintenance management systems and condition monitoring systems.
Political forces	The actors that have the power to directly influence legislation (Carroll and Hannan, 2004).	Political institutions and actors that have the power to influence a manufacturer's service business through legislation: for instance, safety regulations.

### 2.3.2 Network position as the context of solution provision

A manufacturer's position in the network affects, to a great extent, its actions regarding solution provision, access to critical resources and its dependencies on other actors. Here these aspects are focused by viewing network position as the context of solution provision. Accordingly, the aim here is to cross-fertilise between theoretical literature on social networks and service triads in particular and phenomenon-centric literature on solution provision.

The current literature considers the transformation toward solution provision influencing industry networks (Davies, 2004; Holmström et al., 2010; Laine, et al. 2010) and how end users, intermediaries and suppliers participate in service delivery. Some authors even interpret the meaning of the transformation as the manufacturer's change of focus from distributors and integrators to end users (Vandermerwe and Rada, 1988; Wise and Baumgartner, 1999; Schmenner, 2009). In studying manufacturers' downstream transition toward customers, Davies (2003) recognised that some service firms in these integrator positions are moving upstream toward the product supply. It is evident that to analyse how solution provision and actor networks interact, there is a need to apply a network theoretical perspective.

Social network analysis is used to theorise how different processes interact with network structures to yield certain outcomes and also on how

different network structures emerge. The term 'network theory' refers to the former, while the latter is associated with the term 'theory of networks' (Borgatti and Halgin, 2011). This dissertation considers network theory by studying how implementation of organisational responses is affected by company's position in the network. Here the network analysis considers the actors, the bonds between them, and especially how these affect the power structures between the actors. Namely, social position in the network is thought to provide power by bridging other actors to each other (Granovetter, 1973; Burt, 1992) and by giving the focal company access to critical resources (Gulati et al, 2000; Borgatti and Forster, 2003). For example, the position that acts as the only connection between two actors or groups of factors that have a structural hole between them will give the bridging party significant power, as it acts as a broker (Burt, 1980, 2000).

Solution networks differ from manufacturing supply chains in that they are more challenging and complex to manage (see Parasuraman et al., 1985) and the structure is different. Namely, in industrial service delivery, complexity is introduced by bidirectional operations (Sampson and Froehle, 2006) in which the customer is a supplier of the asset to be maintained as well as the supplier of information on the use and performance of the asset. Furthermore, in field services, the customer provides the premises where part of the service operation is performed. Therefore, the supplier also establishes a relationship with the end user in industrial service provision, transforming the supply chain into a triad in which all three actors are directly connected to each other (Choi and Wu, 2009a; Li and Choi, 2009).

Analysis of service triads is an important part of social network analysis, and the according theoretical perspectives are applied here. The literature on service triads focuses on analysing the building blocks of organisational networks, which contain three actors with the possibility of direct relationships between each. The actors can be an integrator, a customer and a supplier of the integrator (Li and Choi, 2009; Rossetti and Choi, 2005, 2008); in this scenario, the triad spans three levels of the network. Two-level network alternatives include two suppliers and an integrator (Choi and Wu, 2009a; Wu and Choi, 2005), a supplier and two integrators (Choi and Kim, 2008), two integrators and a customer, or an integrator and two customers. In analysing the effects of network position this dissertation focuses on supplier-integrator-customer triads.

Because solution integrators source from both goods and services suppliers, it is essential to distinguish these two types of situations in relation to the relationships within a triad. Namely, industrial services require significant input from the customer (Sampson, 2000; Sampson and

Froehle, 2006) in regards to the production process, which implies that a service supplier needs to have a direct relationship with the customer in the triad to be able to deliver its part of the whole system. Conversely, a goods supplier can deliver its product to the solution integrator and have no direct relationship with the customer in the triad, except from an indirect one through the integrator. This kind of a situation would mean that the triad has a structural hole between the supplier and customer, and the integrator acts as a bridge between these two (Burt, 1992; Li and Choi, 2009). The structural hole then gives negotiation power to the integrator (Burt, 1980, 2000), especially toward the goods supplier, as it is usually more dependent on the customer than vice versa.

The relationships among the actors in the triad affect each one; accordingly, the solution network should be regarded as a system (Gotzamani et al., 2010; Aronsson et al., 2011; Lockett et al., 2011) whose efficiency is determined by a number of factors. Each company may use their position in the triad to affect the other actors and form cooperation arrangement with others (Bastl et al., 2013). The efficiency of the whole network then depends on how well the network design is aligned with the structure and characteristics of the product, such as criticality and reliability (Cohen et al., 2006), and also on how well the incentives of different actors are aligned (Lockett et al., 2011). However, manufacturers need to take into account not only product considerations (Wang, 2002; Jiang and Hansen, 2003) in the design of the solution network. On the demand side, the customer, customer relationship and customer's operational capability also shape the requirements of the network structure (Collin et al., 2009; Giannakis, 2011).

The nature of the relationships between different actors in the solution provision network and the level of integration and trust among them are major determinants of the capability of the network to deliver services (Meijboom et al., 2011; Bhakoo and Chan, 2011). In product supply chains, a sequence of dyadic relationships among supply chain members is often sufficient. Solution networks are different in this respect and exhibit a greater number of interrelationships (Rossetti and Choi, 2008; Gotzamani et al., 2010). Accordingly, service triad research has focused on the nature of the relationships among different network actors. However, there is a dearth of research analysing the link between network position and companies' actions regarding solution provision in networks.

## 2.4 Summary of the literature review

This subsection summarises the main findings from the literature review of this dissertation (see also Table 6 below). First, servitization and solution provision discussions seem to be in the phase where first steps are emerging, which will take the research from praising these phenomena as best practices in recognising the role of different contexts in influencing these phenomena. Recent works such as those from Neu and Brown (2005), Windahl and Lakemond (2006), Pawar et al. (2009), Gebauer et al. (2010b), and Ceci and Masini (2011) have striven to explain various industrial service related matters through the effects of a particular context. This dissertation now attempts to take servitization and solution provision research to the phase where the contextuality of these phenomena is systematically studied from a number of perspectives, including appropriate theoretical lenses. This analysis hopefully can lay the groundwork for researchers to explain the reasons behind the identified difficulties of realising the potential benefits of a servitization strategy (Gebauer et al., 2005; Fang et al. 2008; Ceci and Masini, 2011; Eggert et al., 2011; Visnjic and van Looy, 2013).

Table 6. Literature perspectives summarised.

	<b>Servitization / solution provision literatures</b>	<b>Theories for the analyses</b>
Industry context	Servitization literature has mostly applied a forward-unidirectional perspective to the transition process. Some forerunners (e.g., Gebauer and his colleagues, Neu and Brown, 2005; Pawar et al., 2009; Ceci and Masini, 2011) have studied strategy-environment fit, but alternative transition paths have remained underexplored.	Organisational ecology theory (Hannan and Freeman, 1984, 1989)

Network context	Both solution provision (e.g., Davies and Brady 2000; Brady et al., 2005b) and servitization studies (e.g., Oliva and Kallenberg, 2003; Baines et al., 2009a) have mostly explored integrator companies and emphasised the need to operate close to customers, while suppliers have received limited attention.	Social network theory: service triads (Burt, 1992, 2000; Wu and Choi, 2005; Choi and Wu, 2009a; Li and Choi, 2009)
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Second, based on a systematic literature review (see subsection 2.2.1) published servitization research is dominated by a perspective where manufacturers are seen to be carrying out a unidirectional transition toward increasing service provision. Published studies recognising also partly regressive transitions are extremely few: these are Davies (2003), Fang et al. (2008), Matthyssens and Vandenbempt (2010), Turunen (2011), and Kowalkowski et al. (2012). In addition, this dissertation found only two such conference papers: Voss and Zhao (2011) and Velikanov et al. (2012).

Velikanov et al. (2012) report a case study of a medical equipment manufacturer that transitions away from service emphasis toward product-focused operations by introducing a new product with improved functionalities and lesser service needs. Voss and Zhao (2011) present three scenarios of companies with alternative transition paths. First, they present a case of a Chinese software company that broadened the operations to cover retail and manufacturing. They also explain how the UK television industry was first dominated by a rental-based product-service system (PSS) model, which was later offset by pure products that were reliable enough to remove the need for a PSS (cf. Velikanov et al., 2012). Voss and Zhao (2011) also acknowledge competitive dynamics in shaping servitization by discussing the competition between elevator companies providing services and third-party service providers. These notions regarding the importance of product technology and competitive dynamics in affecting servitization are important, and they will be extended and deepened significantly in this dissertation by systematically analysing the interplay between servitization and industry-specific operational environments through the theoretical lens of organisational ecology (Hannan and Freeman, 1984, 1989).

Third, servitization (e.g., Wise and Baumgartner, 1999; Oliva and Kallenberg, 2003; Baines et al., 2009a) as well as solution provision (e.g.,

Davies and Brady 2000; Brady et al., 2005b; Brax and Jonsson, 2009) studies have had a clear emphasis on integrator companies without explicitly focusing on the operations of supplier companies in solution provision networks. However, the requirement of customer input to industrial service production (Sampson, 2000; Sampson and Froehle, 2006) would suggest that the network position would significantly affect solution provision operations taking place in networks. This aspect and especially the role of suppliers will be studied here through the theoretical lens of social network analysis and service triads (Wu and Choi, 2005; Choi and Wu, 2009a&b; Li and Choi, 2009) in particular.

