Service Adoption in The Agricultural Sector

A case study about the role of product-service offerings for Swedish cattle farmers

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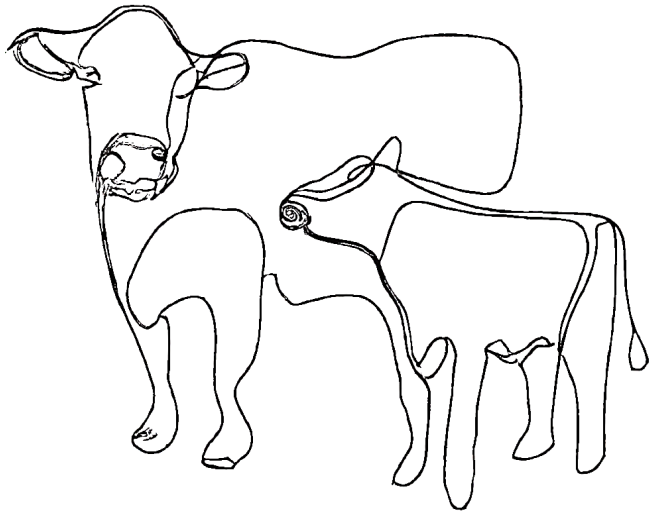

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Abstract

Even in traditional sectors such as the agricultural sector, digitalization has significantly impacted operations. Because of the sector's fundamental role in society, understanding this digital evolvement to support further development is of essence on a grand societal level. Although an increase in the use of product-service offerings is prevalent in the sector, the uncertainties regarding farmers' willingness to adopt service-focused offerings constitutes a gray area in practice and theory. Furthermore, the servitization literature lacks research pertaining to the users' perspectives and the factors influencing servitization, which opens for further contributions to this research domain.

Therefore, this study aims to investigate servitization of IoT products and what impact these services will have on farmers as well as service providers within the agricultural sector. The study applies a case study design, including semi structured interviews with Swedish farmers as well as secondary data from the case company and from other service providers within the sector.

It was found that multiple groups of factors influence user adoption of servitized IoT offerings within the sector: First, factors concerning the impact on working conditions, animal welfare and financial position. Second, farmer's general attitude and mindset towards technological development, provider survivability and trust in technology, mediates adoption. Third, there are factors relating to the intrinsic characteristics of a product-service offering. Fourth, extrinsic factors such as actions from the service provider have the possibility to influence the user adoption of a service. Lastly, various contextual factors, such as access to service connection and government policies and regulations moderates adoption. In relation to these factors, the paper provides a conceptual framework regarding their interdependencies. Additionally, using a business model innovation perspective, suggestions for how a servitizing firm can consider these factors and their interdependencies are presented.

Key words: *Agriculture, Cattle farmers, Business model change, Digital servitization, Product-service-software systems, Product-service adoption, Value co-creation, Servitization*

Prologue

– A day in the life of a cattle farmer –

As the sun began to reach through the bedroom window, Elin slowly opened her eyes and stretched. She was the fourth-generation farmer of a family-owned dairy farm, which she ran together with her husband and with occasional stand-ins from her parents. To the sound of swallows sweeping through the air outside of the window, another day on her farm had begun, and she soon got up from bed to start her morning routine. As usual, she reached for her phone to check for any notifications from the stables. Whether she was on vacation or at home, she found it comforting to know that everything was as it should be with the animals – the morning check was custom.

Elin had installed the software a few years ago, and it had completely transformed the way she ran her farm. With just a few clicks on her phone, she could monitor the health and wellbeing of her cows, track their milk production, and even receive alerts if something was not quite right. After checking in on her animals, Elin settled down with a cup of coffee and a stack of farmer magazines. She sipped on her coffee and flipped through the pages. She enjoyed reading about the latest trends in agriculture and learning from the experiences of other farmers.

Later in the morning, Elin headed out to the fields to check on her crops and make sure everything was growing as it should. She looked over the deep colored greenery of the field, which with the help of precision fertilization and auto steering on the tractor, had not a straw out of place. She considered how the area in front of her could be further improved. Elin knew that becoming a successful farmer requires continuous development and adjustments to accommodate the changing needs of her land and animals.

In the afternoon, Elin visited a local farmers association to discuss the latest developments in the industry. Like her peers, she enjoyed connecting with other farmers, sharing her own experiences and listening to others. They talked about everything from new technologies to government regulations, and Elin left feeling energized and inspired.

As daylight slowly faded, Elin’s phone buzzed with an urgent alert from her milking robot. One of her cows was experiencing an issue that she needed to attend immediately. With a sense of urgency, she rushed to the stable, thankful that the management software had alerted her in time. While tending to her cow, Elin realized that being a modern farmer was not just about hard work and dedication – it was also about embracing new technologies and staying connected to the wider community of farmers. Feeling proud of the life she had built for herself, her family and their animals, she went back inside, knowing that tomorrow would bring another day full of challenges and opportunities.

– Inspired by the narratives of interviewed farmers.

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1.
Introduction

This chapter introduces the research topic by presenting the background and problem discussion that eventually leads to the purpose of this study. A description of the empirical case company is provided, followed by delimitations, contributions of the study and the disposition of this report.

1.1 Background

Agricultural methods and practices have been fundamental in the development of mankind and the sector continues to play a vital role even as society becomes increasingly automated and digitized. When considering the agricultural sector, many people assume that it has a low level of technical sophistication. However, in tandem with other industries, agriculture has undergone digitalization and other technical advancements. Today, software, robots and other enabling digital technologies are increasingly being used by farmers (Jouanjean, 2019). Simultaneously the sector is impacted by decreasing available labor. The EU agricultural sector has seen a persistent decrease in workforce, with an average yearly decline of 2.9% between 2006 and 2021 (Eurostat, 2022). The trend continued in 2021, albeit at a slower rate (-1.0%). Moreover, society is currently confronted with significant challenges – grand societal challenges – including food security, sustainable agriculture and forestry and the bioeconomy (European Commission, 2020). Because of the changes occurring within the industry, and the industry's importance for society, this causes a need to understand the current digital evolvement for further development of agriculture.

Furthermore, as mankind has moved from a production society towards a service economy (Vargo & Lusch, 2004), the research topic of servitization has become more common in recent decades. In more recent years, servitization literature has moved to focus on the relevance and importance of digital technologies in relation to servitization (Raddats, Kowalkowski, Benedettini, Burton, & Gebauer, 2019). An example of such digital technology is Internet of Things which impacts servitization and can increase customer value and profitability (Rymaszewska, Helo & Gunasekaran, 2017). Internet of Things (IoT) is a concept that includes technologies that make it possible to be controlled via the internet or exchange data with the help of the internet (IoT Sverige, 2023). The trend of a more digitalized servitization can be visible in multiple industries including agriculture.

As servitization with digital components becomes more relevant even in traditional sectors, such as the agriculture sector, this creates a need to not only understand the prevalent development but also the impact it has on farmers. Since farmers play a fundamental role in our society one needs to ensure that the evolution of servitization will move on a path that in the end benefits the farmers' community, and in the end society. This in turn raises the importance of understanding how service providers in agriculture can meet the needs of the farmer as their business models become more service focused.

1.2 Problem Discussion

Contemporary farming practices often entail that farmers have at least some connections with established companies that provide central equipment such as milking robots and tractors. Often, this equipment is combined with different service offerings (e.g., Lely, 2023; DeLaval, 2023; Deere, 2023). In the Swedish agricultural sector, there are also numerous technology providers that offer products and services that are related to this central equipment (e.g., Växa, 2023; AgriCam, 2023; DataVäxt, 2023). Such providers include firms focusing on smaller digital devices that can ease the work of the farmer – for example by offering IoT products with monitoring features. The case company of this study – Luda.Farm – constitutes an example of such a firm.

With an increase of companies in the agriculture sector offering smart product-service offerings seeking to simplify the work of the farmer, service providers need to consider how their services can evolve. Consequently, the service providers need to consider many factors that in turn will influence the user's willingness to adopt a service. For example, Luda.Farm is working on the consolidation of subscription payments to make this a more efficient experience for the customer. Additionally due to the announced decommissioning of 2G and 3G cellular networks in Europe, and the shift towards 4G and 5G, this causes pressure for service providers to upgrade products in compliance with new connectivity standards. In turn farmers become pushed to follow along on this trajectory as well. Furthermore, the trend towards servitization and a declining agricultural workforce in Europe may necessitate a shift in Luda.Farm and similar companies' approach to the market, in order to better serve farmers with large land and few employees. This may involve a reconfiguration of how the products are presented to customers, potentially extending the consolidation of subscription payments into a fully customizable package of monitoring and controlling capabilities in a singular service offering. These changes will cause the farmers to have to consider how the new services will affect their farm and how they should adapt to them. This could potentially lead to tensions between farmers and service providers if the farmers experience that their needs are not taken into consideration.

In the research field of digital servitization, gaps in research have been found which has caused a need to conduct further studies in that area. According to researchers Favoretto, Mendes, Oliveira, Cauchick-Miguel and Coreynen (2022) there is a lack of research that focuses in-depth on one individual digital technology's role in servitization. To contribute to the fulfillment of this area of research this study will delimit the focus to IoT products' role in servitization. In addition, the researchers in this field have struggled to fully understand the transition process of servitization and what factors influence this transition (Oliva, 2016, as cited in Kohtamäki et al., 2021, p. 16). Moreover, servitization is often closely related to how the service provider can become more service focused (Oliva & Kallenberg, 2003; Kohtamäki, Parida, Oghazi, Gebauer, & Baines, 2019). Also, because of the contemporary literatures' manufacturer-focus, scholars have called for additional perspective on customers' role in servitization (Brax, 2005; Matthyssens and Vandenbempt, 2008; Raddats et al., 2019).

Because of the lack of adapting a customer focus in servitization literature this creates a need for further investigation in this area (Brax & Jonsson, 2009; Forkmann, Henneberg, Witell & Kindström, 2017). With consideration of the previous research this study will set out to understand more specifically what factors influence the user adoption of a service. Furthermore,

to create a more holistic view on servitization this report will highlight the user perspective with the aim that this will generate valuable understating for service providers. While at the same adding understanding to the presented research gap that stems from a lack of customer focus.

Finally, OECD has expressed a research gap when it comes to digitalization of livestock farming (McFadden, Casalini, Griffin, & Antón, 2022). Accordingly, this research only investigates farmers with cattle to contribute to clarification of the gap presented by OECD. In relation to adoption of new innovation there has been a large focus on services that are technology intensive and a lack of research regarding "goods-related services" (Rexfelt and af Ornäs, 2009; Catulli, 2012). This research has its context in the agriculture industry which can be considered to have a lower technical standard compared to other high-tech industries. The sector also includes goods-related services, for example the previously mentioned product for the case company. Hence, applying focus to goods-related services will add to the lack of research in that area. Not to mention, there are still a lot of opportunities for digital developments through servitization in the agriculture sector. Additionally, conducting research about digital servitization relating to the agriculture sector has the potential to create an impact within the sector.

The overall changes in the agriculture sector and the uncertainties regarding the customers' willingness to adopt a service focused offering constitutes a gray area in the sector. In combination with the ongoing trend of service focused business models this in turn generates a need to investigate these changes further. Furthermore, because of the presented research gaps regarding servitization this generates a need to contribute to the understanding of this area of research.

1.3 Purpose and Research Questions

The purpose of this study is twofold. The primary purpose is to provide insights regarding how the case company and similar companies within the industry can transition into service focused businesses. This by understanding how the business model of companies providing agricultural IoT products can become more service focused, considering conditional factors that influence the servitization potential from a user perspective. The secondary purpose of this study is to contribute to the advancement of theory in the field of servitization, this by studying the case of servitization in an agricultural context. The purpose will be investigated through the following questions:

RQ1: What factors influence the user adoption of servitized IoT products for cattle farmers in the agricultural sector?

RQ1.1: How do these factors relate to and influence each other?

RQ2: Based on the previous research questions, how can IoT providers in the agricultural sector consider these factors while transitioning to a service focused business model?

1.4 Empirical Case

Luda.Farm AB, founded in 2005 as Luda Elektronik AB, is a Gothenburg-based company specializing in internet-connected agriculture products and services (Luda Elektronik AB, 2006). Originally focused on security cameras and equipment, the company shifted to

agriculture in 2015, enhancing farm monitoring through technical development (Luda.Farm AB, 2016). Their IoT-enabled cameras, sensors, and actuators are accessible through the my.luda.farm platform via web and smartphone apps. This platform simplifies farm operations by monitoring and controlling various aspects, such as calving, heating, and fencing. Luda.Farm's vision of "smart farming made easy" demonstrates their commitment to efficient, profitable, safe, and sustainable agricultural solutions (Luda.Farm, 2023).

Luda.Farm offers two IoT products, Luda.FenceAlarm and Luda.SmartPlug, priced at €249 and €99 respectively (Luda.Farm, 2023). Luda.FenceAlarm monitors electric fencing, notifying the farmer of voltage drops caused by wire breaks or vegetation leakage. Luda.SmartPlug is a remote power switch that also monitors current status, power consumption, and ambient temperature. Both products facilitate farm monitoring through the my.luda.farm platform. Farmers access these services through a monthly or annual subscription fee.

In October 2020, the firm was acquired by the company Seafire, whose active and long-term ownership aims to secure further growth and development of Luda.Farm (Seafire, 2023). Today, Luda.Farm distributes its products and services through a network of wholesalers and resellers across various markets in Europe, with its largest markets being France, Germany, Scandinavia and the UK (Jonas Andersson, personal communication, January 18, 2023). Their current product and service offerings include vehicle- and farm surveillance cameras, Luda.FenceAlarm and Luda.SmartPlug.

1.5 Delimitations

The research includes certain delimitations. First, this study focuses on the Swedish market and only Swedish farmers are interviewed. This is because of the growing trend of servitization in Sweden which led to the belief that Swedish farmers would bring forth valuable insights. The study focuses on Sweden only, to ensure that the data is in-depth and generates valuable answers for the Swedish agriculture sector. Furthermore, it was the case company's perception that Swedish farmers are more digitally mature compared to other countries in Europe. Thus, Swedish farmers would have more knowledge and experience to answer questions about IoT product-service offerings.

The primary data collection stems solely from semi structured qualitative interviews which generate well-grounded answers and in turn leave room for a more in-depth analysis. Additionally, because there is not a lot of servitization research with a customer focus, only users of product-service offerings and not the service providers will be interviewed. Furthermore, because of farmers' fundamental importance to our society their thoughts deserved to be represented in research regarding their field. The interviewees will be delimited to livestock farmers as they as they have the most usage form the products offered by the empirical case company. Moreover, focus will be put on IoT products in agriculture since these products are often connected to an application, to other products and to some sort of product-service offering.

1.6 Contributions

This study will offer contributions for both companies in agriculture and to the research area of servitization. The findings will offer insights from a user perspective about business models for IoT products for the case company and other companies in the agriculture sector. It will also

provide companies within the sector a hint as to where the industry is moving and in turn a greater understanding of how they should adapt in conjunction with the industry. The research applies a focus on IoT products, but the findings can offer insights on other technical products within agriculture as well. The findings will also provide an understanding of farmers' general attitude towards for example subscriptions and digitalization which can be helpful for multiple service providers in the agriculture industry. Servitization of business models is a growing trend in multiple industries, meaning that its core idea and research can be transferable to multiple contexts and sectors. Hence, the results of this single case will be somewhat generalized and can be applied in other cases within the agriculture industry.

This study will also contribute to the research regarding servitization, more specifically servitization in the agriculture sector and digital servitization with the help of IoT products. Moreover, the research focuses on users' view of servitization which according to previous research is needed for deeper understanding of the field (Brax & Jonsson, 2009). Additionally, findings regarding farmers' general attitude towards subscriptions and digital technologies will enable understanding of current digital servitization potential within the agriculture sector. The findings will also highlight what factors influence user adoption of IoT products for cattle farmers in the sector as well as how these factors influence and relate to each other. Furthermore, the study will contribute to the understanding of how the users' view on servitization and product-service offerings can be considered in a business model.

1.7 Disposition

The next chapter will present the applied theoretical framework which includes previous research in the field of servitization. This is followed by a description of the applied research methodology such as research strategy, design, data collection, limitations, research quality and data analysis. Chapter 4 includes the empirical findings that are presented in different themes which are later analyzed in chapter 5. In chapter 6 the research questions are addressed to provide them with a summarized answer. Chapter 7 presents concluding remarks, managerial and theoretical implications of this study as well as suggestions for further research. Thereafter the reference list is provided in chapter 8 followed by appendices.

2.
Theoretical Framework

The theoretical framework includes the following three large themes: defining servitization, user adoption of product-service systems and technology providers adoption of service focused business models. The first and second theme includes research that is connected to RQ1, and the third theme relates to RQ2.

2.1 Defining Servitization

In recent decades a new way of business logic has emerged as society has moved from a manufacturing society focused on outputs to a service dominant market logic where intangible assets have become more important (Vargo & Lusch, 2004; Kowalkowski, Gebauer, Kamp, & Parry, 2017). According to this logic, products are seen more as a tool to perform a service and value is co-created together with the customer, not just through the selling or consumption of a product (Vargo & Lusch, 2004). Moreover, by adding service offerings, companies are creating more value and competitive advantages since the services generate new types of relationships with the customers (Vandermerwe & Rada, 1988). The topic of servitization has been discussed ever since the foundational work by Vandermerwe and Rada (1988). However, the literature around the topic of servitization has changed in recent years towards the relevance and importance of digital technologies in relation to servitization (Raddats et al., 2019). IoT is an example of such digital technology that impacts servitization and can increase customer value and profitability (Rymaszewska et al., 2017).

The aim of this report is to investigate what impacts transition into a servitized business model with the usage of digital technologies, in this case IoT products in the agriculture sector. Therefore, it is through the lens of the service dominant market logic and its discovered connection to digital technologies that this literature review has its starting point.

Several attempts have been made to synthesize the scholarly literature on servitization, and it has been suggested that the field has evolved into a mature and diverse discipline with a significant body of literature (Lightfoot, Baines & Smart, 2013; Kowalkowski et al., 2017; Raddats et al., 2019). However, as pointed out by Kowalkowski et al. (2017) there is no widespread consensus among scholars regarding core concepts and definitions of servitization, leading to ambiguity in terminology and usage. This could be explained by the broad research interest in the domain received from various communities – industrial marketing-, service-, strategic- and operation and production management, along with engineering management, etc. (Lightfoot et al., 2013; Kowalkowski et al. 2017). The dispersion is also reflected in the different theoretical lenses used within the servitization literature, such as the strategic-led resource-based and dynamic-capabilities views and marketing-led service-dominant logic views (Baines, Ziaee Bigdeli, Bustinza, Shi, Baldwin & Ridgway, 2017). Baines et al. (2017) furthermore suggests the crossover with the topics of business model innovation and information and communication technologies. This is supported by following servitization reviews which find the field to increasingly deal with digitalization and technological developments (Raddats, Kowalkowski, Benedettini, Burton, & Gebauer, 2019; Kohtamäki, Rabetina, Parida, Sjödin & Henneberg, 2022).

