Looking at the Two Sides of the Equation

How Servitisation Affects the Sustainability-oriented Innovation Adoption Dilemma

by

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Abstract

Title: Looking at the Two Sides of the Equation – How Servitisation Affects the Sustainability-oriented Innovation Adoption Dilemma.

Keywords: Sustainability-oriented Innovation, Servitisation, Service Characteristics, Diffusion of Innovations, Adoption, Barriers and Drivers for Sustainability-oriented Innovation.

Research question: How does servitisation affect the adoption of sustainability-oriented innovations (SOIs)? *A qualitative study on the role of servitisation on barriers and drivers for SOI adoption.*

Methodology: The methodological framework for this research is a qualitative multiple case study following an abductive approach. The agricultural industry was used as an empirical tool to conduct the research and generalise the findings to contexts with similar characteristics. Semi-structured interviews with SOI adopters and providers constitute the main source for data collection. The data analysis and creation of grounded theory followed the recommendations of Gioia et al. (2012) yet leaving room for adaptation to the needs of this research.

Theoretical perspectives: This study builds the bridge between the two research areas of 'SOI adoption' and 'servitisation', drawing on SOI (also: sustainable-, eco-, green- and environmental-innovation), diffusion of innovations, and servitisation literature. This, with the aim to outline SOI adoption barriers and drivers, and service attributes potentially influencing the adoption process.

Conclusions: SOI faces slower market adoption than conventional innovation. This thesis contributes to existing literature by studying the intersection between two expanding business concepts, namely 'servitisation' (1) as a potential approach to increase 'SOI adoption' (2). Beneficial service characteristics have shown to increase customer value by overcoming barriers and reinforcing drivers for SOI adoption (e.g. 'financial model' of services reducing investment costs). Nonetheless, hindering servitisation factors, revolving around reluctance due to organisational change, need to be considered in the transition towards adopting services. Ultimately, this study increases understanding of SOI adoption to enhance its market success, and therefore contributes to the transition towards sustainable development.

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List of Abbreviations

App.	=	Appendix
B2B	=	Business-to-business
BM	=	Business Model
BSC	=	Beneficial Service Characteristic
BMI	=	Business Model Innovation
Ch.	=	Chapter
CI	=	Conventional Innovation
GHG	=	Greenhouse Gases
HSF	=	Hindering Servitisation Factor
Int.	=	Interview
MP	=	Market-pull
ROI	=	Return on Investment
RQ	=	Research Question
TP	=	Technology-push
SOI	=	Sustainability-Oriented Innovation
PSS	=	Product-Service-System

1.Introduction

1.1 Background

Sustainable development has become one of the prime issues and is widely debated in society, research, economy and politics amongst others (Ambec and Lanoie, 2008). There is wide acceptance that natural systems are vulnerable to the fast-paced human development due to nature's limited adaptive capacity (Ambec & Lanoie, 2008). Debates on sustainable development are increasingly prevalent in the business context, referring to the improvement of a company's environmental performance (Ambec & Lanoie, 2008). External and internal pressure are growing, reinforcing companies to adopt more environmentally sustainable (hereafter: sustainable) practices (Adamset al., 2012). Consequently, maintaining a 'business-as-usual' approach, in which companies are preserving their status quo, is increasingly seen critical (Adams et al., 2012; Ambec & Lanoie, 2008).

Correspondingly, the 21st century marks the beginning of a new era of innovation activity in which firms reacquaint themselves with the principles of sustainability-oriented innovation (SOI) *(also: sustainable innovation, eco-innovation, environmental innovation or green innovation)*, complementing economic purpose with societal and environmental value (Adams et al., 2016; Biloslavo et al., 2018; Halila & Rundquist, 2011; Joyce & Paquin, 2016; Osterwalder & Pigneur, 2011). The triple-bottom-line definition of Adams et al. (2016) for SOI (environmental, social and economic purpose) is applied and narrowed towards a specific focus on 'economic' and 'environmental' sustainability through new products and services. Accordingly, the modified definition of SOI is "the intentional change of an organisation's, products and services to realise environmental value in addition to economic returns".

Whereas previously, sustainability and economic purpose were perceived as trade-offs, this dominant logic is shifting and evolving into SOI as a source of competitive advantage (Adams et al., 2012; Porter & van der Linde, 1995). Apart from the growing need for SOIs to counter today's environmental challenges, innovation and sustainability also appear to facilitate one another in a two-way interrelation. From one perspective, innovation has been acknowledged as the key mechanism for facilitating and addressing sustainability concerns (Hall et al., 2017). From the other perspective, sustainability has been highlighted as an increasingly important key driver and facilitator for innovation (Adams et al., 2012; Varadarajan, 2015).

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However, the development of SOIs is only one side of the equation. The environmental success (Noppers et al., 2014) and competitive advantage (Forsman, 2013) of SOIs fundamentally depends on the customer adoption (in the context of this thesis referring to business-to-business [B2B] customers; *justification in Ch.3.1)*. Adoption thereby refers to "the decision to make full use of an innovation as the best course of action available" instead of rejecting it (Rogers, 2003, p.173). Fundamentally, SOI involves peculiarities relative to conventional innovation (CI) leading to slower SOI adoption (Forsman, 2013). The main distinguishing factors are twofold. First, SOIs involve higher complexity within the innovation process due to the ambition to involve the commercial and environmental dimension instead of solely focussing on economic purpose; consequently, providers perceive higher external influence and uncertainty on SOI success (Adams et al., 2012). Second, SOI adopters' notion of a trade-off between sustainability and economics and hence perceiving a lower economic feasibility compared to CIs (Adams et al., 2012; Bossle et al., 2016; Varadajaran, 2017).

Previous literature on SOI has been dominated by a technology-push (TP) perspective that is stand-alone driven and does not involve extensive customer engagement (Adams et al., 2016). This TP-view drives around the ideology "if we build it, they will adopt it", consequently lacking a strong market-fit (Singla et al., 2017, p.241). As a reaction to this, and to tackle its complexity, SOI is increasingly shifting towards people-centred innovation that is systemic and integrated (Adams et al., 2016; Lv et al., 2018). In line, Bocken et al.'s (2014) business model (BM) perspective indicates technology is a necessity for SOI, however the technological issues are nowadays being perceived as less challenging compared to changing customer behaviour (Adams et al., 2016). Companies therefore shift from perceiving SOI as a technological concern, towards seeing it primarily as a challenge to alter their existing BM into value-driven, customer-centred models to ensure SOI adoption (Adams et al., 2016; Tongur & Engwall, 2014).

Hence, alternatives to traditional BMs are increasingly sought for in order to enhance market-value and overcome adoption barriers (Cinquini et al., 2013). In this light, incorporating service BMs appears to be a promising approach to enhance customer value and improve SOI adoption.

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In today's globalised, highly competitive economy with rapidly changing customer demands, a transition from products towards a focus on services can be observed (Cinquini et al., 2013; Zhang & Banerji, 2017). This phenomenon is largely referred to as 'servitisation' with the final outcome of a 'new evaluation logic' where customers seek solutions and services instead of physical objects (Cinquini et al., 2013). Current literature points out servitisation as a strategic alternative to product innovation (Baines et al., 2007), standardisation (Carlborg et al., 2013) and an approach to counter commoditisation (Matthyssens & Vandenbempt, 2008). The perhaps most prevalent evolution within the servitisation debate concerns the role of customers, who are ascribed an active involvement throughout the value chain (Cinquini et al., 2013). Hence, servitisation facilitates a strong opportunity to build unique, loyal customer relationships (Kowalkowski et al., 2017; Tukker, 2004). From the customer point of view, servitisation could enhance value through offering integrated service-products better tailored to their needs (Baines et al., 2007; Coreynen et al., 2017), *potentially* also for SOIs. Besides, services respond to increased margin pressures, not only through revenue stability for the service providers, but also cost stability for customers (Gopalani, 2010; Kowalkowski et al., 2017).

Concluding, two major shifts are apparent within this research. First, SOI tends to be characterised by a slower adoption pace relative to CI. Moreover, SOI frequently derives from TP and difficulties arise to find the market-fit in which customers' needs are adequately met. This leads to a necessity for alternative BMs to enhance a stronger customer focus and hence overcome the SOI adoption barriers. A potential facilitator to improve SOI adoption concurs with the trend towards servitisation, which derives from a strong customer-focus, customisation and attaining financial stability for both provider and adopter.

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1.2 Problem Analysis

Developing SOIs has long been a business opportunity exploited by specialised companies (Ambec & Lanoie, 2008). The pressure to better combine economic purpose with environmental protection is emerging rapidly, and hence, has evolved into a relevant issue for all companies (Adams et al., 2012; Ambec & Lanoie, 2008). Consequently, two shifts within SOI literature can be observed. Firstly, Hansen and Grosse-Dunker (2013) stress that in the last decade, research on environmental sustainability within firms has mainly focussed on 'process improvement and organisational development'. This is confirmed by Boons et al. (2013) who stress SOI literature so far has mainly focussed on intra-firm issues. Secondly, 'customer values and influences towards sustainability' are growing topics of interest, studied across industries and through various lenses. Examples are studies about influencing factors, environmental policies, leadership and psychological motives in the light of sustainability (e.g. Bossle et al., 2016; Gonzalez, 2005; Przychodzen & Przychodzen, 2018; Gauthier & Wooldridge, 2012; Noppers et al., 2014).

Despite the growing body of SOI knowledge within both *organisational* and *customer* perspectives, practitioners are still struggling with creating sustainable value and building the bridge between the two (Klewitz and Hansen, 2014; Oskam et al., 2018). In this light, Fellnhofer (2017) states a fruitful starting point for future research would be contributing to a better understanding on how firms can be supported in ensuring innovative and sustainable ideas are successful in the market. The challenges are related to the prevalent knowledge-gap regarding the incorporation of sustainability success factors into solutions and processes to facilitate and drive its market adoption (de Medeiros et al., 2014; Oskam et al., 2018). Hence, there is a need to increase knowledge about customers' decision-making factors for the adoption of SOIs (de Medeiros & Ribeiro, 2017) and find new approaches to translate these into firms' value creation activities, meaning its products and services (Hansen & Grosse-Dunker, 2013). More specifically, SOIs need fundamental BM redesigns incorporating new perspectives on how to increase customer value and adoption (Lüdeke-Freund & Dembek, 2017; Oskam et al., 2018; Schaltegger et al., 2016). In doing so, Long et al. (2016) suggest further research on overcoming the barriers to SOI adoption from two perspectives, as they conclude there exists a disparity between views of SOI providers and potential adopters (Long et al., 2016). They hint towards research on the two ends of adoption, finding alternative ways

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how SOI providers can effectively incorporate the demand's values and minimise barriers to foster adoption (Long et al., 2016).

When researching ways to foster SOI adoption, it appeared previous studies on SOI adoption have mostly been conducted in the light of sustainable *product* development. This leaves room for research on *service* development as an alternative and currently understudied approach in the light of SOI adoption.

Servitisation is an expanding BM research field (Kamp & Parry, 2017; Rabetino et al., 2017) and there is wide consensus in literature that servitisation adds financial, strategic and marketing benefits, supporting companies to cope with business growth challenges (Baines et al., 2009; Vandermerwe & Rada, 1988). However, in similar manner, many studies on servitisation are conducted on providers' *internal* implications and challenges of the BM transition towards services (Benedettini et al., 2017; Coreynen et al., 2017). Scholars therefore increasingly stress the need for knowledge on how servitisation contributes to *customer value and adoption* (Baines et al., 2017; Kamp & Parry, 2018; Kowalkowski et al., 2017).

Previous literature *has* connected servitisation with sustainability by means of product-service systems (PSS) (Coreynen et al, 2017; Tukker, 2004), an approach seeking to address combinations of product-services to enhance social, economic, environmental and industrial sustainability (Baines et al., 2013). Thereby, existing PSS research has mainly focussed on the benefits, implication and implementation of the PSS as an integrated concept (Barquet et al., 2016; Hannon et al., 2015; Sousa-Zomer & Cauchik, 2016). However, also within PSS literature, the effects of shifting the BM towards service activities have not been studied in relation with adoption. Therefore, linking the two concepts of 'servitisation' with 'SOI adoption' and studying their intersection appears to be entirely <u>novel</u>, yet, even more so relevant due to the higher complexity and slower adoption rate of SOI in comparison with CI.

Concluding, a two-fold research gap was identified concerning (1) the need to increase understanding on how SOI adoption can be improved through incorporating strong customer value into new approaches, and consequently (2) the necessity to increase understanding if and how servitisation contributes to SOI adoption as one such approach to improve SOI adoption.

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This research gap will be addressed and a relevant contribution to the existing knowledge can be made by studying the effect of servitisation (and its characteristics) on SOI adoption (with its barriers and drivers). Hence, the research question (RQ) is as follows:

"How does servitisation affect the adoption of sustainability-oriented innovations (SOIs)?"

A qualitative study on the role of servitisation on barriers and drivers for SOI adoption.

1.3 Purpose

Based on the knowledge gap identified, this research makes a contribution by returning to the core of servitisation, namely enhancing customer value (Durugbo et al., 2010), and analyses how this impacts the SOI adoption. Because only when there is a clear demand and customers actually acquire and adopt new innovations (Zhang & Banerji, 2017), firms are able to extract *real* sustainable value from their offerings (Kuijken et al., 2017) and competitiveness can be examined (Priem, 2007).

In more detail, this research aims to understand how to increase the customer value of SOIs by analysing barriers and drivers of adoption and how they are affected by specific service characteristics. This with the ambition to seek for possibilities of achieving market success and differentiation through SOI in markets characterised with accelerated change, high competition, and a rise in diversity of products (Singla et al., 2017). Hence, deepening the knowledge whether and how SOI adoption can be enhanced via servitisation therefore supports companies in finding the market fit for SOIs, helps to sustain a superior business performance and achieving a competitive advantage.

This research builds up on existing literature, further investigates the barriers and drivers of SOI adoption and adds novelty by studying if, how and which service characteristics potentially mitigate certain barriers and/or further drives SOI adoption. By answering our RQ, we contribute to closing the prevailing research gap about the role of servitisation for SOI adoption. Ultimately, this research contributes to facilitating the path towards sustainable development.

1.4 Case Industry

Previous studies on both servitisation and SOI adoption have mainly been conducted within the context of manufacturing firms (Zhang & Banerji, 2017; de Medeiros et al., 2014). In the quest to expand servitisation research to other contexts, to avoid limiting companies' understanding of servitisation to the biases and hurdles inherent to manufacturers (Kowalkowski et al., 2017), the agriculture appeared to be a particularly relevant industry to study the effect of servitisation on SOI adoption.

This, as the agricultural industry has gained great attention when it comes to SOI, since it is constantly dealing with the tension between ecosystems, biodiversity and economic aims (Diaz-Correa & López-Navarro, 2018; Fei & Lin, 2016). Yet, the agricultural industry is one of the most conservative and adopts new sustainable technologies reluctantly (McCarthy & Schurmann, 2015). This is reflected in the innovation rate, which in the Swedish agriculture is below average across industries (OECD, 2018). Struggles with profitability, low margins and high competition are some of the key reasons why the agricultural industry is so reluctant towards the adoption of new technologies (Shiferaw et al., 2009; Sivertsson & Tell, 2015).

Further, it is claimed that within this industry, current BMs are not optimally designed to diffuse SOIs (Long et al., 2017). Traditionally, customers have expressed themselves by the assets they possess and the production they deliver (Sivertsson & Tell, 2015). However, as owning assets requires high lump-sums of capital, customers are less likely to adopt new innovations once long-term investments have already been made (Shiferaw et al., 2009). Therefore, research by Sivertsson & Tell (2015) has already suggested service models are considered valuable for the future of farming. However, first findings show the adoption of service models might be hindered by farmers' cultural background and preference for product ownership (Sivertsson & Tell, 2015). However, it is stressed that further studies are desired which question the current product-dominant logic and find solutions to strive for smart, sustainable and competitive agriculture (Sivertsson & Tell, 2015).

Concluding, the agriculture is considered a highly relevant context due to the prevalence of the high need for SOIs paired with slow adoption rates. Hence, this industry is being used as an empirical tool to answer the RQ and draw conclusions that can potentially be generalised to other industries with similar characteristics.

2 Literature Review

The following chapter presents relevant literature within the fields of this research and consists of four parts. First, 'Sustainability-oriented innovation (SOI) adoption' (2.1), highlighting specifics relative to CI, the SOI adoption process, and barriers and drivers of SOI adoption and reactions to these. Second, 'BMs for SOI' (2.2), expressing the importance of business model innovation, BMs and sustainability and service BMs for sustainability. Third, 'Servitisation' (2.3), examining the service BM trend, including its dimensions and typologies. Fourth, 'Services and SOI adoption' (2.3), bringing the concepts together and tentatively outlining the relation between them.

2.1 Sustainability-oriented Innovation (SOI) Adoption

2.1.1 Sustainability-oriented Innovation

SOI, also referred to as sustainable innovation, eco-innovation, environmental innovation or green innovation (Adams et al., 2016; Halila & Rundquist, 2011) only recently has reached the status of becoming a mainstream field of study and is still rapidly growing (Adams et al., 2016; Bossle et al., 2016). As outlined in *Ch.1.1*, SOI refers to "an intentional change of an organisation's, products and services to realise environmental value in addition to economic returns". Traditionally, SOIs have been characterised as TP-driven, product-oriented, incremental and internally developed (Adams et al., 2016). This view however is increasingly challenged by more recent research seeing SOI as shifting towards being more people-centred and collaborative across firm boundaries (see figure 1) (Adams et al., 2016). A representation of this shift is the recent research on SOI systems, being a specific kind of innovation system involving multiple actors and focussing on reducing environmental pressures (Kılkıs ̧, 2016).

	Towards sustainable business		
Innovation focus:	Technology	⟶	People
Firm's view of itself in relation to society:	Insular (focused on itself)	⟶	Systematic (part of the organizational ecosystem)
Extent to which innovation extends across the firm:	Stand-alone (involves a single-unit or department)	⟶	Integrated (is in the organization's DNA)

Figure 1. SOI dimensions. Source: Adams et al. (2012).

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Differences SOI and CI

SOI and CI have multiple similarities and yet are distinctive from another (Adams et al., 2012). Both types address changes in technology, BMs or processes, and both aim towards adding value, reducing costs or increasing revenue (Adams et al., 2012). CI involves great levels of uncertainty regarding their market success (Hansen & Grosse-Dunker, 2013). However, SOI is considered more complex, as it involves even more uncertainties, involving both, the environmental and commercial dimension (Adams et al., 2012; Bossle et al., 2016). Consequently, benefits in one dimension can be outweighed by negative side-effects in the other (Adams et al., 2012; Bossle et al., 2016; Hansen & Grosse-Dunker, 2013). Providers of SOIs therefore perceive a greater influence of external forces on their outcomes relative to providers of CIs (Halila & Runquist, 2011). Customers meanwhile frequently perceive sustainability and economics as a trade-off and see SOIs as capital-heavy, involving great investments (Bossle et al., 2016; Ghisetti, 2017; Noppers et al., 2014; Varadajaran, 2017). Ghisetti (2017) describes SOIs as frequently involving new technologies and being more radical in nature compared to CIs. Ultimately, the above differences between SOI and CI lead to a slower adoption of SOIs relative to CIs (Forsman, 2013; Varadajaran, 2017).

2.1.2 SOI Adoption Process

The ultimate aim of offering SOIs is to shift the focus from reducing environmental harm to creating both economic and environmental value (Adams et al., 2016), while enhancing a firm's competitive advantage (Adams et al., 2016; Porter & van der Linde, 1995). Yet, a competitive advantage can only be achieved when the innovation is rapidly diffused and adopted by customers (Greve, 2009).

To understand the adoption process of SOIs, a theoretical understanding about the diffusion of innovations is required. In his 'diffusion of innovations theory', Rogers' (2003) describes the innovation-decision process. Accordingly, decision-makers first acquire knowledge about an innovation, form an opinion about it, take a decision, implement the innovation and finally confirm the decision (Rogers, 2003). For the adoption process, the decision stage is the central one, where an innovation is either adopted or rejected (Rogers, 2003). An innovation thereby is understood as adopted, if the best course of action available is the decision to make full use of it (Rogers, 2003). Roger's (2003) theory on innovation diffusion forecasts that innovation

which offers greater advantages than the products currently available on the market, commonly experience a more rapid and widespread adoption (Rogers, 1995).

Despite the fact this theory has been confirmed by numerous researchers, it seems to have distinctive implications on the adoption of SOIs. Due to the previously outlined differences between SOI and CI, it appears the former encounters more difficulties with market adoption than the latter (Adams et al., 2012; Halila & Rundquist, 2011). As a result SOI tends to be face slower adoption (Forsman, 2013).

2.1.3 Barriers and Drivers for SOI Adoption

Based on the above, existing literature has been consulted to define the distinctive implications on SOI adoption by outlining its barriers and drivers.

Barriers SOI

Regardless of pro-environmental attitudes and drivers for SOI adoption, customers still frequently purchase non-green alternatives (Olson, 2013). In fact, firms are experiencing a value-action gap, in which customers value sustainability-oriented substitutes, however, still adopt conventional offerings (Olson, 2013). One reason for this gap is the common perception of SOIs implying *higher prices*, *lower quality* or *reduced performance* (Olson, 2013). In similar manner, Senyolo et al. (2018) and Ghisetti (2017) conclude barriers to SOI revolve around *higher costs, investments and risks*. In addition, Shiferaw et al. (2007) stress that customers in the agricultural industry will unlikely adopt an SOI if *no short-term economic gains* are involved. According to Halila and Rundquist (2011) and McCarthy and Schurmann (2015), *switching costs* are a main factor within the price decision as part of the SOI adoption process. Generally speaking, the more radical the SOI is, the higher its switching costs are (Ghisetti, 2017).

Pacheco et al. (2018) argue that a barrier for SOI adoption is companies seeing expenses related to SOIs as *costs instead of investmen*ts. Correspondingly, the lack of *long-term thinking* is another prevalent view within companies identified as a barrier to SOI adoption (Pacheco et al., 2018; Vasilenko and Arbačiauskas, 2011). The significance of financial aspects is also particularly stressed by Vasilenko and Arbačiauskas (2012), who claim the *lack of financial resources* is the most significant inhibitor for SOI adoption within Lithuanian SMEs.

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Ghisetti (2017) points out that SOIs initially *lack reliability* since existing and proven technologies are replaced by novel ones. Noppers et al. (2014) researched the importance of *instrumental attributes* (e.g. functionality, price) on SOI adoption and conclude they have a particularly strong hindering effect if they are not favourable, relative to other factors. It could be argued this typically is the case, since SOIs tend to require higher investments and costs (Ghisetti, 2017; Olson, 2013) and initially are less reliable when new technologies are involved (Ghisetti, 2017). Ironically, drawbacks from instrumental attributes could simultaneously strengthen the symbolic attributes (e.g. social status) by signalling to others that the adopter has the financial means to afford the SOI (Noppers et al., 2014).

In a study about the adoption of SOI services, Anttonen et al. (2013) point towards a prevalent *lack of knowledge about customers' processes and needs* as a barrier for adoption, resulting in a mismatch with the customer needs. The authors further state that companies *fail to demonstrate the environmental and economic benefits* of the SOI service via adequate metrics (Anttonen et al., 2013). Vasilenko and Arbačiauskas (2012) claim there is a *lack of information* about SOIs; this is in line with the argumentation of Anttonen et al. (2013), who found *customer unawareness* about SOI services is a main barrier for SOI adoption. Furthermore, companies frequently are not sufficiently *aware about environmental problems* and hence do not seek for SOIs (Vasilenko & Arbačiauskas, 2012).

The role of regulation was treated within the drivers for SOI adoption. However, Anttonen et al. (2013) found *legislative requirements and bureaucracy* could also inhibit the adoption of SOI services when the requirements are too intense and hence reduce their value.

Pacheco et al. (2018) and Vasilenko and Arbačiauskas (2012) state *lack of capacity and knowledge* should be considered a barrier to SOI adoption. A similar barrier is also described by Anttonen et al. (2013); the scholars outline the frequent problem of *lacking budgetary and personnel resources* to acquire knowledge and implement the SOI service. The adoption of SOIs is furthermore hindered by the prevailing willingness to only adopt SOIs when *fully established and tested by the market*; potential buyers hence perceive an early adoption as highly risky (Nygrén et al., 2015). The same barrier was identified by Vasilenko and Arbačiauskas (2012), who found that a *lack of practical examples* reduces the willingness to adopt SOIs. Moreover, *reluctance to make changes in the internal production process* to incorporate SOIs is an obstacle for SOI adoption (Vasilenko & Arbačiauskas, 2012).

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Drivers SOI

Contrarily to the above, a number of researchers point out the existance of driving factors on SOI adoption. To begin with, a series of authors emphasise *supportive regulation* as an important external stimulus to increase SOI adoption (Ghisetti, 2017; Halila & Rundquist, 2011; Hasler et al, 2017; Horbach et al., 2012; Porter & Van der Linde, 1995; Triguero et al., 2013; Vasilenko and Arbačiauskas, 2012). Similarly, Beise and Rennings (2005) point out to a favourable regulative environment as a driver for SOI adoption yet coupled with proactive customer behaviour. SOIs contribute to firms' ability of being compliant with those environmental regulations (Schaltegger et al., 2012; Triguero et al., 2013). This reduces their political, societal and market risk and acts as a further driver for SOI adoption (Schaltegger et al., 2012). Moreover, expectations about future environmental regulations significantly influences companies' adoption process and if environmentally favourable, contribute to enhancing it (Triguero et al., 2013). Similarly, the availability of *public financial support* such as subsidies, tax reductions, or funding programmes is considered an important facilitator SOI adoption (Triguero et al., 2013; Vasilenko & Arbačiauskas, 2012).

However, the view that successful SOI adoption invariably depends on policymaker's support has been challenged. According to Halila and Rundquist (2011) SOI adoption may be successful without supportive regulations if other factors such as the innovator, the innovation, the development process or market surroundings are adequate. Whereas SOI adoption traditionally was largely driven by regulations, firms are now increasingly adopting SOIs due to enabled *cost savings* or *increase of revenue and hence* gaining a *competitive advantage* (Hasler et al., 2017; Horbach et al., 2012; Kammerer, 2009; Vasilenko and Arbačiauskas, 2012). Horbach et al. (2012) point towards *increased customer value* as the key for successful SOI adoption and thereby stress market newness, superior technical performance, lower cost, reliability and quality as the central customer value aspects driving SOI adoption (Halila and Rundquist, 2011). One such driving customer value is *compatibility with other equipment* (Hasler et al., 2017).