### 3. Research design

Research designs imply the strategic choices that guide how research is carried out (Denzin and Lincoln, 2000): the choice of studied phenomena, method selection, data-gathering and analysis. Moreover, research designs manifest the standpoint taken to the philosophy of science, presented as world views including basic sets of beliefs considering the nature of reality, knowledge, values and the way knowledge can be acquired or created. Paradigms consist of ontology, epistemology, axiology and methodology (Denzin and Lincoln, 2000; Healy and Perry, 2000; Mingers, 2003). *Ontology* concerns the nature of reality and *epistemology* concerns the relationship between the researcher and the research object (Denzin and Lincoln, 2000; Healy and Perry, 2000). *Axiology* considers what is valued and what is good (Lincoln and Guba, 2000; Mingers, 2003), while *methodology* describes how the reality can be known and knowledge gained of it (Denzin and Lincoln, 2000).

Positivist and constructivist paradigms are usually represented as the two basic alternatives for a researcher (e.g., Gephardt, 2004). Positivism takes a naïve realism standpoint on ontology, assuming an objective reality exists out there; positivism also emphasises value-free objectivity of the researcher, and favors quantitative methods and hypothesis testing (Healy and Perry, 2000; Lincoln and Guba, 2000; Gephardt, 2004). In contrast, constructivist view assumes that there are multiple realities, the realities are co-created by the researcher and the object, and the researchers should use hermeneutical/dialectical methodologies (Denzin and Lincoln, 2000; Lincoln and Guba, 2000).

Critical realist paradigm (also terms realism, scientific realism and critical scientific realism have been used) is somewhere in between the two above mentioned paradigms. This dissertation research is based on a critical realist view (see McKelvey, 1999; Mingers, 2000; Bhaskar, 2008). Critical realism assumes that there is a reality that is apprehensible only imperfectly and probabilistically (Lincoln and Guba, 2000). The reality is independent of any one person and consists of abstract things borne of people's minds (Healy and Perry, 2000; Bhaskar, 2008). Critical realism

studies people's perceptions to gain understanding of the reality that exists beyond these perceptions (Healy and Perry, 2000). Accordingly, these perceptions offer only one view of the reality, and therefore triangulating by different means has a significant importance in critical realism. How triangulation was achieved in this research is presented in subsection 3.4. Next, the research methods will be presented, starting with overall research design.

### **3.1 Overall research design**

The chronological research process differs from the logical structure of the dissertation presented in this book. The empirical research was started in mid-2008 when the author of this dissertation was employed as a Master's Thesis worker in the research project Sourcing and Service Operations Concepts (SSOC). After that project the work continued in Sourcing and Service Operations Concepts II (SSOC II) and in Future Industrial Services (FutIS) research projects. All the work was carried out in BIT Research Centre (Business Innovation and Technology). The study for the Paper 4 was started first, in the summer 2008. Intertwined with the analysis and publication processes of that paper, the studies for the Papers 2 and 1 were produced, in that order. The latest is Paper 3, whose publication process is still ongoing at the moment of writing this compilation. However, the dissertation entity is presented in the rest of this book according to the logical structure shaped by the research questions and presented below in Figure 6. This is to ensure easier readability and following of the argumentation.

The logical starting point of this dissertation research was the notion that current literature views servitization as a unidirectional transition from manufacturers offering goods with warranty and spare parts to increasing service dominance and solution provision (see systematic literature review in subsection 2.2.1). This ignited the interest to explore the interplay between the context and servitization and solution provision (see Figure 6 for research process), for understanding the multiple paths related to servitization and the reasons behind them. The attention was directed toward the context in which servitizing companies operate. From this point, the research objective of this dissertation was derived.

The research design starts by exploring the effects of operational environment and goes on to review organisational ecology theory and servitization literatures. A conceptual model is presented in Paper 1 and its

predictions on the existence of alternative paths related to servitization are tested in Paper 2. The empirical case of Paper 2 shows not only that operational environment affects a manufacturer’s abilities to provide services, but that its network position also plays an important role. Therefore, the decision was made to explicitly address also the role of the network position and to review service triads and solution provision literatures. Paper 3 analyses six empirical cases and subsequently develops a model on how supplier and integrator companies differ in their focus of development actions regarding solution provision. In addition, the specific challenges of a supplier company to servitize are explored in Paper 4, which develops a field tested model on how that could be solved in practice.

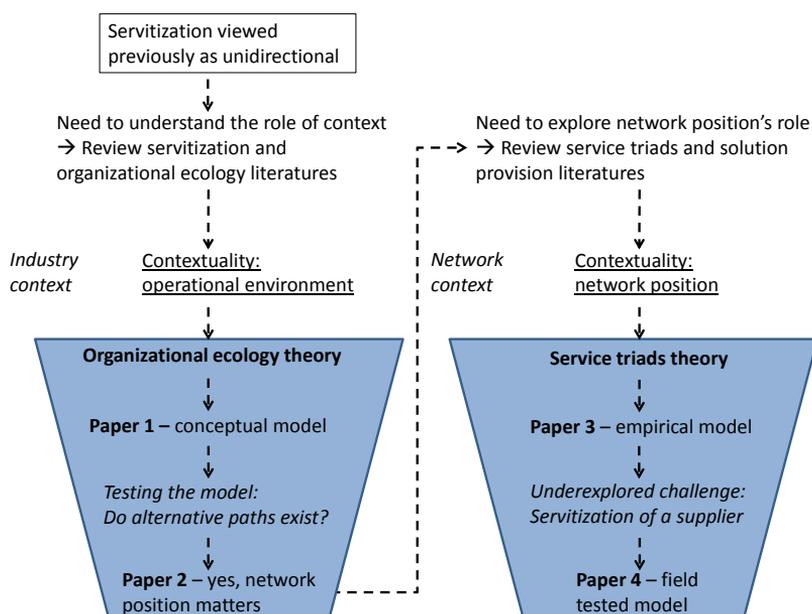


Figure 6. Research design logic in steps and with questions directing the path.

The analysis of the contextual effects of operational environment studied response contents (manufacturers’ offerings in relation to servitization) to reach an overall understanding of the contextuality. At this point it was essential to find the right theoretical lenses that would provide the most explanation power for the analyses. For the operational environment, several different theoretical lenses were considered (see Paper 1 for detailed discussion on this choice), including contingency and institutional theories, of which organisational ecology theory was evaluated to be the most suitable. A detailed conceptual analysis was carried out in Paper 1, on an

industry-level. This theoretical lens was also used in the analysis of the two company cases in Paper 2.

The need to explore network position's effects came from the findings in the empirical case in Paper 2; the relationship to customers was confirmed to be essential in industrial service provision and the nature of the relationship obviously depends on the network position. Here it was deemed necessary to study the responses of an individual company in reference to its network position, in order to reach deeper insights into any single company operating in solution provision networks. This was needed to understand individual company's actions in response to the demands from context. First, an analysis was carried out to understand the link between the network position and the companies' focus of development actions in solution provision network. To reach this, an empirical analysis was carried out focusing on supplier and integrator companies in six embedded solution provision networks in Paper 3. In addition, the intention was to explore how supplier companies can servitize, which has received surprisingly little attention in the literature. This was studied empirically in Paper 4.

### **3.2 Research method choice: case study research**

The research methods were chosen based on the nature of the research questions that are rather exploratory. In addition, the scarcity of theories and of previous studies on the interplay between the operational context and servitization and solution provision directed the method choice toward qualitative methods. For 'what' and 'how', case study is suggested as the applicable method enabling observing the phenomenon of interest in its natural context (Eisenhardt, 1989; Meredith, 1998; Voss et al., 2002; Yin, 2003), which is also applicable to a critical realist study. Further, case study research was selected as the primary method as it fosters understanding the interaction between a phenomenon and its context (Dubois and Gadde, 2002; Yin, 2003). In addition, it supports exploration of new phenomena and building of new theory (Eisenhardt, 1989; Yin, 2003). Accordingly, the decision was to carry out case studies supported by conceptual analysis based on the literature. The data gathered from each company is mainly based on semi-structured interviews with key informants from service development, service sales, product development, production and customer interface. The interviewees were selected as individuals with best insights to the companies' activities regarding the research interests. Other supporting

data sources enabling triangulation of the findings (Eisenhardt, 1989) are company presentations, marketing material, data from IT-systems, workshop memos, a book considering one case company and its key product, and participant observations. The applied research methods are summarised below in Table 7.

Table 7. The applied research methods, research questions and division to Papers.

Knowledge gap	Research question	The focus of analysis and method	Data	Paper
The effects of operational environment on servitization	RQ1: <i>What contextual variables in industry-specific operational environment affect the servitization of manufacturers?</i>	<i>Industry context</i> –Conceptual analysis	Literature, publicly available documents	Paper 1
	RQ2: <i>Are there alternative transition paths related to servitization than those identified in previous research?</i>	<i>Industry context</i> — A single original empirical case supported by a literature case	25 interviews, a book and a CD-ROM on the developments of the company and its key product	Paper 2

The effects of network position on actions regarding solution provision	RQ3: <i>How do manufacturers' development actions regarding solution provision depend on their network position?</i>	<i>Response implementation</i> – Comparative case study	102 interviews, archival and IT-system data	Paper 3
	RQ4: <i>How can a manufacturer servitize when operating as a supplier of integrators?</i>	<i>Response implementation</i> — Single-case study	24 interviews, memos from 8 months spent on-site, IT-system and archival data	Paper 4

Because of the lack of previous studies directly related to the topic of Paper 1, the conceptual analysis was carried out by cross fertilising two separate literature streams: one on servitization phenomenon and another on organisational ecology theory. Paper 1 is purely conceptual and based on existing literature; it focuses on the effects of the operational environment on servitization by viewing this on an industry-level. Paper 2 followed the abductive case study approach (Dubois and Gadde, 2002), with the aim of generating new concepts and elaborating on existing models of servitization as opposed to confirming existing theories. In this approach, theory, empirical data and case analysis are continuously matched to create insights coherent with both theory and empirical observations. In practice, this has meant repeated iterations between literature, data collection and analysis. Paper 2 applied single-case design (Yin, 2003) with 25 interviews and a supporting company case analysed based on secondary data sources. The focus here was on the development paths of the companies' offerings. The two companies were selected as potential representatives of organisations undergoing a reversed path in servitization to study these paths more closely and to identify reasons behind.