Commonly, scholars who seek to define servitization take their stance in Vandermerwe and Rada's (1988) work, acknowledging their foundational contribution in forming a research field of servitization (e.g., Baines et al., 2017; Raddats et al., 2019; Brax, Calabrese, Ghiron, Tiburzi & Grönroos, 2021; Kohtamäki et al., 2022). Building on this primary conceptualization of servitization (Vandermerwe & Rada, 1988), contemporary scholars define it "as the tendency of firms to add increasingly complex, customer-oriented bundles of goods and services to their pre-existing portfolio of offerings" (Brax et al., 2021, p. 519); as "the addition of services to manufacturers' core product offerings to create additional customer value" (Raddats et al., 2019, p. 207); and "a process of building revenue streams for manufacturers from services" (Baines et al., 2017, p. 257). Synthesizing these definitions, servitization can be understood as a process by which firms alter their offerings to infuse or center services in order to increase customer value, whilst also creating novel practices to capture this value. It may also be comprehended as both an empirical phenomena and theoretical concept.

For further rigidity, Kowalkowski et al. (2017) can be used to dissect firms' *infusion* vis-a-vis *centering* of services. According to the authors, servitization is an all-encompassing concept which includes service infusion but goes beyond this. Centering of services involves the conversion of a firm's focus from primarily delivering products to adopting a service-oriented approach. It entails a substantial shift in both business model and mission, where the service aspect becomes a key driver of growth. This is what Kowalkowski et al. (2017) denote servitization. On the other hand, service infusion is referred to as a situation where the significance of a firm's service offerings increases relative to its product offerings. This represents a noteworthy change for the company, but it does not necessarily imply a shift in its business model and mission. Typically, the primary function of the infused service offerings is to safeguard the company's traditional products according to the authors (Kowalkowski et al., 2017).

For the current research, servitization is seen as this more substantial shift in a firm's business logic, leaning on Kowalkowski et al. (2017). However, drawing on the aforementioned definitions and synthesis of them – servitization is also seen as a concept not only referring to processes of transformation, but also the object – offerings, and the means by which these are provided – practices. In the following sections and subsections of the theoretical framework chapter, these offerings, practices and processes are further explained.

2.1.1 Servitized Offerings – Product-Service-Systems

As discussed above, servitization includes changes in a firm's offerings, and when the customer perspective is considered, these can be viewed as the focal point of servitization. After all, it is the offering or system of products and services that the customer prospectively will implement and commonly this offering also constitutes the platform for further interaction with the provider. In the extant servitization literature, a diverse range of taxonomies have been used to classify service offerings (Lightfoot et al., 2013; Raddats et al., 2019; Kohtamäki et al., 2022). (In the current research, service offerings will be used interchangeably with *servitized offerings* to denote a processual change where services are infused to or fully substitute products.)

In their systematic review of literature associated with servitization, Lightfoot et al. (2013) observed that a discussion about the differentiation between products and services generally has been replaced by one which considers inter-relationships between the two.

Raddats et al. (2019) list taxonomies that have been proposed by scholars in the field over the last two decades to distinguish service offerings. These are services supporting products (SSPs) versus services supporting the customer's actions (SSCs); customer versus supplier ownership of equipment; product complements versus substitutes; transactional versus relational; standardization versus customization; offered individually versus integrated bundles; input- versus output-charged; base, versus intermediate versus advanced services; free versus chargeable; and own products versus multi-vendor (Raddats et al., 2019).

Although the authors present various taxonomies conceptualized to be distinct, they make the argument that they are interrelated (Raddats et al., 2019). They exemplify this with the notion that multiple studies indicate that strong relationships are either conditional for, or a precursor to, the development of customized, integrated, process-oriented, and output-based service offerings. Likewise, heightened customization typically involves the integration and bundling of various services or combinations of service and product elements. Consequently, the authors argue that numerous classifications found in the literature are connected to the distinction between SSP and SSC. In several cases, the SSP-SSC dichotomy is combined with another taxonomy to present two-dimensional classification systems (Raddats et al., 2019).

This interrelatedness of a broad set of taxonomies indicates that various configurations of servitized offerings exist, which may have different degrees of complexity. In the servitization literature, some conceptualizations that encompass these variations have been presented, such as *solution offerings* (Nordin & Kowalkoski, 2010) and *product-service-systems* (Tukker, 2004; Baines, Lightfoot, Evans & Neely, 2007). Nordin and Kowalkowski (2010) describe solutions offerings as something which solves customers expressed or latent problems and makes the life easier for them whilst providing value to both customer and supplier. This is according to the authors done in a relational, linear/iterative or algorithmic process, where the solution incorporates characteristics of being customizable; integrative; having a range of options in the bundling of services and hardware; proactive or reactive and vertical or horizontal. The related concept of *product-service-systems* (PSS) has similarly been conceptualized by Baines et al. (2007):

> *"A PSS is an integrated product and service offering that delivers value in use. A PSS offers the opportunity to decouple economic success from material consumption and hence reduce the environmental impact of economic activity. The PSS logic is premised on utilizing the knowledge of the designer-manufacturer to both increase value as an output and decrease material and other costs as an input to a system."* (Baines et al., 2007, p. 3)

Baines et al. (2007) built this on Tukker's (2004) presented a framework that seeks to explain the different categories of product-service-systems in his seminal paper. These are *product-oriented services*, *use-oriented services* and *result-oriented services*. In Reim, Parida and Örtqvist's (2015) systematic review on the scholarly literature on PSS, they revisit Tukker's framework and substantiate it with some examples of PSS business models. They also acknowledge that the growth of PSS literature is driven by the desire to combine economic prosperity and sustainable resource management.

According to Reim et al. (2015), the *product-oriented* category of PSS business models involves a provider selling a product while also committing to deliver a related service. The authors exemplify this with a healthcare equipment supplier retrieving used equipment for recycling or disposal, as well as take-back agreements for household appliances. The focus remains on selling a product with added services, and the provider is responsible for providing the agreed-upon services, hence is not to be seen as a solutions offering (Nordin & Kowalkowski, 2010).

The *use-oriented* category of PSS business models involves the provider making a product available under rental or leasing agreements instead of selling it (Reim et al., 2015). The provider retains ownership and responsibility for the product's usability. Examples include long-term rental of forklift trucks and leasing of baby prams. The customer pays periodically for the use or availability of the product, and the provider's risks and responsibilities increase compared to product-oriented business models.

The last category of PSS business models is the *result-oriented* which involves a provider committing to delivering a certain result or outcome rather than a specific product or service (Reim et al. 2015). Examples of this category include chemical suppliers being paid for chemical services and cleaning services that agree on a cleanliness outcome without defining the physical products used. In these cases, the provider retains property rights, and the customer pays for the agreed-upon result, with complete responsibility falling on the provider.

As the product-service-system conceptualization encompasses a broad range of different offering configurations, the concept plays a central role in the current research. The concept has furthermore been developed in recent studies and now distinctly incorporates digitalization by the addition of *software*, making for *product-service-software systems*. In the following section, this is further described.

2.1.2 Digital Servitization Through Product-Service-Software Systems

The topic of digital servitization has been evident in the servitization literature since its inception, although the importance of the concept has increased more recently (Kohtamäki et al., 2019). Favoretto et al. (2022) conclude in their review of servitization that digital servitization constitutes an expansion of the servitization construct since it is grounded in the same conceptual and theoretical foundations under the servitization umbrella. They also provide the following unified conceptualization of digital servitization:

> *"Digital servitization is the transformational process by which a product company changes its product-centered business model to a service-centered business model with the support of digital technologies, enabling the reconfiguration of its business processes, capabilities, products, and services to improve the value for customers and increase the company's non-financial and financial performance"* (Favoretto et al., 2022, p. 109)

The relation between digital servitization and product-service systems is also pointed out by other scholars. For example, Kohtamäki et al. (2019, p. 390) defines digital servitization as "transition toward smart product-service-software systems that enable value creation and capture through monitoring, control, optimization, and autonomous function". Kohtamäki et al.

(2022) have furthermore proposed that digital servitization is the natural evolution of the servitization literature, building on former understandings and interpretations of the phenomenon. It has also been defined as "the transformation in processes, capabilities, and offerings within industrial firms and their associate ecosystems to progressively create, deliver, and capture increased service value arising from a broad range of enabling digital technologies'' (Sjödin, Parida, Kohtamäki & Wincent, 2020, p. 478).

2.2 User Adoption of Product-Service-Systems

Given the research questions one and two, that aim to investigate factors that influence users' adoption of IoT products for cattle farmers in the Swedish agriculture sector, previous research regarding user adoption will be highlighted.

Acknowledged theories of user adoption have been recognized for a time now. A well-known model for innovation adoption is presented by Rogers (2010) where he presents adoption as a five-step process including knowledge, persuasion, decision, implementation and confirmation. Rogers (2010) states that this process is influenced by certain factors such as the social system, communication and characteristics of the person. This is also discussed by Casidy, Nyadzayo and Mohan (2020) who agrees that the person adopting also impacts the decision to adopt technology. Additionally, the social environment and the tendency to mimic other network actors influence behavior related to product adoption (Hinz, Schulze & Takac, 2014).

Furthermore, research pertaining to adoption and acceptance of technology proposes that innovations are assessed based on their characteristics such as usefulness, its user friendliness and the ease of which a customer can try the new product or service (Casidy et al., 2020). Additional characteristics that influence adoption of a service include availability, its ability to be flexible also, the quality of service and that it in turn generates value has an impact on user adoption of a service (Vaittinen, Martinsuo, & Ortt, 2018).

2.2.1 Understanding the User Expectations of a Service

According to Michel, Brown and Gallan (2008) a "new service-logic perspective" has emerged. To successfully transition into service focus requires a deeper understanding of the customer's role, problems, processes rather than focusing on the management and manufacturing processes (Brax & Jonsson 2009; Michel et al., 2008; Reinartz & Ulaga 2008). Furthermore, in order to innovate services, one should focus on the customer and that value comes while using a product (Michel et al., 2008).

Understanding the customers' expectations of a service becomes important while investigating the customers perspective while transitioning from product focus to service focus. In the article *Understanding customer expectations of service* (1991) authors Parasuraman, Berry and Zeithaml investigate the role of customer expectation in relation to services. The authors argue that in order to deliver a service that is high level it is important to realize and satisfy the customers' expectations of the service in question. The authors state that price is a factor that influences the expectations of a service, since a higher or lower price communicates an expectation of the quality of the service. Parasuraman et al. (1991) mentions a few categories in relation to service expectations such as reliability, responsiveness, assurance and empathy. Reliability refers to service provider performance and that it is performed as expected.

Responsiveness is the service provider's ability and disposition to provide help and deliver the service. Assurance concerns the knowledge of the employees and that they communicate and radiate having necessary knowledge of the service. Lastly, empathy refers to providing necessary care and understanding to the customer.

Eng & Quaia (2009) states the importance of market orientation and that this is strengthened by continuous learning in relation to new product adoption in uncertain environments. According to Eng & Quaia (2009) market orientation refers to finding customer profiles, the demands of the customers and the surrounding competition. Expanding on the understanding of customers and their readiness to implement services, customers personal experiences and their view of these also needs to be considered while promoting and transitioning customers into new services (Brax & Jonsson, 2009). Moreover, understanding the targeted customers and how the product-service system can impact their lives as this in turn will remove uncertainties for the customer (Rexfelt & Hiort Af Ornäs, 2009). Exploring a broad empirical base, this was also highlighted by Baines and Lightfoot (2014) who showed that manufacturers of services strategically utilize performance measures to meet individual customer outcomes. These measures permeate the service delivery system, alongside emotional indicators that showcase customer value. According to Baines and Lightfoot (2014) this approach ensures alignment with customer requirements, effective implementation of manufacturer activities, and ongoing reassurance of efficient contract fulfillment.

Furthermore, by adding the element of continuous learning for the service provider, they can recognize uncertainties with the new product, and thus expand the knowledge about the product even more (Eng & Quaia, 2009). Furthermore, the attributes of the service provider and their relationship with the users is also brought forth in previous research regarding user adoption. The competitive advantage of the supplier of the innovation impacts the choice to adopt the service innovation because the competitive advantage of the supplier reduces the experienced risk associated with the adoption (Casidy et al., 2020).

With regards to trust in a service provider Coulter and Coulter (2002) state that in early stages of a service relationship personal characteristics such empathy and being polite are more important when it comes to generating trust. However, over time similarly to Parasuraman, et al. (1991) Coulter and Coulter also mention the importance of reliability and that trust is dependent on having competent service representatives.

2.2.2 Influencing User Adoption of PSS

Michel et al. (2008) present that one needs to encourage customers to create as much value from a product as possible. Furthermore, by combining different actors that can offer different types of value to the customer will increase the chance of fully meeting customer's needs and increase the value created (Michel et al., 2008). The authors describe that a change into "service-logic innovation" means a change in the customer's role in the buying process and creating value co-creation from different resources. The article presents how to change the role of the customer in this new way of viewing innovation in relation to services. By understanding how to change the role of the customer, one can better understand the transition process from product focused view into the "new service-logic perspective". According to Michel et al. (2008) the first step in how to innovate customers is to "change the role of the customer" which includes deeper customer analysis. Moreover, to understand the customer it also becomes important to identify

the factors that are mainly considered by the customers and communicate the benefits of the services in a way that encompasses the factors that customers find most important (Brax & Jonsson, 2009). This is related to the salesforce as they communicate the benefits of the services. According to Reinartz and Ulaga (2008) it is of importance to train salespeople and teach them the way to sell services and not just products as they can require different techniques.

The second factor is to "change the role of the payer" either by altering what is paid for or altering who is actually paying. Third, the article presents "change the role of the buyer" which refers to changing how customers buy things for example by removing uncertainties in the supply chain. Michel et al. (2008) also states that value creation can be changed also by developing smart offerings which will in turn make the customers smarter.

Eng and Quaia (2009) highlights that communication strategies are needed since an uncertain environment affects both the company and the customers. Furthermore, customer commitment is of importance since this will ease the process of targeting the right customers and it also helps manage negative information about possible failures of the new product (Eng & Quaia, 2009). Additionally, the choice to adopt a service innovation can stem from subjective reasoning that arises from the relationship between the supplier of the service and the user. Casidy et al. (2020) states that if a customer commits on a psychological level to a supplier this impacts adoption of a new service. Customer commitment also creates trust between buyer and seller (Eng & Quaia, 2009).

Lastly, accepting a product-service system solution is dependent on the condition that it generates benefits compared to the alternative of not adopting it (Rexfelt & Hiort Af Ornäs, 2009). This builds on a need for providers and developers to understand what characterizes a good product-service system must include (Rexfelt & Hiort Af Ornäs, 2009). Furthermore, in relation to the product-service offerings needing to generate benefits, research shows that price influences user adoption and that services therefore need to be cost efficient (Vaittinen et al., 2018).

2.2.3 Service Providers' Influence in User Transitioning

This study investigates factors that influence the user adoption of servitized IoT products for cattle farmers in the agriculture industry. Given the study's focus on digital technologies such as IoT, adding theoretical perspective of how digital aspects influence servitization becomes necessary.

Favoretto et al. (2022) express that transition to a service focused business model creates challenges that includes creating a new culture in the company, development of new services, units to handle the services and new processes. Moreover, the development of IoT and other digital advancements have caused a need to renew old business models. The authors state that digital technologies can affect product companies at multiple organizational levels. Moreover, it is mentioned that digitalization and servitization share a close relationship since the two are dependent on each other. This since servitization is dependent on smart technologies and digitalization can generate service solutions. Furthermore, digitalization facilitates servitization since it improves the quality of services and develops operations since it brings forth lower operating costs. (Favoretto et al., 2022)

According to Favoretto et al. (2022) there are multiple motivations as to why servitization can be benefitted by digitalization. For example, utilization of collected data to the company's

advantage when it comes to for example customer interaction. Data is also important when it comes to understanding how customers' use the service since the data can show how to adapt the service in line with customer usage (Reinartz & Ulaga, 2008; Baines & Lightfoot, 2014). Furthermore, the ability to answer quickly to customers and their needs, since digital technologies for example IoT enhances the knowledge and viability of the product which can lead to quicker responses. However, Favoretto et al. (2022) also mentions that the environment of which a company operates in will impact its possible level of digital servitization.

Kowalkowski, Kindström and Gebauer (2013) discuss the term ICT (information and communication technology) which can also be related while investigating digital technologies connection to servitization. ICT is important for servitization processes, since it can often be a key function enabling the process of transition from a product focus to service focus (Matthyssens & Vandenbempt 1998). Kowalkowski et al. (2013) presents that ICT creates better conditions for the execution of services at the same time as it also improves communication in service focused business strategies. Companies that are successful at selling services profitably can quickly innovate internal processes with new technology (Reinartz & Ulaga, 2008). For investments in ICT to have a positive effect on transformation into service business orientation a company needs to apply rational business actions, strategies, resources and support from management (Kowalkowski et al., 2013).

2.3 Providers Adoption of Service Focused Business Models

One aim of this study is to investigate how to transition into a servitized business and what factors influence this transition. In order to honor this aim, existing theories on how a company switches focus from product to service become necessary to investigate and compare to the primary research of this study.

2.3.1 Business Model Change

The business model can be defined as "the design or architecture of the value creation, delivery, and capture mechanisms" (Teece, 2010, p. 191) and is commonly conceptualized using Osterwalder, Pigneur and Clark's (2010) visual Business Model Canvas in both academic and semi-academic literature as well as among practitioners. Within the scholarly servitization community, there is consensus that an amplification of a (manufacturing) firm's service focus requires a reconfiguration of its business model (e.g., Oliva & Kallenberg, 2003; Reinartz & Ulaga, 2008; Kindström & Kowalkowski, 2014; Kohtamäki et al., 2019). The importance of this proposition has also been stressed when the concept of digital servitization is regarded. As the introduction of product-service-software systems reinforces the connectivity between physical IoT hardware and various actors (such as suppliers, the firm, operators and customers), this creates systemic dependencies which must be considered (Frank, Mendes, Ayala, & Ghezzi, 2019; Kohtamäki et al., 2019). Hence, there is a need to holistically reconfigure the business model to ensure alignment of these dependencies and allow optimal outcomes in customer value. Furthermore, although extant literature stresses the significance of business model change or business model innovation, scholars such as Forkmann et al. (2017) and Kohtamäki et al. (2019) also recognize that there are equifinal business model configurations leading to optimal outcomes and servitization success.