An important enhancing role for SOI adoption is having adopters with *beneficial personal attitudes* towards SOIs and *technological affinity* (Hasler et al., 2017). Since SOIs are less harmful to the environment than conventional alternatives, Noppers et al. (2014) point towards positive *environmental attributes* as a promoting factor for SOI adoption. Further, *symbolic*

attributes of the SOIs (positive or negative outcomes for the social status) tend to favour SOI adoption, since they contribute to enhance the reputation of the adopter as environmentally-conscious (Noppers et al., 2014).

In a previous study, Byrne and Polonsky (2001) conclude the market adoption of SOIs is strongly dependent on the *inclusion of stakeholders* within the innovation process. Triguero et al. (2013) narrow this statement and claim *closeness to customers* in the SOI product development process increases market adoption. More recently, Hasler et al. (2017) have confirmed the importance of *high*-quality *customer support*, and the *involvement of external groups* to enhance information and knowledge exchange, ultimately driving SOI adoption. In this light, Vasilenko and Arbačiauskas (2012) specifically point out the importance of receiving *assistance and consultancy from industry associations* and fostering a *strong relationship between businesses and research institutions*. Hasler et al. (2017) further outline the positive contribution for SOI adoption of having *access to funding* to finance the investments in SOIs.

Triguero et al. (2013) stress the importance for adopters to possess knowledge about the SOI, stating that providers must present *adequate information* to increase understanding and knowledge about it. Yet, it is not only knowledge about the SOI itself; the *reputation and information about the provider* of the SOI is named as another driving aspect for SOI adoption (Triguero et al., 2013). Hasler et al. (2017) further outline the importance to see an improvement from using SOIs; hence *observability of the effects* of SOIs is considered another important driver for SOI adoption named in literature. This view is supported in a study about obstacles and drivers for SOI development and implementation within Lithuanian SMEs by Vasilenko and Arbačiauskas (2012), who found that the availability of *demonstration projects* enhances SOI adoption. Lastly, SOI adoption benefits from *wide market availability* (Hasler et al., 2017).

2.1.4 Overcoming the Barriers and Enhancing the Drivers of SOI Adoption

The broad research on barriers and drivers for SOI adoption has also led to a growing interest in understanding how to overcome those barriers. Some of the authors that previously researched barriers and drivers of SOI adoption have made preliminary recommendations on how to overcome them.

Hasler et al. (2016) and Senyolo et al. (2018) for instance suggest increasing the adoption capacity via holistic *educational campaigns* and providing more *knowledge* about SOIs. Further, Hasler et al. (2016, p.13) recommend *"practice sharing, flagship projects, and guidance projects"* to increase observability and drive adoption. Likewise, McCarthy and Schurmann (2015) suggest increasing the observability of SOI benefits by fostering the *network* between providers and potential adopters. Another approach to increase transparency is suggested by Anttonen et al. (2013), calling for SOI providers generating *calculations on cost savings and other benefits* in advance, hence clearly outlining the economic and environmental value provided.

Senyolo et al. (2018) furthermore stress the importance of *interaction* and advise stronger *stakeholder involvement*, aiming for a bottom-up approach towards technology development and encourage industry organisations to monitor new SOIs and adoption practices. Similarly, Hasler et al. (2016) suggest to better connect the multiple players along the supply chain to encourage *active information exchange*.

Another way to overcome SOI adoption barriers is increasing the *clarity of policies* and avoiding contradictory government-funded programmes (Senyolo et al., 2018). Likewise, Hasler et al. (2016) and Vasilenko and Arbačiauskas (2012) claim more *external incentives* such as governmental funds are needed to drive SOI adoption. Moreover, stricter *environmental regulations* and promotion of public-private certification are named means to increase the need to adopt more SOIs (Hasler et al., 2016).

Antonnen et al. (2013) recommend enhancing customer value by closer consideration of *customer needs*, whilst Lioutsas and Charatsari, (2018) and Shiferaw et al. (2007) recommend the *co-creation* of tailor-made SOIs instead of promoting "one-size-fits-all" solutions.

Lastly, some authors have also recognised the uprising need for *BM redesign* to address the apparent challenges that SOI adoption faces (Oskam et al., 2018). Long et al. (2016) outline the need to adjust the BMs to maximise the diffusion of SOIs and particularly name value proposition, key channels, customer relationships, key resources, key partners, and cost structure as BM blocks that are critical determinants to increase SOI adoption.

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2.2 BMs for SOI

2.2.1 Business Model Innovation

BMs embody the logic of how organisations create, develop and deliver value to its customers (Zhang & Banerji, 2017). Thereby, 'customer value' has been recognised as the main purpose for business modelling and has been studied through several theoretical lenses (e.g. strategy, economics, marketing) (Andreini & Bettinelli, 2017). Despite the exponential rise in studies on BMs since the dot-com boom in the 2000s, their usefulness was criticised (Andreini & Bettinelli, 2017). As a result, the BM evolved over time towards a more dynamic approach, with a more specific focus on innovation and development (Andreini & Bettinelli, 2017; Chesbrough, 2010; Demil & Lecocq, 2010). Accordingly, business model innovation (BMI) is strongly represented within entrepreneurial literature (Andreini & Bettinelli, 2017). Within recent years, technology has played a large role in BMI as it facilitates a source of opportunities for new products and services (Anderson et al., 2009; Andreini & Bettinelli, 2017). In this light, the BM guides companies with decisions that need to be made to react to business opportunities to potentially disrupt an industry (Andreini & Bettinelli, 2017).

2.2.2 BMs and Sustainability

There is a rise in both practice and theory concerning BM redesigns for the purpose of sustainability (Oskam et al., 2017). Hence, there are multiple theoretical frameworks and new BMs created driving around the principle of sustainability and triple-bottom-line integration (social, environmental and ecological value) within the BM (e.g. Joyce & Paquin, 2016; Schaltegger et al., 2012; Yunus et al., 2010). Moreover, recent literature on BMI for sustainability stresses on the increasing importance of people-centred, value-driven BMs (compared to technology-driven BMs) to change customer behaviour towards more sustainable behaviour and enhance SOI adoption (Adams et al., 2016; Cinquini et al., 2013; Lv et al., 2018; Tongur & Engwall, 2014).

2.2.3 Service BMs and Sustainability

In line, a review about the development of sustainable BM archetypes by Bocken et al. (2014) introduce a sustainable BM archetype built around delivering functionality rather than ownership, hence, providing services to fulfil customers' needs without actual ownership over

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the physical product. This BM archetype has arisen from the stream within literature around PSS and servitisation and the shift of companies moving from BMs focussing on product offerings to diversifying their portfolio with service offerings, to enhance their value proposition (Bocken et al., 2014). Bocken et al. (2014) state that the service BM archetype can create better alignment with market needs, reduce the resource consumption, can be seen as an opportunity to break the equilibrium of the traditional through-life and end-of-life concerns of ownership. Moreover, it also enhances the durability of products (longer-lasting design), allows reusing materials, and creates the opportunity of upgradability and reparability (Bocken et al., 2014). Precisely due to their distinctive nature, and especially affecting the customer interaction, services have the potential of increasing customer value (Kuijken et al., 2017).

2.3 Servitisation

When researching service BMs, servitisation arose as a key concept, typically referring to the transformation of manufacturing firms solely focussing on product offerings towards stronger integration and focus on service offerings (Baines et al., 2009; Tongur & Engwall, 2014). The term "servitisation" was first defined by Vandermerwe & Rada (1988, p.314) as "the increased offering of fuller market packages or 'bundles' of customer focussed combinations of goods, services, support, self-service and knowledge in order to add value to core product offerings". The concept is now widely recognised and the field steadily expanding (Coreynen et al., 2017). In the light of BMI, servitisation represents the phenomenon in which a company's value proposition, value capturing (revenue model), and capabilities are shifting from exchanging goods towards services in value that is co-created with the customers (Beltagui, 2017; Storbacka, 2011). Ng et al. (2011) particularly point the *consistent and stable sharing of information and risk* as the two key aspects of servitisation that contribute to *value co-creation*. Seen from a technological angle, servitisation is a strategy that emphasises embedding technologies also within the customer's value *proposition*, rather than focusing solely on research and development and therefore aims at innovation within *value-creating technology* (Barnett et al., 2013, Smith et al., 2012; Tongur & Engwall, 2014).

For providers, the increasing shift towards service activities involves three key results: reduced focus on price-competition whilst *raising competitive barriers* (1), *higher customer loyalty* (2), and *increased differentiation* (3) (Cinquini et al., 2013). Baines et al. (2009) state that

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integrated product-service strategies enhance the *longevity* of a business and enhance the ability to defend against competition based in lower cost economies. Besides that, regular service fees enhance the *stability of income* and *higher profit margins* (Baines et al., 2009).

A research stream revolving around servitisation and sustainability is PSS. PSS represent a bundle of service-based BMs designed to combine economic and environmental purpose whilst focussing on functionality and customer need satisfaction instead of product ownership (Hannon et al., 2015; Tukker & Tischner, 2006). Research from Singla et al., (2018) suggests that PSS *enhances MP strategies*, and ensures that demand-based activities fulfil social needs in an environmentally feasible manner (Hannon et al., 2015). Furthermore, PSS BMs contribute to providers' success, facilitating the *customisation* of offerings, enhancing customer *relationships* and increasing the *speed* of innovation due to a closer consideration of customer needs (Tukker, 2004).

However, the shift towards servitisation also involves challenges. In fact, companies frequently abandon their service strategies, mainly due to *labour-intensiveness* and *difficulties* in the BM transition (Coreynen et al., 2017). Furthermore, in the context of service versus product design, services are often considered 'fuzzy' and hard to define and hence discourage companies (both providers and adopters) in their *BM transition* (Slack, 2005). Finally, the shift towards servitisation involves dealing with an unusual domain, unknown competitors and potential new entrants (Baines et al., 2009; Vandermerwe & Rada, 1988).

For the implementation of PSS, critical barriers such as the *cultural status* attached to ownership, *organisational inertia*, *existing profitable BMs*, the *difficulty to demonstrate saving potential* to customers, *lack of supportive regulation* or *little customer awareness* have led to PSS remaining a niche in practice (Hannon et al., 2015).

2.3.1 Service vs. Product Offering

Service offerings differ from product offerings in multiple ways. When considering services, innovation refers to "any recombination of resources that creates new benefits for any actor – customer, developer, or others – in the business network" (Kindström & Kowalkowski, 2013, p.97). This requires integration of a set of competences to create tailored offering aiming to solve customer-specific and strategic pains (Storbacka, 2011; Kindström & Kowalkowski,

2013). Hence, service development tends to focus more on customer *co-creation*, from idea generation until value capturing (Beltagui, 2017; Kindström & Kowalkowski, 2013; Lee & Chen, 2009). Contrarily to products, services normally arise from a *combination of existing elements and technologies* to create greater value rather than developing fully new ones through research and development (Beltagui, 2017; Den Hertog et al., 2010; Tan et al., 2010). Therefore, services mostly lead to incremental and continuous innovation (Beltagui, 2017; Den Hertog et al., 2010). Nevertheless, services could turn into disruptive or radical innovation by altering the means of how customer value is created or delivered (Biemans et al., 2016).

Yet, in line with the servitisation trend, the clear distinction between service and product innovation has been questioned in literature (Kindström & Kowalkowski, 2013). Whereas traditional frameworks stress a clear division of process and product innovation, service innovation includes an intertwined combination of both concepts (Hildebrand, 2009). An example of this is the integrated approach from Gallouj and Windrum (2009) including both non-technological elements of service innovation processes (e.g. services, knowledge, BMs) alongside with technological (product) elements (Kindström & Kowalkowski, 2013). This also allows product-centric companies to deliver service value and due well-integrated BMs, the likelihood of imitation will decrease (Kindström & Kowalkowski, 2013; Neu and Brown, 2008).

2.3.2 Service Characteristics and Dimensions

To create a deeper understanding of the shift towards servitisation, the service dimensions and characteristics of are outlined. Services can be considered as acts, deeds, performances, or efforts (Lovelock & Gummesson, 2004). As part of the service-dominant-logic, Lusch and Vargo (2004) outline the service characteristics of *value co-creation* with customers, a focus on *exchanging specialised knowledge*, and strong *customer-relationships* with high degrees of *feedback*.

In previous literature, services are characterised by the notions of *intangibility* (also: immateriality), *heterogeneity* (also: variability, non-standardisation), *inseparability* (also: simultaneity of production and consumption), and *perishability* (also: inability to inventory service output), also referred to as the IHIP dimensions (Delaunay & Gadrey, 1992; Robinson, 1969; Tidd & Bessant, 2014).

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Despite the popularity of the latter dimensions, Lovelock and Gummesson (2004) concluded that the IHIP dimensions derive from early economic thoughts and are non-generalisable and adequate to represent the advances of technology (Lovelock & Gummesson, 2004). Therefore, Lovelock and Gummesson (2004) proposed a refined set of service dimensions:

- *Tangibility*. Physical actions to persons involve tangible processes, tangible outcomes and tangible impacts to customer's possessions as a result of services (e.g. repair, and cleaning).
- *Homogeneity*. Improvements in service quality and automation lead to achievements of high reliability and consistency in delivery of possession-processing services. It can be delivered and redelivered many times to multiple people with zero variations.
- *Separability*. Possession-processing services do not always involve customer participation during production; they are completely separable from consumption.
- *Durability*. Service performances and output can be captured and can be highly durable.

Still, Barnett et al. (2013) argue that services are frequently defined by their inseparability due to the co-creation of value between supplier and customer. This means that not only the supplier must adapt their existing systems around the offering of service practices, but that customers must also be proactive to drive the change. Taken into account these two ends of change, Barnett et al. (2013) suggest that a more adaptive and responsive approach of developing the service with the customer, instead of progressively taking over customer activity to deliver outcome. This could result in a better jointly movement forward towards servitisation (Martinez et al., 2010).

2.3.3 Typologies of Services

Different services are directed to different customers and can therefore not be studied as a monolith (Anttonen et al., 2013). Within the refined service dimensions of Lovelock and Gummesson (2004), services are distinguished in physical and non-physical actions. In similar view, Kindström and Kowalkowski (2013) suggest distinguishing services in two levels, namely service focus (customer process focus vs. product focus) and revenue model (input based vs. output based).

Specific to B2B services, Trott (2012) outlines the possibility to distinguish 'traditional services' and 'knowledge intensive business services' (KIBS). Both aim to provide high-quality tailored and personal service, however KIBS are defined by its speciality and targeting business with high quality purchasing power (Trott, 2012).

2.4 Services and SOI Adoption

Within this research, the effect of servitisation on SOI <u>adoption</u> will be studied. As outlined in *Ch.1.2 "Problem Analysis"*, this is a prevalent gap in literature. However, some initial research on the combination of both concepts has been conducted, yet, instead of studying the effect and relation amongst the two separate concepts, they are studied together as "SOI services".

For instance, several researchers argue that the willingness to adopt SOI services depends on the adopters' size and financial solidity, the expected long-term benefits and the customer-provider relationship (Halme et al., 2007; Kortman et al., 2007; Mont et al., 2006). Moreover, Kortman et al. (2007) found that the adoption of SOI services depends on the firm's outsourcing strategy for non-core processes.

Anttonen et al. (2013) researched the rationale behind the <u>limited</u> adoption of SOI services, finding a mismatch between the SOI service provided and the customer demand. The authors found despite the increasing need for SOI services, the demand remains characterised by a focus on economics which hinders the adoption (Anttonen et al., 2013). Besides this economic barrier, research by Kuijken et al. (2017) outline that SOI services are often not adopted as the added value of services is frequently not perceived by customers due to its intangible nature (Kuijken et al., 2017).

Contrasting Antonnen et al. (2013), Kortman et al. (2007) stress cost savings remain the primary incentive for customers to procure SOI services. As another driver for adoption, customers increasingly expect enhancement of their environmental reputation and stronger compliance with future legislation as effects of service adoption (Kortman et al., 2007).

3. Methodology

In the following, the methodological choices for research approach and purpose, data collection and data analysis are described, ending with a reflection of decisions taken, using the criteria to assess qualitative business research. For this chapter, particularly the methodological guidance from Bryman and Bell (2011) and Gioia et al. (2012) was contemplated.

3.1 Research Approach and Purpose

3.1.1 Epistemology and Ontology

This study investigates the role of servitisation on the adoption of SOIs by B2B customers in the agricultural industry. The epistemological stance taken is based on interpretivism, according to which social sciences cannot be studied the same way as natural science (Bryman & Bell, 2011). Especially the context of SOI adoption includes barriers and drivers that must be considered as a social construct as it is influenced by financial objectives, structures, culture and tradition amongst others *(see Ch.2)*. In line, this thesis follows a logic reflecting the distinctiveness of human behaviour for adoption and tries to *understand,* instead of *explaining,* it (Bryman & Bell, 2011).

Regarding ontological considerations, a constructionist perspective is adopted, seeing organisations and cultures as constructed through social interaction and constantly being revised by the social actors (Bryman & Bell, 2011). Consequently, this work is to some extent also a construction of the author's version of the social reality (Bryman & Bell, 2011). Therefore, the thesis follows the stance of constructivism of the interpretivism epistemology (Bryman & Bell, 2011).

3.1.2 Research Design and Strategy

The aim of this study is to create, build and contribute new concepts and theories to the intersection of the two research fields, facilitating deeper understanding of the phenomena of SOI adoption and servitisation (Bryman & Bell, 2011). Accordingly, this study will maintain a qualitative approach contrary to a quantitative study aiming at testing existing theories and concepts (Gioia et al., 2012).

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More specifically, an abductive approach is taken to assure the delivery of pragmatic perspectives to the research fields. This is accomplished through a combination of both inductive and deductive components. As a base for this research, the inductive theory approach is adopted, as the aspired outcome is to generate theory and draw generalisable conclusions from observations (Bryman & Bell, 2011). However, deductive strings can be found as the research is to a certain extent also based on existing knowledge, which is subsequently empirically studied, to avoid reinventing the wheel, to build on what is already known and to make sense of existing data (Bryman & Bell, 2011). As example, some barriers and drivers for SOI adoption were found in existing literature. Yet, within this research, these were further studied with the aim of analysing SOI adoption and the role of servitisation within the same context, hence being able to analyse and compare specific adoption variables in relation to service characteristics identified in the context of SOI adoption. Concluding, this combined approach allows creating theory based on observations and first-hand findings [inductive] and relate these to the concepts discovered in previous literature [deductive] (e.g. highlighting both similarly and newly found barriers and drivers to SOI adoption compared to the ones found in literature).

Based on the RQ, the aim is to generate a holistic view on SOI adoption. Therefore, within this qualitative study, different perspectives are analysed. To achieve such holistic understanding, both ends of adoption are studied, namely customers (adopting SOIs) and providers (launching SOIs). Accordingly, companies were interviewed that either adopted or provided SOIs and did, or aspired to do, within a service BM.

Hence, this research can be considered a multiple or collective case study, however with the aim of exploring multiple angles regarding SOI adoption (and the role of servitisation) to generate a comprehensive view with a focus on commonalities rather than in-depth case analyses outlining the differences. The examination of the various cases therefore aims at finding out similarities across cases to enable a broader understanding of the servitisation phenomenon on SOI adoption which can potentially be generalised (Bryman & Bell, 2011).

Concluding, the research strategy and design is geared towards a qualitative, abductive and holistic approach, which provided the framework for the collection and analysis of data (Bryman & Bell, 2011).

3.1.3 Research Process

The case studies have been conducted within the context of the agricultural industry *(see Ch.1.4)*, drawing on B2B customers as a second contextual factor. This is justified by the fact that it appears there is more SOI service potential for B2B customers (Anttonen et al., 2013; Tukker, 2004; Tukker & Tischner, 2006), mainly due to the higher amount of incentives companies experience to adopt services (Mont, 2001).

By the use of explorative interviews and agriculture market research, several key issues emerged. First of all, the potential and pressure for sustainability improvement in agriculture became apparent, predominantly stemming from a slow SOI adoption rate (McCarthy & Schurmann, 2015; OECD, 2018; Sivertsson & Tell, 2015). This problem points towards the need and relevance of refining BMs (Dyck & Silverstre, 2018; Sassenrath et al., 2008; Long et al., 2016). Second, the explorative interviews gave tentative insights into SOI adoption barriers such as high investments for SOIs, low margins and product-dominance within the industry, and indication for the necessity of service BMs. Consequently, studying the effects of servitisation on SOI adoption appeared to be a highly relevant phenomenon, especially in an industry marked by a great need for SOIs, yet slow SOI adoption rate due to economic pressure.

Based on these initial insights, a general literature review was performed on BM constructs, value-creation, customer-focus, TP, MP, servitisation, SOI and adoption. Conducting the literature review confirmed the research gap and validated the phenomenon as prevalent across industries, reducing the bias of studying solely one industry.

Even though Gioia et al. (2012) suggest a "semi-ignorant role" when maintaining a grounded theory approach, it was of high relevance to first create a broad understanding of the concepts within this research field.

In tandem, supplementary explorative interviews were conducted to further deepen the understanding of problems and literature findings encountered in the case context. Concurrently, the literature was again reviewed, leading to the exposure of further concepts (e.g. PSSs) and the generation of alternative RQs. After several iterations, the final research RQ was set, being narrow enough to guide the following semi-structured interviews, however leaving room for alteration based on new insights appearing from these interviews (Bryman & Bell, 2011). Before conducting the semi-structured interviews, a pilot interview was realised, giving valuable feedback for the final interview guide (Bryman & Bell, 2011).

In line with the principles of grounded theory, the researchers aimed at extracting theory based on the gathered data (Bryman & Bell, 2011). Hence, the empirical data emerging from semi-structured interviews was used as a foundation for the analysis. Following the principles of grounded theory, data collection and analysis were closely intertwined, frequently iterating between the two (Bryman & Bell, 2011). The data analysis was realised based on guidance from Gioia et al. (2012) countering the frequent critique of lacking 'qualitative rigor' within inductive research.

Following an "oscillation between testing emerging theories and collecting data", initially collected data led to generation of emerging theories and concepts, tighter specification of the questions and testing with further collected data (Bryman & Bell, 2011, p. 393).

Thereby, data collection was carried on until theoretical saturation was reached, meaning that additional interviews did not lead to emergence of novel insights, categories were well developed and relationships between categories were well established and validated (Bryman & Bell, 2011). In the following, findings were outlined, explaining emergent themes and dimensions, yet prioritising and highlighting key ones to resent them as core ideas of this research (Gioia et al., 2012). Finally, informants' experiences were translated into theory by displaying dynamic interrelationships amongst emerging concepts, aspiring to create a 'vibrant inductive model' (Gioia et al., 2012).

3.2 Data Collection

The data collection resolved around the determined research design and strategy (Bryman & Bell, 2011), and was realised over the span of four months, yet, the cases analysed stemmed from differing points in time.

Concerning data sourcing, valuable information has been subtracted from *explorative [unstructured] interviews* emphasising the problem and shaping the RQ, *company documents* to understand the case company activities, background and operational environment, and *semi-structured interviews* being the main foundation of the research (Bryman & Bell, 2011). This is in line with Gioia et al.'s view (2012) that qualitative research is employed by several data sources, yet at the heart of it remains the semi-structured interview.

Data was collected until categories were formed and their importance confirmed. This process was repeated until theoretical saturation was reached for both data collection and analysis

(Bryman & Bell, 2011). Hence, further data collection did not further narrow the concepts, reviewing of data did not add any more codes and therefore categories were well established, showing variations or relationships between the categories (Bryman & Bell, 2011).

3.2.1 Sampling and Interviewing

For both explorative and semi-structured interviews, two sampling levels could be observed. *As a first sampling level,* companies (and interviewees within) were selected based on a combination of convenience, snowball sampling, and purposive sampling (Bryman & Bell, 2011). Both snowballing and purposive sampling involved targeted searching and expanding of the network, and hence a strategic selection of companies based on predetermined criteria that varied between the explorative and semi-structured interviews and will be outlined in the following (Bryman & Bell, 2011). As a *second sampling level*, the individual layer was considered, whereby the researchers ensured that sampled participants were relevant and acknowledged to answer the RQ posed (Bryman & Bell, 2011).

Explorative interviews

Eight qualitative interviews have been conducted in an unstructured way to begin with the data collection. The purpose was to remain explorative and focus on the company's and interviewee's point of view, whilst remaining flexible (Bryman & Bell, 2011). Conversation-like interviews were conducted, mainly relying on open questions on predetermined topics (Bryman & Bell, 2011), namely company activities, trends in the agricultural industry, customer needs and SOI adoption. Following this approach enhances getting a good understanding of views on the world of certain groups in their social setting (Bryman & Bell, 2011). The selection criteria for the sampling were:

- Criteria 1ˢᵗ sampling level (company):
  - having experience within the agricultural industry (e.g. operationally active);
  - **and/or** in the field of sustainability (e.g. diffusion of SOIs).
- Criteria 2ⁿᵈ sampling level (individual):
  - having a profound and holistic understanding of the agricultural industry (e.g. value chain, customer problems);
  - **and/or** being involved in recent changes or innovation projects.

Please see *app.1* for the list of unstructured interviews conducted.

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Semi-structured interviews

After the explorative interviews, twelve semi-structured interviews were conducted with the aim of providing the researchers with relevant data to answer the RQ (Bryman & Bell, 2011). The structure within this method allows comparability amongst cases, whilst leaving room for modification (Bryman & Bell, 2011).