Paper 3 adopted an inductive case study approach (Eisenhardt, 1989; Eisenhardt and Graebner, 2007) with the focus on development actions of individual companies regarding solution provision, as the aim was to

contribute to the theoretical knowledge on a topic that required deep understanding (Wacker, 1998; Eisenhardt and Graebner, 2007). The case study design offered best fit to investigate a subject that still requires explorative research setting (Eisenhardt, 1989; Yin, 2003). The logic was that a case study design would enable observing the phenomenon in its natural context to reach a more thorough understanding of it (Meredith, 1998). In addition, Eisenhardt's (1989) advice to aim for a larger amount of cases to improve transferability of the results was applied, especially to strengthen the base for theory building (see also Yin, 2003; Ozcan and Eisenhardt, 2009), which in Paper 3 also served the essential goal of gathering enough data from different types of companies. Paper 3 is a comparative analysis of six embedded solution provision networks with a total of 102 interviews (Eisenhardt, 1989). The cases were selected as expressing focal companies in different positions in the solution provision network and with different strategies and offerings. The purpose was to start the analysis on network perspective by explicitly researching three supplier and three integrators in solution provision networks.

Paper 4 was carried out based on single-case design with 24 interviewees (Dubois and Gadde, 2002; Voss et al., 2002; Yin, 2003), using a design science approach (van Aken, 2004; Holmström et al., 2009). The case company was selected because it demonstrated difficulties in shifting toward solution provision, which was related to its position in the network. This circumstance was ideal regarding the fourth research question. The idea was to focus on the operations to study how the transformation could be carried out in a specifically challenging situation, namely in supplier positions. This allowed further zooming in to the level of individual companies. The data in each of the empirical Papers is analysed in an iterative manner, continuously comparing theory, empirical data and case analysis to generate new concepts and to elaborate on existing ones (Yin, 2003).

### **3.3 Sampling, data collection and analysis**

The three research projects SSOC, SSOC II and FutIS (see subsection 3.1) provided me with deep access to several different manufacturing companies with strong experience and strategic emphasis on industrial service provision. From these, the case company was selected for Papers 2 and 4. For Paper 3, companies outside these research projects were also sought after to find the best theoretical sample for the comparative case analysis.

The sampling always used two primary criteria: the companies had to be operating in solution provision networks and known for their well-established and high-functioning service operations. The latter criterion was introduced because the applied selection approach to contingency theory does not explicitly consider performance effects of the fit between organisational responses and context, but essentially assumes that the companies studied are performing well based on the fact that they have survived an evolutionary selection process. Also, this phenomenon applies to all of the case companies who had been working in their industries for decades. The aim was that a sample would enable studying the interplay between context and responses among high-performing companies (Drazin and van de Ven, 1985; Venkatram, 1989). The sampling for Paper 2 was relatively straightforward. Two companies were identified that satisfied the primary sampling criteria and that, based on initial analysis, would experience contrary servitization paths, which were the focus in Paper 2. Paper 4 aims to carry out an in-depth analysis of a company in the supplier position, one that had severe challenges in transforming toward solution provision while remaining an industry benchmark of successful service provision in integrator position.

Paper 3 applies a theoretical sampling method (Eisenhardt, 1989; Miles and Huberman, 1984) as a means to include a wider spectrum of companies and to increase understanding of different kinds of context variables. The focus is selecting companies that would represent theoretical extremes: i.e., companies operating in different positions in the network. In addition, Paper 3 searches companies operating in different industrial sectors within solution provision to reach a rich understanding of the contextual variables under analysis. For each company, a solution provision network was selected, in which the company participated and which played a critical role in determining the success of its solution provision. Because one of the five case companies was identified as involved in two networks, the final analysis covered six embedded cases, with three analysed cases comprising suppliers and three comprising integrators.

The data collection in all of the empirical papers was carried out mainly by semi-structured interviews. In addition, interviews were carried out with the company's supplier and/or customer to incorporate the views of business partners, who can observe the companies externally but still provide thorough insights to the context. The analysis also used supplemental secondary data from archives, internal documents, marketing material, IT-systems, a book, a CD-ROM and annual reports. This data collected from different sources allowed triangulation (Diefenbach, 2009)

and cross-checking of the findings (see more on triangulation in subsection 3.4).

The interviewees were chosen according to their position in the given organisation so that data could be gathered from informants with the most thorough insights to the studied phenomena (Wacker, 1998). The aim was to interview personnel with different viewpoints on the studied phenomena. In practice, a primary contact was first identified from each company, typically a division CEO or sales/development director. This person was asked to provide contact information of the intended informants within the company. All interviews were recorded and transcribed when a permission for recording was received from the interviewee. Interview outlines based on the notes were written during the same day, and the outlines were sent to interviewees to confirm their agreement with the contents of the interview. The transcripts and interview outlines were analysed according to the process summarised below.

The data analysis was based on interview themes, and quotes were selected from transcripts to the data file and grouped according to themes. During the within-case analysis, themes were added if something appeared different than the interview theme structure. Throughout the analysis, an approach was used wherein different qualitative data sources were combined (Yin, 2003). Data collection for each case continued until no new themes emerged, which marked theoretical saturation (Eisenhardt, 1989).

The analysis and interpretation of the data proceeded as recommended by Miles and Huberman (1984). First, a within-case analysis of each case was conducted by 'drawing and verifying conclusions about a single site' (Miles and Huberman, 1984, p. 79). Hence, each case was first investigated independently in order to distinguish the company-specific findings. As the research design for Papers 2 and 4 was single-case, the analysis covered only this phase.

Second, Paper 3 established a cross-case analysis where the findings of each embedded case were interpreted in conjunction with each other. This cross-case analysis was useful in increasing the transferability of the findings and identifying patterns. As expressed by Miles and Huberman (1984, p. 151), a cross-case analysis is useful in seeing 'how such processes are bent by specific local contextual variations'. Detailed discussions on the methods used in each Paper can be found from the original Papers in Appendices I–IV.

### 3.4 Triangulation

Triangulation can be used to improve the validity and reliability of the findings in case research (Eisenhardt, 1989; Voss et al., 2002; Yin, 2003). As mentioned earlier, triangulation is especially important in research that applies a critical realist view in order to acquire multiple viewpoints to the reality, of which each describes only one subjective view. In addition to improving validity, triangulation can be used to enrich data analysis and thereby reach a fuller understanding of the phenomena under study (Denzin, 1989; Flick, 1992; Meredith, 1998; Healy and Perry, 2000; Dubois and Gadde, 2002); this applies especially well to studies applying a critical realist view.

Denzin (1989) identifies four types of triangulation: data, methodological, investigator, and theory triangulation. Data triangulation means using different data sources: interviewees with different backgrounds and responsibilities, observations, archival material and so on (Denzin, 1989). Using multiple methods or, for example, different scales in a questionnaire for studying the phenomena can also improve the reliability and richness of findings (Flick, 1992; Denzin and Lincoln, 2000; Mingers, 2003). Investigator triangulation means controlling investigator bias by using multiple researchers in interviews and data analysis (Denzin, 1989; Flick, 1992). Theory triangulation refers to looking at the data from multiple theoretical views (Denzin, 1989).

In this dissertation research, all four types of triangulation were used. First, different data sources include academic literature, semi-structured interviews, observations, archival material, book about the historical developments related to a case company and the attached CD-ROM, as well as data from IT-systems. In all of the original Papers, the interviews were the main data sources, except in the conceptual Paper 1. Other data sources contributed significantly to enriching the total picture of the phenomena, and enabled the verification of insights gained from the interviews. Second, multiple methods were used on the level of the whole dissertation, and of these methods each offered an important viewpoint to the interplay between the context and companies' responses. As mentioned, Paper 2 applies an abductive single-case design supported by a literature case, Paper 4 applies a single-case design with action-oriented design science approach, Paper 3 applies a comparative multi-case design, and Paper 1 was based on literature.

Third, investigator triangulation was used in each of the original Papers that involved at least two researchers. Paper 1 was a joint effort between a

colleague and myself from the beginning until end, while Paper 3 involved three researchers throughout the process. In Paper 2, all together four investigators were involved in the study, of which one was involved only in the earlier phases; therefore, there are three co-authors in the published version of Paper 2. Paper 4 emerged from a similar situation: namely, three investigators were originally involved and two of them continued their involvement throughout the whole process. By including multiple investigators in all of the Papers, the aim was to minimise the possible subjectivity biases and to maximise the possibilities for acquiring as rich and as detailed a picture of the research objects as possible.

Fourth, different theoretical approaches were searched for and evaluated as possible theoretical lenses, the understanding of which was drawn from analysis of the applicable academic literature. This analysis occurred through the iterative process of data collection and analysis, which continued until the last phases of the analysis. In addition, different investigators originally possessed varied views on the theoretical lenses, which were used in the research, and a common ground was then negotiated before the final phase of data analysis. Multiple theoretical lenses are still present in the final version of the dissertation, which makes use of contingency theory as its main theoretical view and organisational ecology and service triads theories as the theoretical lenses for the two subtopics of the environmental and network position's influences.

## **4. Findings and contributions of the original Papers**

This section summarises key findings and contributions of the four original Papers. It is structured according to the research questions, which allows for a progression from a higher-level perspective to more detailed views. The findings related to the first research question on the effects of the organisational environment on servitization are presented in subsection 4.1.1. The second research question, regarding the existence of alternative transition paths, is answered in subsection 4.1.2. The findings related to the third research question—on development actions regarding solution provision in different network position contexts—are summarised in subsection 4.2.1. The fourth research question—on servitizing in supplier position—is answered in subsection 4.2.2.