This proposition somewhat contrasts literature of more prescriptive nature such as Oliva and Kallenberg (2003) and Reinartz and Ulaga (2008) which seek to detail managerial directions based on "best practice" process and resource configuration for successful servitization. Additionally, this rather early theorizing has also been criticized for being biased towards the transitioning firm, and not taking sufficient account of customers compared to the more dyadic perspectives with a business model innovation stance on servitization (Forkmann et al., 2017). According to Forkmann et al. (2017) the business model perspective is of relevance in the servitization area as it adds to a firmer understanding of the diverse set of contingency factors which drives successful service infusion. In their research, they point toward relational success, indicating that the success of service infusion is a function of value created for both supplier and customer.

A limitation of Forkmann et al.'s (2017) study, which themselves reflect on, is that they limit their research to the dyadic supplier-customer relationship, although the business model conceptualization takes a more holistic approach of a firm's value creation and capturing mechanisms. Hence encompassing areas external to this relationship. This view is also held by Baines et al. (2017) as they review the use of the business model terminology in the servitization literature, finding its earlier vague but ever so increasing crossover – parallel with the amalgamation of ICT – into the scholarly realm of servitization. Baines et al. (2017) therefore call for a more inclusive perspective of the business model concept, whilst asserting that business model and technology debates strengthen adoption of servitization if the structural and human implications are not neglected. As previously mentioned, such comprehensive takes on ICT, the business model concepts and (digital) servitization has been performed in more contemporary literature. This literature stresses exploration of ecosystems and dependencies within them in relation to the business model terminology (e.g., Frank et al., 2019; Kohtamäki et al., 2019; Gebauer, Arzt, Kohtamäki, Lamprecht, Parida, Witell, & Wortmann, 2020; Tronvoll, Sklyar, Sörhammar, & Kowalkowski, 2020; Hsuan, Jovanovic & Clemente, 2021).

Although contemporary literature suggests the importance of realizing a firm's unique situation and assert that equifinal business model configurations exist, it provides some general guidance for how servitizing firms can configure and change their business model. The importance of a business ecosystem perspective and the need for a business model portfolio that transcends company barriers is developed by Gebauer et al. (2020). This is further elaborated by Chen, Visnjic, Parida and Zhang (2021) which states that the success of offering smart solution value propositions for a manufacturing firm depends largely on having a well-functioning value delivery ecosystem composed of suppliers, distributors, partners, and customers. Hsuan et al.'s (2021) proposition that the adoption of product-service-software systems depends on the maturity of the industry-specific digital ecosystem adds to this. The authors also advise firms to apply business model modularity, as it facilitates strategic flexibility and business model innovation regarding digital servitization (Hsuan et al., 2021). More processual perspectives stress the importance of fostering an agile mindset among employees, as digital services are conditional on the life cycles of software development and digital infrastructure (Tronvoll et al., 2020). Such a mindset can facilitate the handling of continuous and discontinuous interplay between digital technologies and different business model elements during a servitization process (Chen et al., 2021).

These processual perspectives on business model change can be compared to seminal empirical studies. For example, Oliva and Kallenberg (2003) present a staged approach for transitioning from product-focused to service-focused offerings. They emphasize the need for organizational changes, process reevaluation, and a shift in business models from transaction-based to relationship-based models. The stages include organizing existing services, exploring profit opportunities, expanding service offerings, and ultimately becoming a fully service-focused company. This approach requires gradual implementation, cultural attitude changes, and the establishment of dedicated service units. It also involves offering flexible solutions, outsourcing maintenance, and emphasizing the value proposition for end users. A gradual implementation and flexible offerings are also suggested by Reinartz and Ulaga (2008), in addition to recommendations to monitor service-associated costs to ensure profitability. Empirical studies have also suggested that six distinct technologies and practices are imperative for successful servitization: localization of facilities and service, micro-vertical integration and supplier relationships, information and communication technologies (ICTs), measurement of performance and demonstration of value, deployment of skilled personnel, as well as the management of business processes and customer relationships (Baines & Lightfoot, 2014). Findings as Baines and Lightfoot's can provide as examples of alterations which servitizing firms may incorporate, they also show close resemblance with the business model perspective, this is further elaborated in the following section.

2.3.2 Business Model Canvas

In order to present the proposed changes to service providers business model which is associated with RQ2 the business model canvas will be used as a tool to structure and visualize these changes. The reason for applying a business model framework is that it can be an organized way of explaining a business model as it includes internal and external components for evolving as well as managing a business model (Al-Debei & Avison 2010; Wirtz, Pistoia, Ullrich & Göttel, 2016; Adrodegari, Saccani, Kowalkowski & Vilo, 2017). According to Kallenberg and Kowalkowski (2014) using business model conceptualizations also helps in the identification of the current situation and target position, and can provide a clear picture of necessary changes, including which major changes need to take place, in which elements, and in what sequence, facilitating service infusion initiatives and strengthening service innovation capabilities. This was also suggested by Barquet, De Oliveira, Amigo, Cunha and Rozenfeld (2013), which empirically tested and showed that the framework can assist companies to identify opportunities and main barriers and challenges for PSS adoption.

In the book *Business model generation – a handbook for visionaries, game changers, and challengers* researchers Osterwalder et al. (2010) explain how the business model came to be, what it entails and how it can be used. Osterwalder et al. state that a business model refers to how an organization creates value internally, externally for their customer and how this value is captured. Moreover, it is presented that the business model canvas contains nine different blocks that together represent what is needed for a business model. The nine blocks include value proposition, key partners, key resources, key activities, cost structure, revenue streams, customer relationships, customer segments and channels. *Value proposition* is a fundamental part as it explains what problem the organization is solving and the motivations behind these. *Key partners* refer to the organization's partnerships where some actions remain internal and

some may be outsourced. *Key activities* include the main activities needed to reach the value proposition. The block called *key resources* concerns what resources are needed to perform the key activities. Furthermore, *cost structure* refers to the cost associated with operating the business and *revenue streams* is how the value proposition is transformed into financial profit. *Customer relationships* concern the relationship a provider has with each customer and how one should keep them as customers. Lastly, *customer segments* are related to which type of customer the company should focus on and channels refer to how the service provider will reach their customers.

Product-service system business model canvas is visible in previous literature but often put focus on certain aspects even though the main elements of the original business model canvas is included (Adrodegari et al., 2017). Given that this study focuses on the user perspective primarily whilst incorporating an inclusive provider-customer contextual ecosystem view, this creates incentives to focus on the blocks that concern external processes rather than internal to the providing firm. Therefore, more attention will be given to the following blocks: value proposition, key partners, key resources, key activities, customer relationships and channels.

3.
Methodology

This chapter includes the applied methodology of this research. It explains the chosen research approach, research strategy, sampling technique, how data was collected and analyzed. Furthermore, the chapter addresses how quality of this research was ensured, discussed with the purpose of being transparent and contributing to validity and reliability.

3.1 Research Approach

The philosophical assumptions of this study is of essence to understand as it is the basis from which our findings emerge. The philosophical term ontology refers to how one views or interprets reality (Bell, Bryman & Harley, 2019). This research aligns with the ontological position constructionism as we acknowledge that the humans and the interviewees in this study are subjective and continuously affected by their environment (Bell et al., 2019). In line with this position, it is of interest to capture subjectiveness as this might bring forth valuable insights to this research. Furthermore, this research has its stance in epistemological term interpretivism which is based on the assumption that reality is subjective, multiple and socially constructed (Lind, 2020). Human beings are complex, and we must constantly talk to people in order to understand their interpretation of a situation. Therefore, to understand humans and the interviewee's actions it becomes appropriate to apply an interpretive perspective.

Given that the research questions aim to investigate how the case company and similar companies can adapt a service focus and what factors influence user adoption this research has an explorative outlook. Thus, a deductive approach is not suitable as it aims to prove existing theories. Although one of the researchers has a background in agriculture, the subsector of cattle farming and the products that Luda.Farm sells is an area that was underexplored by the authors before the start of this research. Because of this an inductive approach is not ideal either since the authors needed to examine theories before the data collection in order to gather general understanding of the industry and the topic. Both the inductive and the deductive approaches have limitations which cause a need to apply a mix of the two approaches (Van Hoek, Aronsson, Kovacs & Spens, 2005). Consequently, because of the limitations of inductive and deductive approaches and that this research does not start completely from theory nor from empirics, an abductive research approach is applied. This is because an alternative approach is then needed (Bell et al., 2019). Although, the research shares more similarities with the inductive approach compared to a deductive approach since there is no already existing hypothesis that is aimed to be disproved or approved (Patel & Davidson, 2017).

Figure 1 presents each step of the used research process for this study. Theory and empirics exist parallel to each other throughout the research process which signals that an abductive research approach is applied (Lind, 2020).

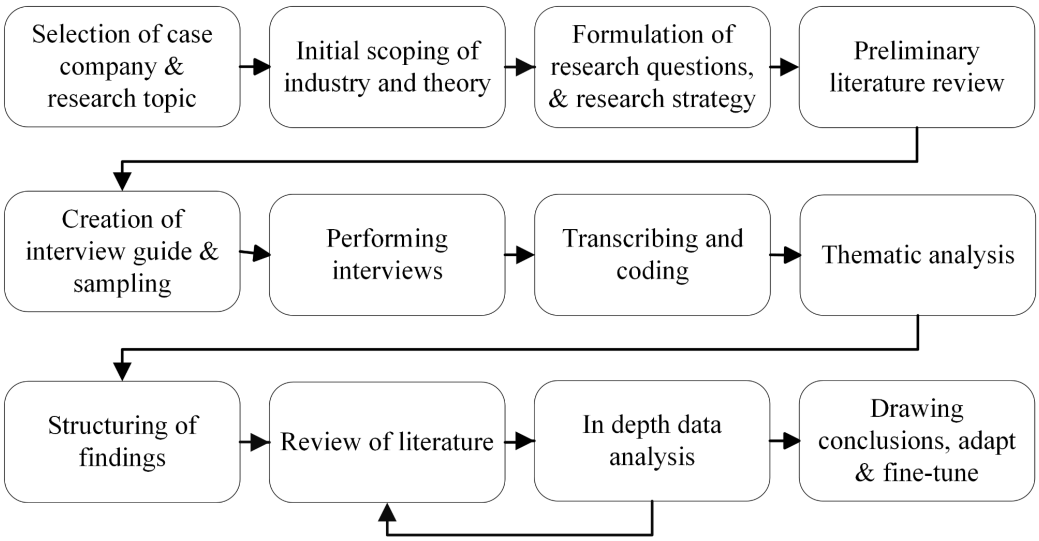

Figure 1. The applied research process.

3.2 Research Strategy

The research approach and its relationship between empirics and theories has an impact on the research strategy. A qualitative method is often connected with an inductive research approach and a quantitative method is usually associated with a deductive approach (Bell et al., 2019). Because of the decision to apply abductive approach, the answer to which research strategy to apply is not as clear compared to if this research were to have been inductive or deductive. Qualitative research is often expressed verbally and offers descriptions with multiple layers (Lind, 2020). This research aims to investigate a service focused business model based on a certain case and the context in which the company Luda.Farm operates in. Meaning that this research is not aiming to find a generalized result unlike the aim of a quantitative investigation (Bell et al., 2019). Consequently, to grasp how Luda.Fram can change the business model and what factors influence user adoption it becomes important to understand the motivation that influences change which will require deep analysis. Conducting deep analysis requires access to rich data that relies on words and explanation rather than numbers. Hence qualitative interviews were applied as this in turn generated opportunities for deeper data analysis.

Nonetheless, one cannot deny that the qualitative method has disadvantages as well that are important to be aware of. A possible disadvantage is that people to some extent have biases which can cause interviewees to give biased and subjective answers. In turn this can influence the validity of this research as the interviewees' answers may not be generalizable (Bell et al., 2019). Moreover, the researchers also have biases based on previous experiences which could influence our interpretation of the data. One of the researchers has long connections to the farmer profession, however, not to the product industry that the case company operates in. Although some biases might be unavoidable, both researchers are aware of them, and a critical thinking approach was applied throughout the entirety of this qualitative investigation.

3.3 Research Design

This study applies a case study research design and focus on one company, Luda.Farm, and its potential customers in Sweden. Case studies are an appropriate choice while studying a change or a process (Davidson & Patel, 2017). Consequently, given the fact that this study aims to

investigate a possible change in a company's business model this aligns with the characteristics of a case study. Moreover, this research aims to understand how the user views and ideas can be put in the context of a service provider. Therefore, applying case study becomes appropriate since it connects the case of the company to the perspective of the users. There are both pros and cons with a case study. For example, a case study allows an in-depth study of a group of people, situation or organization which in turn creates deep understanding of this case. However, this raises the possible issue that the data becomes too specific and non-generalizable (Goffin, Åhlström, Bianchi, & Richtnér, 2019). According to Goffin et al. (2019) many case studies fail to present how they address validity and reliability issues. The authors of this study recognize the importance of validity and reliability of research; thus, these issues are addressed later in the methodology chapter.

3.4 Data Collection

The data collected in this research stems from both primary and secondary data. The method for primary data collection was chosen based on its alignment with this study's research strategy and approach. Given the interpretive focus of this research and that qualitative research is often expressed verbally with in-depth descriptions (Lind, 2020) the primary data was gathered by conducting semi structured interviews with livestock farmers. Considering that this research applies an abductive approach, the primary data have been complemented with secondary data from theories, industry data and user data from Luda.Farm's application. The secondary data offered a deeper understanding of the topic of this research while providing a different perspective on the chosen area of research.

3.4.1 Primary Data Collection

Given the qualitative and interpretive stance of this research it becomes important to learn the underlying reasons for the interviewees' answers and give them the opportunity to elaborate on their statements. In order to fully understand farmers as users of technology, there is a need for rich and descriptive verbal data which is the reason why interviews are an appropriate method to apply for this case study.

The primary data was collected through semi structured interviews. Semi structured interviews offer both flexibility and structure to the interview. The structure in a semi structured interview comes from the prepared interview guide and its themes compared to an unstructured interview where the interviewees discuss freely about a topic (Bell et al., 2019). Moreover, semi structured interviews are also flexible since it is possible to ask follow-up questions since the interview guide does not have to be strictly followed (Bell et al., 2019). Because this research includes many interviews, and that it is beholden to a time frame, some structure to interviews is necessary to ensure that the interviewees discuss the topic of interest. Additionally, the flexibility that comes with semi structured interviews provide time for the interviewees to reflect and therefore answer the questions in a different order if necessary or preferable based on the situation.

3.4.1.1 Sample Selection

This research has implemented both a purposive sampling and a convenience sample. Purposive sampling is when the interviewees are chosen subjectively by the researchers because of their knowledge in a specific area (Bell et al., 2019). This type of sampling has contributed to the

accuracy of the collected data. Accuracy is a term that is discussed with regards to qualitative research and implies that the collected data accurately represents the studied topic (Lind, 2020). Accordingly, collecting interview material from a person with a lot of expertise in the chosen area of research increases the chances of correctly capturing and portraying the topic of this research. Furthermore, given the qualitative nature of this research and the applied case study this limits the area that is investigated, which motivates a need for well-grounded and coherent data content (Lind, 2020). The interview sample is limited to Swedish farm owners or farmers with operative management positions on a farm. This is to ensure that the interviews have an overview of the operations of the farm and are in positions to influence implementation of digital technologies at the farm. Additionally, this study shares characteristics of a convenience sample as the authors gained contact with interviewees through the case company Luda.Farm.

Moreover, the authors have some previous contacts in this industry that were utilized to gain contact with interviewees. Therefore, implementing a convenience sample eased the process of finding interviewees. Furthermore, there are similarities with a snowballing sample since we received contact information to new farmers from previously interviewed farmers. However, it was made sure that these farmers still were enlightened with the previously mentioned limitation. This to ensure that they had the necessary knowledge to participate in the interview.

The topic of triangulation can be addressed while choosing and exploring different sampling methods. One can contribute to triangulation by collecting interview material for multiple sources, hence by interviewing different people (Davidson & Patel, 2017). The sample therefore includes farmers from different cattle farms, varying in size from small to large. The sample also includes reference farmers that were known beforehand to use products from the case company. This ensures that our interview data includes multiple perspectives which leaves room for a more in-depth analysis.

Table 1 presents the sample of the semi structured interviews, where the farms are located and for the sake of transparency the length of the interviews. The sample is divided into three groups: reference farms, small to medium sized farms and large sized farms. The size on the farm is presented based on how many cows they have, small to medium sized farms have less than 200 cows and the larger farms have more than 200 cows. Some farms are not solely focused on cattle and for example also grow crops. However, the reason for categorizing the sample after the number of cows is that the IoT products that the empirical case company offers predominantly are used in relation to cattle. In addition, this satisfies the research gap pertaining to digitalization in agriculture. The reference farmers were known before the interview to be customers and farmers that use the products form the empirical case company. The reason for interviewing reference farmers was to understand their views and why they choose to collaborate and use products from the empirical case company.

Table 1
List of interviewed farmers and farm managers.

Farm size (approx. no. cows)	Name and role	Farm location	Date	Duration
Large sized farms				
450	Johannes Andersson, manager	Knislinge	2023-03-16	50 min
300	Per Brunberg, owner	Johannishus	2023-03-13	75 min
280	Anton Nilsson, owner	Tvååker	2023-03-20	30 min
270	Stefan & Karin* Warefelt, owners	Varberg	2023-03-24	50 min
240	Helene Gunnarsson, owner	Tvååker	2023-04-03	25 min
Small-medium sized farms				
185	Dan-Otto Andersson, owner	Forsheda	2023-03-24	60 min
160	Olof & Eva* Larsson, owners	Getinge	2023-04-04	35 min
125	Emma Vidarsson, prospective owner	Lundsbrunn	2023-03-17	50 min
120	Christer Ljungqvist, owner	Bor	2023-03-21	30 min
Luda.farm reference farms				
60	Hans Johansson, owner	Jörlanda	2023-03-09	35 min
xx	David Ivarsson, owner	Västerlanda	2023-03-23	25 min

*Occasional involvement during interview.