As mentioned, the aim was set to generate a holistic view on SOI adoption and the role of servitisation (figure 2.1b). Hence, different companies and cases within agriculture were sampled targeting at both ends of adoption within the sampling approach (figure 2.2b). Initially, the aim was to study pairs of providers and adopters to enhance triangulation and analyse and cross-check insights through both lenses. However, it became apparent that this sampling approach was unrealistic within the research scope (*see 6.4 Future Research)*. To nonetheless maintain strong validity, the researchers aimed at achieving a representative sample through two approaches. First, purposive (non-probability) sampling allowed avoiding over-representation in one end of adoption (either providers or adopters). Hence, an appropriate balance in both groups was maintained (five adopters, seven providers). Within, different types and development stages of servitisation were targeted (figure 2.3b). Secondly, sampling was performed having a clear focus on interviewees' expertise to address specific issues required to answer the RQ (Bryman & Bell, 2011) (figure 2.4b). Accordingly, the selection criteria for the second round for the sampling frame were:

- Criteria 1ˢᵗ level sampling (agricultural company) (figure 2.1a):
    - being experienced with providing _or_ adopting SOIs in the agricultural industry (figure 2.2a);
    - **and** attempts to provide _or_ adopt a service BM (figure 2.3a).
- Criteria 2ⁿᵈ level sampling (individual):
    - company representative being actively involved in recent SOI projects;
    - **and** being acknowledged in BMs and specifically service BM/servitisation (figure 2.4a)

Figure 2 visualises the above-mentioned sampling frame and corresponding sampling approach. Based upon the criteria and the approach, please see table 1 for the list of semi-structured interviews conducted (divided into providers and adopters).
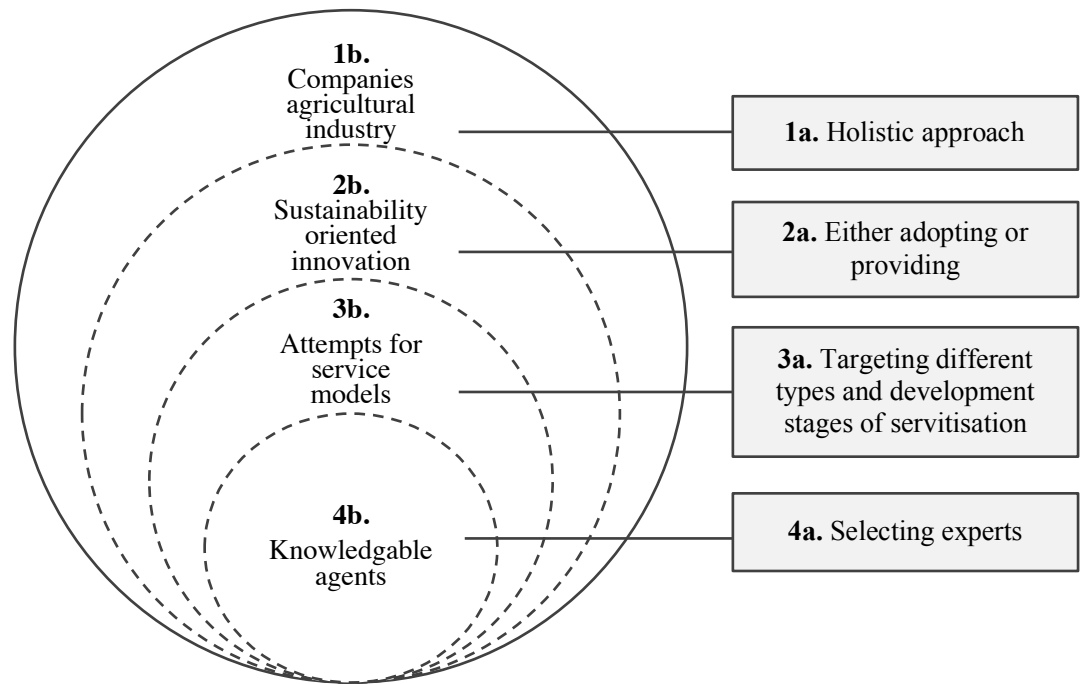
Figure 2. Sampling frame (left) and corresponding sampling approach (right).

No.	Date	1ˢᵗ level sampling (company): Organisation *Sampling-criteria met.*	Country	Company size (empl.) (OECD, 2018) *S: 1-50* *M: 51-249* *L: >250*	2ⁿᵈ level sampling (individual): Position *Sampling-criteria met.*
Adopting SOI (B2B customers)					
Int.1	4/Feb/'19	International Governmental Organisation	Sweden	S	Chief Executive Officer
Int.2	7/Feb/'19	Vertical farming company	International (Swedish based)	S	Head of Research & Development
Int.3	7/Feb/'19				Global Head of Business Development
Int.4	11/Mar/'19	Industry association	Sweden	S	Former farmer and chairman of farming organisations
Int.5	4/Apr/'19	Growing company	The Netherlands	M	Senior Project Manager
Launching SOI (providers)					
Int.6	14/Feb/'19	Energy provider agriculture	International (Swedish based)	L	Head of Special Projects, Business Innovation

Int.7	5/Mar/'19	Bio-technology supplier agriculture	Sweden	S	Director of Product Management and Engineering
Int.8	5/Mar/'19	Greenhouse manufacturer #1	International (Dutch based)	M	Sustainability Manager
Int.9	6/Mar/'19	Greenhouse solutions and manufacturer #2	International (Dutch based)	M	Sales Manager, Indoor Farming North America
Int.10	6/Mar/'19	Greenhouse manufacturer #3	International (French based)	M	USA Country Manager (business developer, sales and entrepreneur)
Int.11	15/Mar/'19	Greenhouse solutions and manufacturer #2	International (Dutch based)	M	Consultant Sales Engineer
Int.12	19/Mar/'19	Agriculture technology and sustainability consultancy	International (American based)	S	Founder

Table 1. Conducted semi-structured interviews. Adapted from Long et al. (2016).

Prior to conducting the semi-structured interviews, the SOIs were studied regarding type of SOI (launched, adopted) and the service development stage (requested, exploring, adopted) to ensure the sample was selected accordingly and to be acknowledged beforehand, facilitating to obtain the most insights possible (*see app*.*2*). The table was complemented subsequent to conducting the interviews for the cases in which too little information was publicly available.

3.2.2 Interview Guide, Topics and Questions

An interview guide was specified before realising the interviews, including a list of fairly specific topics and questions, geared towards answering the research question (Bryman & Bell, 2011). This interview guide was created to "follow a script" (Bryman & Bell, 2011, p.472), yet maintaining the interview process flexible, meaning the researchers might change wording, order or add new questions during interviews (Bryman & Bell, 2011). Please refer to app.3 for the full interview guide.

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Topics

When creating the interview guide, the RQ was divided into several interview categories, which paved the path for the development of the interview questions (Bryman & Bell, 2011). These interview questions derived from the literature review and were created after discussion and consideration of the interview topics (Bryman & Bell, 2011). Moreover, both the creation of the interview categories and the interview questions were considered an iterative process of reviewing and revising (Bryman & Bell, 2011). After the first draft of the interview guide was created, additional issues were identified and incorporated in order to finalize the guide (Bryman & Bell, 2011). Hereafter, the interview questions were structured and ordered into a natural flow, aiming to answer the RQ (Bryman & Bell, 2011). See table 2 for the interview topics.

1. **Interview guidelines**
The first category aims to facilitate a common understanding of the purpose of the interview, to outline the interview process (incl. topics), to minimise concerns regarding recording of the interview and to lay out constituents of confidentiality (Bryman and Bell, 2011).
2. **Background**
The second category is used to generate deeper understanding of the interviewees' company context and operational environment (Bryman and Bell, 2011). Hence, questions revolve around how, in what form, and to whom value is offered and captured and its level of innovation and sustainability to create deeper understanding, avoid missing non-publicly available information and ensuring the sampling criteria is met.
3. **Generic adoption sustainability-oriented innovation (SOI)**
Before diving into the interviewees' experiences with SOI, their view on SOI adoption in the case industry is asked. Thereby, interviewees are questioned about general factors influencing this adoption (e.g. hindering and driving factors).
4. **Experience SOI adoption**
The fourth category aims at gaining insights within the research area of SOI, meaning SOI(s) launched or adopted by the interviewee's company. Thereby, a clear distinction between adopters and providers is made. Providers are asked about the market adoption of the SOI and struggles experienced (including measures to overcome those). Adopters are asked about reasonings why SOIs were adopted or not. Thereby, flexibility for follow-up and specifying questions for the unique SOI cases is given. Hereafter, more specific questions are asked concerning the perceived differences experienced within SOI adoption compared to CI. These questions derive from the literature review, and for example touch upon the described difference in perceived risk and

uncertainty (Bossle et al., 2016), investment costs (Ghisetti, 2017) operational costs (Noppers et al., 2014) and quality (Olson, 2013). These literature-related questions are asked here rather than category three to avoid biasing the interviewee on hindering and driving factors on SOI adoption.
5. BM constructs to enhance SOI adoption
The fifth category aims at gaining providers' insights into BM constructs maintained or altered to enhance SOI adoption. The adopter is asked how the SOI was offered and sold (e.g. how value was created and captured).
6. Role of servitisation to enhance adoption of SOIs
This category aims at asking about the effect of service BMs to enhance SOI adoption, referring to the SOIs from topics five and six, and asking what attempts were made to provide these as a service. Hereafter, more specific questions followed regarding specific traits of services that affected (enhanced or hindered) the SOI adoption. These specific questions are grounded on explorative and literature findings, for example the different financial model, level of collaboration, responsibility shift and complexity of services compared to product selling.
7. Snowballing for further sampling
The last category is used to round off, hence, a catch-all question is asked (Bryman and Bell, 2011). Furthermore, as the sampling method entails a combination of convenience, snowball, and purposive sampling, this category is used to reach further potential interviewees.

Table 2. Interview topics.

Types of questions

Attention was paid to avoid ambiguous, long or double-barrelled questions or questions that include negatives (Bryman & Bell, 2011). Avoiding leading or too general questions was found to be particularly challenging since the hypothesis whether a service BM enhances the diffusion of SOIs needed to be proven (Bryman & Bell, 2011). Not guiding participants was ultimately achieved by avoiding adjectives that already suggest an answer (such as e.g. "excessive"), following the recommendation of Bryman and Bell (2011).

Multiple types of questions (introducing, follow-up, probing, specifying, direct, indirect, structuring questions, interpreting questions) were applied to gain as many insights as possible and avoid repeating a question type which could reduce interviewees' attention (Bryman & Bell, 2011). By doing so, the different types of phenomena, such as values, barriers, behaviours, encounters and relationships, could be studied (Bryman & Bell, 2011, p.479). Moments of silence were used as an opportunity for reflection of both interviewee and interviewer (Bryman & Bell, 2011). 'Catch all' questions were applied at the end to ensure no knowledge relevant to the research was dismissed (Bryman & Bell, 2011).

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Interview preparations

Whenever feasible, the interviews were conducted face-to-face allowing to consider non-verbal communication besides verbal information, which enhanced deeper and richer data collection (Bryman & Bell, 2011). The interviews took place at the interviewees' company in separate meeting rooms, ensuring the interviewee would feel comfortable and would not be disturbed by colleagues or managers (Bryman & Bell, 2011). Another practice to enhance comfortability was the informal setting in which the two interviewers and the one interviewee were seated in a triangular constellation. The interviews with international companies were conducted via videocall. This was chosen over regular calling to remain capable of observing non-verbal communication.

The two interviewers took different roles during the interview. Within each interview, one took an 'active' leading stance and one a 'passive' stance taking observational notes and asking follow-up questions (Bryman & Bell, 2011). In moments of silence, the passive role naturally took over the conversation, whilst the active role analysed the interview guide. Firstly, these roles contributed to a more conversational and informal ambiance (Bryman & Bell, 2011). Secondly, an interview team of more than one person enhances the comparability of non-verbal information and reflections (Bryman & Bell, 2011). Besides, both interviewers tried to maintain the cultivating norms (e.g. knowledgeable, structuring, clear, gentle, sensitive, open, steering, remembering) throughout the entire interview (Bryman & Bell, 2011).

The language spoken was English, due to the international background of both interviewers. However, this was not considered a limitation, as all interviewees had a fluent and professional level (Bryman & Bell, 2011). Lastly, at the beginning of each interview, permission to record was asked; this was granted for all interviews, which facilitated recapturing and repeating examination of the actual data (Bryman & Bell, 2011). Furthermore, interviewees received upfront information about the research purpose, the macro-topics, and the interview procedure to minimise lack of informed consent and harming of participants (Bryman & Bell, 2011).

Post-interview reflections

After each interview, the interviewers reflected upon the interview, noted down main learnings and how the process could be improved (Bryman & Bell, 2011). This included reflections on the content of the interview guide, the setting of the interview and the roles of the interviewers.

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3.3 Method of Data Analysis

3.3.1 Transcribing

Each interview except the first two explorative ones were recorded and transcribed, thus allowing a more thorough and accurate examination of interviewees' answers (Bryman & Bell, 2011). Besides, transcribing enabled the authors to analyse the data repeatedly and iteratively as suggested by grounded theory (Bryman & Bell, 2011). Thirdly, transcribing counteracts the limitation of a researcher's own construction of a social reality according to the constructionist stance taken in this thesis. The constraint noticed while transcribing was that complete and logic sentences are seldom, causing difficulties with transcribing and analysing the data. However, sticking to the interviewees' wording reduced the influence of researchers' values and thus facilitates a more objective data analysis (Bryman & Bell, 2011).

3.3.2 Coding and Data Structure

One of the key tools of grounded theory is coding, whereby data is broken down into components (Bryman & Bell, 2011). The collected data in form of transcribed interviews therefore was analysed and the researchers' perception shaped emergent codes (Bryman & Bell, 2011). An 'open coding' approach was employed, entailing the creation of concepts, that will later be turned and grouped into categories (Bryman & Bell, 2011). Hereafter, 'axial coding' was accomplished by making connection between the categories, in which the data is put back together in new ways (Bryman & Bell, 2011). Initially, to be able to distinguish the context of the cases, two measures were taken. First, codes were distinguished into the two perspectives of SOI adopters and SOI providers and correspondingly marked with "A" or "P". Second, interviewees' initials were kept in the data structure. However, this distinction was abandoned once data was presented. This, since it had the sole purpose of facilitating the researchers to uphold an overview and hence achieve a perspective of 'knowledgeable agents' (Bryman & Bell, 2011); furthermore, the aim of this research is to produce generalisable findings rather than focussing on the context of each SOI adoption case.

The coding process itself consisted of various steps: first interviews were transcribed, second the researchers read over the transcripts without taking notes, third a second reading over the transcripts followed, recording keywords and quotes (Bryman & Bell, 2011). Fourthly, and

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following the mantra of "no data structure; know nothing", the keywords and quotes, referred to as 1st-order concepts, were transferred to a table and subsequently grouped into 2nd-order themes and aggregate dimensions (Gioia et al., 2012, p.21). Overall, 221 codes were collected and shaped into 1st-order concepts by taking the quotes to a higher level of abstraction. Via mutual discussion, the researchers identified patterns and a deeper data structure, leading to the emergence of 36 2nd-order themes and ultimately six aggregate dimensions (Goia et al., 2012) (see figure 3).

In this process of abstraction, the authors avoided forcing the data into an unfitting theoretical structure which would have resulted in diminished value of data and loss of qualitative research flexibility, but rather created concepts, themes and dimensions based on informants' wording and the researchers' perception, acting from a perspective of 'knowledgeable agents' (Gioia et al., 2012).
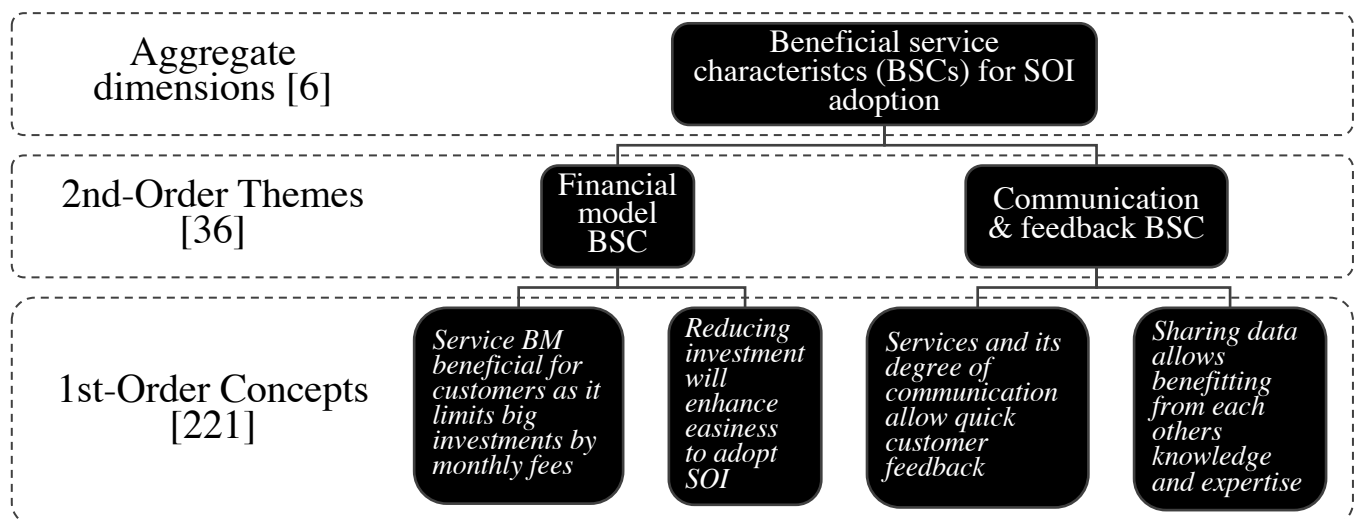
Figure 3. Example data structure (representative selection). Source: Gioia et al. (2012).

3.3.3 Outcomes of Data Analysis

The data structure serves as the basis for the presentation of findings, which follows a logical order based on the created aggregate dimensions (e.g. barriers for SOI adoption). Data concerning the contextual factors about agriculture, SOI examples or organisational implications of the servitisation shift was required to acquire a 'knowledgeable agent' perspective (Bryman & Bell, 2011), yet is outside the research scope not contributing to answering the RQ and therefore was left out. Within the presentation of findings *(see Ch.4)*, a maximum of four representative quotes and 1st-order concepts were selected based on comprehensiveness and clarity of content for the reader to underpin each 2nd-order concept.

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3.3.4 Creation of Grounded Theory

Nevertheless, a data structure is nothing more than a "static picture of a dynamic phenomenon" (Gioia et al., 2012, p.22). The unchanged ultimate goal of this research is building a 'vibrant inductive model' that is grounded in qualitative data and achieves to comprehend the informants' views in theoretical terms (Gioia et al., 2012). Such model was created by devoting space to explain each emergent theme but more so focus on key emergent themes and their examination, particularly their interrelationships (Gioia et al., 2012). In other words, the dynamic relationships between the emerging concepts describing the phenomenon of servitisation and those describing the barriers and drivers for SOI adoption were outlined in the light of their effects on SOI adoption. Furthermore, as part of the abductive research approach, literature about SOI barriers and drivers was reconsidered to contrast new insights.

3.4 Reflection of Method Choices

The most prominent criteria to assess business research –reliability, replication and validity- are particularly connected to quantitative research, whilst its application to qualitative research is controversially discussed, because the terms transmit connotations of measurement (Bryman & Bell, 2011). We follow the stance that qualitative research is a distinctive research strategy and hence apply the alternative terms that parallel the quantitative research criteria, namely *credibility*, *transferability*, *dependability* and *confirmability* (Bryman & Bell, 2011).

Since qualitative research involves the possibility of various accounts of an aspect of social reality, it is fundamental to convince the readers of the *credibility* of one's research process, findings and conclusions (Bryman & Bell, 2011). To enhance credibility, all stages of the research process have been transparently outlined. Moreover, unstructured interviews and semi-structured interviews on both adoption perspectives have been conducted to aim for triangulation of data (Bryman & Bell, 2011).

Typically, qualitative researchers aim to provide a "thick description" of the social world studied (Bryman & Bell, 2011). This however makes it difficult to transfer the findings to another milieu (Bryman & Bell, 2011). Indeed, this study employs a qualitative research strategy using agriculture as an empirical tool, hence, transferability to other contexts can be questioned. Nevertheless, by interviewing a wide array of actors in the agricultural industry,

including adopters and providers, *transferability* of findings to industries with similar characteristics *(see Ch.6.3)* is achieved by providing rich yet broad qualitative insights.

Thirdly, *dependability* of research relates to the influence of the researchers on the results, particularly whether the study is repeatable (Bryman & Bell, 2011). The accessibility of interviewees is a concern for an exact repetition of the study. However, the outright majority of interviewees was contacted with publicly available contact information and channels. Moreover, this thesis draws on its plurality of perspectives composed by SOI adopters and providers. Hence, we argue by sampling an equivalent list of interviewees, the study is repeatable. Furthermore, we kept an 'auditing approach' (Bryman and Bell, 2011), entailing detailed records of process, sampling, transcripts, data analysis decisions and a diary, capturing our main insights.

Lastly, as for *confirmability*, we acknowledge that full objectivity is unrealistic (Bryman & Bell, 2011). Moreover, we recognise that this work is to some extent a construction of our perspective on the social reality (Bryman & Bell, 2011). Thus, we strive to minimize overly intrusion of our personal values. First, in writing this master's thesis jointly, both authors act as auditors for one another, limiting the weight of each author's values (Bryman & Bell, 2011). Second, feedback from thesis seminars and discussions with peers, mentors and supervisors, enhanced continuous reflection on our decisions. Third, by using structured approaches to data collection and analysis, the effects of our personal values on the outcomes were minimised.

As a final note, Gioia et al. (2012,) themselves stress their concern with other researchers applying their framework as a formula and hence limiting the possibility of "rigorously demonstrating connections between data and theory". Thus, the suggestions for methodological recommendations from both Gioia et al (2012) and Bryman and Bell (2011) were considered, however, maintaining room for flexibility and adaptation to the needs of this research.

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4. Presentation of Findings

In this chapter, the findings derived from data collection and analysis according to Gioia et al. (2012) will be presented. First, findings related to SOI adoption will be treated, namely barriers, drivers and essentials for SOI adoption (Ch.4.1). Second, findings about servitisation (Ch.4.2), including its development, beneficial service characteristics (BSCs), and hindering servitisation factors (HSFs) for SOI adoption will be outlined. Table 3 presents an overview of all topics to be discussed.

Representative quotes in tables are used to provide contextual understanding (table 4-9). At the end of each sub-header, an illustration of the data structure is given to enhance transparency (figure 4-9). Within, representative 1ˢᵗ-order concepts are showed to enhance readability (full data structure in app.4).

(Ch.4.1) SOI adoption		
(4.1.1) SOI Barriers	**(4.1.2) SOI Drivers**	**(4.1.3) SOI Essentials**
Economic *Investment*	*Economic*	*Financial feasibility* *Governmental support*
Mindset	*Mindset* *Sustainability*	*Functionality* *Reliability*
Uncertainty	*Performance*	*Education*
Lacking information & awareness	*Branding*	*Observability*
Lacking proof of concept	*Information & awareness*	*Customer & partner selection* *Customer centricity*
Lacking collaboration	*Collaboration* *Segmentation*	*Relationship management*
	Broad offer	*Endurance*
(Ch.4.2) Servitisation		
(4.2.1) Servitisation development *(current & outlook)*		
(4.2.2) Beneficial Service Characteristics for SOI Adoption		**(4.2.3) Hindering Servitisation Factors for SOI Adoption**
Financial model		
Predictability		
Outsource responsibility		*Organisational change*
Co-creation		
Communication & feedback		*Cultural change*
Expertise		

Table 3. Overview 2ⁿᵈ-order themes within two aggregate dimensions.

4.1 SOI Adoption

4.1.1 SOI Adoption Barriers

Various factors were identified that have hindering effects on SOI adoption, referred to as SOI adoption barriers. Primarily, these barriers are composed by hurdles stemming from economics, reluctance to change, lacking awareness and information, and the need for more reference-projects.

Representative Quotes	*2ⁿᵈ-Order Themes*
Int.10: "[…] they are very hard to convince that it will have a return on investment."	Economic SOI adoption barrier
Int.12: "[…] the calculations [for SOIs] don't really work very well."	
Int.9: "Price point from end-consumer side biggest barrier for SOI adoption[...]."	
Int.7: "[...] downtime […] shutting everything down, that's money that's being lost because you're not growing."	
Int.2: "There is no way they would do an investment to be more sustainable, because everything is paid."	Investment SOI adoption barrier
Int.4: "So you have to own it [SOIs] by yourself and that means you are over-invested […]."	
Int.7: "[…] it is this fact that it's been working so far. Why would I change anything?"	Mindset SOI adoption barrier
Int.4: "I never wanted to be number one, I think number two was also always better […]."	
Int.10: "[...] sustainability is not a number one priority for my customers."	
Int.8: "I think sustainable options are less stable […]."	Uncertainty SOI adoption barrier
Int.7: "[...] lot of uncertainty [for SOIs] one of the biggest hindering factors."	
Int.12: "[…] they didn't trust the technology companies which were relatively new […]."	
Int.9: "I would say the biggest thing people aren't focusing on is scale [...]."	Lacking information and awareness SOI adoption barrier
Int.11: "[…] we're just not the most modern industry with a lot of marketing minds so it's not discussed properly."	
Int.3: "Education is our biggest pain point [...]."	
Int.4: "[…] not always you feel that you are kind of a big polluter."	
Int.12: "[...] entrepreneurs had a really difficult time understanding the data that was being submitted, you know, is it economical?"	Lacking proof of concept SOI adoption barrier
Int.11: "As long as they don't know that part [specific customer value], it [SOI adoption] will not happen so fast."	
Int.4: "[…] invisible barrier between us working [...] the business every day and the knowledge center […]."	Lacking collaboration SOI adoption barrier

Table 4. Representative quotes for 2ⁿᵈ- order concepts in SOI adoption barriers.

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Economic SOI adoption barrier

The collected data showed strong evidence for economics as the main barrier for SOI adoption and that choosing an SOI is mainly a price-based decision. This is important to highlight, since interviewees also pointed out that SOIs typically come at high price-points, and need to improve economic competitiveness, particularly stressing the necessity for shorter ROIs in the light of fast-paced technological development and a consequent need to frequently adopt innovations. This is accentuated by SOIs implying high switching costs due to business interruption when implementing the solutions *(Int.7: "[...] downtime [...] shutting everything down, that's money that's being lost because you're not growing.")*. Therefore, interviewees stress the importance of end-consumers' willingness-to-pay for sustainable produces, which needs to increase in order to enhance the feasibility for SOI adoption *(Int.9: "Price point from end-consumer side biggest barrier for SOI adoption [...].")*.

Generally, respondents believe it takes much effort to convince customers on the ROI of SOIs *(Int.10: "[...] they are very hard to convince that it [SOIs] will have a return on investment.")*, whilst others question the overall economic feasibility of SOIs *(Int.12: "[...] the calculations [for SOIs] don't really work very well")*.

Investment SOI adoption barrier

Another barrier towards SOI adoption specifically is that investments of SOIs are perceived higher than for CI. Further, data shows evidence for hindrance of SOI adoption by existing investments in assets, with potential adopters preferring to wait until those investments are fully amortised *(Int.2: "There is no way they would do an investment to be more sustainable, because everything is paid [...].")*. As ROIs tend to be long in agriculture, it takes time before new capital is built up to make new investments, substantially limiting the capability to adopt SOIs. Lastly, if SOIs are sold as products, customers are required to have ownership over their assets, ultimately leading to over-investments and a reluctance to adopt new SOIs *(Int.4: "So you have to own it [SOIs] by yourself and that means you are over-invested with things you don't use [...].")*.

Mindset SOI adoption barrier

Despite attributes related to mindset found to enhance SOI adoption, various interviewees stressed hindering mindset attributes for SOI adoption, particularly typified as resistance to change *(Int.7: "[...] it is this fact that it's been working so far. Why would I change anything?")*.

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There are several explanations being outlined. First, respondents argue the fact that with current systems working, change and adopting alternatives is not very likely. Secondly, it is indicated that the mindset of wanting to be a second mover, is prevalent in agriculture and hinders adoption *(Int.4: "I never wanted to be number one, I think number two was also always better [...].").* Thirdly, traditional practices are passed on within agriculture and reduce the willingness to adopt SOIs. Further, customers frequently built everything up by themselves and hence are reluctant to receive external advice on what SOIs to adopt. Overall, the predominant attitude appears to be that sustainability is not a top priority *(Int.10: "[...] sustainability is not a number one priority for my customers."),* with many competing interests and the primary one being the business-side.