### **4.1 Industry context affecting servitization**

As discussed, the findings on the effects of the industry-level operational environment are presented here. First, the developed conceptual model is presented, followed by a discussion of the found paths related to servitization, which contradict the prevailing current literature perspectives.

#### **4.1.1 The effects of operational environment**

The first research question on the effects of operational environment on servitization was analysed in Paper 1. The detailed findings are presented in appendix 1, and the key findings are reviewed in this section. Paper 1 set out to carry a conceptual analysis on the environmental variables using organisational ecology (Hannan and Freeman, 1984, 1989) as a theoretical

lens. The research was motivated by the notion that the servitization literature lacks a clear analysis of how specific operational environments affect the transition of manufacturers from product sales toward service provision. Previously, the benefits, challenges, and risks of servitization were analysed through the focal-company point of view and discussed from the viewpoint of managerial decision-making (Wise and Baumgartner, 1999; Oliva and Kallenberg, 2003; Baines et al., 2009c), often without complete recognition of the differences between manufacturers operating in various environments. Such an approach has led to the impression that servitization would follow a rather linear and step-wise process of transformation. My disagreement with this notion brought about the need to explain why servitization in some industries might differ from the transition paths presented in the literature. It is noteworthy that the level of analysis in Paper 1 has shifted from focusing on a company to focusing on a whole industry, which has enabled the identification of commonalities and differences among servitizing industries.

The main contribution of the findings in relation to the first research question is to explain the effects of different aspects of the operational environments on the servitization of manufacturers. In addition, this dissertation suggests that certain environmental circumstances can encourage manufacturers to leave the service business and focus on manufacturing, causing the servitized population of the industry in question to decline. These kinds of development paths among servitizing manufacturers have received little attention in the previous literature. By applying organisational ecology theory (Hannan and Freeman, 1989) to analyse servitization, the attempt was to advance the servitization discussion, which is in need of theoretical grounding. Paper 1 developed propositions on how six different variables of the organisational environment affect servitization at the industry-level. However, the claim is not that the variables are limited to these, as additional environmental elements may exist. These six variables form the basis for further analysis and empirical investigation.

First, this dissertation has pointed out that other servitizing manufacturers within an industry play a central role, both as competitors and as ground-breakers, legitimising the service operations of manufacturers. Servitization literature has regarded the competition in product sales as facilitating the transition toward services (Baines et al., 2009a). This dissertation argues that the density of other service-providing manufacturers is also an important variable affecting the transition. Initially, the servitized population is small, and end users are not accustomed to acquiring services from manufacturers. Many servitized

manufacturers fail in service operations, and only a few decide to broaden their service offerings. When the population grows, the legitimacy of the organisational form increases and more companies enter service operations, while fewer exit it (Hannan and Freeman, 1989; Hannan and Carroll, 1992). At some point in the growth process, competition in the service business starts to outweigh the legitimacy effect; hence, more companies are forced to exit the population, and fewer enter it.

Second, competing service companies and the service operations of the end users can form barriers to manufacturers' attempts to servitize. In this sense, the time of entry into service operations is vital. The population within an industry (either servitized manufacturers or their competitors) that is first able to build a strong market position in offering product-related services can resist competition from other populations, even if those others possess superior strategies and structures (Carroll and Harrison, 1994; Carroll and Hannan, 2004). This is a novel insight into the servitization discussion, one which emphasises the role of competition (Baines et al., 2009a).

Third, the legitimacy of servitized operations is a crucial resource in servitization, which the current servitization literature also acknowledges by emphasising the role of service culture (see Johnstone et al., 2009). Over time, end users become accustomed to relying on manufacturers to meet their product-related service needs (Stinchcombe, 1965; Hannan and Freeman, 1984). The availability of service resources within an industry has a positive relationship with the servitization of manufacturers. Fourth, the linkages between manufacturers and relevant institutions facilitate servitization and mitigate the risks caused by organisational change. These linkages increase legitimacy (Baum and Oliver, 1991, 1992, 1996), enable more manufacturers to servitize, and decrease the number of exits. The lack of institutional linkages can partly explain some of the negative effects of servitization on organisational survival and performance as identified in previous research (Gebauer et al., 2005; Neely, 2008; Kohtamäki et al., 2013a).

Fifth, technological innovations can change the competitive positions within the servitized population, as well as the positions between it and rival populations. This variable is also clearly evident in the empirical case of CapgoodCo in Paper 2 (see subsection 4.1.2). The companies initiating the technological breakthroughs grow faster than others do (Tushman and Anderson, 1986). These companies often dominate the market, which causes smaller manufacturers to exit service operations and fewer manufacturers to enter those after the initial build-up of the servitized population. Findings from the CapgoodCo case in Paper 2 show that the

influence of technological development on servitization can sometimes be contrary to the current view that technological development would facilitate servitization by increasing service requirements of the increasingly complex products (cf. Neely, 2008; Schmenner, 2009; Geum et al., 2011).

Finally, political forces shaping the legislation of an industry can significantly affect servitization. They may ban an organisational form or, conversely, lift a ban (Carroll and Hannan, 2004); the former happened to Xerox with their full-service concept, model 914, in the literature case in Paper 2 (again, see subsection 4.1.2). The effects on servitization are clearest in tightly regulated industries in which the lack of maintenance services usually presents human risk. In these kinds of industries, regulation requires maintenance of the products to ensure safety, which increases the demand for product-related services and, hence, encourages servitization. Manufacturers operating in these industries are often considered examples of successfully servitized manufacturers. On the other hand, deregulation of equipment maintenance increases competition from rival populations; therefore, these types of actions may decrease entry rates and increase exit rates of the servitized population.

The six propositions from Paper 1 are synthesised below in Figure 7. Prior servitization studies have examined the founding, transformation, and failure of individual organisations, without determining the impact of these processes for entire industries. Studies that examine how organisational-level events cumulate into a population-level process are essential to determine how change in industries comes about. The dissertation finds this necessary to understand the nature of servitization as a phenomenon taking place across industries and countries. Hence, these findings make significant contributions.

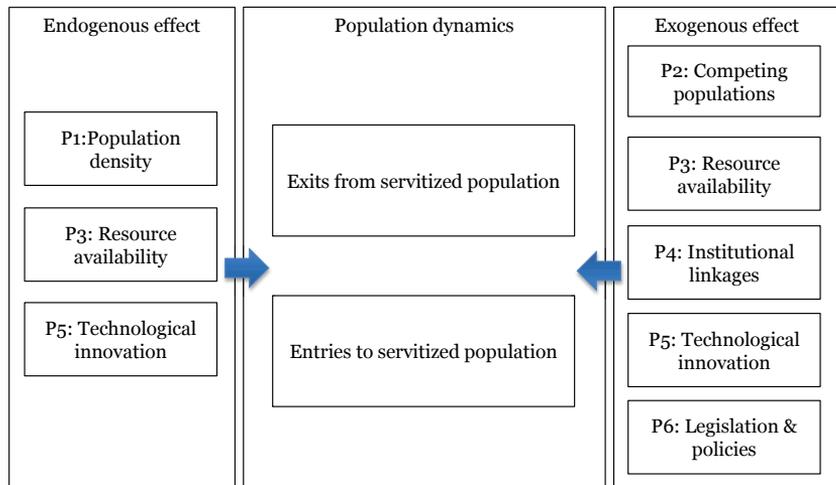


Figure 7. Synthesis of the propositions on the environmental variables affecting servitization.

Managers must understand the organisational environment of the company to be able to decide on strategic actions and resource allocations, such as the extent to which the offering shifts from pure products toward service provision. A strategic move toward a service business should be based on a careful examination of the operating environment. The findings form a conceptual basis for this type of evaluation and enable identification of the key environmental variables affecting servitization in the industries of interest. One of the most important aspects in managerial decision-making is the global nature of different functions. The suitability of manufacturing and service operations in certain areas need to be evaluated on the basis of both legitimation and competition. The propositions in Paper 1 should promote understanding of how different environmental conditions around the globe can affect the success of locating manufacturing and service operations in response to a changing competitive landscape.

The findings offer a conceptual background with which to analyse how different aspects of the organisational environment cause differences in servitization. In addition, the findings may change the way existing research on servitization is interpreted. Part of the difficulty in servitizing may be explained by environmental circumstances, rather than by mere challenges in managerial decision-making.

The first research question was targeted primarily to *identifying* the environmental factors. However, it might be of interest to discuss shortly the possible interaction between the six identified factors. It is evident that such interactions are numerous, possibly deserving a series of focused in-depth studies. The complexity of these interactions should become clear

when considering just one of these factors, for example technological innovation. Namely, all five other environmental factors are known to contribute indirectly to technological innovations. If we consider the evolution of maintenance related technologies within the airline industry in the U.S. through the past decades, we can address some interaction patterns. To start with, safety regulations have always been driving servitization within the industry, as has resource availability, namely the scarcity of “spare” aircrafts. Condition monitoring technologies have been applied since decades and an important party affecting the development of these has been an institution called National Aeronautics and Space Administration (NASA). More recently, the market entry of low cost carriers has introduced an increasing cost pressure to all major airlines, which is surely reflected on the strive for even more effective technologies for improving the efficiency of service provision and asset management operations. Here I could only scratch the surface on possible interaction patterns, but hopefully some sparks for future research will be ignited.

#### **4.1.2 Reversed servitization paths**

The second research question, regarding the existence of alternative transition paths related to servitization, is addressed empirically in Paper 2. The detailed findings are presented in appendix 2 and here the key findings are reviewed. Paper 2 sets out to explore alternatives to the prevailing unidirectional transition path of servitization literature (e.g., Wise and Baumgartner, 1999; Oliva and Kallenberg, 2003; Baines et al., 2009a), which was identified in the systematic literature review in subsection 2.2.1.