3.4.1.2 Interview Process

The interviews were performed in Swedish with the aid of an interview guide that was specifically designed to capture the interviewees' thoughts about the chosen area of research (see Appendix). The interview guide includes themes and questions that are relatable to these themes. However, given the interviews are semi structured the interview guide is flexible and can be somewhat adapted to the interviewees' preference (Bell et al., 2019). A pilot interview was conducted with a farmer in order to test out the question and adjust unclarities, with the aim that our interview guide would generate viable findings. The interviewees are informed of the aim and research topic while being contacted with an interview request. This is to ensure that the interviews are prepared and completely aware of what they are participating in. The conversations during the interviews aimed to be lighthearted to make the interviewees comfortable and began with some general open-ended questions to influence a discussion. The interviews were held at a Teams or Zoom as the interviewed farmers are sometimes located far from each other. Not being limited to farmers close to Gothenburg made it possible to contact farmers of different origin, size and experience thus creating a sample that is more inclusive. Although, it is recognized that only performing interviews digitally causes some limitations which is addressed in the limitations section. At the introduction of the interview the interviewees were asked if they consent to being audio recorded, with the explanation that this will ease the data processing. The rationale behind recording the is that this gives more room for the interviewer to be fully present, not having to take detailed notes. In addition, recording the interviews eased the process of coding and analysis as the recordings allowed interviews to be transcribed verbatim, hence reducing the potential loss of data that might occur in case of notetaking.

According to Lind (2020) authenticity can be related to qualitative research which refers to if the data can be considered genuine and if it is communicated in a truthful way. Consequently, all interviews were transcribed to avoid misinterpretation of the data and to ensure that the data is communicated in line with how the interviewees presented it. The interviews were transcribed in close connection to the end of an interview to assure that the interviewers did not disregard any material. The interviews were transcribed through Teams given the short timeframe of this research and the number of interviews that the research entails. Thus, a transcription software program generated efficiency. This in turn left more room to analyze and present the data which is the true core of this research. However, transcription software is not perfect since it can misinterpret for example different dialects. To avoid misinterpretation, the transcribed data was controlled manually by the authors with the help of the audio recording directly after the interview has been transcribed. In order to be respectful of the interviewees schedule the interviews were conducted around 30 minutes to 1 hour. Furthermore, having too much interview data can make the data analysis and coding a strenuous endeavor.

3.4.2 Secondary Data Collection

This research implements an abductive approach and because of this it has been inclusive of secondary data as a complement to the primary data. The secondary data relates to the primary data collection in order to triangulate the data collection (Bell et al., 2019).

The first type of secondary data is presented in the empirical findings and concerns information about the user habits of the application that the empirical case company has. This secondary data collection includes data such as: payment methods used, registered users per product, last log in and when their account was created. This data is aimed to generate an understanding of the usage of services in an application and not just the product itself. Moreover, the interviewed farmers brought forth multiple digital technologies that they implement at their farm. Therefore, table 2 in the empirical findings chapter was created to illustrate the current usage of digital technologies and servitization amongst cattle farmers in Sweden. Table 2 is also aimed to explain what and how digital technologies are used to avoid misinterpretation later in the analysis chapter.

Before the primary data collection, a literature screening was carried out to take a more narrative form. Aligning with Bell et al.'s (2019) description of a narrative literature review, the objective of this screening has been to gain an initial understanding of the research topic. In addition, this screening has not been focused on specific keywords but has instead allowed for a more explorative approach in finding important and critical aspects of the current knowledge of the topic, including the screening of articles for further references of relevance in relation to the research topic. For this tentative literature screening, electronic databases such as Google Scholar and Supersök by the Gothenburg university library have been used. This included scoping of the industry and from various sources to inform the researchers about its current status and characteristics. This aims to ensure internal and external relevancy of the research. Internal in the sense of getting to know the interviewees and their language to have efficient interviews, and external to ensure relevancy for the industry. This screening also, as a side-effect, lets the researchers identify seminal papers and influential scholars in the area, based on citations and author recurrence in case of more recent publications.

Furthermore, secondary data from previous research was also used in this report to create a greater understanding of the areas of research. The previous research was compiled into a theoretical framework with the aim to examine current research that has an impact on what is investigated in this study. The theories are connected to the following areas: defining servitization, user adoption of product-service systems and technology providers adoption of service focused business models The theoretical framework is built on articles that could be found on Google Scholar and in Supersök by the Gothenburg university library. Some of the generated and used keywords are: servitization, product adoption theory, product-service systems, expectation of a service, transition from product to services, digital servitization and business model change. Some criteria were applied while determining if a theory was relevant to adopt in this study. First, all the theoretical articles based on previous research have been peer reviewed to ensure quality of the paper. Second, it was a continuous choice to apply theories that are current in time to make sure what is stated in the theoretical framework is not outdated. Therefore, most of the theories were published after 2005. However, in order to fully understand the development of servitization some preceding seminal articles were applied as well, generating a more holistic and in-depth theoretical framework.

3.5 Data Analysis

Given the abductive approach of this study, theoretical and empirical findings were analyzed iteratively during and after data collection. In accordance with the interpretative and inductive characteristics that are visible in the abductive approach of this research, the analysis of data has been performed inductively as the aim of the analysis is to build theory rather than testing the theory acquired in the literature review. Thereby, a thematic analysis was conducted in this research. Goffin et al. (2019) provides suggestions on how a firm analysis of gathered data can be conducted. They describe three important areas of the analysis that should be considered: Inter-coder agreement, case presentation and case interpretation.

In alignment with Goffin et al. (2019) the interview material has been coded by each of two researchers independently, as this allows for determining inter-coder agreement and becomes a form of triangulation. Coding was done in a systematic way to ensure agreement and Nvivo was used to ensure organization and structure of rich and thick interview data. Doing this has ensured adequate analysis of the data, facilitated the presentation of data, and exemplified how the thematic analysis has been conducted. This further contributes to a greater transparency in how the analysis has been conducted as the linking between the data and developed constructs can be presented in a clear way. Considering the abductive approach of this research, the codes are condensed into different themes based on repetitions; indigenous typologies or categories; metaphors and analogies; etc. (Bryman et al., 2019, p. 519), emerging from an iterative process of tracking back and forth between empirical data and theory. Emerging themes have thus been related to extant literature and selected in relation to the research area. This aligns with Goffin et al.'s (2019) recommendations for case interpretation:

> *"Theorizing needs to go further and requires activities such as abstracting, generalizing, relating, selecting, explaining, synthesizing, and idealizing. In the iterative process of theorizing, it is important to look for relationships between*

> *variables, finding intervening variables, and building a logical chain of evidence."* (p. 597).

Goffin et al. (2019) also note that theorizing should lead to concrete results in the form of development of models or conceptual frameworks, or alternatively propositions to be tested in further research. This does also reflect the overall agenda of this study, as the aim of it is to generate understanding of user adoption of servitization in the agriculture sector and seek to answer how firms can deal with this. A conceptual framework is presented in the analysis chapter of this paper (see Figure 2). Detailing the process that has been applied during coding; this has to a great extent followed recommendations given in Bryman et al. (2019) inspired by grounded theory.

The material was transcribed and coded as soon as possible after interviews to attain better understanding of it. The process commenced with open reading of the transcripts and notetaking of important findings. In a second round of reading, coding was conducted. Iteratively, codes were reviewed in relation to transcripts and literature. During this process, the analysis moved from a close relation to transcripts and first-order codes, to the formulation of second-order themes which finally was combined in third-order aggregate dimensions. Figure 2 shows the data structure which evolved from this process.

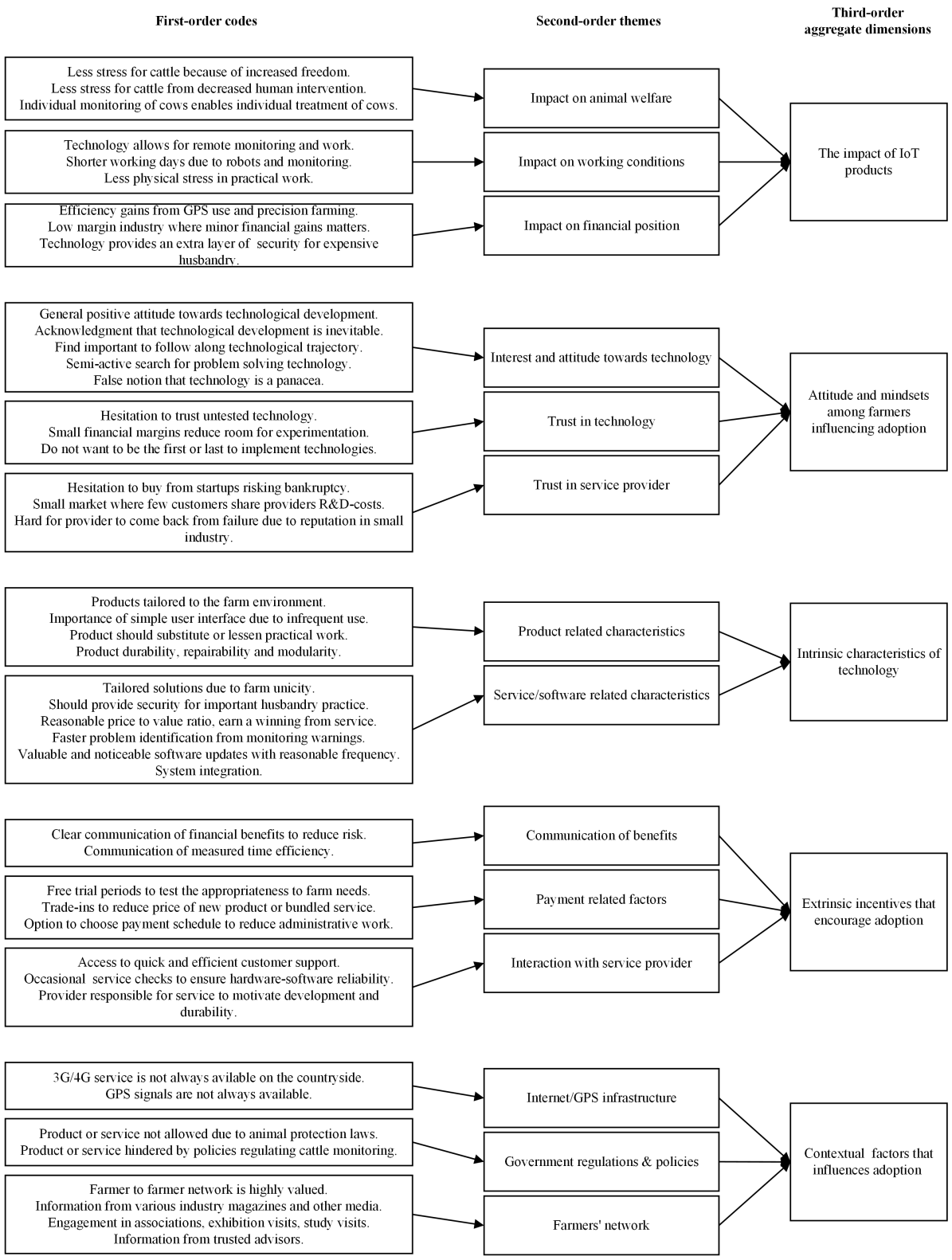

Figure 2. The data structure that emerged from analysis of interviews.

3.6 Limitations

This research's primary data is limited to the interviewed farmers and does not provide primary data from a company perspective. This is because of the time constraints given for conducting the study. All interviews were performed primarily via Teams (and Zoom in some cases)

because of proximity issues since the interviewees' residence varied from nearby to hours away. Meeting the interviewees in person and seeing their full body language would generate a clearer view of their perceptions while answering the interview questions. In addition, visiting the farm would have given a holistic view of the topic and a deeper understanding of how the digital technologies are used at a farm. Furthermore, some interviewees might be more comfortable speaking in person which can cause them to give hesitant answers. Moreover, by conducting the interviews via Teams the research became limited to farmers who had access to Teams and therefore used at least some technologies. Thereby we lost the perspective of farmers who do not apply any technology at all.

Being aware of the strengths and weaknesses in the study is arguably the first step of overcoming these possible weaknesses. Every single aspect of this research will not be applicable in all cases of the agriculture industry which is similar for most qualitative research since its aim is not to find a generalized quantifiable result (Bell et al., 2019). Since qualitative research is often expressed with multiple layered descriptions and because people have biases, subjectiveness is to some extent unavoidable (Lind, 2020).

3.7 Research Quality

The quality of this research is addressed in terms of dependability, credibility, transferability and confirmability. The first term for addressing the quality of qualitative research is *dependability* which refers to the degree one has described the phases of the research (Bell et al., 2019). Thus, in turn making it possible to repeat the study. This report includes reflections and explanations to the choices that were made within the entire research process. By explaining each choice, it is our goal that this study will communicate complete transparency and in turn earn trustworthiness. This is further strengthened with the provided model in the beginning of this chapter, which describes the research process. The description can be audited by others and by the researchers themselves to ensure transparency (Bell et al., 2019).

The second term is called *credibility* and refers to the presentation of the collected data and if it can be trusted to be rightfully presented (Bell et al., 2019). The data content and whether it seems probable is often considered in business research (Bell et al., 2019). Thereof, the interviews were transcribed in its entirety and were used as a complement to confirm that the data is rightfully presented. Quotes from interviewees are used throughout the empirical findings and analysis chapter to support the presented data. To further strengthen the credibility of this study both researchers have coded the transcribed data to ensure that what is presented in the empirical findings is true to what the interviewees have stated.

The third aspect with regards to qualitative research quality is *transferability* includes if the findings can be generalizable to another situation (Bell et al., 2019). This case study is focused on the user perspective and how cattle farmers can come to accept a service focused business model. The chosen sample consists of different farmers that vary in size which generates multiple perspectives on service focused business models. Additionally, to gain more perspectives, not all interviewees are customers from the empirical case company. Therefore, by including multiple viewpoints in the sample structure the representativeness of the entire sample can be strengthened (Bell et al., 2019). The sample could also be considered strategic since it includes a purposive sampling method. Purposive sampling helps ensure that the interviewees are knowledgeable in their fields and combined with the multiple perspectives

gained from different types of interviewees this makes the collected data and derived conclusions more generalizable. Moreover, transferability can also be improved by giving sufficient information about the data and the context of this report (Shenton, 2004). To honor complete transparency this report includes a detailed case description, where the data is collected and how.

The fourth aspect to address is called *confirmability* and refers to if the researcher has imprinted their own values in and interpretations into the report (Bell et al., 2019). As previously stated, the researchers are aware that biases are to some extent unavoidable. The aim of this research is to make a contribution that can be applied for other products in agriculture rather than just the products that are involved in this case. In order to achieve this, the findings need to accurately represent the interviewees' reasonings and not the reasonings of the authors. Therefore, the authors approached each interview with an open mindset and viewed the data as objectively as possible. The transcription of the interviews was used as a tool to examine if the data is presented based solely on what was stated by the interviewees. Moreover, being transparent in the methodology section with the limitations of our study and our own biases, the confirmability could be improved. Furthermore, to enhance this study's confirmability, the analysis and coding of the data was initially done individually. Later, the coding was compared and deviations were examined together in order to ensure an objective presentation of the data.

3.8 Ethical Viewpoints

There are four ethical rules to be considered in social humane sciences: the information requirement, requirement regarding consent, the confidentiality requirement and a requirement regarding utilization (Davidson & Patel, 2017). This research adheres to these ethical requirements to ensure the fair treatment of all participants. The information requirement refers to informing interviewees or other concerned actors about the purpose of the study which was done before each interview (Davidson & Patel, 2017). The requirement regarding consent indicates that participation in the study is voluntary (Davidson & Patel, 2017). To assure compliance with this requirement all interviewees were asked to participate in this study in a sufficient amount of time before the actual participation to ensure that they have time to decline or accept. Furthermore, if involved actors and interviewees changed their minds about participating this choice was accepted. The confidentiality recruitment expresses the need for all involved actors and interviewees to have a choice of confidentiality (Davidson & Patel, 2017). In order to align with this requirement no in-depth personal information is shared with any unnecessary parties. Lastly, the requirement regarding utilization refers to the promise that personal information about involved actors and interviewees was only used for the purpose of this research (Davidson & Patel, 2017). To honor that requirement all personal information was deleted as soon as possible after the research ended.

4.
Empirical Findings

This chapter presents the findings from 11 semi structured interviews with Swedish cattle farmers. The findings are presented and structured based on five larger themes visible during the data collection and analysis: Impact of servitized products, attitudes and mindset of the farmers, intrinsic characteristic of product-service offerings, extrinsic incentives that encourage adoption and contextual factors. Additionally, secondary empirical findings from the case company, as well as from other service providers within the sector is presented. For a comprehensive overview of the data structure, see Figure 2 in methodology chapter 3.5.

4.1 Impact of Digital Technology and Servitized Products

Farming and husbandry of cattle involves diverse work and business practices, where the organization of operations differ from farm to farm and between farmers. However, contemporary agricultural practices related to animal husbandry in Sweden commonly includes interaction with cattle in form of daily feeding, cleaning and milking and routine practices such as artificial insemination, overseeing of calving and medical operations. Other practical work does oftentimes include cultivation, harvesting and preparation of grass or row crop for forage and animal feed. Additionally, farmers are in many cases owners and managers of an enterprise, thereby performing administrative tasks such as bookkeeping, organizational planning and animal health journaling and reporting. For an overview and typology of the interviewed farmers' implemented technology, see table 2.

During the researchers' interviews with farmers, many interviewees did not only provide rich descriptions of the multifaceted nature of their work but also described how this has been influenced over the last 15 to 20 years by digital technologies. Agreement is also seen in how farmers view this influence to have been accelerated over the recent years, with some attributing the Covid-19 pandemic as a catalyst for rapid development. Consequently, the interaction with cattle that takes place on farms nowadays may not be in the form of human-animal interaction – in several instances it is in the form of interaction between cattle and robots (typically milking or feeding robots) or interlinkage of human and animal with intermediary technologies (such as estrus/heat control systems or camera monitoring). This tendency was stated by several farmers and among them Helene – a SMF owner who during the spring of 2023 conducted an installation of the latest generation of milking robots at her farm – remarked that "It will go from a lot of eyes to a lot of apps and technology instead".

The evolution and implementation of digital technology in the sector is perceived by the farmers to be ubiquitous. It does not only impact the core activities of animal husbandry, but equally affects related practices such as the aforementioned crop cultivation and job duties of more administrative character. The described impact of technology on farming practices that was reflected on by the interviewees can be categorized in three distinct areas. These concerns the working conditions of farmers and employees; the health and well-being of cattle – animal welfare; and miscellaneous effects which farmers associate to influence their financial position.

Table 2
Overview and typology of interviewed farmer's implemented technology and services.