Uncertainty SOI adoption barrier

Another possible barrier for SOI adoption outlined is the perception of SOIs being uncertain and less reliable *(Int.8: "I think sustainable options are less stable [...]."; Int.7: "[...] lot of uncertainty [for SOIs] one of the biggest hindering factors.").* This lack of trust in SOI reliability is particularly prevalent for SOI providers that are new to the market *(Int.12: "[...] they didn't trust the technology companies which were relatively new [...].").* In line, lack of redundancy of SOIs is mentioned as a major hindering factor towards SOI adoption.

Lack of information and awareness SOI adoption barrier

Another indicated barrier to SOI adoption is the lack of information and awareness. It appears despite the high amount of GHGs in this industry, the role of being a large polluter is not always perceived *(Int.4: "[...] not always you feel that you are kind of a big polluter [...].").* Furthermore, there is a prevalent lack of awareness to scale to make SOIs adoption attractive. A likely cause for the low degree of awareness is lacking education about SOIs, being outlined as the biggest current pain point for SOI providers that needs to be overcome to enhance SOI adoption *(Int.3: "Education is our biggest pain point [...].").* From a marketing perspective, respondents criticise that sustainability is not sufficiently discussed in agriculture, with a prevalent lack of marketing and consequently information and awareness that hinders SOI adoption *(Int.11: "[...] we're just not the most maybe modern industry with a lot of marketing minds so it's not discussed properly.").*

Lacking proof of concept SOI adoption barrier

Based on interviewees' insights, it became apparent that SOIs need to be proven before customers are able to assess quality and reliability, and that adopters have difficulties assessing the economic benefits of SOIs *(Int.12: "[...] entrepreneurs had a really difficult time understanding the data that was being submitted, you know, is it economical?")*. Furthermore, interview data shows that as long as customers do not see the specific customer value, they will not adopt SOIs that fast *(Int.11: "As long as they don't know that part [what the specific customer value is], it [SOI adoption] will not happen so fast.")*.

Lacking collaboration SOI adoption barrier

The last barrier found in data was a prevalent lack of interaction between practitioners and research institutions possessing the knowledge and frequently being the source of creation of new SOI ideas; hence the current lack of collaboration hinders the SOI adoption *(Int.4: "[...] invisible barrier between us working [...] the business every day and the knowledge center [...].")*.

Representative 1st-Order Concepts   2nd-Order Themes   Aggregate Dimension

- Hard to convince customers that SOIs have good ROI
- SOIs not economically feasible
- SOIs come at very high price points

Economic SOI adoption barrier

- No investments from customers in SOIs expected, since everything is already paid
- Fear of over-investment in assets due to SOI ownership

Investment SOI adoption barrier

- Unwillingness to change
- Unwillingness to be first-mover
- Resistance to change main reasons

Mindset SOI adoption barrier

- SOIs less stable
- Uncertainty involved with SOIs
- Lack of trust in new SOIs

Uncertainty SOI adoption barrier

SOI adoption barriers

- Lack of education about SOIs and sustainability
- Lack of communication and marketing
- Lacking awareness for pollution caused

Lacking information and awareness SOI adoption barrier

- SOI needs to be proven before assessment of quality and reliability
- Lacking knowledge on specific customer value

Lacking proof of concept barrier SOI adoption barrier

- Lacking interaction between practitioners and research institutes

Lacking collaboration SOI adoption barrier

Figure 4. Data structure for SOI adoption barriers.

4.1.2 SOI Adoption Drivers

Contrasting the barriers for SOI adoption, findings also demonstrated a wide array of factors positively influencing the SOI adoption, mainly revolving around economics, attributes towards knowledge and sustainability, and the performance of SOIs.

Representative Quotes	*2ⁿᵈ-Order Themes*
Int.5: "I think it's a bigger investment but in the end it pays off."	Economic SOI adoption driver
Int.7: "I would say there's less risk with sustainable innovation because they can get funding from the government [...]."	
Int.8: "[...] and because of that [positive image of SOIs] they can ask more money for their product."	
Int.7: "I would say there's less [financial risk with sustainable innovation because they can get funding from the government [...]."	Public support SOI adoption driver
Int.4: "I'd say I wanted always to develop a little bit every day."	Mindset SOI adoption driver
Int.5: "So you also need to learn and yet look to other markets [...]."	
Int.5: "The first thing is where should I go to find more information about it [SOIs], and if I was hungry about new knowledge."	
Int.9: "People are looking at solutions to combat global warming and rising sea levels […]."	Sustainability SOI adoption driver
Int.12: "[…] the other piece is that there are certain drivers and climate change and in society […]."	
Int.6: "It [drive for sustainability] is from the two owners as well they because they've been starting the company and [...] it's just in the blood."	
Int.5: "It's [the reason for the adoption of the SOIs] always the quality, so we can grow better quality."	Performance SOI adoption driver
Int.5: "You can't grow anymore on the old way because you need to have more product per meter, product for the energy etc."	
Int.5: "I think this is one of the most important things we can do it more efficient."	
Int.12: "[Sustainability] for their marketing is very effective."	Branding SOI adoption driver
Int.12: "[…] if it [SOIs] allows the farms to basically improve the marketing value of their project as more green, I would say that's one of the biggest assets."	
Int.8: "But also for more image purposes, so they can sell vegetables that are more sustainable […]."	
Int.4: "[…] older ones [farmers] prefer fairs."	Information & awareness SOI adoption driver
Int.4: "Farmers need 'hints' to know where to learn about SOIs […]."	
Int.4: "Young farmers go to YouTube […]."	

Int.5: "We would be working close with the suppliers [to hear about SOIs and adopt them]."	Collaboration SOI adoption driver
Int.5: "[…] some [SOIs were adopted] also more like that you invented together."	
Int.9: "We want to work it out with them initially just to make sure this profitable business […]."	
Int.9: "I think it [SOI adoption] depends on the region, the country, the climate in certain areas […]."	Segmentation SOI adoption driver
Int.1: "I would first go to the big ones [to diffuse SOIs]. Because they would be maybe more open to try something new."	
Int.12: "[…] a lot of interest [to adopt SOIs] from young people trying to enter the industry."	
Int.9: "[…] we're focusing on growers [...], who are ready to take that leap where it requires experience […]."	
Int.8: "I think the adoption is quite good or quite easy as well because they can make a choice […]."	Broad SOI adoption driver
Int.7: "[…] it is so integrated, but if we were to sell the entire system, I think that that would make a lot of sense and a lot of interest for customers."	
Int.4: "It's like buying a car. You have several options and I think that's a good way of doing it."	

Table 5. Representative quotes for 2ⁿᵈ- order concepts in SOI adoption drivers.

Economic SOI adoption driver

Interviewees stressed to perceive SOIs as economically attractive due to their characteristics of reducing operating costs due to higher efficiency, improving quality of produces, and involving positive return on investments (ROI) that involve larger investments yet pay off in the end: *"Int.5: "I think it's a bigger investment but in the end it pays off."*

Furthermore, SOIs contribute to a better brand image, enabling SOI adopters to charge higher prices: *Int.8: "[...] and because of that [positive image of SOIs] they can ask more money for their product."*. The data collected has also shown that SOIs are perceived as involving less financial risk than CIs since governmental funding particularly subsidise SOIs: *Int.7: "I would say there's less risk with sustainable innovation because they can get funding from the government […]."*

Mindset SOI adoption driver

The interviewees mention positive attitudes as a driving factor for SOI adoption; customers showed the aspiration of continuously improving and developing their businesses. Furthermore, there is evidence that customers actively seek for information about SOIs and are

highly interested to acquire new knowledge *(Int.4: "The first thing is where should I go to find more information about it [SOIs], and if I was hungry about new knowledge")*. Despite customers' reluctance of being first-movers with SOI adoption, interviewees' outline their interest to adopt SOIs and the fact that customers have to adopt SOIs due to pressure to cultivate more sustainably. Furthermore, benchmarks with other markets lead to inspiration for SOI adoption and hence act as a driving factor.

Sustainability SOI adoption driver

Findings from interview data have shown that sustainability is valued and is a driving factor for SOI adoption, with customers seeking for solutions that combat climate change and preserve the planet for future generations. Thereby, the societal shift towards sustainability acts as a further catalyser towards SOI adoption. In addition, some companies prescribe to the value of sustainability and therefore would not adopt innovations that are not SOIs. Lastly, data indicates that avoiding bad conscience due to unsustainable cultivation is another driving factor for SOI adoption. Overall, many customers aspire to move towards sustainability by means of adopting SOIs, yet have budgetary constraints.

Performance SOI adoption driver

Evidence from interviews displayed the driving effect on adoption of SOIs by enabling to improve quality, productivity and sustainability, in short, performance improvements *(Int.5: "It's [the reason for the adoption of the SOIs] always the quality, so we can grow better quality."); (Int.5: "You can't grow anymore on the old way because you need to have more product per meter, product for the energy etc.")*. Furthermore, SOIs create value by increasing safety, uniformity and reducing resource consumption, thereby making SOIs attractive for adoption.

Branding SOI adoption driver

Evidence shows that beneficial positive branding effects are beneficial for adoption, since SOIs can be used for storytelling and marketing, thereby differentiating themselves in the competitive agricultural industry *(Int.12: "if it [SOIs] allows the farms to basically improve the marketing value of their project as more green, I would say that's one of the biggest assets.")*.

Information and awareness SOI adoption driver

To drive SOI adoption, interviewees' outline adequate information about the SOIs through suitable channels, hence increasing their awareness. Specifically, customers need 'hints' on where to learn about SOIs; thereby, older ones prefer fairs whilst younger customers favour digital channels to inform themselves about SOIs.

Collaboration SOI adoption driver

Having a close collaboration with providers to hear about, test or co-invent SOIs, drives the adoption *(Int.5: "[...] some [SOIs were adopted] also more like that you invented together.").* Furthermore, providers and adopters collaborate to ensure that the business is mutually profitable. Interestingly, interview data suggests that SOIs developed in collaboration are better solutions than those developed internally. Finally, SOIs are faster adopted when the pricing is adequate, and target-groups are well-defined; this can be enhanced via provider-adopter collaborations and consequent higher degrees of communication and feedback.

Segmentation SOI adoption driver

The collected data suggests an adequate market segmentation and selection as a driver for SOI adoption, with factors such as countries or firm size significantly affecting the willingness to adopt SOIs; for instance, larger players appear to be more open for SOI adoption (*"Int.1: "I would first go to the big ones [to diffuse SOIs]. Because they would be maybe more open to try something new."*). In similar manner, some markets are pointed out as being used to working with sustainability and efficiency and furthermore having governments that subsidise SOIs. Of further relevance is the segmentation into age, with younger customers being more open to adopting SOIs relative to older customers. Lastly, targeting experienced adopters drives SOI adoption, since they have the expertise to understand and adopt SOIs.

Broad offer SOI adoption driver

Respondents argued SOI adoption is enhanced via a wide array of choices *(Int.8: "I think the adoption is quite good or quite easy as well because they can make a choice [...]."*) and offering entire systems instead of separate components that additionally to the environmental aspect involve various angles, namely technology, business-commercial and social impact *(Int.7: "[...] it is so integrated, but if we were to sell the entire system, I think that that would make a lot of sense and a lot of interest for customers.").*

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Representative 1st-Order Concepts   _2nd-Order Themes_   _Aggregate Dimension_

- SOI reduces adopters' costs
- SOIs have higher investments but are economically feasible
- Sustainability creates the opportunity to raise prices of products
- SOIs financially less risky than CI due to governmental funding

Economic SOI adoption driver

- Aspiration to develop a little bit every day
- Getting inspiration from other markets
- Hungry for new knowledge

Mindset SOI adoption driver

- Solutions wanted that combat climate change
- Sustainability deriving from owners and integral part of company
- Climate and society change as adoption driver

Sustainability SOI adoption driver

- Increase quality by adopting SOI
- Productivity and sustainability need to be increase
- Increase efficiency by adopting SOI

Performance SOI adoption driver

- Sustainability as marketing tool
- Sustainability to improve marketing one of biggest assets
- SOIs contribute to a better brand image

Branding SOI adoption driver

SOI adoption drivers

- Customers need 'hints' where to learn about SOI
- YouTube as source of inspiration for young generation

Information & communication SOI adoption driver

Continued on next page.

- Close collaboration between suppliers to be informed about SOIs
- Co-invention between supplier and customer
- Manufacturers help customers ensuring a profitable business

Collaboration SOI adoption driver

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- Cultural, regional, climatic differences

about SOI

- YouTube as source of inspiration for young generation

Information &
communication
SOI adoption
driver

- Close collaboration between suppliers to be informed about SOIs
- Co-invention between supplier and customer
- Manufacturers help customers ensuring a profitable business

Collaboration SOI adoption driver

- Cultural, regional, climatic differences
- Big players are more open to adopt SOIs
- SOI interest by young generation entering the industry
- Focus on customers with experience and willingness to adopt SOIs

Segmentation SOI adoption driver

- Adoption of SOI benefits from wide array of choices
- Customers' interest in buying integrated sustainable systems
- Having several options for adoption (e.g. leasing, buying)

Broad offer SOI adoption driver

Figure 5. Data structure for SOI adoption drivers.

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4.1.3 SOI Adoption Essentials

Furthermore, factors were found in empirical data that are required for SOI adoption. These 'essentials' must be fulfilled to allow SOI adoption. These factors stress the importance of ROIs, subsidies for economic feasibility, customisation addressing customer needs, reliability to avoid business interruptions, education to increase the sense of urgency for sustainability and the availability of proof-of-concepts.

Representative Quotes	*2ⁿᵈ-Order Themes*
Int.5: "They [SOI adopters] will always go first for profitability over sustainability."	Financial feasibility SOI adoption essential
Int.11: "[...] you invest more to lower your operational expenditures or it's to boost your yield."	
Int.10: "[…] everytime it is a balance between investment and operating costs."	
Int.9: "There needs to be more government support [...]."	Governmental support SOI adoption essential
Int.10: "[SOIs] have a lot of trouble competing if there is no incentive from governments or public policy."	
Int.4: "[…] when you have interest in productivity I don't think it would be very difficult to sell it into customers."	Functionality SOI adoption essential
Int.4: "[…] when customers have interest in productivity, I don't think it would be very difficult to sell it into customers."	
Int.7: "[…] you need sort of almost like a turnkey solution. [...] It has to be plug-and-play."	
Int.3: "Need for redundant system, otherwise risk of losing an entire production cycle [...]."	Reliability SOI adoption essential
Int.8: "So you need stable options and that could also mean that there's a backup [...]."	
Int.7: "[...] it has to be something that's reliable [...]."	
Int.4: "[...] if you don't get the guarantees, you don't use [the SOI for] renewable energy."	
Int.4: "[…] it's a way of culture change."	Education SOI adoption essential
Int.3: ""Education of consumers for how technology benefits agriculture is an extremely critical point."	
Int.2: "[…] the customers today need to be educated on what is sustainable today."	
Int.3: "Education of consumers for how technology benefits agriculture is an extremely critical point."	
Int.11: "We have to prove it, everything we do, before it's believed of course […]."	Observability SOI adoption essential
Int.7: "[…] if we can show that this actually works then they would consider it."	
Int.12: "[…] they want to see the product. [...] you can't just go around with a sheet, and say like 'this is the product and this is how much it costs, no they need to taste it."	
Int.1: "[…] have to show a really good business case."	

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Int.11: "So you then [to prototype] you need to find like a small consortium […] that want to be first mover with it."	Customer & partner selection SOI adoption essential
Int.11: "So it matters then with who you do business whether you can build that business or not."	
Int.9: "[…] pretty selective on the project we take on because we don't want to take on projects that are failing."	
Int.3: "[...] business cases will evolve, everything needs to be customized [...]."	Customer-centricity SOI adoption essential
Int.4: "You [...] must know that if you have questions or doubts you have a contact that you can talk to or mail to and feel that he or she is interested in you as a customer."	
Int.9: "[...] it's developing those relationships as well and having a good reputation in the market."	Relationship management SOI adoption essential
Int.4: "You must feel confidence to the company. You need to feel confident with the partner you are working with."	
Int.5: "[...] also with our clients, they need to trust us [...]."	
Int.4: "I think that's always a new product specially from a company that's not well known it is the start-up process and it takes any it takes a longer time than you expect."	Endurance SOI adoption essential
Int.11: "So [SOI adoption] takes time, takes money, takes believers, takes endurance."	

Table 6. Representative quotes for 2nd- order concepts in SOI adoption essentials.

Financial feasibility SOI adoption essential

Many customers do not adopt SOIs for sustainable purposes only; in fact, the adoption decision is mainly driven by economics. In line, interviewees' highlight that customers will choose profitability over sustainability and hence require positive returns before adopting SOIs *(Int.5: "They [SOI adopters] will always go first for profitability over sustainability.")*. Further, to enable SOI adoption, they must facilitate cost reductions or enable to increase revenue *(Int.11: "[...] you invest more to lower your operational expenditures or it's to boost your yield")*. Overall, customers balance investments with operating costs when considering an SOI adoption and choose for the best price-quality offering *(Int.10: "[...] everytime it is a balance between investment and operating costs.")*.

Governmental support SOI adoption essential

The findings suggest that the SOI adoption depends on governmental support and is hardly competitive without it *(Int.10: "[SOIs] have a lot of trouble competing if there is no incentive from governments or public policy.")*. Meanwhile, some interviewees went beyond that, claiming that SOI adoption is dependent on more governmental support *(Int.9: "There needs to be more government support [...].")*.

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Customer-centricity SOI adoption essential

Based on interview data, the observation could be made that despite the fact that standardisation improves efficiency, customisation for each business case needs to be offered to enable SOI adoption *(Int.3: "[...] business cases will evolve, everything needs to be customized [...]")*. Further data showed if providers want to gain a competitive advantage, they need to listen to and incorporate customers' needs. To facilitate SOI adoption, interviewees point out the need for excellent customer service in the form a reliable contact and supporting the customers *(Int.4: "You [...] must know that if you have questions or doubts you have a contact that you can talk to or mail to and feel that he or she is interested in you as a customer.")*.

Relationship management SOI adoption essential

Moreover, interview data indicates the need for a strong relationship and trust between the adopter and the provider as an SOI adoption essential *(Int.5: "[...] also with our clients, they need to trust us [...]")*. It is a requisite to have strong customer relationships alongside with a well-established market reputation. A reason named is that customers require confidence in the company and its products/services.

Reliability SOI adoption essential

SOIs are being perceived as less reliable; hence, incorporating and demonstrating that this is not the case and no losses of revenue occur (e.g. business interruption) is an essential factor appearing in interview data *(Int.7: "[...] it has to be something that's reliable [...].")*. Therefore, customers seek for reliability guarantees and do not adopt SOIs if those are not given *(Int.4: "[...] if you don't get the guarantees, you don't use [the SOI for] renewable energy.")*.

Education SOI adoption essential

Interview data outlines education as fundamental requirement to convince customers to adopt SOIs, who need to be educated on the necessity for sustainability, and how technology benefits them. "*Education of consumers for how technology benefits agriculture is an extremely critical point*." *(Int.3)*. If no education provided, the SOI adoption depends on the customers' understanding of the SOI. Hence, besides providers taking responsibility for the development of SOIs, interviewees claim they should move outside their comfort-zone and educate their customers. Especially since some SOIs are described as being disruptive to customers' existing operations, their know-how must be expanded through education or consultancy. However, it

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must also be noted that it is considered to be a slow and painful process, involving major efforts and cultural change.

Observability SOI adoption essential

A widely argued requirement for SOI adoption is observability of the SOI, indicating the need for explanation on the specific benefits gained (e.g. increasing yields), particularly via metrics and proof-of-concepts, so the customers understand the value added. Customers are highly focussed on results and trust is only granted when clear benefits are demonstrated. *"We have to prove it, everything we do, before it's believed of course [...]." (Int.11).* When observability is shown, customers are able to calculate the business case and consider adoption. An outlined method to achieving observability is acquiring and showcasing of reference projects. Another way to enhance observability is by prototyping the SOI and showing customers, while improving and learning for the concept yourself. Customers want to 'taste' it, rather than getting showcased a sheet with all the specifications. *"[…] they want to see the product. [...] you can't just go around with a sheet, and say like 'this is the product and this is how much it costs, no they need to taste it"* (Int.12).

Customer & partner selection essential for SOI adoption

Data gathered showed the importance of a strong customer and partner selection and network to ensure SOI adoption. Especially in the starting phases, *"[…] you need to find like a small consortium of people believe in it, companies that would benefit from it, or companies that want to be first mover with it."* (Int.11). This to enhance adoption from the beginning and avoid failure. *"So it matters then with who you do business whether you can build that business or not."* (Int.11).

Functionality SOI adoption essential

The interviewees outlined that when SOIs enable productivity improvements, little difficulties will be faced in the terms of market adoption. *"[…] when customers have interest in productivity, I don't think it would be very difficult to sell it into customers."* (Int.4). Also, functionality is a requisite in terms of providing a solution which is 'plug-and-play', hence avoiding downtime and business interruptions. Lastly, a turnkey solution in which multiple functionalities are integrated appears to be an essential for SOI adoption with increasing significance.

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Endurance SOI adoption essential

Several interviewees pointed out that the process from launch to successful market adoption requires motivation, perseverance and time. Especially in the beginning of the launch of a new SOI, endurance and patience are needed before market acceptance is achieved. *"So [SOI adoption] takes time, takes money, takes believers, takes endurance." (Int.11).*

<u>*Representative 1st-Order Concepts*</u>   *2nd-Order Themes*   *Aggregate Dimension*

- Profitability over sustainability
- Investment needs to reduce operational expenditures or increase revenue
- Maintain balance between investment and improvement operating costs

Financial feasibility SOI adoption essential

- More incentives required
- SOIs need governmental incentives or regulation to be competitive

Governmental support SOI adoption essential

- Provide solutions that increase productivity
- Provide plug-and-play downtime solution

Functionality SOI adoption essential

- Redundant system required
- Stable solutions are a requisite
- Offer reliable solutions
- SOIs not adopted when guarantees not given

Reliability SOI adoption essential

Continued on next page.

- Culture change involved
- Educate customers on sustainability
- Education on characteristics and benefits of technology needed

Education SOI adoption essential

- Proof of concept before customers believe it
- Need to prove new systems before customers consider it
- Should make the value as tangible with numbers as possible
- Need to see really good business case for SOI

Observability SOI adoption essential

SOI adoption essentials

- Find partners who want to be first movers

Customer and partner selection

- Redundant system required
- Stable solutions are a requisite
- Offer reliable solutions
- SOIs not adopted when guarantees not given

Reliability SOI adoption essential

- Culture change involved
- Educate customers on sustainability
- Education on characteristics and benefits of technology needed

Education SOI adoption essential

- Proof of concept before customers believe it
- Need to prove new systems before customers consider it
- Should make the value as tangible with numbers as possible
- Need to see really good business case for SOI

Observability SOI adoption essential

SOI adoption essentials

- Find partners who want to be first movers
- Be selective on choosing the project to avoid failing projects

Customer and partner selection SOI adoption essential

- Customisation is a must for each business case
- Customisation required to survive as business

Customer-centricity SOI adoption essential

- Develop relationships and good reputation
- Confidence in company (SOI provider) needed
- Trust amongst provider and adopter is needed

Relationship management SOI adoption essential

- Have patience and endurance in early stages of the SOI launch
- Provide time, money, believers and endurance

Endurance SOI adoption essential

Figure 6. Data structure for SOI adoption essentials.

4.2 Servitisation

4.2.1 Servitisation Development

This aggregate dimension explains the findings concerning the current status of servitisation altogether with findings about the future outlook of servitisation in the agricultural industry.

| *Representative Quotes*	*2nd-Order Themes*
Int.10: "[servitisation] starting now but it hasn't been processed yet."	Servitisation status
Int.9: "We see a lot of companies trying to enter that business that's more of a kind of a monthly fee […]."	
Int.4: "I think they're [younger customers] much more open for different kinds of solutions of offer services for either shorter periods or long periods […]."	
Int.12: "[servitisation is a] natural sign of the maturing of a market [...]."	
Int.11: "We are aware of that just selling technology will not be the future […]."	Servitisation outlook
Int.10: "To implement this model at other industry than the IT, I do not say it is not going to happen, I just say that it is going to take time."	
Int.7: "[…] the society that we live in now, is definitely a lot more interest in the service-based society."	
Int.7: "[…] with a level of automation […] providing services is the way that our economical system is going to move towards."	

Table 7. Representative quotes for 2nd- order concepts in Servitisation Development.

Servitisation status

The findings of this research show that servitisation is trending, however, not widely implemented yet. *"[Servitisation is a] natural sign of the maturing of a market […]"* (Int.12), a trend which is *"[…] starting now, but it has not been fully processed yet."* (Int.10). Yet, a transition became apparent in which providers are increasingly experimenting with service offerings and different ways of value creation and capturing. Also, customers show growing interest towards different service solutions, yet, for now, openness towards services is especially prevalent within the younger generation.