Paper 2 presents two company cases that are contrary to the views presented in the literature. The first original empirical case was conducted following a single-case research design: It focuses on the development path of the service operations of CapgoodCo (a pseudonym), a global capital goods manufacturer. Then, building on a secondary analysis of publicly available material, the findings are supported through a comparison with the company case of Xerox, the photocopier manufacturer that was forced to unbundle its service package and start selling hardware and services separately.

The findings on the development path of CapgoodCo are summarised next. In the early 1970s, the firm started to manufacture capital goods, introducing a new and innovative technology. From the very beginning, the company provided integrated offerings consisting of technology products

and various advanced services, enabling its end users to reap the potential benefits of the new products. The service portion of CapgoodCo's offering thereafter decreased significantly. The company ended up in a situation where the majority of its product sales went through various intermediaries, causing it to lose contact to end users and increasing product dominance in the product–service continuum (Figure 8). At the moment of the research, the company was struggling even with warranty handling, and its service provision mostly consisted of delivering spare parts according to customer orders. Hence, the company's challenge with service provision was contrary to the situation that most manufacturers described in the servitization literature: The firm was struggling to retain a relevant role downstream, where it previously had been successful.

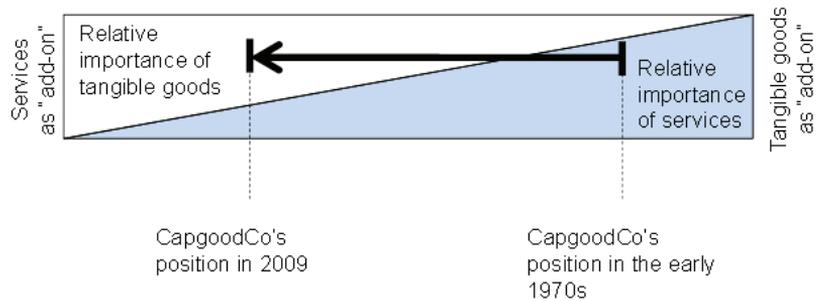


Figure 8. CapgoodCo's changed position in the product–service continuum.

The findings on the development path of Xerox's first commercially successful photocopying machine, model 914, are summarised next. Xerox's innovative full-service business model initially enabled the company to bring the model 914 to the market, despite the high manufacturing cost. Accordingly, the competitive situation and business model innovation were the reasons behind Xerox's early servitization. In the early 1970s the company was accused by the Federal Trade Commission on 'unfair methods of competition in commerce', and was therefore required to adjust its business model to reach a settlement. After the regulation change, i.e., the settlement, the company was forced to open up the after-sales service market to competition and also to move their offerings in the direction of selling pure products. Hence, Xerox can be seen as having taken a step backward in the product–service continuum (Figure 9).

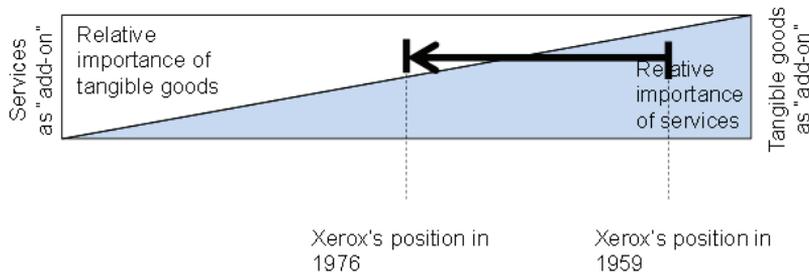


Figure 9. Xerox's changed position in the product–service continuum.

The two cases discovered the existence of reversed servitization paths, and found indications on environmental variables as their causes. In the case of Xerox, the changing variable was regulation, whereas in the case of CapgoodCo, the reversed developments were initiated by changing product technology. Namely, the development that pushed CapgoodCo upstream and toward increasing product dominance was caused by supply chain intermediation, induced by product technology evolution. As CapgoodCo's current visibility in the indirect channels is only to its delivered base, its previous service orientation has become more or less traditional manufacturing. Xerox was forced to take a step back in its servitization because of a major change in the regulation of the industry. The settlement with the Federal Trade Commission required Xerox to unbundle its integrated solution and open the service market to competition, which meant moving toward a more traditional business model of competitively selling products and additional services separately. Although both cases exhibit reversed servitization, they differ in that CapgoodCo transitioned backward from offering a product–service system to product dominance, while Xerox extended backward its offering from a full-service solution to coverage of both the product and services.

As discussed earlier, the literature almost unanimously suggests that manufacturers are increasingly moving toward service provision (e.g., Wise and Baumgartner 1999; Mathieu 2001a; Baines et al. 2009a; see also subsection 2.2.1), whereas the cases of CapgoodCo and Xerox exhibit reversed patterns during the analysed time intervals. In previous examples (Sawhney et al. 2004; Matthysens and Vandenbempt 2010; Kowalkowski et al. 2012) of companies taking steps backward in servitizing, management has retreated from service strategy in reaction to the unsuccessful development of business performance. In both of the cases described in this research, the situation differs. The production volumes and revenues of CapgoodCo have soared: From 1986 to 1996, the production volumes

quadrupled and the sales in 2000 were 50 times the number in 1981. Thus, the market for the core physical product grew while the conditions to provide associated product services became unfavorable. Xerox, for its part, was able to increase its revenues from \$30 million to \$2.5 billion in just 13 years. Accordingly, the companies have been in general extremely successful, although environmental variables have forced them to reverse their servitization paths. Moreover, the previous literature has emphasised internal aspects as the main challenges for OEMs building a service portfolio (Mathieu 2001b; Brax 2005). The cases analysed herein support the claim that environmental developments may drive manufacturers to retreat from successful servitization strategies.

The interpretation of the dissertation is that CapgoodCo's development path does not fit into models presented in the existing servitization literature (see subsection 2.2.1), because the company's industry had undergone a major structural change since the new technology was first introduced. Correspondingly, Xerox's photocopying industry experienced a major change introduced by a regulatory authority. In other words, in the cases of both CapgoodCo and Xerox, one variable shaping the operational environment changed gradually, which led to a major change in solution network structures and competitive dynamics, respectively. Servitization literature has not been concerned with industry-level changes; implicitly, all industries are assumed to be static, at least from the manufacturers' point of view. Such an assumption does not fit every industry--at least, not those characterised by high technology or changing regulations.

The conclusion is that the main reasons for the reversed paths (from services toward products) were not related to the company's internal capabilities or the chosen competition strategy. Instead, changes in the environments in which the companies operated pushed the companies on the opposite paths. The case of CapgoodCo also shows that the supply network may change significantly during the life cycle of the product technology, which can have major implications on servitization. Accordingly, the findings on network position affecting servitization and solution provision are presented next.

#### **4.2 Response implementation: Companies' actions affected by solution network position**

To understand the effects of the operational context on manufacturers' response implementation, solution network position has to be examined. The previous subsection 4.1 explored the industry-level operational

environment. However, in the case of services, it is crucial to consider where each manufacturer of interest operates in the network. This finding was clearly identified in the empirical analysis of CapgoodCo in subsection 4.1.2. The theoretical reason behind the need to consider network position is that services require direct customer input to the production process (Sampson, 2000; Sampson and Froehle, 2006); accordingly, most servitization and solution provision literature study manufacturers operating in an integrator position. Accordingly, we need greater understanding of how the network position is linked to solution provision taking place in networks, which will be explored in the next subsection. Of particular interest are the possibilities and ways to shift toward solution provision in a supplier position, which is addressed in subsection 4.2.2.

#### **4.2.1 The focus of suppliers' and integrators' development actions in solution networks**

Research question 3, regarding the dependence of a manufacturer's actions regarding solution provision operations on its network position is addressed empirically in Paper 3. The detailed findings are presented in appendix 3 and here the key findings are reviewed. Paper 3 sets out to analyse three supplier and three integrator companies operating in six solution-providing, embedded supplier-integrator-customer triads. Solution provision literature (Davies and Brady, 2000; Davies, 2003; Brax and Jonsson, 2009) mostly concerns integrator companies, often noting their suppliers but usually not analysing those in detail. The aim here is a more balanced approach, explicitly analysing both suppliers' and integrators' roles in solution provision networks by using a service triads viewpoints (Wu and Choi, 2005; Choi and Wu, 2009b). Through qualitative analysis of the six networks, four propositions (of which two are divided into two parts) were developed regarding the ways suppliers and integrators focus their actions in solution provision. The key findings are summarised in Figure 10 below. The approach to studying such actions of two groups of companies on the supply side is novel and brings valuable insights to both theory and practice. The findings enrich the stream of studies on solution provision networks by explaining the companies' development actions and decisions.

The primary theoretical contributions of the findings from Paper 3 are three-fold. First, the findings on the suppliers contrast the underlying structural perspective of solution provision networks (Davies, 2003; Davies

et al., 2006). Namely, the analysis revealed that suppliers of high-technology products can reach a structurally powerful position in the network, despite being located upstream in value chain. Regarding some of these companies the imperative actually seems to be maintaining the upstream position instead of going downstream (cf. Wise and Baumgartner, 1999). The high-technology suppliers' focus their actions for developing their product technology, information gathering, technology support resources, and brand (see Figure 10 below), which bring more power than the linear sum of those would. However, seeing the whole picture regarding suppliers' structural power requires looking also beyond the triad view. Namely, it requires understanding the multitude of networks in which the supplier might participate, which then sheds light on the supplier's central position in this wider constellation (see Burt, 1992), instead of the seemingly distant position within the triad.