Technology/service	Description – area of use / value creation	Common provision type / value capture	Provider(s)	Sample frequency
Milking robot, automatic milking system (AMS)	Stationary, automated sorting and milking without human intervention. Cleans udder, attaches milking cups, monitors milk flow/quality(/biomarkers). (Data collection/analysis for health and productivity purposes.) One robot serves approx. 60 cows.	Hardware transaction + subscription on herd management software, priced per cow + service agreement.	DeLaval, Lely	Prevalent
Feeding robot, automatic feeding system (AFM)	Mobile, dispenses feed based on feeding plan to feed table. Monitors feed levels, adjust rations. (Data collection/analysis of feeding patterns for health and productivity purposes.)	Hardware transaction (+ service agreement)	Gea, DeLaval, Lely	Prevalent
Farm or herd management software	Tools for crop planning, inventory management, financial tracking, labor management, breeding, health monitoring, feed management, etc. (Automated record-keeping and authority reporting integration, data analysis.)	Base subscription + additional cow/ha based fee.	DeLaval, Lely, Dataväxt, Växa, AgriCam	Prevalent
Kokontrollen®	Milk testing service of various biomarkers (fat, protein, cell count, urea) for health and productivity purposes. Additional fertility testing. Compiles and analyzes data from member farms for inter-herd comparison.	Membership subscription fee	Växa	Average/prevalent
GPS for tractor, implements and combine	Precise vehicle control. Planting, fertilizing, and harvesting. Reduce overlaps and missed areas. Precision row crop farming – variable rate based on ground mapping. (Data collection for mapping, yield monitoring.)	Hardware transaction + GPS service subscription based on accuracy, service agreement	DataVäxt (Trimble), John Deere, Case IH, misc.	Average
Connected camera	Surveillance (with motion detection), manual "extra layer" monitoring of i.e. robots, stables, calving.	Hardware transaction (+ connectivity subscription)	Luda.Farm, misc.	Average
Connected estrus/heat and health monitoring system	Activity and rumination monitoring using collar sensors, transponder and base unit. Evaluates the reproductive, health, nutrition, and wellbeing status of cattle.	Hardware transaction + software subscription	Växa, misc.	Average
Drone	Same principle as a connected camera, but mobile.	Hardware transaction	Misc.	Rare
NoFence™, virtual fencing	Solar-powered GPS collar with digital boundary. Tracks movement of cows and controls by audio cues, electric pulse if necessary. For managed grazing, conservation grazing, and agricultural fencing.	N/a for Sweden. Served countries: Hardware transaction + software subscription.	NoFence	Rare/average (aspiration)
Bacticam®	Micro laboratory for on-site udder health testing, using bacterial cultivation, hardware enabled photography, and AI analysis.	N/a	AgriCam	Rare (aspiration)
Camera with AI	Cameras with additional AI software for i.e. hull analysis, calving time detection.	N/a	N/a	Rare (pilot)

4.1.1 Impact on Animal Welfare

Although many of the interviewed farmers connect the use of digital technologies to the introduction of milking robots at the turn of the millennium, digitalization of Swedish cattle husbandry has a more far-reaching history, as one of the farmers informed about. Computational power was introduced in agriculture during the 1960s when Svensk Husdjursskötsel started to systematize information from affiliated control, insemination and breeding associations using central electronic data processing (Qviberg, 2007). According to the farmer, an owner of a larger farm, one of the objectives with this was to create a better understanding of conditions in stables and animal health.

> *"It is incredible, but that is where it all started and that is also what made Sweden a world leader in animal health."* – Per, LFO

Aligning with the intent of this early technology, several farmers described how contemporary technologies are supporting them in ensuring the health of their animals. Examples of this which were mentioned in several interviews was estrus/heat and activity monitoring – technology which allows continuous monitoring of individual animals with the help of connected sensors. When deviant behavior is registered the farmer or employees are notified directly through phone or web application, which allows them to take appropriate action.

> *"We receive the information faster than if we had gone and checked ourselves […] We might have discovered this cow, but maybe two days too late. If we can find her earlier, then we have time to do something about it. [The information] is available in an app and on the computer. The advantage is also that the app [and information notifications] can go to several [people] […]. It can go to our daughter or to an employee. Then more people get the same information early on [and] we get the same base for decision-making."* – Stefan, LFO.

These perspectives on the technology's impact on animal welfare relates to more somatic aspects of animal health – which can easily be analyzed and detected through testing, visual examination or a combination thereof. Frequently, these quantifiable aspects were linked directly to productivity by the farmers – a healthy cow produces more milk with better quality. One example of this link was given by a SMFO farmer when she reasoned about the value of buying AgriCam's (see table 2) udder health service, where the cost of the service was set in relation to the average number of sick animals over a period on the farm. Hence technology's impact on animals' measurable health will inevitably relate to aspects regarding the financial position of farmers as well. However, interviewees did also emphasize how technology can have a positive impact on more psychological aspects of cattle's health. With the help of milking and feeding robots, and various sensors and other monitoring equipment such as cameras, the animals can benefit from greater autonomy according to the farmers. This autonomy is regarded to improve the well-being of the animals as the technology allows them to act as they please, independent from human interruption and inconsistency caused by work schedules and employee rotation. Consequently, the cows live a better life and experience less stress with the help of technology, according to the interviewees. This perspective on animal

welfare was also mentioned in conjunction with arguments regarding the working conditions for humans in several cases as visible in the following quotes:

> *"The more automated it is, the better it is for both our work situation and for the animals' well-being. […] The less you disturb the animals, the better. The more they get to choose their habits, the better."* – Emma, SMFO

> *"[With this technology] we believe that we are providing a much better work environment for employees and simply a better working environment for the cows – that you do not have to push them together but allow them to live their own lives and milk themselves when they want."* – Helene, LFO

> *"Inside the stables it is remarkable how these systems allow us to make the cow feel better, as we practically give her the opportunity to take care of herself. […] It creates a completely different everyday life for both us and the cow. She experiences significantly less stress, and it is incredibly quiet in these stables, there is never anyone mooing and being anxious. Instead, they go and eat, they take a rest, they go to the brush, they drink water. […] Thanks to the technology the cow will be able to live its life in a different manner. A lot calmer and more comfortable."* – Per, LFO

Although less prominent compared to measurable health, the association between technology's positive impact on immeasurable well-being of animals and financial gains was also evident among the farmers. One of the interviewed owners of a larger farm stated that "It is incredibly expensive to have animals that are not doing well. It is important that everyone is well and that they then produce, and they will not do that if you do not look after them well". Additionally, much like the aforementioned statement regarding the value-cost reasoning on udder health service, the willingness to pay for animal health-improving services was mentioned by another small to medium size farm owner: "If it is something that on a daily basis ensures the health of the cows, I am more inclined to pay and make sure it is new stuff that works".

4.1.2 Impact on Working Conditions

Noticeable in the above quote from Helene when she reflected on the impact from technology, it is not only the impact on animal welfare that is regarded, but also the working conditions for employees. This was also expressed among farmers who had installed milking robots earlier. Accordingly, the evolution of digital technologies has had a positive impact on the work environment for the farm employees. Applying digital technologies have lessened and eased the workload for employees at farms, making them feel less tired by the end of the day. Overall, applying digital technologies has allowed farmers to reduce the number of employees, whilst making the work easier for those working at the farm.

> *"Digitalization leads to less practical work, and we can solve problems faster because we often know where the problems lie."* – Christer, SMFO

Another positive impact from the interviewees' applied technology is when it allows them to participate in remote work. According to the interviewees, utilization of monitoring technologies and warning systems helps them and their employees save time by reducing unnecessary trips to the farm or walks to the stable. One interviewed farm owner stated that since he does not reside on the farm, access to cameras and the option to control the technology from home is important for his daily life.

> *"Our goal is to be at the farm between six in the morning and five in the afternoon. The farm should be able to run on its own; we should be able to see a lot from home and only go in if necessary."* – Anton, LFO

The interviewees also mentioned how helpful cameras are whilst being abroad either on private or business trips. This is because they can monitor the animals and steer the robots from a distance. In turn the interviewees can balance the workload for their employees even when they are in a different location.

> *"When I am away, I can tell my employees that 'if you have something to do tonight, I can be the backup and call if necessary.'"* – Per, LFO

Although the farmers expressed a generally positive sentiment towards the technological development and use of digital technologies, some negative aspects were also pointed out in relation to working conditions. Two farmers mentioned that there might be difficulties in utilization and taking full advantage of technologies due to time constraints for learning or relearning in some cases. This as some practices on a farm are performed on an infrequent basis, or because of rotation of different self-employed contractors during peak seasons. Another negative aspect that was brought up during interviews is the stress that can be caused by being always connected. This can be exemplified by the account from one farmer: In order to avoid mistaking text message notifications from friends as alerts from the feed robot system, she had to modify the notification sound on her phone.

4.1.3 Impact on Financial Position

The fact that technology allows the farmers to notice problems faster is also brought forth by the interviewees as a financial gain since this improves their efficiency. The interviewees stated that the usage of certain technology makes them more efficient, where several reasoned about precision farming practices. By using GPS steering and by controlling implements from ground and yield mappings and sensors that constantly monitor field conditions, the farmers are allowed to be very precise during practices such as fertilization and weed control spraying. The technology makes it possible to use only what is necessary. One of the farmers mentioned how he expects the technological development to further amplify precision farming, leading to increased productivity and financial gains.

> *"Now people are looking to make entire farms run by drones. For example, one could precision treat weeds with the help of drones. This will be very beneficial since there will be no wheel tracks and you will only do it where there is a need for it."* – Per, LFO

Moreover, one interviewee pointed out that because of low financial margins in the industry, small changes with technology or in the work environment can make a large difference in the end. In addition, the interviewees said that having animals is expensive and therefore digital technology as an aid provides an extra layer of financial security. One farmer also reasoned about how this financial security is of importance for all three impact areas, showing how they interrelate.

According to the farmer, violations of animal welfare standards and other incidents could be caused by human stress or depression stemming from a strained financial situation. Such a situation may lead to a vicious cycle as the financial position of the farm is dependent on the health status of the animals. Correspondingly, the farmer also mentioned how digital and monitoring technologies can alleviate such stress and make the work bearable.

4.2 Attitudes and Mindsets Among Farmers Influencing Adoption

In the interviews the interviewees explained their attitudes and thoughts about new technology. The topics discussed in relation to this concerned their general interest and search for technology, trust in technology, trust in technology providers and if they have found new digital technologies that they are looking to implement.

4.2.1 Interest and Attitude Towards Technology

According to the interviewees, the agriculture sector has undergone a lot of digital changes in the last 10 or 20 years. Farmers also point out that digital technologies were introduced early in the industry and that the agriculture sector has been innovative for a long time. Moreover, it was pointed out that a lot has happened in recent years and there is a common belief amongst the interviewees that the industry will continue to evolve along the fast trajectory.

> *"One of the first things I tried was a sensor that was placed at the front of the tractor and this sensor was a heat camera, this was 20 or 25 years ago, and these have become a lot more evolved now."* – Per, LFO

The interviewees stated that they view technology as omnipresent, and the digital technologies have become a part of the mindset of the farmers. The quote below is an example of such a statement.

> *"We use technology daily and I cannot imagine being without it, it has become integrated." – Hans, RF*

Overall, the interviewed Swedish farmers have a positive attitude towards technological development. According to the interviewees, they found the digital evolution within their sector to be exciting and are eager to know where the industry will end up. Furthermore, farmers see a need to follow along with the development to remain relevant and effective.

> *"It is an exciting time ahead; a lot has happened and there is a lot to come. Digitalization is definitely a large part of this, and I believe that in order to remain efficient you need to follow along with the development."* – Emma, SMFO

However, it was pointed out by one farmer that he lacks interest in technology because according to him it takes a lot of time. In the quote below he explains his thoughts about technology connected to services and his disinterest in it.

> *"Maybe it is not an interest for me because I do not have time for it. However, for others or in other places for example in the city it can probably be sold."* – David, RF

There were somewhat varied statements from the interviewees concerning if they actively search for new technology to implement on their farm. Some farmers mentioned that they need to experience a need to actively start looking for new technology. However multiple interviewees mentioned that they often stumble upon new interesting technology.

> *"We use time reports to measure working hours and it makes you think about what task that takes the most time and how one can save even more time on that task. Because of this, it is always there in the back of your mind, and you look around, think, and ask others how they do it."* – Johannes, LFM

On the contrary, one farmer mentioned that he thought himself to be quite passive in the search for new technology because he lacked an interest in technology in general. Although the interviewed farmers searched for new technology, they expressed that they are sometimes hesitant to trust entirely new technology.

4.2.2 Trust in Technology

The overall belief from the interviewees is that digital technologies can help generate profits in the end. Although the interviewed farmers find the development to be helpful and interesting it has also been said that there is a delusion that technology always leads to a financial profit which is not always the case. One of interviewees also acknowledged that digital development is and will occur and that there is nothing he can do about that. In the quote below one farmer states his thoughts on how technology sometimes is viewed by farmers.

> *"I would like to see that technology proves me wrong because I have nothing against it, but sometimes it feels like there is a too large of a belief that computer technology quickly solves all problems."* – Dan-Otto, SMFO

The interviewed farmers also mentioned that even though they did not want to be the first to try out new technology they stressed the importance of not being the last to implement in order to not fall behind. In the quote below a farmer expresses how much he searches for new technology and thoughts and why he can be hesitant to try entirely new technology.

> *"On a scale of one to five I believe I am a four or a three. I actively search for new technology, but I realize that we operate in a low margin industry and there is only a certain amount of room to experiment with new technology."* – Dan-Otto, SMFO

The interviewees mentioned that they receive information about new technology or technology in general from farmers' media such as ATL, Lantmannen, Land, other union magazines and company advisors.

4.2.3 Trust in Service Providers

Adding to the trust in technology, the interviewees also mentioned that trust in the provider impacts their view of the service and if they want to adopt it. According to the farmers they sometimes prefer buying locally because then they can trust that they can receive help faster if necessary. The interviewees are reluctant to buy technology from startups since there is an uncertainty if they will remain in operation after a couple of years. One interviewee mentioned that it was difficult to determine which companies will make it in the end, for example. This was related to the size of the agricultural sector in Sweden, where several farmers stressed the fact that a small number of customers (farmers) must carry the research and development costs of technology providers. According to one farmer, the size of the industry could also be reflected in trust being weakened due to a bad reputation of a firm.

> *"Companies that introduce inferior products have an uphill climb in the next five years with rebuilding their reputation, which is a drawback with the industry being so small."* – Johannes, LFM

Additionally, multiple interviewees expressed that they buy some technology from well-established consumer product companies because they trust in those companies and the products. The interviews mentioned that they bought mostly from companies such as DataVäxt, Lely, DeLaval and Växa. Furthermore, some interviewees mentioned that they sometimes buy products that are intended for manufacturing and process industries to get a more generalizable product and have easy access to spare parts.

4.3 Intrinsic Characteristics of the Technology

The interviews brought forth some intrinsic characteristics of technology that farmers consider should be included as a feature in a product-service offering. They presented both product-related factors pertaining to tangible hardware, as well as factors that are more related to service or software combined with the product.

4.3.1 Product-Related Characteristics

When considering factors related to hardware, the importance of having *user-friendly* products was mentioned by multiple interviewees. This is because many products are used infrequently which can cause farmers to forget how to use the product in an efficient manner. One interviewee stated that having a user-friendly product-service offering is of such great importance that it can even be more important than the price in some cases.

Expanding on the topic of user friendliness, a common denominator in the interviews was expectations related to efficiency in using the product. Interviewees mentioned that the efficiency gained from technology should lead to less practical work in the end. In relation to this the interviewees stated that digital technology must generate more benefits compared to what it costs.

With regards to *product durability*, sustainable products that can last for a long time and withstand weather and other common conditions on a farm are essential. This is because it takes time to switch and repair products according to the farmers. The issue of sustainability was raised in connection with the *repairability* of products. One farmer highlighted that certain products are intentionally designed to prevent battery replacement, despite the potential for significantly extending the product's lifespan if this option were available. Consequently, the adoption of more modular products is perceived as a potential solution to address this particular challenge.

4.3.2 Service-Related Characteristics

Many interviewees highlighted the fact that each farm is unique, and every farm and farmer has a preferred way of working. In relation to this the farmers stated that there is a need for unique and *tailored solutions* since all farms are different and in turn have different preconditions and requirements, something which the following quotes highlight:

> *"There are as many solutions as there are farmers. There is not a dairy farmer who has a farm that looks the same as the next dairy farmer; everyone has different conditions and therefore different solutions. [...] This is how we take care of our cows, and it is not at all the same as how our neighbor takes care of their dairy cows, even though we are only one kilometer apart."* – Emma, SMFO

> *"It is not like a sheet metal hall where you manufacture something and are protected from the surroundings, instead each farm has unique solutions to varying degrees, making it difficult to mass-produce something that works everywhere."* – Johannes, LFM

The interviewees also discussed some characteristics regarding the service of the technology, which was related to efficiency gained from the service, fast problem identification, that the service should offer security, noticeable updates and system integration. In general, all the interviewees applied some type of IoT subscription service but how many applied subscriptions they had varied. A large farm had around a total of 20-25 subscriptions including cell phone plans, whilst some smaller farms only had 1-3 subscriptions in total.

Interviewees' inclination to subscribe on service packages varied. On the one hand most interviewees found their applied services to be useful and saw the included service package as a security since they are dependent on the hardware. By using a subscription service, they can feel more on the safe side if something malfunctions. However, some interviewees also mentioned the price in relation to the usefulness and gained efficiency of the service subscription was an important aspect. In relation to this, one interviewee stated that services need to be financially beneficial in the following quote:

> *"If the cost is low, it becomes more attractive, of course. If the cost is higher, it becomes less attractive. And then it depends on the type of product, what it offers, and what work it is supposed to perform for me."* – Stefan, LFO

On the other hand, a few interviewees stated that all-inclusive service offerings are not always better, and one needs to calculate if this is the case. Furthermore, one interviewee did not have a personal interest in technology and therefore mentioned that he was not personally interested in subscriptions but believed that others are. However, multiple interviewees mentioned that services added to products allows for faster problem identification**,** which was one reason as to why they choose to adopt such service. This is because the services connected to products include features that make it easier for the farmer to monitor the farm, something many consider important.

4.3.3 Software-Related Characteristics

Multiple interviewees expressed their preference for subscriptions on software, in some cases related to a product. The reason for this is that the farmers feel it ensured they received timely *updates*, thereby enabling them to maintain up to date with the technology. Consequently, it is crucial for farmers to perceive tangible benefits from the updates they pay for within their subscriptions. Additionally, updates should be provided within reasonable timeframes, balancing frequency and necessity.

Multiple interviewees highlighted the issue of inadequate *system integration* when it comes to various subscriptions and product-service offerings. They observed that different applications or brands often fail to collaborate efficiently. For instance, one interviewee noted the challenge of integrating the farm's two tractor brands, each equipped with distinct sensors and GPS systems, resulting in an inability to establish seamless connections between the two systems. Another interviewee mentioned that although she had explored a farm management program that aimed to bridge different systems, she deemed it excessively expensive.