Servitisation outlook

Data showed that society's interest is moving towards a more service-oriented society. Especially in the light of rising digitalisation and fast-paced technology development, it is stressed that traditional product selling will not be the future. This trend is especially fostered by the rise of industrial processes and automation, resulting in enhanced predictability and

control, which is described to be beneficial for service BMs. Within the near future, growing customer enthusiasm for financing SOIs via service models is expected. However, servitisation has not yet been widely implemented in all industries (such as the agricultural industry), however it is indicated that this trend is taking off and simply requires some time. *"To implement this model at other industry than the IT, I do not say it is not going to happen, I just say that it is going to take time." (Int.10).*
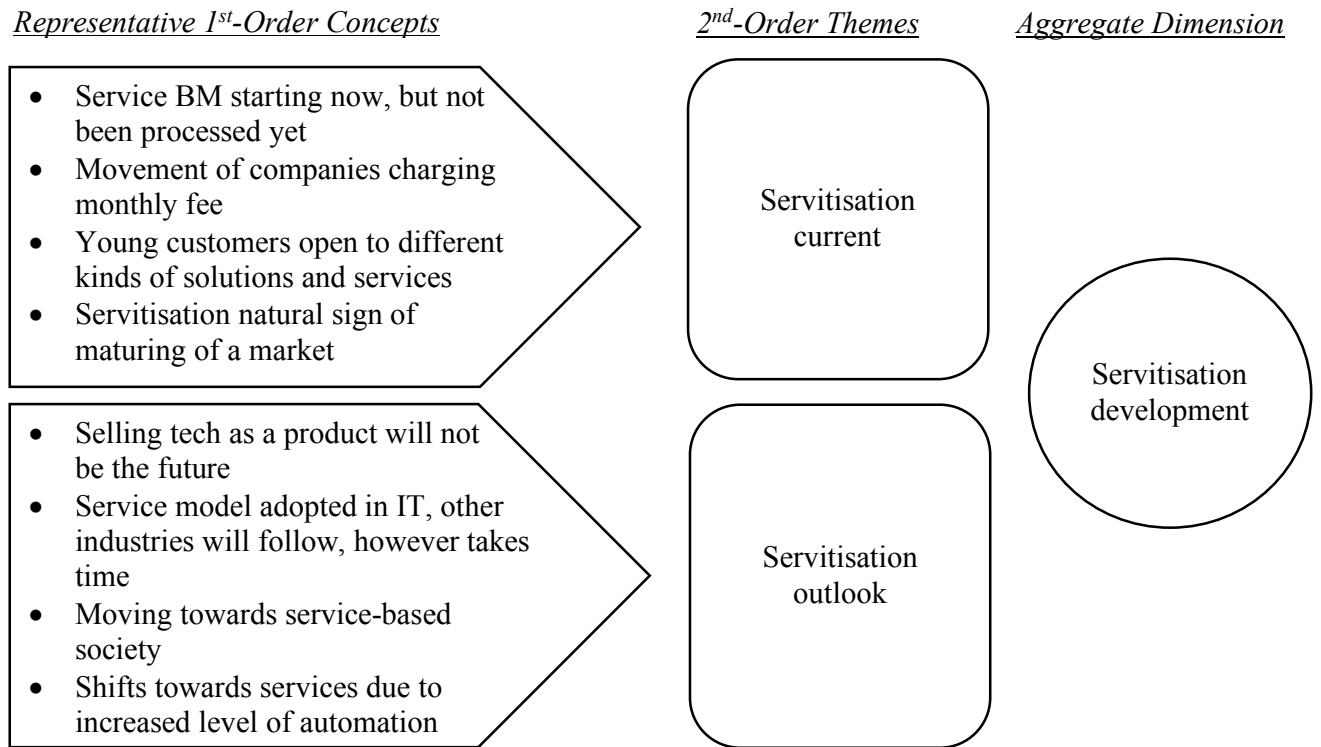
Figure 7. Data structure for Servitisation Development.

4.2.2 Beneficial Service Characteristics (BSCs) for SOI Adoption

The second aggregate dimension explains the findings concerning the service characteristics beneficial for SOI adoption. The data of this research presents six prevalent characteristics. <u>Note</u>: despite SOI not being explicitly mentioned in all quotes or 1ˢᵗ-order concepts, all data on servitisation is collected within the light of SOI adoption (see interview guide app.3).

Representative Quotes	*2ⁿᵈ-Order Themes*
Int.5: "[…] especially good for people or for companies who need to make a step to get more high tech [...] [but] don't have the money to invest."	Financial model BSC
Int.4: "I want to try it for a short time of period and I don't want to invest so heavy in machines that if there was option of having other kind of getting the services […]."	
Int.7: "[…] but sometimes the funds aren't there or there are new emerging companies […] so that leasing is the best solution."	
Int.12: "Capital costs are extremely high [...], so the leasing models are very attractive because there's a lot of interest but not necessarily a lot of capital to begin at the starting point."	
Int.12: "[Price predictability is] absolutely a benefit of services."	Predictability BSC
Int.11: "[Benefit of services is] cost stability. So it will be a long term contract."	
Int.11: "So they know now the price of the electricity will not change for the coming 10 or 15 years so they can […] build much better with this case."	
Int.11: "It's about security [the benefits of service BMs]. So they are not responsible for assuring the power. That's then the responsibility of the of the service provider."	Outsource responsibility BSC
Int.1: "[…] not like to have a system that we will have to run ourselves. […] we would like to concentrate on what we're good in."	
Int.12: "[…] the [BSC] value that is that it's hands off […] it's taken care of."	
Int.12: "[…] co-creation comes in as in the actual installation stage because that creates a new model [...] allowing to create a different service price and category meaning that there's a different scale created."	Co-creation BSC
Int.7: " […] we really saw that consultative sales and also working with a technical service department really helps us to understand the needs of the customer."	
Int.12: "[…] with the service one, you tend to see a higher degree of communication, because you're in their operation."	Communication & feedback BSC
Int.12: "[Within services] they benefit from each other's knowledge and experience through the small platform."	
Int.4: "So the service could get in contact with the farmer in our case and [...] like to hear some feedback."	
Int.9: " […] you're putting the right experience in the right place."	Expertise BSC
Int.5: "But other things we are not so [good at] you need to have also experts from outside."	
Int.7: "[...] offering expertise that they do not have."	

Table 8. Representative quotes for 2ⁿᵈ- order concepts in BSCs.

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Financial model BSC

"*Capital costs [for SOIs] are typically extremely high [...].*" (Int.12). Therefore, multiple sources outlined that the financial model of services is a prevailing helpful characteristic to break down the fear towards SOI adoption. The main reason for this is that payments are made on a regular basis yet involving smaller amounts. Therefore, SOI adoption within service BMs would typically not require high capital costs at the starting point. Besides reduction of investment, it is also indicated that service models could facilitate overcoming the barrier over-investments, in which new equipment or systems typically need to be bought. Looking into specific customer needs and segments, the financial model of services enhances the ability of customers to afford adopting new solutions within, for example, leasing models. Especially when customers are struggling with raising funds, leasing is considered a beneficial solution. Hence, this allows a wide range of customers to adopt high tech, as it also suits customers which typically are not in the financial position to commit to large investments. Services are therefore "*[...] especially good for people or for companies who need to make a step to get more high tech [...] [but] don't have the money to invest.*" (Int.5). Also, it allows customers to try out new solutions, without large upfront commitment and investments. This financial model would especially benefit smaller B2B customers, usually seeking for pilot projects and then aiming for scalability.

Predictability BSC

Gathered evidence shows that predictability is a second BSC to SOI adoption, due to its costs stability which also enhances financial planning. This allows B2B customers to make long-term cost estimations, facilitating transparent assessment of business cases. "*So they know now the price of the electricity will not change for the coming 10 or 15 years so they can [...] build much better with this case*" (Int.11). The current perceived risk of SOIs can be also be minimised as services frequently link the monthly payments to a key performance indicator.

Outsource responsibility BSC

The third BSC found in the light of SOI adoption builds on the fact that service BMs outsource responsibility from customers to service providers: "*The [BSC] value that is that it's hands off [...] it's taken care of.*" (Int.12). Findings show that generally, customers are willing to outsource their non-core activities, so that they can focus on their core business where their main expertise lays. This indicates when customers consider adopting new systems outside

their core-business, they require systems that do not need to be taken care of. Following this thought, customers are increasingly asking for 'plug-and-play' services, helping customers to be more effective in their business. Services also have the benefit of creating security, because then the service provider would take responsibility in assuring stable service. However, it must be noted that some generations are predominantly bound to the traditional approach of owning assets and would struggle giving away responsibility. Therefore, it is not surprising that especially the younger generation is mentioned as interested in outsourcing and showing less interest in owning all products and systems themselves.

Co-creation BSC

Data showed evidence that co-creation is another BSC to SOI adoption. Close customer contact via consultative sales have proven to be beneficial to understand customer needs. Co-creation within services also allows to create unique pricing and scaling approaches. Furthermore, services enhance a stronger long-term relationship between provider and adopter as they facilitate co-creation beyond purchase.

Communication & feedback BSC

The interviewees described the high level of communication and feedback as a BSC to SOI adoption. Within services, "*[...] you tend to see a higher degree of communication, because you're in their operation. […]*" (Int.12). Services enable high degrees of communication between parties, giving providers insights into current market adoption dynamics, and therefore valuable input on how to improve adoption and increase customer satisfaction. An example of this is the ability to quickly test and understand acceptable price levels.

Expertise BSC

Another BSC to SOI adoption emerging from empirical data is providing expertise as part of services; "*[…] you're putting the right experience in the right place.*" (Int.9). Services are often distinguished by the delivery of specialised expertise needed and lacking: "*[...] offering expertise that they do not have.*" (Int.7). Hence, offering expertise is described to enhance the overall quality of customers' operations.
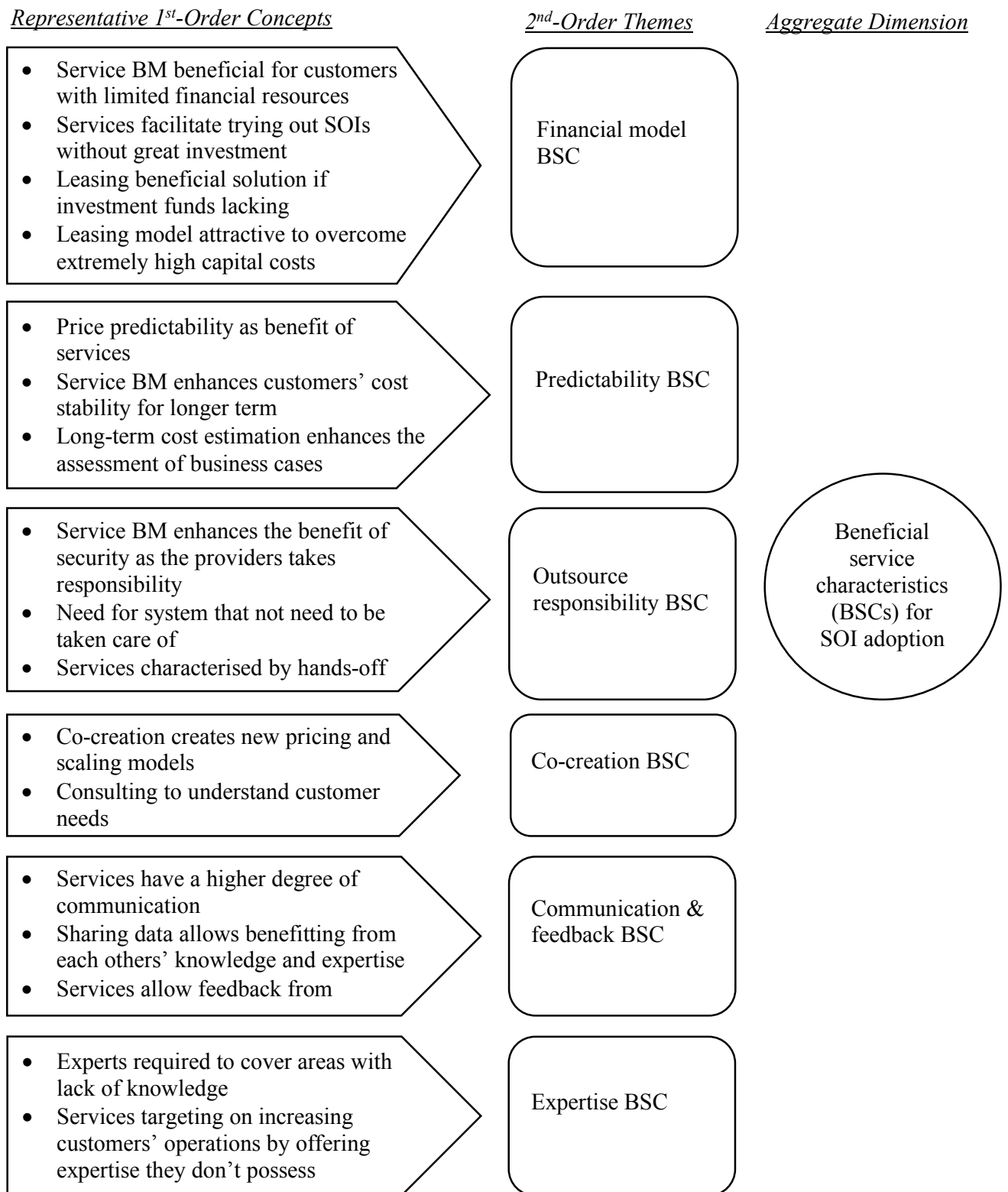
Representative 1st-Order Concepts   2nd-Order Themes   Aggregate Dimension

- Service BM beneficial for customers with limited financial resources
- Services facilitate trying out SOIs without great investment
- Leasing beneficial solution if investment funds lacking
- Leasing model attractive to overcome extremely high capital costs

Financial model BSC

- Price predictability as benefit of services
- Service BM enhances customers' cost stability for longer term
- Long-term cost estimation enhances the assessment of business cases

Predictability BSC

- Service BM enhances the benefit of security as the providers takes responsibility
- Need for system that not need to be taken care of
- Services characterised by hands-off

Outsource responsibility BSC

Beneficial service characteristics (BSCs) for SOI adoption

- Co-creation creates new pricing and scaling models
- Consulting to understand customer needs

Co-creation BSC

- Services have a higher degree of communication
- Sharing data allows benefitting from each others' knowledge and expertise
- Services allow feedback from

Communication & feedback BSC

- Experts required to cover areas with lack of knowledge
- Services targeting on increasing customers' operations by offering expertise they don't possess

Expertise BSC

Figure 8. Data structure for BSCs.

4.2.3 Hindering Servitisation Factors (HSFs) for SOI Adoption

On the other side, the data also showed evidence for factors within servitisation which potentially hinder the adoption of SOI. These both mainly concern the reluctance stemming from the change in B2B customers' organisational structures and cultures.

Representative Quotes	2ⁿᵈ-Order Themes
Int.8: "I'm not sure if the greenhouse users are interested in doing so, because it changes the set of your company [...]."	Organisational change HSF
Int.7: "[Services require] a lot more of the full system that needs to be incorporated […]."	
Int.8: "[Adopters' transition towards services] also creates a hindrance for them that they are not interested so much in […] understanding how those things work."	
Int.11: "I think it might complicate the process little bit because it takes longer. [...] It's a bit more of a journey. "	
Int.7: "[Customer downside of service BM] there is this changing of mindset that you do not have to pay for software."	Cultural change HSF
Int.4: "[...] it takes some time before you trust [...]."	
Int.12: "I agree on this cultural barrier [giving away parts of their business and trust on their expertise], I mean, they have always managed everything themselves."	
Int.12: "[…] it [services] just narrows the kinds of customers that might be interested in your solution, because it's maybe less traditional than buying the product straight out."	

Table 9. Representative quotes for 2ⁿᵈ- order concepts in HSFs.

Organisational change HSF

A certain reluctance for servitisation of SOIs can be observed in the data, meaning factors further reducing the SOI adoption pace. First of all, data showed that the transition towards services requires major changes in the customers' operations: adopting services *"[…] changes the set of your company [...]"* (Int.8). Shifting to services requires an extensive change of the customers' current day-to-day internal processes, organisational systems and financial approaches. The incorporation of these changes is considered a complex process. Especially since a product-dominance can be observed, this shift requires extensive convincement and educational efforts.

Cultural reluctance HSF

Lastly, within the data, cultural reluctance became apparent as a hindering factor to adopt SOIs within service BMs. The aspiration for ownership and taking full pride for operations is described as being reduced by services and hence limits their adoption. In this light, adopting SOIs within service BMs is considered less likely because customers have always been able to manage the full operation themselves. Secondly, it requires a high level of trust in the service-provider to deliver according to customers' standards: *"[...] it takes some time before you trust [...]."* Int.4. However, this cultural reluctance cannot be generalised over all segments. The adoption of services is hindered by specific segments which are not used and open to this type of BMs. Still, this indicates that the adoption of services is narrowed to a certain type of customer profile. Concluding, servitisation is described as a difficult path, involving large efforts of changing the customers' mindset.

Representative 1ˢᵗ-Order Concepts

- Reluctance to services due to shift of company set-ups and shift of responsibility
- Services require large change of organizational processes
- Adopters' transition to services creates hindrance
- Complexity of incorporation of services within current processes

- Downside of service BM is changing customer' mindsets
- Lack of sense of ownership in services, want to take full pride
- Used to self-management, creating cultural barrier for outsourcing
- Newness of services narrows kind of customer

2ⁿᵈ-Order Themes

Organisational change HSF

Cultural change HSF

Aggregate Dimension

Hindering servitisation factors (HSFs) for SOI adoption

Figure 9. Data structure for HSFs.

5. Analysis and Discussion

In this chapter, the empirical data is translated into the theoretical world, outlining interrelationships between the concepts and building a model that is grounded in qualitative data. This will be done in tandem with consideration of the literature review, particularly building on diffusion of innovations, SOI barriers and drivers and servitisation literature. The aim of this chapter is to deliver answers to our RQ and thus outline the effects of servitisation on SOI adoption.

5.1 The Effect of Barriers and Drivers on SOI Adoption

To visualise the SOI adoption, Rogers' (2003) diffusion curve is revisited. For adoption, the decision stage is central, where an innovation is either adopted or rejected (Rogers, 2003). During this decision stage, adopters consider whether making full use of the innovation is the best course of action (Rogers, 2003). Thereby, both existing literature and empirical data highlighted the existence of barriers that hinder SOI adoption and lead to a shift of the diffusion curve towards later adoption, whilst drivers enhance SOI adoption and shift the diffusion curve towards earlier adoption (see figure 10).
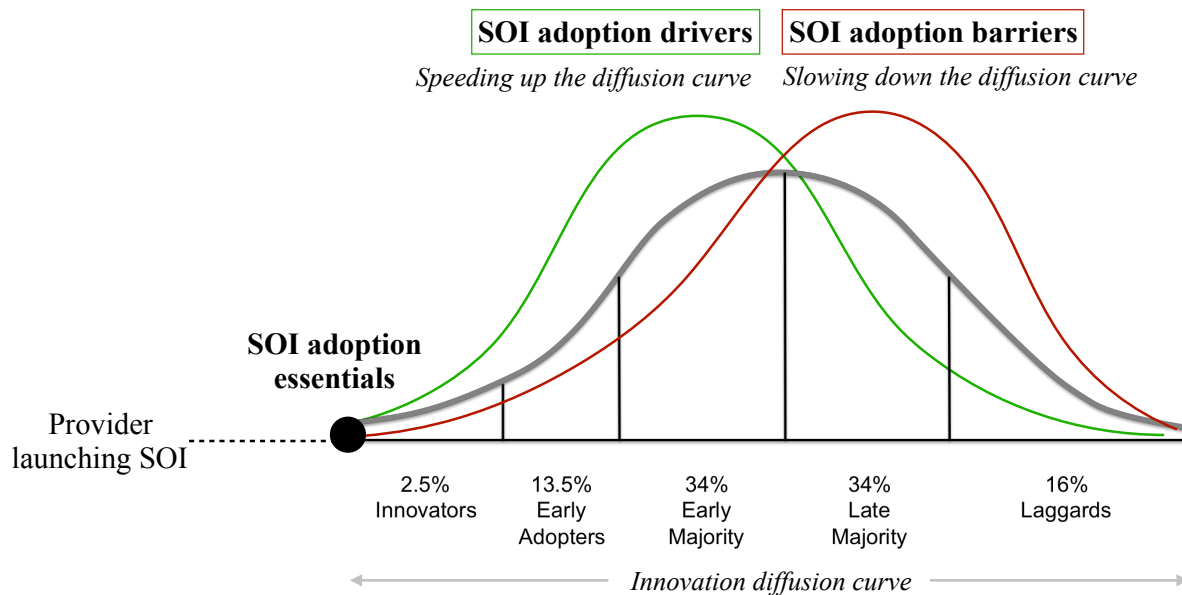
Figure 10. Effect of barriers and drivers for SOI adoption on the diffusion curve.

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5.2 Core and Influencing Barriers and Drivers for SOI Adoption

When analysing factors influencing the decision-making for SOI adoption, two different categories, namely barriers and drivers (1) and essential factors (2) appeared. Thereby, barriers and drivers itself could be distinguished into core and influencing ones (see figure 11).

(1) Some barriers and drivers for SOI adoption are fundamentally pertinent to the SOI adopter and include characteristics present within the core of either the SOI (e.g. *'uncertainty'*) or the adopter itself (e.g. *'mindset'*). Other barriers and drivers however can be controlled by the SOI provider (e.g. *'information & awareness'*) and hence influence the SOI adopter in the decision stage. Therefore, the distinction into **'core'** (pertinent to SOI or SOI adopter) and **'influencing'** (controllable by SOI provider) barriers and drivers is made. Thereby, several barriers for SOI adoption can turn into drivers if they are favourable instead of unfavourable or vice versa turn from drivers into barriers. This is the namely the case for economic, mindset, information and awareness, and collaboration driver/barrier for SOI adoption.

The identified barriers and drivers for SOI adoption are largely in line with the ones identified in existing literature (*only using different terms, preserving informants' wording)* and will be explained separately when analysing the effect of servitisation. In line with literature, this research stresses that economics acts as the key factor (barrier *and* driver) to SOI adoption. One novel barrier was found concerning *'lack of collaboration'*, emphasising the lack of knowledge sharing between practitioners and academia which hinders SOI adoption. Contrarily, the negative implications of too intense regulation and bureaucracy (Anttonen et al., 2013) were not found in interview data.

Meanwhile, the empirical evidence gathered also led to the discovery of novel drivers. Accordingly, SOI adoption benefits from offering flexibility of choice for components and value angles (*'broad offer'*), from facilitating to increase the marketing value via sustainability, namely providers' reputation, storytelling, and differentiation from competitors ('*branding'*) and right segmentation and demographic selection (*'segmentation'*).

(2) Data about barriers and drivers showed results that some factors affecting the SOI adoption appear to be **'essential factors'**, meaning they must be in place to enable SOI adoption. This is novel and not distinguished in previous literature.

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When developing and launching an SOI, financial feasibility (positive ROI, facilitating cost reduction or increase in revenue), functionality (facilitating productivity) must be granted and therefore function as main essentials. Other requirements to ensure SOI adoption are customer centricity (tailoring SOIs to customers' needs), relationship management (ensuring a good network, reputation and trust), education (on sustainability and technology), observability (proving the value), considerate customer and partner selection (targeting right segments to avoid failure), governmental support and endurance (long timelines before market adoption).

Some overlap and similarities may be found between essentials and drivers and/or barriers, as result of maintaining integrity with the data *(when interviewees stressed that certain factors 'must' be present, they were considered as essentials)*. These similarities arguably follow a logic nature. To name an example, *'financial feasibility'* is an essential to SOI adoption; further improvements of economic feasibility can further *drive* adoption and lacking economic feasibility can function as *barrier* to adoption. In similar manner, strength in *'functionality essential factor'* contributes to the performance driver, et cetera. Still, the authors of this thesis believe that such distinction is crucial to answer the RQ since the adoption essentials must be inherent to the SOI independently from its BM and therefore cannot be influenced by servitisation.

SOI adoption essentials	Core barriers	Core drivers
Financial feasibility *Governmental support*	*Economic Investment*	*Economic*
	Mindset	*Mindset* *Sustainability*
Functionality *Reliability*	*Uncertainty*	*Performance*
		Branding
	Influencing barriers	**Influencing drivers**
Education	*Lacking information & awareness*	*Information & awareness*
Observability	*Lacking proof of concept*	
Customer & partner selection *Customer centricity*	*Lacking collaboration*	*Collaboration* *Segmentation*
		Broad offer
Relationship management		
Endurance		

Figure 11. Essentials, barriers and drivers for SOI adoption.

5.3 The Effect of Servitisation on Barriers and Drivers for SOI Adoption

Figure 12 illustrates the holistic overview of the created theoretical model. Based on evidence from analysed data and existing literature, this overview represents the effects of the positive and hindering service characteristics on the barriers and drivers for SOI adoption, subsequently determining SOI adoption. The following sub-chapters outline the effects separately and are complemented by an illustration of each effect (see figure 13a-e, 14a-g, 15).
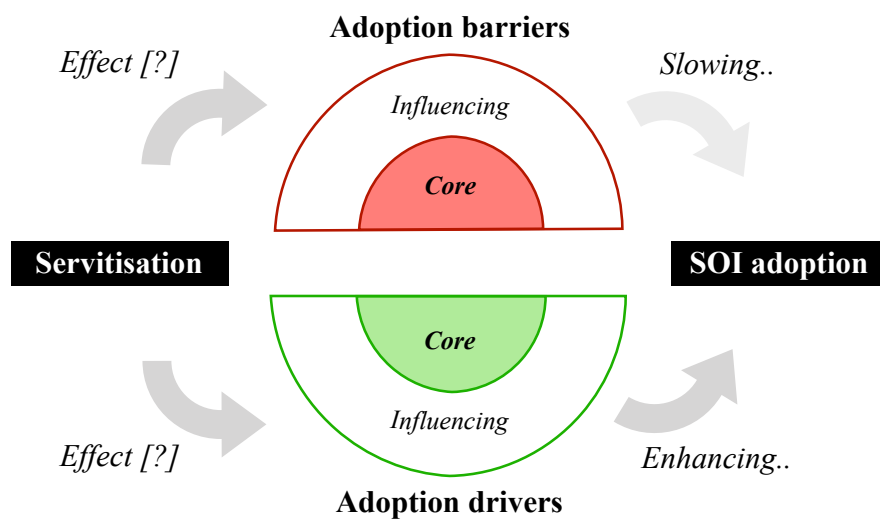
Figure 12. The effects of servitisation on SOI adoption.

5.3.1 Positive Effects of Servitisation on SOI Adoption

Core barriers

Services mitigating economic and investment barriers

Strong evidence from findings shows that some elements of the economic barrier (namely price-sensitivity and difficulty to convince on economic feasibility) and all elements of the investment barrier (namely waiting for full amortisation, little financial resources, fear of overinvestment) can be mitigated through the BSC '*financial model*' (figure 13a). Literature confirms the economic barrier, describing the prevalent perception of SOIs being less attractive financially (Ghisetti, 2017; Olson, 2013; Senyolo et al., 2018). Likewise, the investment barrier is described by researchers' pointing out that companies aspire for short-term returns, seeing expenses related to SOIs as costs instead of investments (Pacheco et al., 2018; Vasilenko &

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Arbačiauskas, 2011). In addition, lacking financial resources contribute to hindering SOI adoption (Anttonen et al., 2013; Vasilenko & Arbačiauskas, 2011).

Meanwhile, the BSC '*financial model*', characterised by its cost-stability (Gopalani, 2010; Kowalkowski et al., 2017), reduces these barriers as there is no need to commit to large upfront investments, instead smaller, regular service fees are paid. This breaks down the SOI investment fear and facilitates customers to pilot and try out without fearing mis- or over-investments. Additionally, the newly found BSC '*outsource responsibility*' indicates that asset ownership is avoided and transferred towards the provider.