	<b>Suppliers</b>	<b>Integrators</b>
Actions on <b>organizational</b> power sources	<ul style="list-style-type: none"> <li>• Brand</li> <li>• Technology</li> <li>• Support resources</li> </ul>	<ul style="list-style-type: none"> <li>• Brand</li> <li>• Company size</li> </ul>
Actions on <b>relationship's</b> power sources	<ul style="list-style-type: none"> <li>• Information</li> </ul>	<ul style="list-style-type: none"> <li>• Information</li> <li>• Interconnection</li> <li>• Demand-share</li> </ul>
Resulting <b>network</b> position	Located upstream, bridging delivery channels. A great number of integrators and customers.	At customer interface, bridging suppliers and customers. A few customers, a great number of suppliers.

Figure 10. The focus of suppliers' and integrators' actions on organisational and relationship's power sources, as well as their resulting network position.

Second, the findings extend theories regarding the use of a bridge position (Burt, 1992; Li and Choi, 2009) by explaining how solution-providing companies act to reach such position and how changes resulting from their development actions enable it (see Figure 10 above). Integrators aiming to bridge focus on fewer customers but develop long-term partnerships (Davies and Brady, 2000) with broad offerings covering a vast variety of products, possibly including additional technologies not designed in-house. In the case of offerings covering competing technologies, the findings confirm that integrators may prefer to acquire the required support

capabilities through mergers and acquisitions (see Turunen, 2011). The findings indicate that suppliers can acquire a bridge position linking delivery channels of different industries together and thereby achieving a structurally powerful position. The approaches taken by suppliers and integrators in the sample seem to be strategic alternatives, emerging due to the need to allocate scarce development resources.

Third, the findings also contrast the literature's views of the role of information as a source of power for the integrators and their suppliers (Brax and Jonsson, 2009; Davies et al., 2007). The analyses of the six embedded cases confirmed the expectations of the crucial importance to have adequate and accurate information (Ala-Risku, 2009), but the integrators did not seem to be able to induce advantage from information over suppliers. The suppliers had made significant investments in developing IT-based tools for gathering and managing information of customer needs and installed bases of equipment. In addition, two suppliers had developed internal organisations specialising in certain customer industries and applications, which gathered information through multiple channels regarding the applications of interest. This information played a central role in enabling the development of new product varieties, thereby increasing the number of delivery channels and consequently improving the structural position.

The findings have three further implications. First, the propositions offer a conceptual tool to assist in constructing strategies to focus development actions, the focal-company being either a supplier or integrator. Second, the propositions have reference to performance issues. For example, suppliers seem not to be able to successfully strive for integration of services and products using competitors' technologies, because doing so would necessitate a position close to customers. Becoming an integrator would then be a natural option, and the findings provide insights into the actions required when considering such a possibility. Third, the propositions enable understanding the interplay between the resultant changes from development actions. Namely, they explain how certain decisions and actions may lead to changes in different areas, and also which strategic actions are alternatives to each other. For example, heavy investment in finding new customer applications for the offering will support the supplier's search for power, but when carried out by an integrator, this strategy might be in conflict with the possibilities resulting from their different network position.

#### **4.2.2 Transformation of a supplier toward solution provision**

The research question 4 on servitizing in a supplier position is addressed empirically in Paper 4. The detailed findings are presented in appendix 4 and here the key findings are reviewed. Paper 4 presents an empirical case of a manufacturer that was struggling with its service operations, as it supplied subsystems to integrators controlling direct relationships with end users. The literature has emphasised the need to operate close to customers in solution provision (Wise and Baumgartner, 1999; Sampson, 2000; Sampson and Froehle, 2006), and therefore servitization of companies operating in supplier position has received little attention. Paper 4 aimed to address this gap.

The case company HitechCo was found to improve its delivery of industrial services by building a relationship with end users, which implies a triadic operational model. As a subsystem supplier, the company aimed to form a service network with intermediaries and corporate end users. As a supplier of intermediaries, the company might not even know where the installed base and end users are located. This lack of knowledge impeded its ability to position and pool resources effectively in its service network, although it still possessed critical product knowledge needed for maintenance operations. In order to provide solutions in the new situation, the company needed to establish a relationship with the end users and thereby fill the structural hole in the triad.

In principle, providing solutions by going around intermediaries would have been possible, but these intermediaries represented the biggest sales channel in product sales, and therefore the company avoided endangering relationships with them. Hence, these companies preferred to access end users by forming ways to collaborate with intermediaries. Further, multiple levels of collaboration were needed; intermediaries were heterogeneous, with greatly varying resources and strategies. Four distinctive collaboration levels (see Table 8) were identified, enabling the case company HitechCo to provide industrial services better aligned with the variety of interests and capabilities of the intermediaries.

Table 8. Proposed collaboration levels for HitechCo.

Collaboration levels	Field services—customer site		Facility-based services—workshop		Spare parts & training
	Troubleshoot & Exchange	Simple PM	Complex PM	Repair	
<b>a) HitechCo supports</b>	Intermediary	Intermediary	Intermediary	Intermediary	HitechCo
<b>b) Workshop services</b>	Intermediary	Intermediary	HitechCo	HitechCo	HitechCo
<b>c) Workshop &amp; preventive maintenance</b>	Intermediary	HitechCo	HitechCo	HitechCo	HitechCo
<b>d) Total care</b>	HitechCo	HitechCo	HitechCo	HitechCo	HitechCo

The procedure (see Figure 11) of selecting the appropriate collaboration level forms the second part of the case company’s solution to shift toward solution provision. The selection process begins by considering the product in question. The first stage of the selection process considers the solution integrator’s strategy, and the second market structure identifies the party to collaborate with. As a collaborative arrangement is established with the intermediary, the capabilities and willingness of that party to carry out different kinds of service tasks need to be discovered and evaluated. Based on the analysis of capabilities and willingness, a particular type of collaboration level is selected.

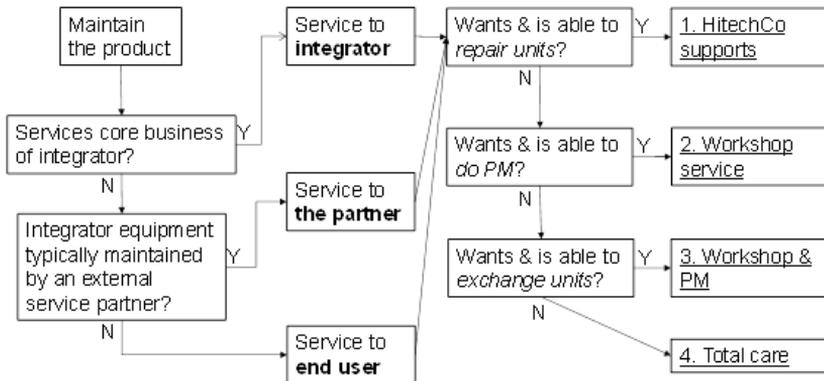


Figure 11. Selection process for collaboration level.

The case company provides training, specialised maintenance equipment, and service workshops for service production. These are combined in the collaboration arrangements with the intermediary’s end user

understanding, field service engineers, and information on the installed base of the solution integrator's equipment, in order to produce services that will effectively and efficiently satisfy end user needs. The services are delivered through delivery channels that are in most cases operated by the intermediary.

Paper 4 shows how a supplier company can shift toward solution provision when a company has lost contact with its end users. The relationships between the actors at each level—supplier, integrator, and end user—are major determinants of the capabilities to provide industrial services not only for each service provider but also for the whole service network. The literatures on solution provision and servitization have concentrated on the dyadic service provision between the manufacturer and its end user. However, many situations require close collaboration between the service-providing manufacturer and its suppliers, of which solution integration (Davies and Brady, 2000; Davies et al., 2007) is an example. Solution providers and integrators have to rely on specialised suppliers in providing services related to the subsystems, since the suppliers possess essential capabilities and resources for their products.

The case company devised a strategy to shift toward solution provision in a supplier position. Through this solution, the company aimed to fill the structural hole and establishing a working triadic operational model in the supply network (Choi and Wu, 2009b). The situation was made complex by its co-opetitive nature: the integrators were both important customers in product sales and to some degree competitors in service operations (Brandenburger and Nalebuff, 1996). Accordingly, the solution enabled the supplier to establish a triadic collaboration, with downstream parties exhibiting various needs, capabilities, and strategies without endangering relationships.

The findings show the importance of the relationship between the subsystem supplier and the end user for service provision in the network, when end user relationships are controlled by solution integrators and other downstream parties. The supplier's ability to collaborate is impeded by the lack of a relationship with the end users. In other words, there is a structural hole between the two parties in the service-providing triad (Burt, 1992; Li and Choi, 2009). This structural hole is not only detrimental for the service provision of the supplier, but it also significantly affects service provision in the whole triad because the integrators are not capable of providing services for the electrical components provided by the supplier. On the other hand, the supplier's service capabilities are contingent on installed base information and access to the field service sites, which require a relationship with the end user.

Paper 4 also describes how capabilities and resources needed for industrial service provision can be dispersed in the network and especially how these can be brought together for effective service delivery. In the empirical case, integrators controlled the customer base and were capable of carrying out maintenance and repair, especially for the mechanical parts of their products. On the other hand, the subsystem supplier possessed know-how and resources to service the electrical parts of the integrator products. The proposed solution brought together the differentiated capabilities of the supplier and the integrators, which was necessary regarding the network's ability to provide effective industrial services to corporate end users.

Specifically, it was found that high-technology manufacturers eventually face the situation of commoditising products, which leads to changing network structures through supply chain intermediation. This shift forces the companies to choose between becoming a solution integrator that provides customers with integrated solutions, or a subsystem supplier of solution integrators that control the end user relationship. The findings increase the understanding on the dynamics of the triadic service networks and the roles of different parties, as well as the relationships between these parties. The findings inform researchers and managers on how essential the subsystem supplier's involvement can be in industrial service provision and what effects the lack of a working relationship between the subsystem supplier and end user can have on the whole service-providing network.