The interviewees conveyed a strong desire for the establishment of a common data standard within the industry. They emphasized the need for companies to enhance their capability to send and accept data between systems. This sentiment is reflected in the following quotes, where an interviewee expresses the necessity for improved data interoperability whilst also highlighting the centrality and dominating role of some industry players:

> *"There has to be a standard that everybody works against in order to make it possible to move the data."* – Emma, SMFO

> *"We have robots from Lely and have all the information there about our cows, I would say that it is our foundational database. Therefore, companies that want to make a new app for example about calf health must be able to send information to Lely in order to ensure that I know that everything can be found in my database."* – Emma, SMFO

The interviewees emphasized the challenges associated with transferring data between various applications and software. Farmers particularly highlighted the need to manually transfer and organize data, which they found to be an arduous task. This additional workload has led to their reluctance in adopting numerous different applications. The following quote from one farmer shed light on their sentiment towards inadequate system integration:

> *"I do not want an app for the cows, one for the vehicles, one for lights in the ceiling, one for activity responders and one for the fence. The applications need to cooperate with each other in some way."* – Dan-Otto, SMFO

4.4 Extrinsic Incentives that Encourage Adoption

In relation to the usage of subscription services the interviewees brought forth different extrinsic incentives that encourage adoption of a new subscription service to their farm.

4.4.1 Communication of Benefits

According to the interviewees an important incentive to start using a subscription service was if the user knows that it generates a financial benefit and saves time. This is because then the farmers can avoid a certain amount of risk while trying if a new service actually works for them. With regards to this the interviewees stated that it is hard to measure how much more efficient or how much money a farm makes by applying a subscription service. Therefore, knowing beforehand how much financial benefits and how much time the service saves is important. In the following quote a farmer expresses the difficulties and thoughts that are connected to trying to understand if a product-service offering will be beneficial.

> *"Ok what am I really buying, does it work on my farm, is it going to generate something for me or is it going to be a forced cost that will only generate costs and not work for me."* – Emma, SMFO

4.4.2 Payment-Related Factors

The interviewees discussed multiple payment-related factors that would encourage them to try a new product-service package. The discussed factors concerned: free trial periods, trade-in options and the option to choose a preferred payment schedule.

A topic that was addressed widely by the interviewees was the implementation of trial periods and how that is a helpful way to test out new product-service packages. According to interviewees if a company offers a free trial period this would cause an incentive to try out a new service. One interviewee stated that sometimes products and services are manufactured in a reality that does not always work as well at an actual farm. Therefore, it was important for the farmer to try out the product in real life to see if it efficiently solves the needs on his farm. Moreover, one interviewee brought forth the perspective that trial periods are especially important for more expensive product-service offerings since these often require large investments. In addition, one interviewee put emphasis on the fact that the time frame for the trial period needs to properly match the service package to ensure that one has enough time to see the result. In the quote below one interviewee talks about his views regarding the times it takes to start liking a product.

> *"If it is a good product, you feel that you cannot be without it. It becomes a habit fast and then you do not want to be without it."* – Christer, SMFO

The topic of trade-ins was also discussed. The interviewees stated that sometimes they trade-in their old product and get a cheaper price on the service as a result of the trade-in. Furthermore, they also sometimes choose an older secondhand product in exchange for a cheaper price on

the product-service package. This was a good option according to the interviewees if one wanted to test out a new product-service package and not start out with the most expensive choice. In relation to this the interviewees stated that they buy secondhand products but sometimes expressed hesitancy with secondhand digital technologies. However, if the farmers are assured that the product works as well as a new one, they could buy secondhand digital technologies as well. Moreover, some farmers said that sometimes having the flexibility to choose a payment schedule was helpful for them. They expressed that for cheaper services it was preferred to pay yearly to avoid administrative bookkeeping work each month. However, for more expensive services some valued the option to split their payment on a monthly basis.

4.4.3 Interaction with Service Provider

Moreover, different interactions with service providers were mentioned to create an incentive that encourages adoption of a service. According to interviewees such interactions included: quick access to customer support/service; occasional manual service checks; and that the service provider is responsible for all service and continuous development of product. The interviewees stated that customer service is of essence since it ensures that one can easily get help if a product should fail. The interviewees also stressed the importance of having easy access to customer service almost all hours of the day but at the same time access to quick manual service if needed. Multiple interviews mentioned how they are satisfied with the service TeamViewer as this allows them to get efficient customer services from a distance. In relation to this, multiple interviewees mentioned that having nearby access to spare parts is also important. Moreover, it was mentioned by the interviewees that the option is to have frequent software updates of the product combined with yearly manual checks to ensure that the hardware works as it should. In the following quote one interviewee expressed troubles that he faced with customer service:

> *"We are having trouble with our feed facility and have problems getting in contact with the company which is very troubling for our farm."* – Anton, LFO

Furthermore, a few farmers discussed service package offerings that are included from service providers. They stated that all-inclusive service offerings do not always include all aspects and some service instead needed to be performed by the farmers. According to one farmer this does not incentivize companies to develop better products, and he prefers that the companies remain responsible for service to motivate them to improve their product even more. Although according to the interviewees, certain services are not optional and are included in all different service packages offered together with a product. The interviewed farmers proposed that a company should offer a combination of the different interactions that have been brought up in this section. One interviewee also wanted the opportunity to take part in the development of product-service systems feedback from a user perspective from the start rather than waiting for the product to be introduced to the market which is exemplified in the following quote:

> *"More collaboration, sometimes the firms develop unnecessary features."* – Stefan, LFO.

4.5 Contextual Factors That Moderates Service Adoption

The interviewees brought forth some contextual factors that had an impact on their applied product-service offering. These findings were contextual in a sense that depend on the farm's prerequisites to implement products that require internet connection, network, government policies and regulations.

4.5.1 Internet and Service Infrastructure

The interviewees stated that some service providers fail to take into consideration that farms have different preconditions to receive *good service/internet connection*. According to one interviewee, because of the farm's location and bad connection his GPS did not always know where it was. This led to inefficiencies with the crop management program which caused him a lot of extra work to go through the data and see if it was correct or not. Another interviewee also mentioned that having a good service connection is something that is often taken for granted by product and service providers, but this is not always the case. See quote below from an interviewee from a large Swedish farm:

> *"This area is quite densely populated compared to other parts of Sweden but there is still no service at all places, meaning that not all 4G or 3G products work, which can be quite constraining sometimes."* – Johannes, LFM

4.5.2 Government Regulations and Policies

A factor that also impacts the option to adopt a certain service is connected to the *government policies and regulations* that farmers need to follow. For example, multiple farmers expressed an interest in a new product called NoFence (see Table 2), however due to Swedish regulation this product-service package cannot be used yet. Furthermore, one farmer presented that he had an interest in the fence alarm that the case company sells. Although even if he installs the fence alarm and uses its connected services, he is still obligated by law to monitor his cattle daily. According to him, since he still must go out to the enclosed pasture he can just as well monitor and turn off the fence manually.

4.5.3 Farmers' Network and Advisors

In relation to contextual focus that influences user adoption of a service the topic of a farmer's *network* was brought forth. The interviewees mentioned that they discuss and encounter new technology at union meetings, exhibitions and from company advisors. Furthermore, different exhibitions were also mentioned to be important. However, according to all the interviewees a highly important source of information is the words of the surrounding network and satisfied colleagues. This is because the interviewees farmers view each other more as colleagues that work together for the greater good of the entire sector rather than competitors. Therefore, they value the words and suggestions of technology from each other a lot.

4.6 Secondary Data from Empirical Case Company

The following data explains information about the usage of the empirical case company's application that is connected to their IoT products. The data includes user distribution, payment behavior, registered account compared number of sold units, when most accounts were created and the last time the users generally have logged in to the application.

4.6.1 User Distribution and Payment Method

Out of the empirical case company total number of users 18% are Swedish which is the second largest user group per country. The country that has the greatest number of registered users is France which stands for 30% of the total number of users. Germany stands for 15% of the total number of users. It is worth mentioning that both Germany and France have a much larger population than Sweden and therefore have more farmers. This could explain a larger need for farm related IoT products from France and why France has more registered users.

The case company has three payment methods including cards that are connected to the application, invoice and SEPA Debit. In the countries that have the greatest number of users, a card is the most common payment option. In Sweden, 97% of the users pay with a card and 3% pay via invoice simply because in Sweden card payment is now the only option. Those who pay with invoice are customers that still have access to the older options.

4.6.2 Registered Application Users per Sold Unit

This refers to the number of registered units/accounts divided by the number of sold units to that country. The data shows that half or less of the products are registered for an account in the connected application for each product. Although compared to the other countries Sweden has a higher percentage of registered app users for each product compared to France and Germany. France shows similarities with Sweden when it comes to FarmCam Mobility and Fence alarm but show a lower percentage of only 3% compared to Sweden's 14% for smart plug. Germany has fewer registered units per sold units in general. Their highest number is 25% registered FarmCam Mobility units per number of sold FarmCam Mobility. The other two products have a percentage less than 10%. Therefore, compared to Sweden and France, German farmers are generally less inclined to use the application and the services provided in that application for their IoT products. Sweden has more registered units per total number of sold units compared to the other countries even though Sweden most likely has fewer farmers due to a smaller population.

4.6.3 Creation of Account and Latest Login

It has been possible to register an account via the case company's application since 2015. The number of registered accounts increased by a few percent over 2018 and 2019 but it was not until 2020 that a large increase in registered users occurred. Between the years 2020 to 2022, 80% of the accounts in the application were created in Sweden. Over the first 2023 quarter, fewer users have registered, which probably somewhat stems from the fact that the farm season for cattle is in its beginning phase of the year, especially in Sweden.

In Sweden 50% of the registered users had their latest log in last year and 28% have logged in to their account at least once this year. In other words, around 80% of the registered accounts in Sweden have been used at least once in the past 17 months. For the case of French and German farmers, almost 85% have used the app at least once in the past 17 months. Furthermore, this data was gathered in the beginning of the year, when the farm season has barely started in some locations. Therefore, some farmers might not have seen a need to log in since the applications are not used as much during the winters when the cattle are inside. However, the numbers show that most of those who are registered for applications that the case company provides have quite recently used it in some capacity.

5.
Analysis

This chapter elucidates the analysis of empirical findings in relation to the applied theoretical framework. The primary findings will be compared with the literature as well as the secondary data. The impact of servitized products, attitudes and mindset of the farmers, intrinsic characteristics of product-service offerings, extrinsic incentives that encourage adoption and an analysis of mediating contextual factors will be examined. Lastly, the chapter includes a section of how the findings of factors influencing user adoption can be used in a business model context which relates to RQ2.

5.1 Necessary Impacts from Servitized Products for User Adoption

Implementing the underlying approach on servitization in agriculture of this study – primarily through a dyadic provider-customer perspective with customer side foci, and secondarily incorporating a more inclusive provider-customer contextual ecosystem view – we commence this analysis by reasoning around factors central to farmers' business and operational success. Acknowledging that farming can be viewed as a lifestyle analogous to practical work and running a business, the analysis is inclusive of a subtle notion of emotional success.

Our thematic analysis of the empirical findings indicate that farmers consider impacts on three areas when they evaluate if a product or service should or should not be implemented at their farm. These areas are *animal welfare* (aw), *working conditions* (wc) and *financial position* (fp), where the interpretation can be formed that technologies which farmers perceive to positively impact these areas are more likely to be adopted. Although the areas can be regarded as somewhat distinctive, they do relate to each other, not least implicit in one farmer's reasoning regarding the intricate circular relationship between (1) financial loss (fp) → (2) psychological stress (wc) → (3) deterioration of animal husbandry (aw) → (1) financial loss (fp). Numerous statements also portray interrelation between pairs of these areas.

Additionally, our empirical data suggest that digital technologies, and digital servitized products, impacts these areas both positively and negatively through various mechanisms. For animal welfare, the impact is considered as generally positive. However, in relation to working conditions and financial position the sentiment varies, although leaning to positive.

Our understanding based on empirical data in relation to the extant servitization literature is that these three areas are what farmers value and where technology providers should place attention to create value for their customers. The mechanisms by which farmers demonstrate that technology caters to their needs and creates benefits commonly include automation, monitoring, control, and data analysis for optimization. This show close resemblance with propositions regarding value creation in the service-logic and servitization literature: That value is co-created in a relational process between provider, customer and ecosystem actors (e.g. Michel et al., 2009; Sjödin et al., 2020) and that digital servitization and smart product-service-software systems enable value creation and appropriation through monitoring, control, optimization, and autonomous functions (e.g. Kohtamäki et al., 2019; Sjödin et al., 2020). Empirical examples of how this can be achieved can be found in table 2, where milking or feed robots can depict value creation from autonomous and monitoring functions, and Kokontrollen

and Bacticam exemplifies value co-creation by ecosystem actors leveraged by digital technologies and servitization.

Consequently, our research adds to the theoretical understanding of how servitization can increase value creation. Additionally, it enriches and details the empirical comprehension of the processes by which customer value arises in the specific context of cattle farming. In this context, we also show where the end foci of servitization and the reconfiguration of a technology provider's business processes, capabilities, products, and services should be placed in order to improve value for customers (Favaretto et al., 2019). Namely to create a positive impact for animal welfare, working conditions and farmer's financial position. However, our findings also point towards the risk of "value destruction". If a provider's service infusion for example leads to more administrative work for the farmer or incurs high costs relative to the benefits generated, this will negatively impact their working conditions and financial position. This can be related to Rexfelt and Hiort Af Ornäs's (2009) proposition that the adoption of a product-service system solution is dependent on the condition that it generates benefits compared to the alternative of not adopting it.

5.2 Attitudes and Mindsets Among Farmers Influencing Adoption

The thematic analysis of the empirical findings showed that in some cases the attitudes and mindsets among farmers influences the adoption of servitized IoT products in the agriculture sector. This includes the farmers mindset or attitude towards the technological development within their industry, trust in the service provider and attitude towards trying new technology.

5.2.1 Basic Interest and Attitude Towards Technology

As one can determine by reading the empirical findings, generally the interviewed farmers had a positive attitude towards digital development and found this development to be exciting. According to the interviewees, digital technologies have the ability to generate profits in the end and the farmers had multiple positive experiences related to digital development. The findings regarding the farmers attitude towards technology and product-service offerings is of essence to understand. This is acknowledged by previous research which stresses the importance for deeper understanding of customers in relation to servitization (Brax & Jonsson 2009; Michel et al., 2008; Reinartz & Ulaga 2008). Furthermore, Brax and Jonsson (2009) state that expanding on the understanding of customers, their readiness to implement services, customers personal experiences and their view of these needs to be considered while transitioning customers into new services. Hence, the findings regarding farmers' attitude and mindset of digital technologies in the agriculture sector serve as a complement to the previous research. This by providing insights about cattle farmers attitude and mindset and not just a confirmation that it is crucial to understand. Moreover, one farmer stated that he generally lacked an interest in technology and therefore chose to mostly avoid using it. Which confirms research from Casidy et al. (2020) stating that the person adopting also impacts the decision to adopt technology.

The interviewees had in general a positive attitude towards product-service offerings and used multiple subscriptions to applications. This notion is further strengthened by secondary data provided from the case company. Based on secondary data from the case company's application, 18% of the users are Swedish which is the second largest user group per country.

The country that has the greatest number of registered users is France and stands for 30% of the total number of users. It is worth mentioning that France has a much larger population than Sweden and therefore has more farmers. This could explain a larger need for farm related IoT products from France and why they have more registered users. However, an interesting point here is that Sweden has more registered units per total number of sold units compared to the other countries even though Sweden most likely has fewer farmers due to a smaller population. This indicates that Swedish farmers are more inclined to register and take part of the services included in the application compared to the other countries.

5.2.2 Trust in Service Providers and Technology

Trust in the service provider was discussed by the interviewed farmers in relation to their attitude or willingness to try a product-service offering. The previously mentioned data from the case company indicates a relationship between trust and the fact that the case company is Swedish. This is because the interviewed farmers mentioned that they sometimes have an easier time trusting a company that is close by. Additionally, multiple interviewees stated that they prefer buying locally and from a company that can provide quick support if needed which becomes easier if the company operates in the same country or nearby. Furthermore, the interviewees stated they have more trust in companies that they know many have tried and heard about. Accordingly, the farmers stated that most of them know about the case company. Hence, since the case company is Swedish this might make it easier for both parties to build trust because of proximity.

Furthermore, the interviewees are hesitant to buy from startups and prefer well established companies. Although most of the previous research is from a provider perspective there are theories about adoption of product-service offerings from a user perspective such as the findings from this study. In previous research, the attributes of the service provider and their relationship with the users is also brought forth regarding user adoption. Casidy et al. (2020) state that the competitive advantage of the supplier reduces the experienced risk associated with the adoption. Accordingly, well established companies have a higher competitive advantage, and the interviewed farmers base their trust in the service provider largely on the provider's stance and experience on the market. Thus, Casidy et al. (2020) findings that competitive advantage of the supplier reduces the experienced risk can be confirmed to be true for cattle farmers in the Swedish agriculture sector as well. In the following quote one farmer explains why he sometimes can be hesitant to try new technology.

> *"I actively search for new technology, but I realize that we operate in a low margin industry and there is only a certain amount of room to experiment with new technology."* – Dan-Otto, SMFO

Meaning that the findings in this report suggest that because of the financial conditions and low margins in industry that farmers operate in, they are hesitant to try new technology or buy from startups. This is because the farmers are not sure if the providers are going to be in business in a couple of years. These findings differ from previous research regarding trusting and understanding customer expectation of a service. Instead, researchers Parasuraman et al. (1991) highlight topics such as reliability, responsiveness and assurance as factors that influence the customer expectation of a service. Although, there are some similarities with the empirical

findings and the literature. For example, the topic of reliability which Parasuraman et al. (1991) refer to as, the service providers performance and that the service is performed as expected. Similarly, the interviewees stated that they found that products that they know many have tried to be more reliable. Coulter and Coulter (2002) also mention that as the service relationship grows, reliability is important since trust is dependent on having competent service representatives. Likewise, Parasuraman et al. (1991) mentions the factor assurance which concerns the knowledge of the employees and that they communicate and radiate having necessary knowledge of the service. However, the interviewed farmers associate having the necessary knowledge with the service provider being in business for a while. Moreover, they see established incumbent firms and widely tested products as the largest and first needed sign of trust. This suggests that trust in a service provider is mostly dependent on the conditions of the industry, in this case financial conditions and thus adds additional insights to the previous research. The following quote also highlights that because the agriculture industry is small, this has an impact on customers' perception of trust in available products.