Another aspect to these barriers is the difficulty of convincing customers about the financial feasibility of SOIs. The evidence shows that this might be mitigated through BSCs '*co-creation*' and '*communication & feedback*'. Literature stressed that services entail co-creation with customers from idea generation until value capturing (Beltagui, 2017; Kindström & Kowalkowski, 2013; Lee & Chen, 2009; Lusch & Vargo, 2004, Storbacka, 2011). More specifically, findings showed that the SOIs benefits from '*co-creation*' through its mutual development, testing and close contact between providers and adopters, allowing assessing and tailoring financial feasibility to the customers' circumstances, reducing the '*economic barrier*'. Meanwhile, existing literature confirms the high level of '*communication & feedback*' within services, pointing out the consistent and stable sharing of information as part of services (Ng et al., 2011). Within the light of SOI adoption, this BSC has shown to enhance transparency and allow customers to be more informed about economic, next to the sustainability, benefits. Vice versa, feedback enables providers to quickly understand customers' acceptable price points and adapt to this.
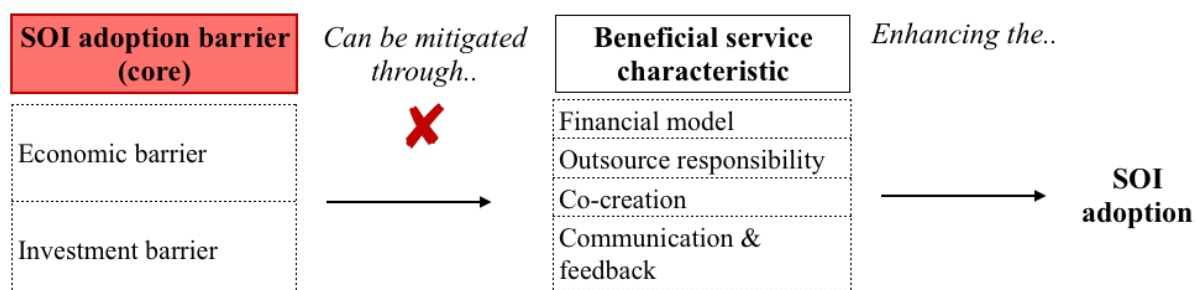
Figure 13a. BSCs overcoming barriers (economic/investment) for SOI adoption.

Services mitigating mindset barrier

A significant positive relation is found between the 'mindset' barrier and the BSCs '*co-creation*' and '*communication & feedback*' (figure 13b). In line with research from Vasilenko & Arbačiauskas (2012), findings outline customers' reluctance to change to SOIs. More specifically, the results showed this stems from customers preference for traditional practices, being a second mover, a lack of openness to external advice and sustainability not being a top priority.

The BSC '*co-creation*' in turn facilitates mutual invention, development and testing of SOIs, enabling to favourably influence adopters' mindsets. Particularly, it facilitates mitigating the reluctance to change and altering it towards a more favourable one for SOI adoption. In similar manner, if benefits of SOIs are '*communicated*' persuasively, adopters' reluctance to change is addressed so they better understand why an SOI should be adopted. Visa versa, providers are able to alter their offerings according to the '*feedback*' perceived to ensure SOIs are tailored to customers' needs.
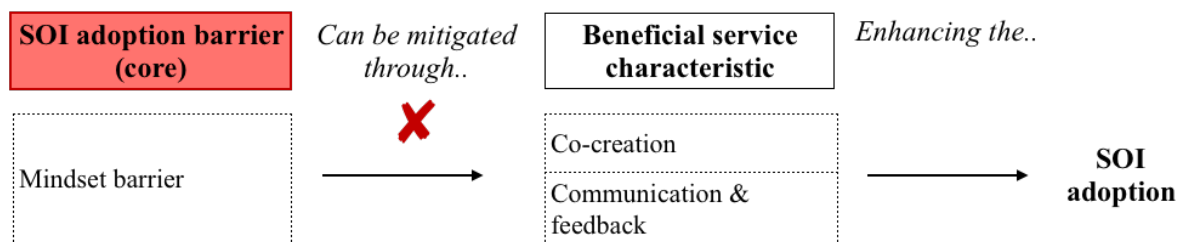
Figure 13b. BSCs overcoming barrier (mindset) for SOI adoption.

Services mitigating uncertainty

Uncertainty, indicating the lack of perceived reliability, trust and certainty, was found in interview data and existing literature as another core barrier to SOI adoption (Ghisetti, 2017). The results show that several BSCs contribute to the mitigation of this barrier (figure 13c). First, the identified BSC '*predictability*' is characterised by facilitating stability and (cost) predictability. This facilitates better financial planning and future business orientation, reducing the perceived uncertainty of SOIs. Secondly, evidence was found that trust was enhanced through the high degree of collaboration, contact and communication within services (BSCs '*co-creation*' and '*communication & feedback*'). Thirdly, evidence was found that the BSC '*outsourcing responsibility*' allows the shift of responsibility (and thus uncertainty) from customer to provider. Lastly, in line with Lusch and Vargo (2004), stating that services focus

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on exchanging specialised knowledge, providers' *'expertise'* appeared to be a BSC, leading to higher levels of reliability and reducing the perceived uncertainty.
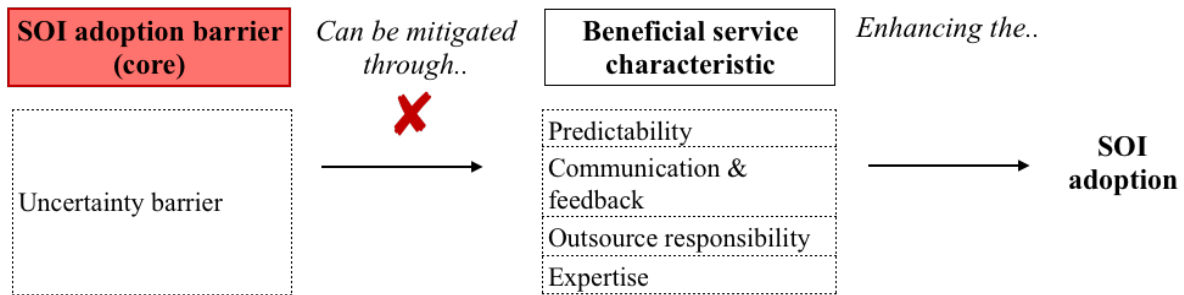
Figure 13c. BSCs overcoming barrier (uncertainty) for SOI adoption.

Influencing barriers

Services mitigating lack of information & awareness

Also, correlations between influencing barriers and BSCs became obvious, of which the lack of information & awareness that can be mitigated through the BSCs *'communication & feedback'* and *'expertise'* (figure 13d). The lack of information and awareness derives from customers' unconsciousness about their environmental behaviour. Furthermore, there is a lack of discussion and education on how to improve this behaviour, being also highlighted as barrier for SOI adoption by various researchers (Anttonen et al., 2013; Pacheco et al., 2018; Vasilenko & Arbačiauskas, 2012). This barrier can be relieved through the BSC *'communication and feedback'* allowing sharing and benefiting from each other's expertise and knowledge. Furthermore, the BSC *'expertise'* particularly facilitates the transmission of specialised knowledge that adopters typically do not possess to tackle the prevalent lack of information and awareness about SOIs.
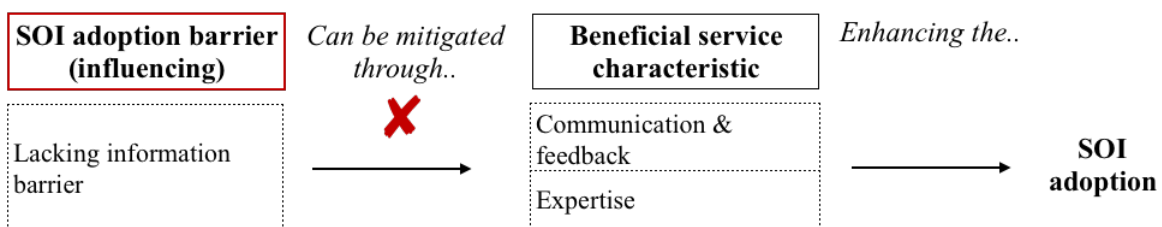
Figure 13d. BSCs overcoming barrier (lacking information & awareness) for SOI adoption.

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Services mitigating lacking proof of concept

Literature has stressed the importance of observability within sustainable solutions (Anttonen et al., 2013; Nygrén et al., 2015; Vasilenko & Arbačiauskas, 2012). More detailed, findings have pointed towards lacking observability of SOI benefits to assess value, quality and reliability of SOIs as an adoption barrier.

In a similar manner as the latter barrier, the results show that this influencing barrier can be mitigated through servitisation (see figure 13e). As services often bring in a certain level of *'expertise'* (BSC), service providers act as knowledgeable agents with the ability to offer and point out highly specialised value. The BSC *'communication & feedback'* facilitates high degrees of communication, assisting in transmitting benefits of an SOI and hence acting as proof-of-concept (of the benefits of SOIs). Also, the BSC '*co-creation*' facilitates SOI adoption as co-invention increases transparency and mutual knowledge transfer of the SOI benefits.
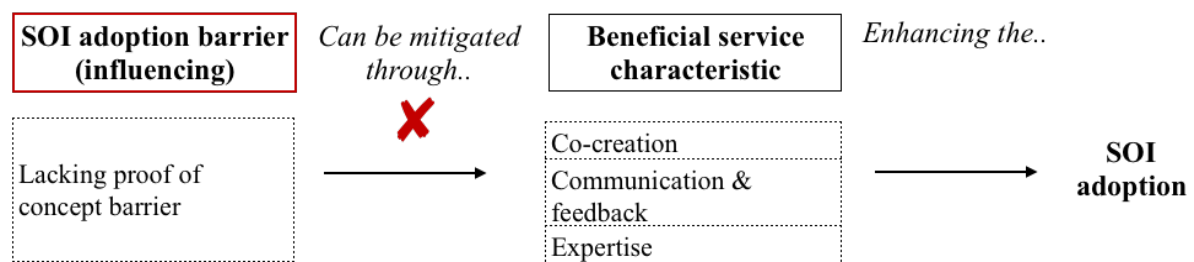
Figure 13e. BSCs overcoming barrier (lacking proof of concept) for SOI adoption.

*Services **not** mitigating lacking collaboration*

Surprisingly, no significant effect of a specific BSC on the newly presented influencing barrier *'lacking collaboration'* was found. Potentially, this can be explained with findings within this barrier mainly outlining the lacking collaboration amongst academia and practitioners, not outlining a lacking collaboration between adopters and providers, of which the latter could potentially be mitigated through '*co-creation*'.

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Core drivers

Services **not** enhancing economic driver

Literature has pointed a shift towards aligning sustainability and economic purpose (Adams et al., 2012; Porter & van der Linde, 1995). Conforming this thought, findings show an increasing tendency towards seeing SOI as an economic advantage. However, regardless of services reducing the barrier of large upfront investments, remarkably no significant effects of BSCs on the economic driver were found when analysing the findings. Hence no BSCs significantly contribute to either achieving a better ROI or increasing prices in comparison to SOI adoption in the product-form. Short-term costs can potentially be reduced through service-fees, however, on the long run it is likely that regular service fees end up outweighing the costs of ownership.

Services enhancing mindset driver

A positive attitude towards improving the business and acquiring new knowledge about SOIs has shown to drive adoption (figure 14a). Hasler et al. (2017) support this evidence by stating that having a positive attitude towards SOIs and technological affinity enhances SOI adoption. Also, it is found that this driver can be further enhanced by the BSC of '*co-creation*' and its effect of developing better solutions, therefore facilitating adopters to improve their business. Furthermore, the BSCs '*expertise*' and '*communication & feedback*' further fuel having a positive mindset as a driver for SOI adoption, since providing expertise and communicating extensively as part of a service BM facilitates providers to acquire new knowledge.
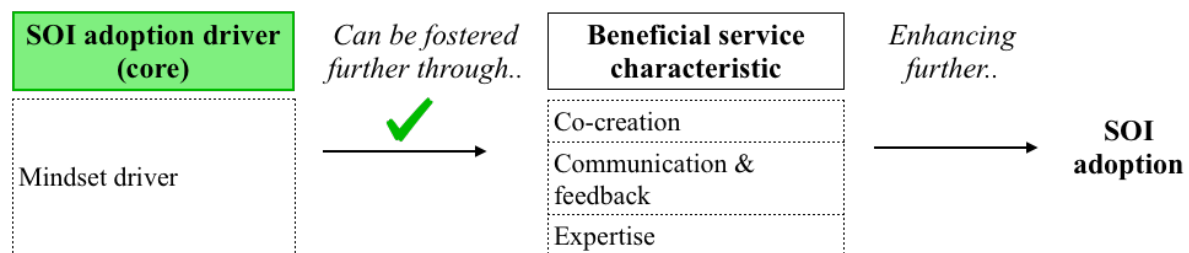
Figure 14a. BSCs enhancing driver (mindset) for SOI adoption.

Services **not** enhancing sustainability driver

Adopters value sustainable solutions to combat climate change, overcome their bad conscience or respond to societal pressure. SOI adoption benefits from these factors; this is also stressed by Noppers et al. (2014), outlining the promoting effect of positive environmental attributes on SOI adoption. Yet, no evidence for significant effects of servitisation and its BSCs on this driver was found, meaning no specific improvement of environmental value stemming from

service BMs. However, it could be argued that specific service BMs such as leasing- or sharing-models do enhance sustainability since physical products are co-utilised, therefore enhancing resource-efficiency.

Services enhancing performance driver

SOI adopters value the benefits of increasing efficiency, quality and sustainability of SOIs. A series of researchers confirm that SOIs increase firm performance (e.g. higher customer value and revenue or lower costs) and its consequent beneficial effect on adoption (Hasler et al., 2017; Horbach et al., 2012; Kammerer, 2009; Vasilenko & Arbačiauskas, 2012). The BSC of *'co-creation'* meanwhile has been described as leading to the development of better SOIs, thus even more increasing efficiency and sustainability of customer operations (figure 14b). Second, *'expertise'* as part of service BMs enhances the customer value by supporting adopters to improve the quality of produces and the efficiency of operations, thereby strengthening the performance driver for SOI adoption.
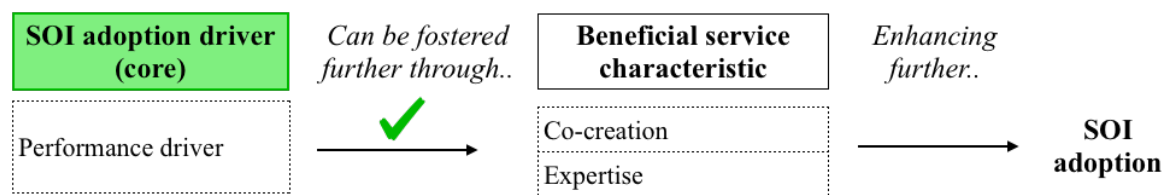
Figure 14b. BSCs enhancing driver (performance) for SOI adoption.

Services enhancing branding driver

The results revealed that the novel *'branding driver'* for SOI adoption, emphasising the effect of increasing adopters' marketing value through sustainability, is further fuelled via *'co-creation'* (figure 14c). This BSC leads to the development of tailored and unique solutions that therefore enable SOI adopters to improve their storytelling and reputation as sustainable players that are able to differentiate themselves from competitors.
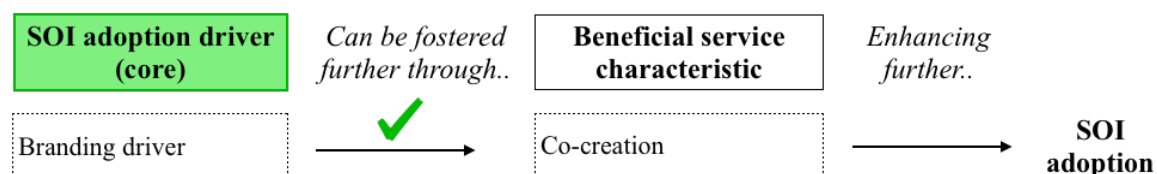
Figure 14c. BSCs enhancing driver further (branding) for SOI adoption.

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Influencing drivers

Services enhancing information & awareness

Empirical evidence highlighted the enhancing effect on SOI adoption adequate and sufficient information is available and the right channels are used to increase awareness. This point is similarly stressed by Triguero et al. (2013), claiming that adequate information about SOI and provider increase SOI adoption. Likewise, Hasler et al. (2017) point towards the need for observability of SOI benefits and demonstration projects. Consequently, '*communication & feedback*' is a BSC that further strengthens this driver with its high degrees of communication, quick feedback about customer needs, and benefitting from each other's expertise (figure 14d).
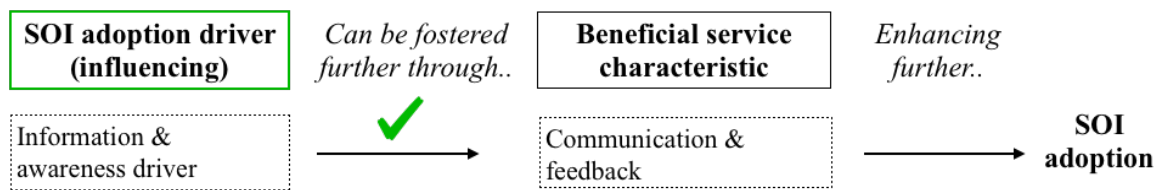
Figure 14d. BSCs enhancing driver (information & awareness) for SOI adoption.

Services enhancing collaboration

Co-invention and ensuring economic feasibility have shown to mutually create better solutions, being named by respondents as augmenting SOI adoption. Various researchers have confirmed that SOI adoption benefits from a good customer-provider relationship (Halme et al., 2007; Kortman et al., 2007; Mont et al., 2006), the inclusion of stakeholders in the innovation process, and customer-closeness (Byrne & Polonski, 2001; Hasler et al., 2017, Triguero et al., 2013). Ng et al. (2011) revealed that key aspects of servitisation are the consistent and stable sharing of information and risk. In line, analyses on the findings showed that '*co-creation*' and '*communication & feedback*' are BSCs to SOI adoption, as it reinforces the above driver due to close collaboration, contact and knowledge sharing between SOI service provider and adopter, ultimately enhancing a rich understanding of customer needs and the collaboration between the two (figure 14e).
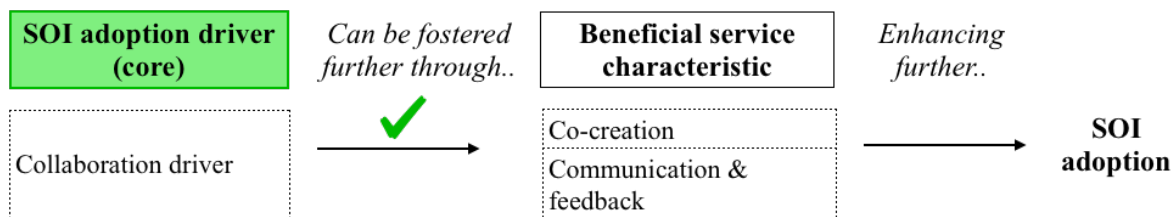

Figure 14e. BSCs enhancing driver (collaboration) for SOI adoption.

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Services enhancing segmentation

An adequate segmentation and demographic selection have proven to be an enhancing and newly found factor on SOI adoption. '*Co-creation*' as a BSC meanwhile implies close contact between providers and adopters, leading to a better understanding of customer needs. This reinforces the above driver by means of knowing what segments are particularly interested in SOI adoption and hence should be in the main target focus (figure 14f). Moreover, '*communication & feedback*' describes the characteristic of having high degrees of communication and quick feedback as part of a service BM. This facilitates finding the right target segment with the highest interest for SOI adoption, hence further strengthening the segmentation driver for SOI adoption.
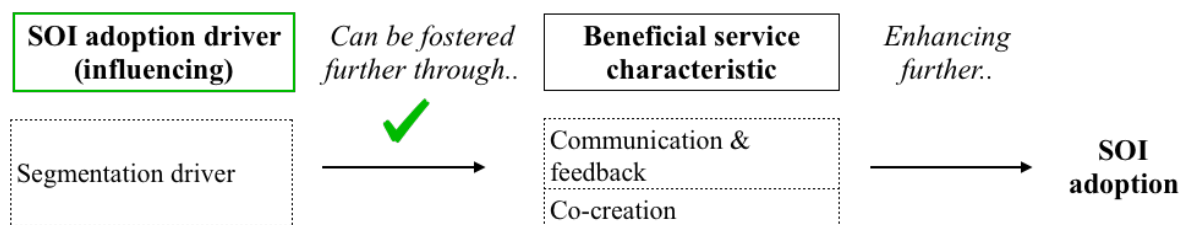
Figure 14f. BSCs enhancing driver further (segmentation) for SOI adoption.

Services enhancing broad offer

As newly found driver, respondents highlight the preference of SOI adopters for flexibility of choice and solutions including several components and value angles. The BSC '*co-creation*' in turn facilitates the creation of unique solutions that are characterised by being tailored to adopters' needs, hence further fostering the broad offer as an SOI adoption driver (figure 14g).
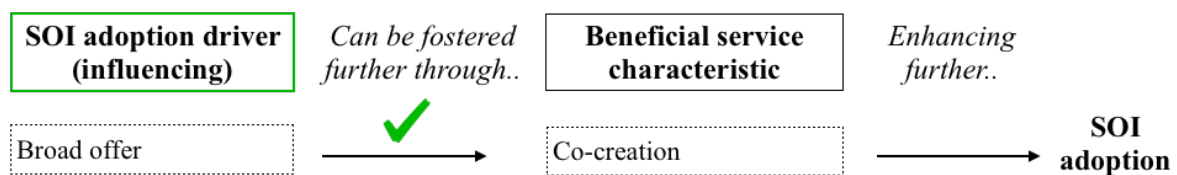
Figure 14g. BSCs enhancing driver (broad offer) for SOI adoption.

5.3.2 Hindering Effects of Servitisation on SOI Adoption

In line with literature, servitisation is an upward trend. However, its broad implementation and market acceptance require time, especially within strongly product-dominated industries (such as agriculture). Despite the previously outlined positive effects on SOI adoption, servitisation also implies two hindering repercussions that became apparent within this research (figure 15).

First, similar to the critical barrier organisational inertia to PSS adoption described by Hannon et al. (2015), this research provides evidence that *'organisational change'* is a hindering factor for servitisation. Two hindering effects of this factor on SOI adoption were identified. First, the alteration of adopters' company processes and setting when transitioning from procuring products versus services. Secondly, the increased complexity of services and proactive participation of customers in value creation (see *'co-creation'*) potentially provokes rejection of service offerings as they are equal to higher efforts. These insights confirm Kortman et al.'s (2007) research, stressing that SOI service adoption depends on firms' outsourcing willingness for non-core processes.

Secondly, and in line with the cultural barrier to PSS (Hannon et al., 2015), *'cultural reluctance'* is found to be a major HSF for SOI adoption. Customers' mindset, in which sustainability is of shortcoming importance, already appears to be a core barrier to SOI adoption. Let alone that adopters *also* need to change their product-dominant mindset towards service-offerings with their implication of lacking ownership and self-management, the adoption pace is further slowed. Seen from the other perspective, the mindset and sustainability drivers for SOI adoption can be reduced due to these cultural and organisational implications, hence negatively affecting SOI adoption.
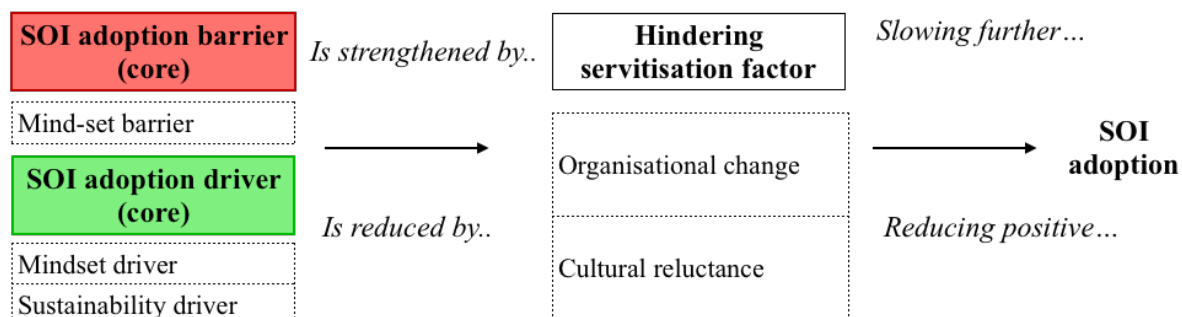

Figure 15. HSFs fueling barrier and reducing driver for SOI adoption.

5.4. Concluding Analysis

As a final thought and returning to the IHIP dimensions, as stated by Kuijken et al. (2017), the value of services is often not perceived due to their *'intangible'* nature. However, this study does not reveal strong confirmation on the fact that the service dimensions hinder SOI adoption. In fact, it appeared Lovelock and Gummesson's (2004) 'new' dimension *'tangibility'* applies more to servitisation, as the change of firms solely focussing on product offerings towards stronger integration and focus on service offerings often involves tangible processes or outcomes (Baines et al., 2009; Gallouj and Windrum, 2009; Kindström and Kowalkowski, 2013; Tongur & Engwall, 2014). This integrative approach offers broad possibilities and opportunities for SOIs. Also, the long-term value of SOI-services indicates that Lovelock and Gummesson's (2004) 'new' dimension *'durability'* applies, marking that service performances and output can be captured and are highly durable.

However, this research does confirm that service inseparability (*'co-creation'*) implies that both ends of adoption need to adapt their existing systems in order to drive the change towards SOI services (Barnett et al., 2013), constituting a hindering effect on SOI adoption. Nevertheless, evidence showed that on the adopters' side, the younger generation is increasingly open towards both, SOIs and services; a trend that together with the increasing level of automation (*'homogeneity'*) is beneficial for SOI service providers. Yet, it must be stressed that the uniqueness and possibility for customisation ('no one-size fits all') appeared to be a highly valued service characteristic by adopters and must not be dismissed through automation.

To conclude above discussion, table 10 captures all effects of BSCs and HSFs on barriers and drivers for SOI adoption. Based on the rich qualitative data, it became apparent that the *'financial model'*, *'co-creation'* and *'communication & feedback'* are the BSCs with the most significant implications. On the contrary, and despite strong evidence for positive effects of service BMs on SOI adoption, *'organisational change'* and *'cultural reluctance'* were found to potentially further slow the adoption pace. However, whether these negative implications outweigh the benefits of servitisation brings on SOI adoption cannot be confirmed as part of this analysis (*see Ch.6.4 Future Research*).

Barriers & drivers ↓	BSC →						HSF →	
	Financial model	Predic-tability	Outsource responsibility	Co-creation	Commu-nication & feedback	Exper-tise	Organisation change	Cultural reluctance
Core barriers								
Economic	X		X	X	X			
Investment	X		X	X	X			
Mindset				X	X		X	X
Uncertainty		X	X		X	X		
Influencing barriers								
Lacking info. & awareness					X	X		
Lacking proof of concept				X	X	X		
Lacking collaboration								
Core drivers								
Economic								
Mindset				X	X	X	X	X
Sustainability							X	X
Performance				X		X		
Branding				X				
Influencing drivers								
Info. & awareness					X			
Collaboration				X	X			
Segmentation				X	X			
Broad offer				X				

Table 10. Overview effect BSCs on barriers and drivers.