The solution devised by the subsystem supplier also includes some hindrances in its application. On the network level, triadic cooperation between supplier, integrator and end user improves the value to the end user by improving service quality and aligns the interests and capabilities of supplier and intermediary. However, the intermediaries must be convinced of the benefits of cooperating to effectively apply the solution. When a supplier is unable to convince its intermediaries, cooperation in carefully developed collaborative arrangements is not possible for the supplier. In addition, integrating the service operations of the manufacturer and the intermediary can be costly and time-consuming. The different actors in the service network might also be afraid of losing their key competitive capabilities to each other, which is a barrier to introducing collaborative triads.

## 5. Discussion

This dissertation was motivated by the observation that manufacturers in developed countries are struggling to find ways to compete with competitors from countries with lower cost levels. The application of a servitization strategy has been suggested as one possible response: as the manufacturer increases the proportion of services in the offering, it moves toward becoming a solution provider. Accordingly, understanding central aspects of servitization and solution provision has become a must for most manufacturers in developed economies; as a result, the related academic literature has expanded.

The majority of the servitization research has viewed the phenomenon rather optimistically, listing reasons in support of its application, emphasising the potential benefits and identifying some practical challenges. Even the possibility that some manufacturers might reverse their servitization strategy and decide to focus on manufacturing and selling goods has received relatively little attention. The servitization research seems currently to be in the typical early phase where the strategy is praised as a best practice (see Sousa and Voss, 2008) that ought to be applied irrespective of the context. Further, servitization and solution provision research are in need of more explicit considerations of the role of the context in which servitization strategy is applied and solution provision operations carried out.

This dissertation applied a more critical view on servitization and solution provision and made a serious attempt to systematically study their contextuality. The context was divided into two parts: industry-level operational environment and the solution network position.

The analysis of the contextuality proceeded from higher-level considerations of the effects of operational environment on companies' servitization within an industry to the more detailed focus on individual companies' solution provision, as affected by their network position. The findings provide novel insights into how six different aspects of operational environment either encourage or inhibit servitization of companies within an industry. In addition, the findings on two manufacturers—undergoing

development paths contrary to those presented in servitization literature, labeled ‘reversed servitization’—have the potential to move servitization research into the stage of acknowledging the versatility of the paths related to the phenomenon. In addition, the findings show that the actions of suppliers and integrators in solution provision networks differ clearly from each other. Further, supplier companies’ transformation toward solution provision requires cooperation with integrator companies in order to reach customers.

Next, the theoretical implications of the dissertation research will be discussed, the implications to managers presented and the limitations and further research avenues discussed.

### **5.1 Contribution to theory**

This dissertation contributes to servitization (Wise and Baumgartner, 1999; Oliva and Kallenberg, 2003; Baines et al., 2009a) and solution provision (Davies and Brady, 2000; Davies et al., 2006, 2007; Brax and Jonsson, 2009) discussions by analysing the operational contingencies that influence these phenomena. There is growing research interest in these globally important phenomena, which seem to be taking place in most economies. However, most of the research does not clearly recognise the limitations of a servitization strategy. Accordingly, the primary contribution of this dissertation is to analyse the contextuality of these phenomena: the variables in the context, which either facilitate or inhibit servitization, and on the other hand, the actions regarding solution provision affected by the context.

This dissertation’s contributions to theory are presented here, based on the division proposed by Sousa and Voss (2008). They claim that contributions of contingency theory are achieved by (a) identifying the contingency variables, (b) grouping context based on contingency variables and (c) determining the organisational responses by context. This dissertation has contributed to all of these: contingency variables have been identified in the operational environments and on the other hand, organisational responses assigned to different solution network positions. The contingency variables and organisational responses found in this research are summarised below in Table 9. These also naturally provide the basis for grouping different contexts based on the identified variables.

Table 9. Summary of the found contextuality of servitization and solution provision.

	<b>Industry perspective</b>	<b>Network perspective</b>
Responses	Controlled variables: - <i>servitized/non-servitized</i>	Measured variables: - <i>collaboration arrangements with network parties</i> - <i>development actions regarding solution provision</i>
Context	Measured variables: - <i>population density</i> - <i>competing populations</i> - <i>resource availability</i> - <i>institutional linkages</i> - <i>technological innovation</i> - <i>legislation and policies</i>	Controlled variables: - <i>supplier/integrator position</i>

The research objective of this dissertation was essentially dual, covering both the context and the responses of servitizing manufacturers. An attempt to study the both of these *at the same time* would have been likely to reach less than satisfactory findings on the both areas, simply because of requiring the analysis of too many variables at once; the complexity would have been too great to manage successfully. This necessitated that part of the complexity is controlled at time. Accordingly, a natural choice regarding the research design was to control the responses and the context in turn, while the other one is studied closely. In practice, this directed to carrying out the analysis in two parts that are called here industry and network perspectives.

The industry perspective covered research questions 1 and 2. Here context was defined as dependent and operationalised as the operational environment, while response contents were controlled and operationalised as companies' offerings in relation to servitization. The idea was to study a number of contexts in which the environmental variables vary and response contents can be controlled. Research questions 3 and 4 were covered in the network perspective, where the context was controlled and responses measured. The former was operationalised as a supply network position and the latter as development actions regarding solution provision.

Firstly, this research contributes to the servitization discussion by explicating the context variables affecting servitization of manufacturers. The set of these variables is specific to each industry and therefore affects

the manufacturers within that industry in a comparable manner. The findings suggest that six variables in the operational environment—population density, competing populations, resource availability, institutional linkages, technological innovation and legislation and policies—affect the amount of companies that are servitized within an industry, by either encouraging or inhibiting servitization within that industry. These findings extend the initial understanding of the environmental effects on servitization, initiated by forerunners such as Gebauer and his colleagues (e.g., Gebauer and Fleisch, 2007; Gebauer et al., 2010b). In addition, the findings provide a basis for a systematic analysis on such effects in any selected industry.

The analysis also identified reversed servitization paths of two manufacturing companies that were contrary to those presented in the current servitization literature. These findings suggest that servitization literature needs to acknowledge versatile transitions companies can undergo in relation to solution provision. While some manufacturers decide to increase the proportion of services in their offerings, others can do the opposite. To understand the reasons behind these versatile paths, more attention must be directed toward exploring the effects of the context, instead of the currently dominant view of explaining the different paths based on differences in managerial decision-making.

Secondly, this dissertation contributes to the understanding of contextual effects by exploring how manufacturers' development actions regarding solution provision depend on the network position. Namely, the findings suggest that whether the company operates as a supplier or integrator in the network affects, to a great degree, how the company takes action to develop its sources of power (cf. Windahl and Lakemond, 2006). In particular, the role of supplier companies provides novel insights into solution provision literature, which has focused on integrator companies without detailed considerations of the suppliers.

The findings also indicate that shifting toward solution provision seems to be quite different and more challenging for a supplier company, a fact which has not received much attention in previous studies that have mostly concentrated on integrators. The possible lack of a relationship with customers using the equipment (see Burt, 1992; Li and Choi, 2009 for structural hole) is the major cause of these challenges. Whereas integrator companies can benefit from their position close to customers and can combine goods, services and technologies from different suppliers to customise offerings, suppliers have to collaborate with integrators to reach the customers. Without such relationships, the suppliers cannot deliver solutions to customers, but they can focus on developing their product

technology and searching for additional delivery channels for their products. When deciding to shift toward solution provision, the suppliers have to accommodate with varying needs and strategies of their integrators that control the access to customers.

This dissertation argues that without explicit considerations of the kinds of environments manufacturers operate in and their position in the solution network, the challenges related to servitization cannot be fully understood. The lack of such a focus in previous research might be one explanation for the largely inexplicable difficulties of realising financial benefits of servitization (see Gebauer et al., 2005; Fang et al., 2008; Neely, 2008). This research aims to shed some light on these issues and possibly even change the ways the previous findings on financial implications of servitization are interpreted.

This research also contributes to discussions on servitization and solution provision by offering a way to grouping different contexts based on the context variables (see Figure 12), which could be done as follows. First, the effects of the operational environment are argued to be rather similar to all manufacturers within the industry, and the industries can be grouped based on the six environmental variables identified in Paper 1. Second, the context also depends on whether the manufacturer operates as an integrator or as a supplier of integrators. Therefore, the context is determined by context variables in these two perspectives: industry-specific operational environment and network position. Thus, within each industry there are two different contexts of servitizing manufacturers: namely, those operating as suppliers and those operating as integrators.

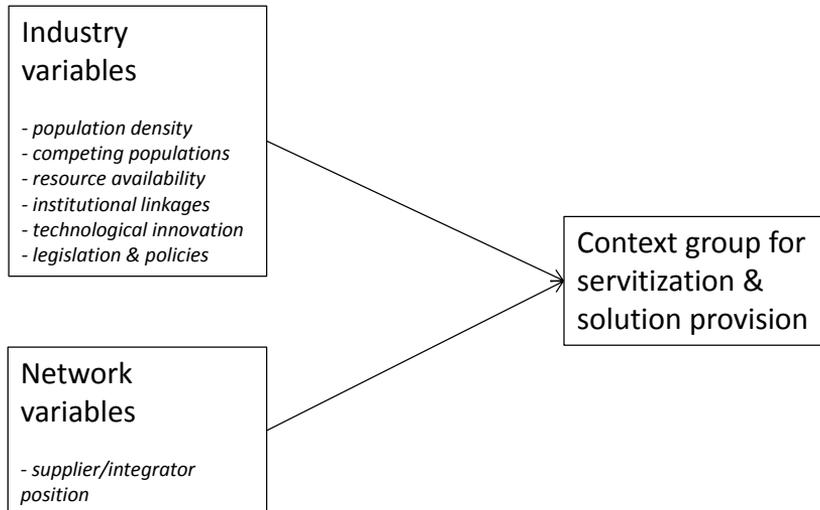


Figure 12. Grouping different contexts based on context variables.