> *"Companies that introduce inferior products have an uphill climb in the next five years to rebuild their reputation, which is a drawback with the industry being so small."* – Johannes, LFM

The quote above proves the importance of having a good reputation which also could explain why incumbent well established firms and products have more trust compared to startups. This is because their reputation is most likely intact if they are considered to be well established by the interviewed farmers. The topic of trust is also discussed in regard to how much the interviewees search for new technology. The common answer is that the farmers do not want to be the first to try but also not the last to try a new product. Which strengthens the notion that farmers have more trust in a product that is well established. Furthermore, this research does not suggest that the agriculture industry is the only industry where startups with new products generally have a harder time creating trust with the customer. This research mainly points out how trust in the service provider is created in an industry specific manner. Moreover, that trust is dependent largely on the financial conditions within the agriculture industry.

5.3 Intrinsic Characteristics of the Technology

Turning to the technology, there are some qualities that farmers reflect on that are deemed to be included. This is what we have chosen to call intrinsic characteristics of the technology, where the technology can be seen in a wider concept inclusive of aspects relating to hardware, software and how these are provided and related. Thus, this can be related to the concept of product-service-software systems and digital servitization (Kohtamäki et al., 2019; Sjödin et al., 2020; Favaretto et al., 2022). The farmers pointed towards different parts of this system view of the offering, examples include: First, the product (hardware) should be tailored for or at least possible to deploy in a farm environment and its user interface should be simple as some practices on a farm are performed on an infrequent basis. It should also be durable, reparable and modular according to the farmers. Second, concerning the service, this should be a tailored solution since every farm is unique, it should also have a reasonable price to value ratio. Third, relating to software, farmers called for greater system integration between different applications

and software. In the following subsections, these three areas will be extended and related to PSS and PSSS literature. When appropriate, the analysis will also build on some technology adoption and diffusion literature.

5.3.1 Product-Related Characteristics

When it comes to the tangible product, interviewees view some characteristics as important. The most prominent are that the product should be built for the conditions on farms, and that it should be easy to use. This is fairly intelligible but has some intricate underpinnings, such as the fact that some products do not meet the criteria of sustaining in farm environments. With regards to the user friendliness, this is partly requested since some products are used infrequently or by rotating personnel or contractors. In a sense, some products require 'recurring adoption', a notion that extends current adoption literature. As the literature suggests that innovations are evaluated based on their perceived usefulness, user-friendliness, and the ease with which potential customers can trial the new product or service (Casidy et al., 2020), our study highlights that this might be a recurring process for a single customer. However, this can potentially be alleviated by moving from product to more inclusive result-oriented PSSs (Tukker, 2004), where the provider offers SSCs which from a customer perspective reduces the role of the product (Raddats et al. 2019).

The farmers request products that are durable and easily repairable, for example by having the product lifespan extended by the promotion of battery replacements. In many cases they were also willing to use secondhand hardware, if the provider guaranteed its functionality. The mentality of many farmers seems to follow a 'better repair than replace the product' logic, and being hands-on they often take action and sometimes try to forcefully repair the product. Even though this might not be sanctioned by the provider nor the hardware, note for example the John Deere Right to Repair lawsuit (e.g., Rooth, 2023). This sentiment of the farmers proposes their inclination to adopt systems that allow better repairability and extension of product life. Such connections to sustainable product use could also be seen to correspond directly to the understanding of PSS given by Baines et al. (2007), where the concept is regarded to inherently allow for environmental impact reduction of economic activities by not relying on material consumption. This whilst also increasing value for both provider and customer. The current study adds to this notion and highlights the applicability of it from a user perspective. Of course, a battery replacement could be made for a standalone product. However, many of the discussed products were advanced connected products, for these monitoring of battery status could for example enable the provider to proactively send out new batteries or exchange the product when advanced battery replacements are necessary to ensure durability by encapsulation. Such a practice could constitute a simple example of a use-oriented PSS (Tukker, 2004; Reims et al. 2015) and how monitoring capabilities of PSSS (Kohtamäki et al. 2019) can allow for charging the customer based on ensured availability and thus the output of the offering (Raddats et al. 2019). In relation to technology adoption literature, the price sensitivity of farmers further highlights that the value provided must be communicated effectively (Brax & Jonsson, 2009) and that prices must be set accordingly (Vaittinen et al., 2018).

5.3.2 Service-Related Characteristics

The discussion above shows how PSSS changes the role that products play for the customers and can support the formation of farmer demanded features of products in relation to services and software. Inevitably, this pushes the focus to services although the interrelatedness of the three concepts sometimes makes the different parts of these systems difficult to distinguish. The topic of service also relates heavily to the interactions with the provider, which is seen as extrinsic according to the discussion that will follow in chapter 5.3. However, based on interviewees statements, it is indicated that some service-related features of a PSSS can be viewed as intrinsic, including those with a high degree of interaction between provider and customer. This as they are a part of the provided system and thus not appropriable by the customer until the offering is accepted.

Features that are sought of by the farmers and falls within this category includes customizability, provider responsibility, accessible customer support, a rational value to price ratio and regular (i.e., semi-annual/annual/biannual) manual service checks. These were the most prominent characteristics of an offering which the farmers reasoned about, where some have close resemblance with findings in extant servitization and PSS(S) literature.

The customizability aspect was stressed by several farmers. Since no two farms are alike, this requires providers to sufficiently tailor a provisioned PSSS to the specific farm and its conditions. For advanced services, farm visits and consultancy were seen as vital to facilitate efficient farm deployment. The notion of customizability is ubiquitous in the literature (Kowalkowski et al., 2010; Vaittinen et al., 2018; Raddats et al., 2019) and provider responsibility and knowledge utilization is often seen as imperative for a result-oriented PSS (Baines et al., 2007; Reims et al., 2015). This also pertains to provision of various bundles of products or services. Using the case company as an example, the provision of a PSSS could include an initial consultation meeting with the farmer to build a portfolio of product elements (i.e., cameras, FenceAlarms, SmartPlugs) suitable to keep animals in place on the farm and the farmer could be charged accordingly based on number of input elements (Raddats et al., 2019). However, extending on a result-oriented PSS logic (Reims et al., 2015), the result – keeping animals in place – could entail that the hardware elements are of no interest to the farmer and the case company could interchange FenceAlarms for virtual fencing or something else, where the farmer instead would be charged based on the output, in this case the number of animals held in a certain area over a period.

Furthermore, accessible customer support and rational value to price ratio are something which show resemblance with extant literature. This could pertain to aspects such as availability, provider-customer relationship and increased value which all have been shown to be important aspects of product-service provision (Baines et al., 2007; Kowalkowski et al., 2010; Vaittinen et al., 2018; Raddats et al., 2019).

Lastly, farmers' view that the provider should perform regular manual maintenance on hardware is interesting, and something which is lacking in the literature, at least directly. In the literature on digital servitization, such practices are seen to be substituted by for example monitoring and proactive maintenance when needed, before hardware malfunction (Kohtamaki et al., 2019). An interpretation of the farmers' sentiment regarding this could thus be that it is an expression for a slight technology distrust. Hence the practice of having manual checks, where the provider or affiliated service personnel comes out to the farm, could be seen as

something that increases the relational aspects of a PSSS, which aligns with the literature (Kowalkoski et al., 2010; Raddats et al. 2019).

5.3.3 Software-Related Characteristics

In relation to the third aspect of a PSSS – software – farmers clearly urged for providers in the industry to create software that better integrate between different systems, along with a desire to receive timely, valuable and verifiable software updates to stay up to date with the development. This supports literature on servitized offerings, which highlights that services might need to include multi-vendor support (Raddats et al., 2019) and strongly corresponds with the contemporary and wider servitization literature on servitization processes relating to industry specific digital ecosystems (Sjödin et al., 2020; Hsuan et al., 2021). For instance, Tronvoll et al. (2020) and Chen et al. (2021) propose that providers must observe, react and interplay with the digital ecosystem around them. This could for example be through the consideration of other providers' product-service-software systems and ensuring interoperability or inter-transferability of data, essentially supporting multi-vendor systems as suggested by Raddats et al. (2019). Micro-vertical integration and fostering relationships between providers has also been suggested by Baines and Lightfoot (2014).

Several farmers stated that the lack of interoperability between differently branded software systems lead to arduous and time-consuming manual work. Accordingly, this was in many instances seen as a factor heavily constraining the adoption of digital solution offerings or PSSSs involving data treatment and analysis. Additionally, some farmers suggested that certain equipment on the farm is regarded as central, and thus the related software system and database is seen as central. Hence the current research reinforces the latest advancements in contemporary literature on digital servitization, showcasing the importance for providers to continuously consider the broader digital ecosystem (Sjödin et al., 2021; Tronvoll et al. 2020; Hsuan et al., 2021; Chen et al., 2021). However, adding to this, the current study also highlights the existence of incumbent dominant systems in some industries, agriculture being one, which smaller actors and new entrants must consider. It also demonstrates how the customer requests frequent evidence, in the form of software updates, that the provider is developing in line with or ahead of industry standards.

5.4 Extrinsic Incentives that Encourage Adoption

In the thematic analysis of the empirical findings some extrinsic incentives that encourage adoption became visible. These incentives were brought forth by the interviewees as suggestions or thoughts on what would make them willing to try out a new service. Because these incentives could all be related to actions that the service provider can make, the theme was named: extrinsic incentives that encourage adoption. Previous research related to servitization is often written from the perspective of the company. As stated in the introduction while presenting research gaps in previous studies, researchers in this field have struggled to fully understand what factors influence this transition (Oliva, 2016, as cited in Kohtamäki et al. 2021, p. 16). The factors brought forth in this section are based on suggestions from the users and has its focus on understanding factors that influence this transition into servitization. Furthermore, this makes the findings related to these sections different compared to previous research. First, because of the lack of research about such influencing factors in previous

studies. Second, because findings come from the users of just the agriculture sector this study offers more specific suggestions of actions from service providers.

5.4.1 Communication of Benefits

Communication of the benefits associated with a product-service offering was discussed by the interviewees in relation to actions that the service provider could make to encourage user adoption. The interviewees' statements about why communication of benefits are important in relation to service adoption shares similarities with Eng and Quaia (2009) research about risk avoidance with the help of communication strategies. Moreover, it also confirms research from Brax and Jonsson (2009) that relates to a need for communication that goes in line with the customer's expectations.

According to the interviewees the desired communication entails knowing more precisely the financial benefits as well as the time efficiency that a user gains from a product-service offering. The interviewees stated that it can be risky to try a new product-service offering because it is hard to measure benefits of a service. With this in mind, the service provider can use measurements as a tool to communicate more detailed benefits. In other words, knowing more about the service beforehand and detailed measurement of its benefits allows farmers to avoid some risk that comes with trying out a new product-service package. Eng and Quaia (2009) state that the service provider needs fitting communication strategies since the uncertain environment that involves risk affects both the company and the customers. Thus, the findings in this report that users experience less risk if the service provider has fitting communications strategies confirm Eng and Quaia (2009) research. Therefore, by applying a communication strategy that clearly communicates the financial benefits and the gained time efficiency of a service both the user and service provider will experience less risk. The user because he or she knows more about the product-service package and the service provider because they know more about the user and therefore can apply a suitable communication strategy.

Beyond suitable communication strategies, Brax and Jonsson (2009) state the importance of identifying what is mainly considered by the customers and Rexfelt and Hiort Af Ornäs (2009) highlight that understanding how the product-service system can impact users' lives will remove uncertainties for the customer. Similarly, the findings of this study suggest that there is a need for a specific communication concerning finance- and efficacy-related benefits as this would remove risk and uncertainties for the farmers. Additionally, Eng and Quaia (2009) state that by continuously learning about the customer, companies can recognize risks and uncertainties with the new product. However, the interviewed farmers in this study experienced a lack of financial and efficiency communication that removes risks associated with trying a new product-service offering. Therefore, this speaks of a current lack of continuous learning and understanding from the service providers regarding what type of communication is important for cattle farmers in the Swedish agriculture sector.

5.4.2 Payment-Related Factors

The interviewees discussed payment-related actions form the service provider that would encourage them to try a new service. These factors include free trial periods, trade-ins and the options to choose a payment schedule.

5.4.2.1 Free Trial Period

Free trial periods were of interest to all the interviewees as according to them this would enable them to test a new product-service package and see if it works for them. The topic of free trial periods shares similarities Michel et al., (2008) research about innovating the customer. Additionally, parallels can be drawn to secondary data form the case company regarding account creation and last login of the accounts. According to Michel et al. (2008) a way to innovate a customer is to "change the role of the payer" either by altering what is paid for or altering who is actually paying. In this case a free trial period would entail changing who is actually paying. Hence, trial periods become a tool to influence farmers to try a new service, or in Michel et al.'s (2008) words, a way to innovate the customer into trying new offerings. The findings from this study differ with Michel et al. (2008) research in the sense that they do not provide any specific example of actions that can be related to innovating the customer through altering who is paying. Meaning that the findings in this study builds on the research of Michel et al. (2008) by adding further specific explanations on how to innovate the customer to try a new service in an industry specific manner.

The case company offers a one-year free trial period for their subscription service connected to their IoT products. Their data suggest that trial periods have a positive outcome on the continuous usage of the services connected to the application in Sweden. The secondary presents that between the years 2020 to 2022 80% of all the existing accounts in the application were created. More than a third of the accounts were created in 2020 which is the highest percentage of registered accounts per year for the case company. By 2020 almost 50% of all accounts had been started. Furthermore, almost 80% of the users have logged in at least once in the last 17 months hinting that most of the registered users have continued to use the application after the trial period has ended. Additionally, between the years of 2021 and 2023 about the other half of the account were created. In Sweden not many new accounts have been started this year most likely due the fact that the farm season for cattle is in its beginning phase of the year, especially in Sweden because of its geographical location and weather. However, the year of 2021 was the second highest percentage of created accounts, and their trial period would have ended in 2022. Still the data shows that 28% of the farmers have already logged in to the application this year (2023) even though it is still early in the Swedish farming season. This indicates the effectiveness of free trial periods since many customers continue to use the application and its included services after the trial period is over.

5.4.2.2 Trade-Ins

Trade-ins entail trading in an older product and getting a new one for a cheaper price. This was something that some farmers participated in but also something that they found interesting because of circularity and sustainability. By trading in an old product, the service provider could recycle or repair the product and later send it out to another user for a cheaper price. This was seen as positive action by the interviewed farmers and something that they would encourage. However, according to the farmers they need the assurance that the secondhand product works as well as a new one. Implementing trade-ins requires some restructuring of the service provider business model. Given that the farmers encourage the implementation of trade-ins for IoT products, these findings confirm Favoretto et al. (2022) that development of IoT requires new business models that are more in line with such development. Moreover, implementing trade-

ins require smart IoT products that communicate when they need to be repaired. This also leads to a larger service focus for the service provider since by offering trade-ins they need to offer services related to customer support and repairs/service. In turn the offered services become more extensive and improved. Thus, the findings also confirm Favoretto et al.'s (2022) statement that digitalization facilitates servitization since it improves the quality of a service.

5.4.2.3 Payment Schedule

The interviewees stated that to avoid administrative work they wanted to have some flexibility while choosing their payment schedule. According to the interviewees they wanted to pay yearly for cheaper services and monthly for more expensive services. The importance of offering flexibility in services is confirmed by previous researchers Vaittinen et al. (2018) who state that a service's ability to be flexible influences the user adoption. Furthermore, according to the secondary data from the case company 97% of the Swedish users pay with a card. Therefore, offering flexibility in payment schedule should not be administratively challenging for the case company since almost all customers have the same payment option.

Furthermore, table 2 in the empirical findings chapter presents the mentioned technologies that the farmers are using. For example, the milking robot which is usually bought from DeLaval or Lely and includes subscriptions for different service packages. If a farmer wants to combine IoT products from other service providers for example cameras from the case company this adds to their number of subscriptions and administrative work. Which again causes a need to have the option to structure all different payment schedules in a way that lessens the administrative bookkeeping work. Moreover, in the introduction to case company it is mentioned that they are looking to simplify the payment process by putting all units a customer has under one sum. Based on the interviewees statement that they look to avoid monthly unnecessary administrative work suggested that the empirical findings agree with the case company's option to simplify the payment process.

5.4.3 Interaction with Service Provider

The interviewed farmers discussed some extrinsic incentives that encourage adoption that is related to the interaction with service providers. Customer support, manual service checks and that the company is responsible for the service was mentioned as a necessary interaction with the service providers from a farmer point of view. If a service provider offers these interactions the interviewees were more inclined to test or start using a service product offering from them. Given the name of this theme it becomes clear that the word interaction is dependent on communication. Therefore, the importance of communication plays a role in all the mentioned interaction related actions from service providers that are mentioned under this section. Previous research from Kowalkowski et al. (2013) presents that ICT (information and communication technology) creates better conditions for the execution of services. This suggests that a service provider's information and communication technology play a part in the presented findings that concerns interaction with the service provider.

5.4.3.1 Customer Support

The need for efficient ICT in services has been brought up by the interviewees in relation to quick customer support. This is because the interviewees find customer support to be of essence if a product fails especially if it is used a lot on the farm. Thus, customer support is partly

dependent on effective ICT that gives the service provider the necessary tools to answer quickly to the users' needs. Although, it is not always clear if failing customer support stems from lack of personnel from the service provider or failing ICT since these two factors are somewhat intertwined. According to the interviewees they are satisfied with the service TeamViewer as this allows them to get efficient customer services from a distance. This in turn is an example of effective ICT and how it creates better conditions for execution of a service. Thereof, these findings confirm Kowalkowski et al. (2013) research presenting that ICT creates better conditions for the execution of services.

Also, in relation to customer support Favoretto et al. (2022) presents that there are multiple motivations as to why servitization can be benefitted by digitalization. One such motivation is the ability to answer quickly to customers and their needs, since digital technologies for example IoT enhances the knowledge and viability of the product which can lead to quicker responses (Favoretto et al., 2022). This in turn can also be related to the need for customer support since this allows the service provider to give support from distance when the need arises. Hence, the notion that digitalized and effective customer support will improve servitization is supported both by the interviewed farmers and in previous research form Favoretto et al. (2022).

5.4.3.2 Manual Checks and Companies Being Responsible for Service

In addition to customer support, the interviewees also suggested occasional manual service checks and that the company is responsible for service and continuous development of the product. Michel et al. (2008) research of how to innovate customers into a service focus mentions the topic of "service-logic innovation". According to Michel et al. changing into "service-logic innovation" involves value co-creation from different resources. The notion that value comes from different types of resources is confirmed amongst the interviewed farmers in this study. This is because the interviews propose a combination of services such as occasional manual service checks and that the company is responsible for service and continuous development of the product. These examples are different services that require different resources but when put together they create more value for the farmer. However, the applied theoretical framework does not suggest what combination of resources that should be combined given a specific context. Thus, the finding of this report builds on previous research regarding influencing user adoption of product-service systems. This is because the findings suggest that to influence user adoption of services through interaction in the agriculture sector service providers should combine the following resources: offering manual checks, customer support and that service providers should be responsible for service to encourage continued development of the products.