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6. Conclusion

This chapter concludes the key insights and names the contributions to existing literature through theoretical implications. Furthermore, implications for practitioners, research limitations and future research suggestions are outlined.

The purpose of this thesis was to research servitisation as an approach to enhance SOI adoption by overcoming its barriers and reinforcing its drivers, hence increasing customer value and market success of SOIs. This was approached by conducting a qualitative study in the agricultural industry on both, adopters' and providers' experiences with SOIs and service BMs to answer the following RQ:

"How does servitisation affect the barriers and drivers for sustainability-oriented innovation (SOI) adoption?"

Environmental pressures are rising and maintaining a 'business-as-usual' approach is increasingly seen as critical. SOIs are therefore essential to increase efficiency of operations and sustainability. Yet, SOIs are characterised by higher levels of complexity and uncertainty compared to CIs and are mostly developed with an internal TP and product-oriented approach. Furthermore, as the development of SOIs is only one side of the equation, and environmental and competitive success of SOIs fundamentally depend on customer adoption, this research aimed at studying servitisation as a customer-centered approach. This, as literature indicates servitisation could enhance value through offering integrated service-products tailored to customers' needs. In turn, the insights from this study deepen understanding of SOI customer value by analysing barriers and drivers for adoption, and as an approach to impact this adoption, how they are affected by specific service characteristics.

Conforming current literature, *'economic feasibility'* appeared to be the main 'fuel' to drive SOI adoption; vice versa, when not in place, to hinder SOI adoption. Further, this research complemented current literature on barriers and drivers towards sustainability, by **(1)** identifying and distinguishing 'essential' SOI adoption factors from 'barriers and drivers' for SOI adoption, and **(2)** the discovery of one new barrier (*'lack of collaboration'*) and three novel drivers (*'broad offer'*, *'branding'* and *'segmentation'*).

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Answering the RQ showed that servitisation has favourable implications on SOI adoption through six BSCs, meaning mitigation of barriers and reinforcement of drivers. Particularly the BSCs of *'financial model'*, *'co-creation'*, and *'communication & feedback'* were found to reduce the main barriers (e.g. *'economic'*, *'investment'*, *'lacking information & awareness'* and *'lacking proof-of-concept'* barriers). Likewise, the same BSCs simultaneously contribute to increase drivers' positive effect on SOI adoption (e.g. *'performance'*, *'mindset'* and *'branding'* drivers).

This research therefore has further strengthened confidence in servitisation as an uprising and promising BM trend guiding companies in decision-making to react to business opportunities to enter, operate or disrupt an industry. Besides existing sustainable BMs, these findings outline a potential answer to the rising importance of value-driven, sustainable BMs.

However, on the other side, the shift towards servitisation and the consequent *'organisational change'* and *'cultural reluctance'* also were found to hinder SOI adoption and therefore need careful consideration when aspiring for service offerings.

6.1 Theoretical Implications

By answering our RQ, we therefore make a twofold contribution to existing literature.

(1) So far, SOI literature has mainly focussed on either an internal or customer perspective but lacks how to build the bridge amongst the two, meaning outlining new approaches on how to increase customer value and adoption. The results of this research contribute to how providers can be supported in enhancing successful market-adoption of SOIs through servitisation. This research therefore firstly contributes to closing this gap by highlighting success factors of SOI adoption. Hence, this study increases knowledge about decision-making factors for SOI adoption and how to translate them into value creation activities to ultimately achieve a stronger market-fit and lay the ground towards sustainable development.

(2) Secondly, this research adds value to servitisation as it places the concept, with beneficial and hindering implications, in the new application field of SOI. This study reveals novelty regarding service characteristics as their effects are researched within the light of SOI adoption. Whereas literature on services characteristics mainly described abstract service dimensions, strategies or typologies, this research reveals service characteristics from a customer-perspective, and their positive or hindering effects on SOI adoption.

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6.2 Managerial Implications

6.2.1 SOI Providers

SOI providers suffer from slow adoption rates, as it determines the commercial and environmental success of SOI development. Providers thus far have lacked understanding about the customer-decision making factors, being unable to take evidence-based measures to improve SOI adoption. By outlining servitisation as an approach to do so, SOI providers receive rich insights into what service characteristics particularly should be strengthened in their existing or future service offerings.

Furthermore, the distinction into SOI 'core' and 'influencing' barriers and drivers adds value to decision-makers at SOI provider companies. This, as the gained insights provide the understanding that particularly the 'influencing' barriers and drivers are susceptible for SOI providers. To name specific examples, the *'lacking information & awareness'* barrier for SOI adoption implies the possibility for SOI providers to increase communication and marketing efforts, whilst the *'broad offer'* driver for SOI adoption implies adopters' desire to be able to select from a wide array of choices and moreover receive integrated offers, meaning holistic systems that incorporate sets of complementary parts. In addition, being aware of the presence of the 'essential factors', allows providers to examine which parts of their value propositions need to be refined in order to fulfil the minimum requirements for SOI adoption. This particularly entails making SOIs financially feasible, reliable, productivity-enhancing, and devoting extensive efforts in educating customers about the necessity for SOIs.

Hence, the insights of this study support providers in developing SOIs with a stronger market-fit, thereby accelerating adoption. Ultimately this research therefore contributes to SOI providers' business performance in the quest of creating economic and environmental value.

6.2.2 SOI Adopters

Decision-makers at firms adopting SOIs benefit from this research as they are under pressure to increase productivity and sustainability and thus depend on economically feasible yet sustainable solutions, yet, feel more reluctant to adopt SOIs compared to CIs. Therefore, adopters require and greatly benefit from refined offerings to overcome the factors that hinder them from adopting SOIs.

Particularly in product-dominated contexts, such as this case industry, increasing the understanding about BSCs such as *'co-creation'* and *'communication & feedback'*, implies a

proactive stance of customers within the innovation development process. This logic further equals that adopters have the possibility to influence the way providers offer SOIs and can for instance specifically demand service BMs.

At the same time, this study entails evidence about factors of servitisation that potentially jeopardise the positive effects of BSCs on SOI adoption, namely *'organisational change'* and *'cultural reluctance'*. Insights into these hindering factors increase adopters' awareness on the implications of adopting SOI services, and hence, foster decision-making capabilities, enabling them to make better choices as for which SOIs to adopt and whether they favour a product or service BM.

6.3 Research Limitations

There is no such thing as perfect research. Likewise, this study entails limitations mainly stemming from its *research strategy*, *research design*, *sampling approach* and *data analysis*. These limitations arguably do not lessen the contribution, however, are crucial to accurately make sense of the results and identify fields for future research (Bryman and Bell, 2011).

Research strategy

Taking an interpretivistic stance is equivalent to acknowledging that science cannot be objective (Bryman & Bell, 2011). Moreover, the relationships to informants led to a degree of subjectivity (Bryman & Bell, 2011). This subjectivity was mitigated, first, by acknowledging our interpretative work, rationalising, sense-making and constructive activity. Secondly, by aspiring for detachment through maintaining a reflective approach, and thirdly, via employing structured approaches to data collection and analysis.

As criticism to grounded theory, it is argued that theory-neutral observation is unlikely due to researchers being influenced by existing conceptualisations and knowledge (Bryman & Bell, 2011). Despite the deductive strings within this research (e.g. extensive literature review), the inductive stance is taken as basis by starting off with observations and analysing patterns. Moreover, even though this research *does* nourish on existing knowledge (contrary to grounded theory building), the researchers on purpose did not collect and analyse the data in tandem with any theoretical framework about SOI or servitisation to exploit the data in an at most theory-neutral way.

Research design

The employed research design has strengths and limitations. The results are strengthened by showing great similarities amongst the different cases used (despite e.g. varieties in countries and company sizes), in line with the strategy chosen to study commonalities across cases to enable a broader understanding of a phenomenon which can potentially be generalised (Bryman & Bell, 2011). However, aiming at this broad exploration of multiple angles (adopter and provider) to generate a comprehensive view rather than in-depth case analyses also entails downsides.

First, no clear distinction between SOIs was made when collecting and analysing data, meaning types of innovation (e.g. radical or incremental), service typologies (e.g. customer-process focus or product focus), and service BMs (e.g. pay-per-use or leasing model). Second, the initial aim of creating 'pairs of adoption' ultimately was unfeasible for this research. Consequently, different SOI, adoption and service development stages were analysed in monolith, potentially causing discrepancy and variation of results.

Furthermore, despite keeping the contextual categories in mind, some loss of context was noted (Bryman & Bell, 2019). However, this strategy was still preferred over a narrative approach to avoid fragmentation of data.

Sampling approach

Gaining access to the social setting is one of the most difficult steps in organisational ethnography (Bryman & Bell, 2011). Despite some information being publicly available, most aspects of organisational ethnography require access to non-public settings (Bryman & Bell, 2011). Hence, data accessibility was the main concern of our research. Apart from the difficulty accessing non-public settings, the information required was very specific, hence only a limited number of organisations were eligible (*see sampling criteria*). Evidently and unavoidably, a sampling bias occurred, meaning the distortion in the representativeness of the sample as some members of the sampling frame stood little chance of being selected for inclusion in the sample (Bryman & Bell, 2011). Still, arguably the chosen approach considered many facets within the sampling frame, resulting in achieving a holistic approach to data collection.

In addition, identifying the right informants was a challenge since they needed to be acknowledged in the fields of SOI adoption or commercialisation and service BMs. Therefore, we followed the recommendation by Bryman & Bell (2011) to employ an opportunistic approach, trying to reach as many eligible organisations as possible within the boundaries of

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our time limitations and then broadening our network via snowballing. Moreover, a number of different channels were selected to approach informants, hence increasing chances of success.

Generalisation

Qualitative research is conducted to generalise theories, rather than populations (Bryman & Bell, 2011). Similar to this research, often rather small samples are studied (Bryman & Bell, 2011). Generalisation of the sample to other industries therefore needs careful consideration. The agriculture was considered a highly relevant industry to study this phenomenon, as the outlined problem is widely present. However, specific characteristics of the agricultural industry influenced the context of SOI and thus the overall conclusions. The empirical data shows that the industry and its customers are driven by a product-dominant mindset, traditional practices and great economic pressure due to low profit margins, leaving less room for investments. From a provider-perspective, it became apparent that service BMs are not widely used by SOI providers in the case industry yet *("[Service BM] not a model that has been fully adopted yet [...]")* and even face scepticism *("So I think especially in farming [...] I am very sceptical of them")*. The two latter contextual perspectives from both ends of adoption could imply that the wide application of service BMs in agriculture might require more time than in other industries. Overall, we are confident about the transferability of findings, yet generalisation is arguably primarily applicable to industries with similar contextual characteristics; in this light, transport and construction were tentatively identified as examples for such industries.

6.4 Future Research

Considering the above-mentioned limitations, future studies could further enrich literature within the following specified research areas.

(1) Due to the approach of finding similarities across different edges within the sample frame, it is suggested to strengthen our comprehensive findings by more targeted research. This entails the following possible structures. First, two sets of SOI cases can be studied, contrasting SOI products with SOI services, to precisely distinguish the effect and shift from companies' traditional product development to servitisation. Secondly, and also deriving from the outlined limitations, explicit future research could entail a clear distinction in typologies of services (*see Ch.2*) and/or different types of SOI. This would guide practitioners in finding specific approaches suitable to their organisation to enhance the diffusion of SOIs. Thirdly, the limitation revolving around generalisation can be mitigated by conducting future research of this phenomenon across industries. This to study and highlight both commonalities and contrasts between industries with varying context.

(2) Furthermore, the literature review showed that servitisation, and the strong inclusion of customers (e.g. '*co-creation*'), has effect on multiple stages within innovation and BM development (e.g. both value creation and capturing). Hence, researching the role of servitisation within different stages of SOI development would contribute to deeper understanding and complement to closing the current literature gap.

(3) Lastly, this research showed six BSCs and two HSFs affecting SOI adoption. However, the hindering factors likewise to the BSCs appeared to have strong implications (e.g. 'organisational inertia'). Despite the generational change enhancing the cultural openness to services, and the increasing automation leading to favourable changes of organisational processes, these concerns require attention. Therefore, more profound research on the significance of each BSC or HSF is recommended with the aim of finding out whether (or not) the BSCs weigh out the HSFs. This to being able to make a thought-through conclusion whether servitisation is the right path to overcome the SOI adoption dilemma.

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Appendices

Appendix 1: Explorative [unstructured] interviews

No.	Date: Introductory phase	1st level sampling (company): Organisation	Experience in agricultural industry	Experience in field of sustainability	2nd level sampling (individual): Position	Profound and holistic understanding of agricultural industry	Involvement in recent changes, projects or innovations
Exp.1	Jan.–Feb.	Engineering consultancy (R&D focus, urban planning, infrastructure, sustainable development)	Yes.	Yes.	Senior Consultant & Business Developer	No.	Yes.
Exp.2					Department Manager (energy)	No.	Yes.
Exp.3					Project Leader & Business Developer	No.	Yes.
Exp.4					Innovation Coach & Landscape Architect	No.	Yes.
Exp.5					Innovation Manager	No.	Yes.
Exp.6	Jan.–Feb.	University of agricultural science (incl. business/ innovation hub)	Yes.	Yes.	Business Developer	Yes.	Yes.
Exp.7	Jan.–Feb.	University of agricultural science (collaborative initiatives)	Yes.	Yes.	Professor and director	Yes.	Yes.
Exp.8	Jan.–Feb.	Agricultural economics center	Yes.	Yes.	Professor	Yes.	Yes.

Table. Explorative interviews conducted (incl. criteria met).

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Appendix 2: SOIs and services adopted or provided

Company	SOI Description		Service Development or Adoption Status	
SOI adopters				
Int.1 International Governmental Organisation	Safeguarding genetic agricultural resources through sustainable conservation for future purpose, using smart cooling systems.		Energy and cooling as a Service –*requested and exploring*	
Int.2 & Int.3 Vertical farming company	State-of-the-art technology for food production and resource reduction.		Plug-and-play service – *requested*	Smart interfaces/control systems as a service - *requested*
Int.4 Industry association	Tracking software for tractors to reduce fuel and labour costs and enhance efficiency.		Software as a service – *adopted*	Equipment as a service (e.g. solar panels and machinery) - *requested*
Int.5 Growing company	Nursery with high automatisation and sustainability (e.g. water storage, daylight water heating through tubes, initiatives for energy reduction).		Co-created projects with suppliers and manufacturers (co-invention, advice, learning and piloting) – *adopted; more trials requested*	
SOI providers				
Int.6 Energy provider agriculture	Integrated energy solutions (e.g. heating and cooling solution using waste energy)	Software which steers and optimises all the energy flows.	Energy as a service – *widely adopted in the market.*	Bundled software service – *service launched on the market.*
Int.7 Bio-technology supplier agriculture	Light control system and software, monitoring and reducing energy consumption		Software as a service – *service on the market; slowly adopted by the market; field trials for further market exploration.*	
Int.8 Greenhouse manufacturer #1	Turnkey greenhouse eco-systems and support services, focussing on maximising yields and sustainable energy usage.		Greenhouse as a service – *initial market exploration.*	

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Int.9 & Int.11 Greenhouse solutions and manufacturer #2	Indoor technology and greenhouse manufacturing improving indoor irrigation, climate control, and maximising customers' yields.		Greenhouse and technology as a service – *initial market exploration*.	
Int.10 Greenhouse manufacturer #3	Turnkey greenhouses (incl. heating, electricity, irrigation) and SOI services (e.g. climate control, water management, energy recovery)		Greenhouse as a service – *initial market exploration*.	
Int.12 Agriculture technology and sustainability consultancy	Feasibility and strategy consultancy on sustainable agricultural technology (hardware, software, platforms)	Management service for local farming solution (ownership, management and maintenance; the customer becomes host of the system)	Advice as a service – *adopted by the market*.	Integrated equipment, systems and software as a service – *services on the market; increasingly adopted by the market; field trials for further market exploration*.

Table. Details SOI (service) cases conducted. Adapted from Long et al. (2016).

Appendix 3: Interview guide

1. Interview guidelines
Question type: Introducing questions (Bryman & Bell, 2007, p.477)
▪ Purpose of the interview. ▪ Ability to share transcripts and final report afterwards. ▪ Question whether to anonymise (company) names. ▪ Possibility to refuse a question. ▪ Question whether interview recording, transcription and coding is ok. ▪ Agenda with topics to cover
2. Background
Question type: Structuring question (Bryman & Bell, 2007, p.478)
Moving on to the topic of background.
Question type: variety (Bryman & Bell, 2007, p.477-478)

▪ **Business:** name, type of business, title/job function *(introducing question)*
▪ **Product/service offering and capturing**
  - What types of product(s) and/or service(s) does [company] sell?
  - *(introducing question)*
  - In what form(s) is [company's] product(s) and/or service(s) being sold to the market? *(direct question)*
▪ **Level of innovation and sustainability**
  - On a scale from 1-10, how active is [company] with innovation?
  - On a scale from 1-10, how active is [company] with sustainability?
▪ **Customers**
  - **Launching SOI:** Who are your customers? *(introducing question)*
  - **Adopting SOI:** Who are your consumers? *(introducing question)*
  - What are the challenges to serve these segments? *(follow-up question)*

3. Generic adoption sustainability oriented innovation (SOI)
Question type: variety (Bryman & Bell, 2007, p.477-478)

▪ What is your opinion on overall adoption of SOIs in ag-market? *(introducing question)*
  - What are generic factors hindering the adoption of SOIs in ag-market? *(follow-up question)*
  - What are generic factors driving the adoption of SOIs in ag-market? *(follow-up question)*

4. Experience SOI adoption
Question type: Structuring question (Bryman & Bell, 2007, p.478)
Moving on to the topic of experiences with SOI innovation.
Question type: variety (Bryman & Bell, 2007, p.477-478)

▪ What type(s) of SOI did you launch or adopt (buy)? *(introducing question)*
  - Was it sold as service(s) or product(s)? *(specifying question)*
  - Follow-up question(s) to get deep understanding of the SOI. *(follow-up question)*

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Question type: variety (Bryman & Bell, 2007, p.477-478)

- **Launching SOI:** Were **your** SOI(s) successfully adopted (bought) by the market, and why/why not? *(open question)*
  - What other struggles did you experience in the process of launching an SOI? *(follow-up question)*
  - What did you do to overcome those struggles to enhance the diffusion? *(follow-up question)*
- **Adopting SOI:** What were the reasons you **did** buy the SOI(s)? *(open question)*
- **Adopting SOI:** What were the reasons you **did not** buy certain other SOI(s)? *(open question)*
- <u>Literature-specific questions</u> *(specifying questions)*
  - Do you see a difference in perceived risk/uncertainty between products/services that are sustainable or those which are not? (Ghisetti, 2017; Bossle et al., 2016) Why or why not?
  - Do you see a difference in perceived operational costs between products/services that are sustainable and those which are not? (Noppers et al., 2014) Why or why not?
  - Do you see a difference in investment required between products/services that are sustainable and those which are not? (Ghisetti, 2017) Why or why not?
  - Do you see a difference in perceived quality between products/services that are sustainable and those which are not? (Olson, 2013) Why or why not?
  - Do you see a difference in reliability between products/services that are sustainable or those which are not? (Noppers et al., 2014) Why or why not?
  - Do you see a difference in convenience than conventional innovation between products/services that are sustainable or those which are not?? (Noppers et al., 2014) Why or why not?
  - Attitudes (e.g. traditions and culture) as a barrier (Noppers et al., 2014)

5. Business Model constructs to enhance adoption of SOIs

Question type: Structuring question (Bryman & Bell, 2007, p.478)

Moving on to the topic of business models (to enhance diffusion of sustainability)

Question type: variety (Bryman & Bell, 2007, p.477-478)

- **Launching SOI:** What types of BMs do you regularly use for SOI? *(introducing question)*
- **Launching SOI:** How do you construct or alter your BM to enhance the market success of SOI? *(follow-up question)*
- **Adopting SOI:** How was the SOI "sold" to you? *(open question)*
- **Adopting SOI:** What did you value the most of the SOI? *(open question)*
- **Adopting SOI:** What drove you to make the decision to adopt (buy) the SOI? *(open question)*

6. Role of servisation to enhance adoption of SOIs

Question type: Structuring question (Bryman & Bell, 2007, p.478)

Moving on to the topic of service business models (to enhance diffusion of sustainability)

Question type: variety (Bryman & Bell, 2007, p.477-478)

- What overall experience do you have with service business models for SOI? *(introducing question)*
  - What types of services? *(specifying question)*

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- **Launching SOI:** Referring back to the SOI [topic 5], did/would this service BM enhance the market success of the SOI? If so, why? *(direct + follow-up question)*
    - What service characteristics specifically enhanced the market success of the SOI? *(direct question)*
    - What service characteristics hindered the market success of SOI? *(direct question)*
    - Explorative findings *(specifying questions)*
        - What do you think would benefit your customers more on a financial level, buying products or paying for services?
        - Do you believe that services rather that products influences your relationship with your customers? And, do your customers value that?
        - How much do your customers value being in charge of everything (meaning core and non-core activities)?
        - Do you think that a service compared to a product would make it easier for your customers to focus on their core business? If so, would they value this?
- **Adopting SOI:** Referring back to the SOI "[see topic 5/6]", did/would the fact that the SOI was sold to you as a service increase your willingness to adopt it? *(direct + follow-up question)*
    - What did you **like** about the service? *(direct question)*
    - What did you **dislike** about the service? *(direct question)*
    - Explorative findings *(specifying questions)*
        - What do you think would benefit you more on a financial level, buying products or paying for services?
        - Do you believe buying services rather that products influences your relationship with tech suppliers?
        - How much do you value being in charge of everything (meaning core and non-core activities)?
        - Do you think that a service compared to a product would make it easier to focus on your core business?

Catch-all and snowballing for further sampling

Question type: Structuring question (Bryman & Bell, 2007, p.478)

Coming to the end of the interview.

Question type: variety (Bryman & Bell, 2007, p.477-478)

- Catch-all question [!]
- Thanking for insights
- Asking for further contacts for interviewing
    - Company: experience with SOI in ag-industry, service BMs
    - Individual: company representative, involved in SOI projects, acknowledged BMs and service BMs

End.

Table. Interview guide.

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Appendix 4: Full data structure (Gioia et al., 2012)

Quotes	First order concepts	Second order themes	Aggregate dimensions
Int.10: "[…] they are very hard to convince that it will have a return on investment."	Hard to convince customers that SOIs have ROI	**Economic SOI adoption barrier**	**SOI adoption barriers**
Int.5: "[…] nowadays I think you need to have a shorter return on investment because the Innovation goes so quick."	Shorter ROI required since innovation-development fast		
Int.12: "[…] the calculations [for SOIs] don't really work very well."	SOIs not economically feasible		
Int.5: "But still it is the client, does he want to pay for a more sustainable option and that's always the difficult thing."	Willingness-to-pay for SOIs is a difficulty		
Int.9: "It [SOI] comes at very high price points."	SOIs come at very high price points		
Int.7: "[…] downtime […] shutting everything down, that's money that's being lost because you're not growing."	Loss of money due to downtime when changing to SOIs		
Int.10: "[the main barrier of SOI adoption] It is economics."	Economic reasons as barrier		
Int.11: "Often, it's a price based decision."	Price-based decision		
Int.7: "[…] apart from cost it is that downtime that changing over to something else that that cost is a lot more disruptive than the actual cost of the investment."	Downtime costs when switching to an SOI		
Int.9: "Price point from end-consumer side biggest barrier for SOI adoption […]."	Price-point from end-consumer biggest barrier for SOI adoption		
Int.9: "What is the [end] consumer willing to pay. […] We still see the average consumer, you know, even if it's grown with pesticides, but its three times cheaper than you know, organic head of lettuce."	End-consumer price sensitivity		
Int.9: "[…] it's a strong idea in terms of the environment's efficiency whatnot, it still really comes down to price important."	Prices more important than sustainability		
Int.7: "[Investments perceived higher for sustainable innovation compared to conventional] yes."	Perceived investments higher for SOI	**Investment SOI adoption barrier**	
Int.2: "There is no way they would do an investment to be more sustainable, because everything is paid."	No investments in SOIs expected, since everything is paid already		
Int.4: "[…] if you make two, three per cent return on investment it takes some time to built up some new money for next thing you want to do."	Long time required to build up capital for investments		
Int.4: "So you have to own it by yourself and that means you are over-invested with things you don't use."	Fear of over-investment in assets due to SOI ownership		
Int.7: "[…] it is this fact that it's been working so far. Why would I change anything?"	Unwillingness to change	**Mindset SOI adoption barrier**	
Int.4: "I never wanted to be number one, I think number two was also always better."	Unwillingness to be first-mover		
Int.4: "I would say that [resistance to change] was the main reason […]"	Resistance to change main reason		
Int.5: "Yes, I agree on that [traditions hinder SOI adoption], just in our location is very very different."	Family traditions hinder SOI adoption, yet this cannot be generalised		
Int.10: "[…] sustainability is not a number one priority for my customers."	Sustainability not top priority for customers		
Int.12: "[…] farmers have a lot of competing interests and concerns."	Many competing interests		
Int.11: "They are first interested in their own business and do that properly."	First interest in own business and do that properly		
Int.9: "[…] they don't really pay any […] respects, [because] they started from the ground up."	Little attention paid to attempts to sell new solutions; customers built everything up themselves		