Understanding the context in which a manufacturer operates aids in analysis of the manufacturer's possible actions regarding solution provision. Namely, the industry-level environmental variables provide insights for whether the context favours servitization or inhibits it. In addition, network position can necessitate forming collaborative constellations with integrators if solution provision operations are preferred by a supplier. Network position is also linked to the development actions regarding solution provision. Namely, suppliers of high-technology products typically focus on developing the use of their product technology and searching new customer applications for the technology. Integrators, on their part, develop closer relationships with a smaller amount of downstream parties and combine goods, services, and technologies from several suppliers with their own resources to offer customers customised solutions.

Despite that the research objective was essentially dual and the explicit intention was to control for responses when context was analysed, and the other way round, reflecting on the findings directs toward interesting links between the findings on the two perspectives. Namely, Paper 2 presented an empirical case where a change in the operational environment (in particular, in the technology employed) turned the focal company from a solution integrator to become a supplier of integrators. In this situation the company had to partly unbundle its previous servitized offering. This evidenced an example of the possible interaction dynamics between industry and network contexts leading to a reversed servitization path. Even though these kinds of interactions were defined to be out of this

dissertation's scope of analysis, such dynamics among other environmental factors and network position are arguably plentiful and should provide an interesting avenue for further research.

Different kinds of interactions can be found when reflecting on the findings of Paper 3 on the conceptual model developed in Paper 1. The case companies in Paper 3 actively aimed to shape the contexts where they operated, which would eventually lead to changes in the industry-specific environment. For example, the suppliers' increased efforts on product technology development may reinforce their structural positions, but at the same time increase their relative distance from the users of their manufactured equipment. Such development patterns could push the industry to situations of service-focused solution integrators and technology-focused suppliers of these integrators. Further, the suppliers then might find servitizing increasingly challenging. However, just to remind the reader, these matters were not explicitly addressed in this research, but they are stated here for directing future research attempts.

## **5.2 Managerial contribution**

The wider topic of the research—servitization and solution provision of manufacturing companies—is of particular interest to the most investment goods manufacturers. The research enables the manufacturers to gain understanding of the contextuality of these phenomena, which has the potential to contribute to the competitiveness of Western manufacturing companies in the fierce global marketplace. The findings of this dissertation should enable the manufacturers to avoid the trap of seeing servitization strategy as a best practice, which seems to be the prevailing perspective among many servitization researchers. Accordingly, this research indicates that managers need to answer not only the questions of how to shift toward solution provision or how to overcome the challenges related to servitization. They must also understand thoroughly the context of operations, and based on that understanding decide whether to shift toward, or even away from, solution provision and decide how far to go in the chosen direction.

The findings on the reversed servitization paths highlight the versatility of the development paths related to servitization. They suggest to the managers that the changes in the context can significantly alter the premises of service provision and can even push the company away from providing customised solutions. It is important to understand that such

developments might not be the result of deficiencies in managerial decision-making or the execution of the chosen strategy; rather, the changed context requires different kinds of responses from the companies.

The managers of investment goods manufacturers can also benefit from the developed understanding of how the six environmental variables can affect servitization of their companies. When considering entering solution provision or on the other hand withdrawing servitization strategy, practitioners have to keep a close eye on the characteristics of their industry: what are competing manufacturers deciding, what does the service resource availability look like, how is the industry regulation related to service provision developing and so on. Systematic analysis of all of the environmental variables should enable managers to form an understanding of whether the context is favoring solution provision, traditional manufacturing, or some other choice regarding servitization.

Given that the operational environment is not enough for the managers to understand the context of servitization and solution provision, the effects of their companies' network position must also be evaluated. This research elucidates the various possibilities and requirements posed by operating either close to customers as an integrator or, alternatively, in a more distant supplier position. The position greatly affects the strategic emphasis and resource allocations of the manufacturers. In particular, the relationship to customers of the network is a necessity in solution provision, and therefore suppliers might have to cooperate with integrators to reach the customers and thereby servitize.

### **5.3 Limitations and avenues for further research**

All academic research unavoidably contains limitations stemming from the chosen methods, theories and scope. The primary methodological limitation of this research is its somewhat limited ability to draw direct generalisations. Namely, case studies allow only analytic, instead of statistical, generalisations and therefore the findings cannot be directly generalised to other populations. This limitation applies here especially to the findings on responses to different network positions, because both original Papers on the network perspective relied on case studies, whereas the main analysis on the variables in the operational environment was carried out conceptually. However, deep understanding of the phenomena was reached through gathering rich data sets, their systematic analysis, and the utilization of proper theoretical lenses. This enables that the core insights gained should be applicable when approaching similar research

problems outside of the empirical context of this dissertation. In essence this means that grouping contexts based on the division presented in Figure 12 (on page 70) can be considered as a starting point for further analysis in other contexts where servitization and solution provision take place.

The scope of this research was delimited to large multinational/global manufacturers of investment goods. Therefore, direct generalisations to other companies such as SMEs, manufacturers of durable goods or providers of input-to-process type offerings in industrial settings, as well as pure service providers, should be avoided. However, the findings of this dissertation are in align with and could be considered as extending some of the theoretical contributions of Gebauer et al. (2010b) and Kowalkowski et al. (2013), who especially focused on SMEs. This indicates that the findings of this dissertation might potentially have some transferability to other contexts, but this should be tested in further studies (see Table 10 below for a summary of further research avenues). Also, the analysis covered the context in the industry perspective and organisational responses in the network perspective. Accordingly, the variety of responses to operational environments was not explored, nor was the multitude of different possible contexts in the network perspective focused. For example, the responses from the industry perspective differentiated only between manufacturers that were servitized and those that were not. However, the case studies of companies undergoing “reversed servitization” paths provide also insights on how these particular companies responded to the changing environments. This should provide an interesting starting point for further research with an especial focus on such responses. In addition, the multitude of different kinds of network contexts where solution providing companies operate could be analysed through research methods enabling deep understanding of the complex social networks.

Table 10. Possible avenues for further research.

<b>Research topic/question</b>	<b>Research method</b>	<b>Theories</b>	<b>Empirical field</b>
How can the dissertation's core findings on contextuality be transferred to other contexts?	Multi case studies, analyses of large databases	Contingency, organizational ecology, and social network theories	SMEs, manufacturers of durable goods, providers of input-to-process type offerings
What are the particularities in the networks that affect solution provision?	Case study	Social network theories going beyond the triad	Solution providers in various industrial sectors
How does the alignment between servitization strategy and operational context affect performance?	Statistical methods: for example a survey	Interaction approach to contingency theory	Servitized manufacturing companies in specific industries
What kinds of systemic effects do interrelationships among different kinds of contextual factors have on servitization of manufacturers?	Multi case study	System approach to contingency theory	Manufacturers operating in a few different context groups
How can manufacturers shape the contexts of servitization by introducing new service related technologies?	Longitudinal case studies utilizing design science approach	Industry dynamics, innovation diffusion, and dominant design theories	Integrators of technology-based new services

The decision to use a selection approach to contingency theory in higher-level analysis brought about additional limitations. First, this approach did not allow for the possibility of explicitly considering the performance implications of aligning organisational responses with different contexts. However, this is in line with the research designs in most of the previous servitization and solution provision studies applying a contingency theoretical approach and also serves well the overall research aim of understanding the interplay between the response and context. Further, performance implications could be analysed in the future through the use of quantitative methods, which enable measuring how aligning the response to various contexts can affect company performance. This could also explicitly address the previously identified challenges in realizing the supposed financial benefits of a servitization strategy and thereby contribute to this central unresolved paradox regarding servitization studies. Second, the systemic effects of contingency variables—how operational environments and network position jointly affect servitization and solution provision—were out of scope. Accordingly, there are apparently complex dynamics among environmental factors and network position and they should provide an interesting avenue for further research. Again, the rich insights gained through this research enable some level of basic understanding of the possible systemic effects, as those briefly discussed at the end of the subsection 5.1. Still, a detailed analysis on such interrelationships is preferably carried out by future case studies, before jumping into conclusions.

The theories used in the analysis of the operational environment and network position also produce limitations. Namely, organisational ecology assumes that organisations are relatively inert and have little opportunity to shape their environments. One could argue that in some situations organisations are able to change parts of their context through their own active efforts. This is especially apparent when regarding industrial goods manufacturers that are innovators of new high value service technologies. Namely, by introducing technology-based service innovations for servicing the installed equipment, which improve customers' processes significantly, these companies can change the dynamics of their industries and thereby the contexts where they operate. To explore how manufacturers can actively shape their environments regarding servitization, further studies are suggested, which would focus on service technology innovators. A suitable way to carry out such research is to use a design science approach (van Aken, 2004; Holmström et al., 2009). Finally, using service triad theories, the dissertation has studied three interacting companies, instead of exploring the wider network of actors participating in the solution

## Discussion

provision. Therefore, the network perspective of this research is limited to the triadic focus regarding network position as the context of solution provision. Accordingly, the network context could be analysed more into detail in future through social network theories going beyond the triad.

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Could western manufacturers partly escape the increasing competitive pressures from low-cost countries through servitizing and providing customized solutions? In what kinds of situations could these strategies be applied, and how?

Such pondering has been the practical motivation behind this doctoral dissertation that applies a critical view on servitization and solution provision of manufacturers. The contextuality of these phenomena is systematically studied through a combination of literature-based conceptualizations, the utilization of theoretical lenses, and analyzing empirical cases of investment goods manufacturers who have long and successful histories in providing industrial services. The findings provide insights into how network position and industry-specific environment either restrict or increase the possibilities for servitization, and how industrial companies can respond to the contextual pressures.



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