Quote	Code	Sub-theme	Theme
Int.8: "I think sustainable options are less stable."	SOIs are less stable	**Uncertainty SOI adoption barrier**	
Int.8: "Yeah, that [lack of redundancy] would be the biggest problem."	Lack of redundancy of SOIs		
Int.7: "[…] lot of uncertainty […] and creating that change […] is one of the biggest hindering factors."	Uncertainty involved with SOIs		
Int.12: "[…] they didn't trust the technology companies which were relatively new."	Lack of trust in new SOIs		
Int.3: "Education is our biggest pain point."	Lack of education about SOIs and sustainability	**Lacking information and awareness SOI adoption barrier**	
Int.11: "[…] we're just not the most maybe modern industry with a lot of marketing minds so it's not discussed properly."	Lack of communication and marketing		
Int.9: "I would say the biggest thing people aren't focusing on is scale […]."	Lack of awareness on scaling to make SOIs economically attractive		
Int.4: "[…] maybe not always you feel that you are kind of a big polluter."	Lacking awareness for pollution caused		
Int.7: "[…] sustainable innovation needs to be proven before they can assess quality and reliability."	SOI needs to be proven before assessment of quality and reliability	**Lacking proof of concept SOI adoption barrier**	
Int.12: "[…] entrepreneurs had a really difficult time understanding the data that was being submitted, you know, is it economical?"	Difficulties of understanding the data		
Int.11: "As long as they don't know that part [what the specific customer value is], it will not happen so fast."	Lacking knowledge on specific customer value		
Int.4: "[…] invisible barrier between us working [...] the business every day and the knowledge center […]."	Lacking interaction between practitioners and research instutions	**Lacking collaboration SOI adoption barrier**	
Int.7: "[SOI has] lower power consumption which means lower costs."	SOI less costly due to lower power consumption	**Economic SOI adoption driver**	**SOI adoption drivers**
Int.3: "[...] sustainable solutions will bring down the farmer's costs [...]."	SOI reduce adopters' costs		
Int.5: "I think it's a bigger investment but in the end it pays off."	SOIs have higher investments but are economically beneficial		
Int.5: "With the new nursery we could or we could save up to 40-50 percent of energy."	SOI reduces energy costs		
Int.5: "So if you can reduce the amount of water you use a you reduce your cost of water, so it's more sustainable and you get more profit and if you pay that every month a fee that yeah will be perfect."	Demand for SOIs combining economic and ecologic purpose		
Int.6: "[...] reduce the energy cost for the customer and at the same time reduce the CO2 emission [...]."	Reducing energy costs while reducing the CO2 emmission enhances market fit		
Int.11: "I think we are focusing a lot on sustainability, but mainly from the primary process, the growing the vegetables and achieving a good quality product with a good cost price. Not necessarily from other values like improving the environment or something."	Sustainability seen as a means to reduce operating costs and not to improve the environment		
Int.8: "[...] and because of that [positive image of SOIs] they can ask more money for their product."	Sustainability creates the opportunity to raise prices of products		
Int.2: "[…] don't do trade-off on profitability when we make it sustainable. It [non-sustainable activities] would be just as costly, uhm, actually even more costly."	Unsustainable activities are more costly, hence no trade-off between sustainability and profitability		
Int.3: "Significant margin increases due to innovations in the agricultural industry."	SOIs in the agricultural industry increase margins significantly		
Int.7: "I would say there's less risk with sustainable innovation because they can get funding from the government [...]."	SOI financially less risky than CI due to governmental funding		

Int.4: *"I'd say I wanted always to develop a little bit every day."*	Aspiration to develop every day	**Mindset driver for SOI adoption**
Int.6: *"They don't want to lead, but they can also not afford to not do anything."*	Customers do not want to be first movers but are pressured to move towards sustainability	
Int.5: *"So you also need to learn and yet look to other markets [...]."*	Getting inspiration from other markets	
Int.4: *"The first thing is where should I go to find more information about it, and if I was hungry about new knowledge."*	Hungry for new knowledge	
Int.9: *"People are looking at solutions to combat global warming and rising sea levels […]."*	Solutions wanted that combat climate change	**Sustainability SOI adoption driver**
Int.5: *"[…] we won't to do it [adopt unsustainable innovations] because it's also sustainability is now a DNA, to do everything as much sustainable as possible."*	Aspiration to do everything as sustainable as possible	
Int.4: *"Running the family business, it's ehh I wanted it to be there after when I'm not there anymore […]."*	Interest in conserving farm and environment for future generations	
Int.12: *"[…] the other piece is that there are certain drivers and climate change and in society."*	Climate and society change as adoption driver	
Int.4: *"I think the ambition [to adopt SOIs] of lots of farmers are more than they are capable on their economic plan."*	Ambition of customers to adopt SOIs is great	
Int.5: *"It [drive for sustainability] is from the two owners as well they because they've been starting the company and [...] it's just in the blood."*	Sustainability deriving from owners and integral part of the company	
Int.4: *"[…] once time to go to bed I wanted to feel okay with me, that I've done something good during the day."*	Adopted SOIs to have a good conscience	
Int.5: *"It's [the reason for the adoption of the SOIs] always the quality, so we can grow better quality."*	Increase quality by adopting SOIs	**Performance SOI adoption driver**
Int.5: *"[...] overall it is really important that you can make those steps little by little and grow and get get yourself a better product and a better future."*	SOIs to grow better quality produces	
Int.5: *"You can't grow anymore on the old way because you need to have more product per meter, product for the energy etc."*	Productivity and sustainability needs to be increased	
Int.5: *"So we like to keep it as efficient as well and we are all busy but we do so ambitious as well as innovative."*	Adoption of SOIs due to desire to be efficient and innovation	
Int.5: *"I think this is one of the most important things we can do it more efficient."*	Increase efficiency by adopting SOIs	
Int.11: *"That gaining can come from safety, uniformity, security, it can come from reducing resources if water is scarce or your power sources are scarce."*	Providing safety and uniformity of SOIs	
Int.5: *"[...] if you have a product and you with a good story with storytelling behind it [...] that's way easier [...], you sell something with a good story."*	SOIs can be used for storytelling and enhancing adopters' sales	**Branding SOI adoption driver**
Int.12: *"[Sustainability] for their marketing is very effective."*	Sustainability as a marketing-tool	
Int.12: *"[…] if it [SOIs] allows the farms to basically improve the marketing value of their project as more green, I would say that's one of the biggest assets."*	Sustainability to improve marketing one of the biggest assets	
Int.7: *"[…] there's also that interest from the growers that they are also in and the competitive market so that they need to differentiate themselves in a way [...] 'this is tailor-made for me'."*	Adopters value customization to differentiate themselves in the competitive market	
Int.8: *"But also for more image purposes, so they can sell vegetables that are more sustainable."*	SOIs contribute to a better brand image	
Int.4: *"[…] older ones [farmers] prefer fairs."*	Fairs as a source of new innovation knowledge (especially older generation)	**Information and awareness SOI adoption driver**
Int.4: *"Farmers need "hints" to know where to learn about SOIs […]."*	Customers need 'hints' where to learn about SOI	
Int.4: *"Young farmers go to YouTube […]."*	YouTube as source of inspiration for young generation	

Int.5: "We would be working close with the suppliers [to hear about SOIs and adopt them]."	Close collaboration with suppliers to be informed about SOIs	**Collaboration SOI adoption driver**
Int.5: "[…] some [SOIs were adopted] also more like that you invented together."	Co-invention between supplier and customer	
Int.5: "[…] if they have new Innovations, they also want to test it with us. So we are really working together with them to get a better solution for everything."	Suppliers testing innovations together with customers to create better solutions.	
Int.9: "We want to work it out with them initially just to make sure this profitable business."	Manufacturers help customers ensuring a profitable business	
Int.5: "So it's more like a partnership."	Partnership with suppliers to test and subsequently adopt or reject SOI	
Int.11: "[…] you have a relation with your customers build that over a longer term."	Long-term relationship between adopter and provider	
Int.12: "[…] just testing pricing and you're kind of just testing integrations and getting closer to like what your ideal customer would be."	Testing pricing and integrations with customer to tailor services and products	
Int.1: "[…] depends on product. How big […], how much energy supply can it provide. […] it should not have too much capacity nor too little capacity. If your system is a very large one, I would first go to the big ones. Because they would be maybe more open to try something new."	Big players are more open to adopt SOIs	**Segmentation SOI adoption driver**
Int.1: "[…] definitely try Dutch market, the German market, some Danes as well. […] they are highly efficient, they are used to working with sustainability. […] also supported by the government."	Dutch, German and Danish market attractive due to focus on efficiency and sustainability	
Int.12: "[…] a lot of interest [to adopt SOIs] from young people trying to enter the industry."	SOI interest by young generation entering the industry	
Int.9: "I think it [SOI adoption] depends on the region, the country, the climate in certain areas."	Cultural, regional, climatic differences	
Int.9: "[…] we're focusing on growers who have experienced who have been farming for a while, who are ready to take that leap where it requires experience and adopting those technologies."	Focus on customers with experience and willingness to adopt SOIs	
Int.4: "I think it will take it takes this long the time the young people going in now, they adopt and immediately."	Younger customers quickly adopt SOIs	
Int.8: "I think the adoption is quite good or quite easy as well because they can make a choice."	Adoption of SOIs benefits from wide array of choices	**Broad offer SOI adoption driver**
Int.7: "[…] it is so integrated, but if we were to sell the entire system, I think that that would make a lot of sense and a lot of interest for customers."	Customers' interest in buying integrated sustainable systems	
Int.3: "Complete solution involving technology innovation angle, business-commercial angle and social impact angle […]."	Holistic approach involving technology, business and social impact	
Int.4: "It's like buying a car. You have several options and I think that's a good way of doing it."	Having several options for adoptio (e.g. leasing, buying)	

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Quote	Code	Sub-theme	Theme
Int.9: "You want to [earn] return on investment in agriculture […]."	ROI required	**Financial feasibility SOI adoption essential**	**SOI adoption essentials**
Int.5: "[…] it's also finance like do you have the possibility to pay for it."	Sufficient financial resources must be existant		
Int.5: "[…] you need to make a decision. [...] what is price-wise and what quality-wise the best?"	SOI is required to have best price-quality offering		
Int.12: "[…] return on investment is important to Smallhold and its customers."	ROI important		
Int.5: "They [SOI adopters] will always go first for profitability over sustainability."	Profitability over sustainability		
Int.8: "[…] whenever there's an opportunity they can invest in and they get a decent return then they would be interested in doing so."	If a decent ROI, customers will invest		
Int.8: "They won't do it just because the climate, well, a lot of them."	Most customers won't do it only for the environment		
Int.11: "[…] it's mainly business orientated. So the economics drive mainly those decisions."	Adoption of SOIs is mainly economics-driven		
Int.9: "[SOI] needs to reduce cost of operation […]."	Pressure to reduce costs of operation		
Int.9: "I think you really have to look at the return on investment […]."	ROI needed		
Int.7: "Why would I bring in new people to tell me how my operation is run unless there is return on investment even on the service products?"	Customers only value expertise of external parties when there is a clear ROI		
Int.4: "[…] if it would have been minus every year I wouldn't have done it."	Customers require positive returns on SOIs		
Int.9: "[SOI] needs to reduce cost of operation."	Pressure to reduce costs of operation		
Int.10: "[…] everytime it is a balance between investment and operating costs."	Maintain balance between investment and improvement operating costs		
Int.11: "[…] you invest more to lower your operational expenditures or it's to boost your yield."	Investment needs to reduce operational expenditures or increase revenue		
Int.3: "[Switching to sustainable operations] all boils down to cost of production."	SOI only adopted when in line with required cost of production		
Int.9: "[…] maximize yields and they're going to be able to kind of get that capital costs back within, I think you really have to look at the return on investment."	Look on ROI and enable maximising yield and paying back their capital costs		
Int.9: "I think it takes a lot of yeah a lot of support from the government."	Support from government needed	**Governmental support SOI adoption essential**	
Int.9: "I think we need to catch up on the incentives […]."	More incentives required		
Int.9: "There needs to be more government support […]."	More governmental support required		
Int.10: "[SOIs] have a lot of trouble competing if there is no incentive from governments or public policy."	SOIs need governmental incentives or regulation to be competive		
Int.7: "[…] approach it is that you need sort of almost like a turnkey solution."	Provide a turnkey solution	**Functionality SOI adoption essential**	
Int.7: "It has to be plug and play."	Offer plug-and-play solution		
Int.9: "[…] efficiency within the system […]."	Provide efficiency		
Int.4: "[…] when you have interest in productivity I don't think it would be very difficult to sell it into farmers."	Provide solutions that increase productivity		
Int.7: "It has to be no downtime."	Avoid downtimes		
Int.3: "Need for redundant system, otherwise risk of losing an entire production cycle […]."	Redundant system required	**Reliability SOI adoption essential**	
Int.4: "[…] if you don't get the guarantees, you don't use you to renewable energy […]."	SOI not adopted when guarantees not given		
Int.8: "So you need stable options and that could also mean that there's a backup […]."	Stable solutions are a requisite		
Int.7: "[…] it has to be something that's reliable […]."	Offer realiable solutions		

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Int.9: "I think that [convincing customers to adopt SOIs] takes a lot of education […]."	Much education needed	**Education SOI adoption essential**
Int.9: "[…] relying on someone who may not be as well-versed or understanding of the newer innovation."	Relying on people's understanding of the SOI	
Int.7: "We can add value to the customer [by] putting in consultants because […] we have technology that is disruptive to their growing style."	New technology disruptive to growing style > need for consultancy	
Int.4: "[…] it's a way of culture change."	Culture change involved	
Int.3: "It is a question of understanding […]."	Provide understanding about the SOI	
Int.11: "So, just putting a grid there and say, 'okay, well, now you have power connect to it and good luck with the greenhouses' that will be too limited. So a company where you work for now, they should move outside they're comfortable zones, and we should as well."	Companies should move outside their comfort zone to educate customers and drive the change	
Int.9: "[Tackling the SOI adoption barrier by] education, awareness."	Increase awareness for SOIs	
Int.3: "Education of consumers for how technology benefits agriculture is an extremely critical point."	Educate consumers on how technology benefits agriculture	
Int.2: "[…] the customers today need to be educated on what is sustainable today."	Educate customers on sustainability	
Int.3: "So the educational aspect, of what tech makes what output, and how tech benefits agriculture. This is a [...] slow and painful process."	Education on characteristics and benefits of technology needed	
CS : "I think the main thing is to try to get demonstration and small groups to discuss […]."	Offer demonstrations and small groups to discuss	
Int.11: "We have to prove it, everything we do, before it's believed of course […]."	Proof of concept before customers believe it	**Observability SOI adoption essential**
Int.7: "[…] really focused on results [but] if you if we can show that this actually works then they would consider it."	Need to prove new systems before customers consider it	
Int.9: "I think just the amount of reference projects […]."	Acquire a significant amount of reference projects	
Int.11: "But this indoor farming, we built and invested in ourselves, in the center here. We're proving it, showing it to clients, educating everybody learning ourselves also from it. And in that way try to put it into the market."	Prototyping by SOI provider to prove and show it	
Int.12: "I mean they want to see the product. [...] you can't just go around with a sheet, and say like 'this is the product and this is how much it'll cost', no they need to taste it."	Customers want to see and taste the product	
Int.9: "[…] the need and explaining the improved access to higher yields."	Explain how the SOI increases the yield	
Int.11: "So then it's really calculating the business case."	Calculating a business case	
Int.11: "[…] you need to make this really specific, so bring it back to numbers. So they understand the value of it."	Should make the value as tangible with numbers as possible	
Int.1: "[…] have to show a really good business case."	Need to see a really good business case for SOI	
Int.11: "So it matters then with who you do business whether you can build that business or not […]."	Choice of customers and partners	**Customer & partner selection SOI adoption essential**
Int.11: "So you then [to prototype] you need to find like a small consortium […] that want to be first mover with it."	Find partners who want to be first movers	
Int.9: "[…] pretty selective on the project we take on because we don't want to take on projects that are failing."	Be selective on choosing the project to avoid failing projects	
Int.4: "That's all that's who has a good network. That's also very important."	Importance of a good network	

Int.4: "You [...] must know that if you have questions or doubts you have a contact that you can talk to or mail to and feel that he or she is interested in you as a customer."	Provide excellent customer service	**Customer-centricity SOI adoption essential**	
Int.3: "[…] business cases will evolve, everything needs to be customized."	Customisation is a must for each business case		
Int.6: "[...] if we are to survive long-term, we have to offer what the customer wants."	Customisation required to survive as a business		
Int.12: "[…] the more you standardize that process, the better. But in the end there's like an aspect of customization."	Standardisation aspired yet customisation required		
Int.11: "So, just putting a grid there and say, 'okay, well, now you have power connect to it and good luck with the greenhouses' that will be too limited. So a company where you work for now, they should move outside their comfortable zones, and we should as well."	Move outside the comfort zone by providing more customer-centric solutions		
Int.9: "[…] it's developing those relationships as well and having a good reputation in the market."	Develop relationships and a good reputation	**Relationship management SOI adoption essential**	
Int.4: "You must feel confidence to the company. You need to feel confident with the partner you are working with"	Confidence in company [SOI provider] needed		
Int.4: "I think it [trust and relationships] is very important […]."	Trust and relationships are key		
Int.4: "Could you trust that the work was done the right way when you didn't see it while you were doing it."	Trust needed that the work is done properly		
Int.5: "[…] also with our clients, they need to trust us."	Trust amongst provider and adopter is needed		
Int.4: "I think that's always a new product specially from a company that's not well known it is the start-up process and it takes any it takes a longer time than you expect […]"	Have patience and endurance in early stages of the SOI launch	**Endurance SOI adoption essential**	
Int.3: "This is a huge and extremely slow and painful process."	Slow and difficult process		
Int.11: "So takes time, takes money, takes believers, takes endurance."	Provide time, money, believers and endurance		
Int.10: "It [service BM] is starting now but it hasn't been fully processed yet."	Service BM starting now, but not been processed yet	**Servitisation status**	**Servitisation development**
Int.9: "We see a lot of companies trying to enter that business that's more of a kind of a monthly fee."	Movement of companies charging monthly fee		
Int.4: "I think they're [younger farmers] much more open for different kinds of solutions of offer services for either shorter periods or long periods."	Young customers open to different kinds of solutions and services		
Int.12: "[Servitisation is a] natural sign of the maturing of a market, when you see more service-based."	Servitisation natural sign of maturing of a market		
Int.11: "We are aware of that just selling technology will not be the future, and not only the future."	Selling a technology as a product will not be the future	**Servitisation outlook**	
Int.11: "[…] the more industrial our process has become, the more predictable and the more controlled the growing of vegetables becomes, the more we could consider moving to a service model, and the more we probably will have to do that as well."	Industrial processes > enhanced predictability > enhanced control > shift to service model		
Int.10: "To implement this model at other industry than the IT, I do not say it is not going to happen, I just say that it is going to take time."	Service BM adopted in IT, other industries will follow, however takes time		
Int.7: "I see a lot of the market moving towards leasing options, towards different financing solutions because a lot of growers are really interested in moving into new technology."	Moving towards leasing and financing solutions as customers interested in new tech		
Int.7: "[…] the society that we live in now, is definitely a lot more interest in the service-based society."	Moving towards a service-based society		
Int.7: I think that that's where we are moving towards with the economy system that we have now, is that what and within a level of automation is that providing services is the way that our economical system is going to move towards.	Shift towards services, due to increased level of automation		

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Int.10: "[…] good model. Even for the customer, it will limit their investment towards a monthly fee."	Service BM beneficial for customers as it limits big investments by monthly fees	**Financial model BSC**	**Beneficial service characteristic (BSCs) for SOI adoption**
Int.10: "[…] from a financial point of view it is very tempting [for the customers]."	Service BM is tempting from the customer's financial viewpoint		
Int.5: "[…] especially good for people or for companies who need to make a step to get more high tech [...] [but] don't have the money to invest."	Service BM beneficial for customers with limited financial resources		
Int.4: "[…] it was possible that they could afford as buying it but because we also had in our [leasing] model."	Leasing models enhancing affordability		
Int.4: "It's [service BMs] coming here and there but definitely [beneficial] because as investments are very high, ehhm we are sometimes very over-invested."	Service BM helps to overcome barrier of high investment		
Int.4: "I want to try it for a short time of period and I don't want to invest so heavy in machines that if there was option of having other kind of getting the services."	Services facilitate trying out SOIs without great investments		
Int.8: "[…] whenever they don't have to invest it, of course, it will become easier."	Reducing investments will enhance easiness to adopt SOI		
Int.7: "[…] but sometimes the funds aren't there or there are new emerging companies that needs to get sort of a pilot with a successful investment or return of investment so that they can expand to then purchase, so that leasing is the best solution."	Leasing is a beneficial solution when investment funds lacking		
Int.7: "[…] smaller growers are usually pilot projects that are looking to sort of expand and they need to prove their concept and so having a smaller monthly or quarterly cost makes more sense to them."	Smaller customers usually seek for pilot projects looking to scale		
Int.7: "I mean if there's more opportunity for that [selling products as a service to remove the high investment barrier], we do a lot of license deals or looking more toward that now. And that's where there's a lot of interest and that's when that fear barrier breaks down."	Increasingly seeking for licensing deals to break down barrier of investment (opportunity)		
Int.4: "When you have different kinds of services in getting capacity for something, it might be easier for you to try something new."	Services enable having the capacity to try something new		
Int.12: "Capital costs are extremely high [...], so the leasing models are very attractive because there's a lot of interest but not necessarily a lot of capital to begin at the starting point."	Leasing model attractive to overcome extremely high capital costs		
Int.4: "[…] robots [...] became quite expensive so that they're like to have more and more of some kind of leasing with monthly payments instead."	Monthly payments allow usage of high technology (e.g. robots)		
Int.7: "Smaller growers yes [seeing the financial benefit of a service model], larger growers want to buy everything in a one stop shop and have that investment done."	Smaller customers see the financial benefit of a service		
Int.10: "You have to limit the risk for them. If you link your monthly fee to a KPI […] outcome, that will really limit the perception of the risk for the customer."	Limiting the customers' perception of risk by linking monthly fee to a KPI outcome	**Predictability BSC**	
Int.12: "[Price predictability is] absolutely a benefit of services."	Price predictability as benefit of services		
Int.11: "[Benefit of services is] cost stability. So it will be a long term contract."	Service BM enhances customers' cost stability for longer term		
Int.11: "So they know now the price of the electricity will not change for the coming 10 or 15 years so they can build with food production and cost, they can build much better with this case."	Long-term cost estimation enhances the assessment of business cases		

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Int.11: "It's about security [the benefits of service BMs]. So they are not responsible for assuring the power. That's then the responsibility of the of the service provider."	Service BM enhances the benefit of security as the provider takes responsibility	**Outsource responsibility BSC**
Int.4: "Younger farmers coming in now and taking over the farms they are not so interested in that they have to own everything themselves."	Young customers less interested in owning everything themselves	
Int.7: "Service and maintenance […] something that they definitely look at outsourcing […]."	Customers willing to outsource non-core activities, such as service and maintenance	
Int.1: "[…] not like to have a system that we will have to run ourselves."	Need for system that does not need to be taken care of	
Int.1: "[…] sourced in, [so] we would like to concentrate on what we're good in."	Want to focus on what they're good at	
Int.6: "[...] more or less every customer wants to go for the left business model [EaaS] where we actually own stuff in their building."	Most customers are not interested in ownership of energy infrastructure	
Int.12: "It just [service] allows them to focus on their business […]."	Services allow focussing on own business	
Int.12: "the [beneficial service] value that is that it's hands off, you know, they have to make the initial investment and then it's taken care of."	Services characterised by hand-off	
Int.9: "They focus on their business."	Services allows focussing on own business	
Int.7: "[…] we work with a couple of third parties in the production and product development, we do take in consultants and we take in companies that do design work for us and simulations and sort of user interface things."	Outsourcing non-core (e.g. production, product development, simulations, design)	
Int.3: "[…] we would like to have it as a long-term service, that we can just plug and play. And take to all the places that we go to."	Long-term service interesting when plug and play	
Int.12: "[…] if they could lease things like the lights and some of the equipment that helps them be more effective."	Leasing equipment enhances effectiveness	
Int.7: "[…] we really saw that consultative sales and also working with a technical service department really helps us to understand the needs of the customer."	Consulting to understand customer needs	**Co-creation BSC**
Int.12: "[…] co-creation comes in as in the actual installation stage because that creates a new model [...] allowing to create a different service price and category meaning that there's a different scale created."	Co-creation creates a new pricing and scaling model	
Int.5: "[…] it's [services] not just a product that you buy [...] and then it's done, like loads of time with maintenance and we select continue.	Stronger relationship due to services beyond purchase	
Int.12: "[…] with the service one, you tend to see a higher degree of communication, because you're in their operation."	Services have a higher degree of communication	**Commu-nication & feedback BSC**
Int.7: "testing the [licensing] model at the moment sort of understanding what are acceptable prices and levels"	Testing (license) models to understand acceptable prices	
Int.12: "[Within services] there's benefits to the shared data between various other users, so that they benefit from each other's knowledge and experience through the small platform"	Sharing data allows benefitting from each others knowledge and expertise	
Int.12: "[…] so that [high level of communication in services] allows you to get customer feedback very quickly."	Services and its degree of communication allow quick customer feedback	
Int.4: "So the service could get in contact with the farmer in our case and [...] like to hear some feedback."	Services allow feedback from customers	

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Quote	Code	Theme	Category
Int.9: "[…] you're putting the right experience in the right place."	Putting the right experience in the right place	**Expertise BSC**	
Int.9: "We're going to support them. And we also provide members of our service team if there's certain issues that need to be fixed."	Services provided for certain specific issues		
Int.5: "But other things we are not so [good at] you need to have also experts from outside."	Experts required to cover areas with lack of knowledge		
Int.9: "[…] we buy them as products and we're confident and launching them, but we do have that service element to our business because it's such a, yeah, it takes some highly skilled people to focus on fixes and bugs."	Selling greenhouses as products and offering services to fix bugs by highly skilled people		
Int.7: "[…] consultancy hours that we sell [..] we have very knowledgeable biology based staff that work with growers."	Consultancy on specialised tasks offered		
Int.7: "Our services are very much targeted towards how do we increase and help your operation? And […] learn with our knowledge base? […] offering an expertise that they don't have."	Services targeted on increasing customers' operations by offering expertise they don't posess		
Int.8: "I'm not sure if the greenhouse users are interested in doing so, because it changes the set of your company [...]"	Reluctance to services due to shift of company set-ups and shift of responsibility	**Organisational change HFS**	**Hindering servitisation factors (HSFs) for SOI adoption**
Int.7: "[Adopters' transition towards services] also creates a hindrance for them that they are not interested so much in [...] understanding how those things work."	Adopters' transition to services creates hindrance		
Int.4: "[…] it was a change in how you doing something done by hand is been adopted supposed to be done automatically."	Services require large change in organizational processes		
Int.7: "[services require] a lot more of the full system that needs to be incorporated."	Services require full change of organizational systems		
Int.7: "[…] larger growers want to buy everything in a one stop shop and have that investment done."	Larger organizations are used to buying products, financial approach needs to be shifted if adopting services		
Int.11: "I think it might complicate the process little bit because it takes longer. [...] It's a bit more of a journey."	Complexity of incorporation services within current processes		
Int.7: "[Customer downside of service BM] there is this changing of mindset that you do not have to pay for software."	Downside of service BM is changing customers' mindsets	**Cultural reluctance HSF**	
Int.4: "Could you trust that the work was done the right way when you didn't see it while you were doing it. [...] it it takes some time before you trust	Downside of services is that it requires more trust		
Int.9: "[Lack of sense of ownership as hindering service characteristic] I think it definitely they want to take full pride and in the crop that they grow"	Lack of sense of ownership in services, want to take full pride		
Int.12: "I agree on this cultural barrier [giving away parts of their business and trust on their expertise], I mean, they have always managed everything themselves."	Used to self-management, creating a cultural barrier for outsourcing		
Int.12: "It [services] just narrows the kinds of customers that might be interested in your solution, because it's maybe less traditional than buying the product straight out."	The newness of services narrows the kind of customers		