5.5 Contextual Factors that Moderates Service Adoption

The access to good cellular connection (3G and 4G), farmers network, government policies and regulations was brought up by the interviewees in relations trusting a new product or service. These findings differ from the previous literature regarding servitization that mostly focus on the perspective of the service provider. These factors of encouragement are not directly connected to the actions from service providers but rather from the context and farmers' interactions within the agriculture industry.

For example, the interviewees mentioned that they search for or come across new technologies mostly through farmers' media, union meetings, exhibitions or by direct contact with other farmers. According to Eng and Quaia (2009) customer commitment creates trust between buyer and seller which is something that can be leveraged by service providers. Farmers' union meetings, exhibitions or discussions with satisfied colleagues are situations where customer commitment can be created. In turn this could explain why they trust these situations to be a fitting way to search for new technology. However, according to all the interviewees the most important source of information comes from the surrounding network and other satisfied colleagues. This is because the farmers view each other more as colleagues that work together for the greater good of the entire sector rather than competitors.

Meaning that to encourage user adoption of a service, service providers need to employ strategic partners and reference farmers that can spread positivity of the service within their network. Thus, service providers in the agriculture sector need to understand how to approach and utilize the social system around the farmer. Network is discussed by researcher Hinz et al. (2014) who presents that the social environment and the tendency to mimic those in the surrounding network influence behavior related to product adoption. Furthermore, Rogers (2010) states that user adoption is influenced by the social system and thus confirming that farmers are influenced by those around them. Hence, the findings in this report confirms Rogers (2010) and Hinz et al. (2014) research stating that the social environment impacts user adoption. However, the importance for service providers to utilize strategic reference users is not discussed in the theoretical framework but based on the findings in this study it is very much relevant for cattle farmers in the agriculture sector.

Same could be said regarding the notion that access to good connection 3G and 4G is taken for granted by service providers but is not a certainty according to the farmers. Which suggest that service providers should examine these preconditions beforehand to ensure that services fit the unique needs of the farm. Access to good connection is also somewhat dependent on localization and what governmental actions have been done to ensure internet service in a certain area.

Adding to the aforementioned factors, the notion of a digital ecosystem specific to the industry (Hsuan et al., 2021) could also be regarded as a contextual factor. As presented in the section regarding intrinsic characteristics of technology (5.3.3), this is something which farmers consider conditional for the providers' ability to provide an adoptable service system which aligns with contemporary literature (e.g., Tronvoll et al. 2020; Hsuan et al., 2021). The argument could however be made that also the user's capability to adopt a service will be affected by the industry specific digital ecosystem surrounding them. One of the interviewed farmers did for example mention the centrality of the milking robot system at her farm, which was viewed as the central database which other systems preferably would integrate to. Hence, at her farm the dominant system is the same as the milking robot system, which however might deviate from a prevailing industry specific ecosystem and thus constricting the farmer's capacity to adopt product-service-software systems pertaining to the dominant ecosystem. The 'problem' of aligning with the ecosystem is thus not only something that pertains to the provider, but dualistic and affects both parties.

5.6 Adapting a Service Focused Business Model

Adding on the perspectives of the previous themes this section is connected to RQ2 and will present how the previously mentioned factors will influence the business model for a service provider within the agriculture sector. This is because the development of IoT and other digital advancements have caused a need to renew old business models (Favoretto et al., 2022). The following section will apply the aid and structure from the business model canvas combined with reflections from the empirical finding as well as other applied literature, see Figure 3. The reason for applying a business model framework is that it is an organized way of explaining a business model as it includes internal and external components for evolving as well as managing a business model (Al-Debei & Avison 2010; Wirtz et al., 2016). Product-service system business model canvas is visible in previous literature but often put focus on certain aspects even though the main elements of the original business model canvas is included (Adrodegari et al., 2017). Given that this study focuses on the user perspective this creates incentives to focus on the blocks that have larger external impact rather than internal processes within the business. Therefore, more attention will be given to the following blocks: value proposition, key partners, key resources, key activities, customer relationships and channels.

<table>
<tr><td rowspan="2">Key Partners
Well established companies – Lely, DeLaval; strategic reference users</td><td>Key Activities
Customer support; developing user-friendly products; manual service checks; noticeable software updates; R&D – co-creation</td><td rowspan="2">Value Proposition
Delivering a user friendly product-service offering that is uniquely designed based on the farm's needs with clear communication of how it positively impacts animal welfare, financial positions and working conditions.</td><td>Customer Relationships
Allow for clear communication and support from the service provider; feedback from the user; in person farm visits.</td><td rowspan="2">Customer Segments
N/a</td></tr>
<tr><td>Key Resources
Competent personnel that knows how to integrate software; efficient ICT</td><td>Channels
Exhibitions; union meetings; farmers' media; advisors from well established companies; farmers' network</td></tr>
<tr><td colspan="3">Cost Structure
N/a</td><td colspan="2">Revenue Structure
N/a</td></tr>
</table>

Figure 3. Suggested business model canvas for service providers operating in agriculture.

5.6.1 Value Proposition

Value proposition is a fundamental part of the business model as it explains what problem the organization is solving and the motivations behind these (Osterwalder et al., 2010). Furthermore, in this case having an appropriate value proposition that goes in line with what the users find of essence is important for companies trying to compete with incumbent companies. Based on the interviewees comments the following value proposition is suggested: delivering a user-friendly product-service offering that is uniquely designed based on the farm's needs with clear communication of how it positively impacts animal welfare, financial positions and working conditions of a farm (see Figure 3).

5.6.2 Key Partners

Key partners refers to the organization's partnerships where some actors remain internal and some may be outsourced (Osterwalder et al., 2010). In order to have valuable key partners service providers need to create partnerships with companies that are well established within the agriculture industry. This is because according to the farmers they have the most trust in those companies since they have managed to stay in business for multiple years. Furthermore, such well established companies for example milking robot company Lely or DeLaval offer extensive service packages and have a lot of customers as one can see in table 2. This creates an opportunity for other service providers to create products that are compatible with their offerings. Meaning that other smaller companies can enter and remain in the market by making sure that their product can be a part of a larger service system.

Similarly, research about product-service-software systems reinforces the connectivity between physical IoT hardware and various actors (such as suppliers, the firm, operators and customers), this creates systemic dependencies which must be considered (Frank et al., 2019; Kohtamäki et al., 2019). Thus, causing a need to holistically reconfigure the business model to ensure alignment of these dependencies and allow optimal outcomes in customer value. Therefore, for the case company and similar service providers, optimal outcomes in customer value are dependent on creating partnerships with well-established companies by enabling product system integration with these well-established companies. This in turn will allow the case company and similar service providers to compete with large incumbent companies. Chen et al. (2021) states that the success of offering smart solution value propositions depends largely on having a well-functioning ecosystem value delivery system composed of suppliers, distributors and partners. This again supports the interviewees statements that indicates the importance of strategic partnership as this allows for a more well-functioning ecosystem.

Additionally, having strategic reference users is of essence because of how important network is in the agriculture sector. These reference users can offer feedback on the development of the product based on actual need and they can also use their network to spread positive perceptions about a product-service offering. This is also expressed by Chen et al. (2021) who mentions that customers are of importance for a well-functioning ecosystem of value delivery. Thus, if a service provider applies feedback from strategic reference users, they get valid information if the product is effective in real life situations. According to the interviewees they would appreciate being able to provide feedback in service development, which is exemplified in the following quote:

> *"More collaboration [between farmers and developers], sometimes the firms develop unnecessary features."* – Stefan, LFO

5.6.3 Key Resources

Key resources concerns what resources are needed to perform the key activities (Osterwalder et al., 2010). Based on the interviewees and answers regarding what resources they expect from a service they want competent personnel that know how to develop software that can be integrated in other companies' software systems. Furthermore, the interviewees expressed a need for efficient customer service which speaks to the importance of having capable ICT (information and communication technology) as a tool to perform customer service. The

importance of ICT is also acknowledged by Kowalkowski et al. (2013) who presents that ICT creates better conditions for the execution of services at the same time as it also improves communication in service focused business strategies. Although, for investments in ICT to have a positive impact on transformation into service focused rational business actions, strategies, resources and support from management are needed (Kowalkowski et al., 2013).

Because competent personnel are seen as a key resource their mindset will in turn have an impact on the user. Consequently, this speaks to the importance of making sure that the personnel have appropriate mindsets that positively impacts user adoption of a service. This is discussed by Tronvoll et al. (2020) who stresses the importance of fostering an agile mindset among employees. Such a mindset can facilitate the handling of continuous and discontinuous interplay between digital technologies and different business model elements during a servitization process (Chen et al., 2021).

5.6.4 Key Activities

Key activities include the main activities needed to reach the value proposition (Osterwalder et al., 2010). The interviewees mentioned multiple activities that could be done as an incentive for adopting a service. However, in this section the most talked about and relevant to a business model will be presented. The following are key activities that are important to the users: customer support, occasional manual service, developing user-friendly products, noticeable software updates and R&D where the user has the opportunity to be involved and offer feedback. Some of the activities mentioned by the interviewees can be found in product adoption theories and the digital servitization literature. For example, Casidy et al. (2020) presents that user friendliness influences the acceptance of technology. With regard to key activities such as noticeable updates and user feedback, previous research shows the importance of continuously considering the broader digital ecosystem to stay relevant (Tronvoll et al. 2020; Hsuan et al., 2021).

5.6.5 Customer Relationships

Customer relationships concern the relationship a service provider has with each customer and how one should keep them as customers (Osterwalder et al., 2010). The interviewed farmer values customer support and service which indicates the need for a somewhat deeper relationship where farmers can express their concern and recessive help if needed. Furthermore, according to the interviewees each farm is unique and in turn requires a tailed solution based on these needs. Consequently, this suggests that the farmers value a relationship with the service provider where they have the room to communicate their needs. This could be done by having a salesperson visit a farm which allows the customer to state the specific need in their environment and in turn the salesperson can offer a tailored solution. Thus, the customer relationships need to allow for clear communication from the service provider but also feedback from the user. Researchers Forkmann et al. (2017) point toward relational success, indicating that the success of service infusion is a function of value created for both supplier and customer. Thus, Forkmann et al. (2017) research is confirmed by what interviews stated regarding their need to have a two-way communication relationship with their service provider as this is needed for the user to gain more value. Additionally, the service provider receives more value from this

type of customer relationship because they get the opportunity to gather feedback directly from the user and in turn further increases the value created.

5.6.6 Channels

Channels refers to how the service provider will reach their customers (Osterwalder et al., 2010). Channels to some extent depend on having effective information and communication technology (ICT) become important which was mentioned in earlier sections. This is because customer support and service is valued by customers and therefore the provider needs ICT that is easy for the user to handle. Furthermore, according to interviewees they receive information about new technology through the following: exhibitions, union meetings, farmers media, advisors from well established companies and from the farmers' network. This indicates that communication and marketing should go through the above-mentioned channels.

6.
Discussion

This chapter connects directly back to the research questions with the aim to discuss and provide a structured and summarized answer to each question. It includes factors influencing user adoption which pertains to RQ1, how these factors relate to each pertaining to RQ1:1 and how the factors can be related to a business model context which concerns RQ2.

6.1 Factors Influencing User Adoption

This section is directly related to RQ1: What factors influence the user adoption of servitized IoT products for cattle farmers in the agriculture sector? In the analysis of the empirical findings there are different themes that can be used to group the different factors that influence the user adoption of servitized IoT products in the agriculture industry.

First, there are some factors regarding the impact of servitized IoT products. IoT products should have a positive *impact* on working conditions, animal welfare and the financial conditions of the firms in order to be relevant. Farmers put emphasis on that product-service offering needs to generate financial benefits and improved or ease of working conditions.

Second, the *attitudes and mindsets* amongst farmers will also influence the user adoption of an IoT service. In relation to this, it becomes clear that the farmer's basic interest in technology will influence the perception and willingness to adopt a product-service offering. The topic of trust is also of essence since personal trust in the service provider and its technology will have an impact on the choice of whom to buy a service form. In this case, farmers wanted to buy well established products for companies that have been in operation for multiple years as this signals that the company will remain in business according to the farmers. This stems from the financial condition within the agriculture sector that includes low margins and therefore not much room to experiment.

Third, there are some *intrinsic characteristics* of the technology that influence user adoption, which includes both the perspective of the technology and the connected service. The product-related characteristics encompass that the product is user-friendly, and that the technology and its connected service leads to less work. In other words, it has a positive impact on time efficiency. Moreover, how long the product lasts is also of importance and that it is possible to have tailored solutions based specifically on the needs of the farm. The Service-related characteristics concerns that the service must generate benefits for the user. The service should also serve as a security in a sense that it can for example be used for monitoring purposes. Furthermore, the different systems and their connected services need to be able to integrate with each other as it is time consuming to transfer data. Also, the updates of the product and its software should generate a noticeable change otherwise the farmers question the need to continually pay for them.

Fourth, there are some *extrinsic incentives* that encourage user adoption meaning that they are coming from the service provider. The incentives include communication related factors which refers to communicating financial and efficiency benefits as it is hard to know what and what the service will generate in the end. Furthermore, there are incentives connected to payments such as free trial period, trade-ins and choosing payment schedule. The effectiveness

of trial periods can be viewed in the secondary data from the case company which indicates a continuous usage of the app and its connected services after the trial periods have ended. The extrinsic incentives introduce how different types of interactions between service provider and user influence user adoption. These interactions are related to access to quick customer support combined with occasional manual checks for service providers. The service provider should also be responsible for service as this will motivate themes to create good products according to the interviewees.

Lastly, *contextual factors* encourage user adoption as well. These include access to good connection including 3G and 4G which is needed in IoT product-service offerings. Additionally, government policies and regulation impact the choice a farmer makes regarding the implementation of a new product-service offering. Furthermore, the network of farmers greatly influences the farmers decision to adopt a service since they see each other as colleagues working for the greater good of the entire sector.

6.2 How the Factors Relate to Each Other

The following section is directly linked to RQ1.1: How do these factors relate to and influence each other? Figure 4 is a presentation of how the factors that influence user adoption of servitized IoT products in the agriculture industry relate to each other. Its purpose is to present an overview of each theme in a structured manner and to provide a context to where each factor is present in the user adoption process. Furthermore, based on the understanding of the interrelatedness of these factors, four research propositions was generated that are presented in this section.

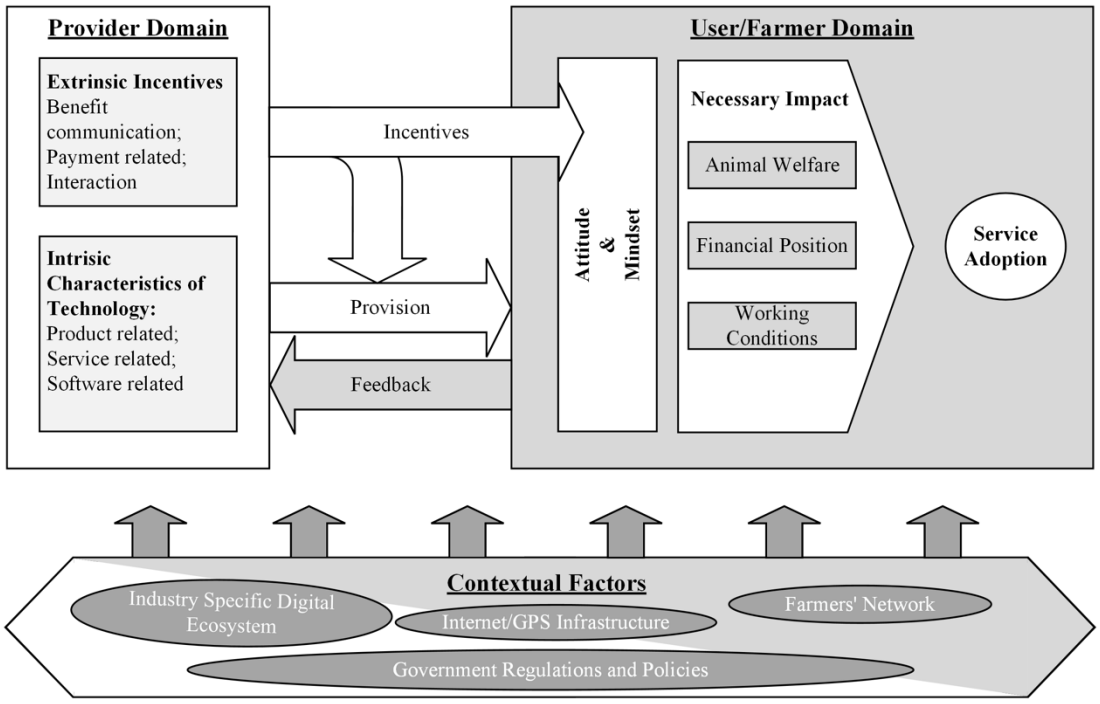

Figure 4. Overview of factors influencing user adoption of servitized IoT products in the agricultural sector.

First, the model is divided into the following three sections: provider domain, user domain and contextual factors. Provider domain refers to actions and technology-related characteristics that

the service provider is in control of. User domain includes factors that come from inside the farmer and the necessary impact that is needed in order to adopt a new service. The contextual factor offers a third perspective by illustrating that factors form the ecosystem in the agriculture that is surrounding the service provider and user also impact adoption of a service. The model shows that adoption of a product-service offering is dependent on the necessary impact on animal welfare, financial benefits which leads to the following research proposition.

RP1: In the context of cattle farming, a service that has an impact on animal welfare, financial positions and working conditions has a higher chance to be adopted.

In the lower left corner, the intrinsic characteristics of technology is located which entails the product-, service- and software-related features of the product-service offering. These characteristics influence the provision/delivery of a service since by inducing certain features the farmers' mindset about a product-service offering can be altered. It may also involve various ways to gather feedback from the user (in the form of data/ICT or more direct co-creation) for further enhancement of the product-service-software system. Furthermore, including certain features will also affect the impact the product-service offering will have on animal welfare, financial position, working conditions and in turn the willingness to adopt a service. The impact of the intrinsic characteristics of technology generates the following research proposition.

RP2: The intrinsic characteristics of technology should generate the impact that is necessary according to the users and incorporate user feedback.

Extrinsic incentives up in the left corner represent the factors related to the theme: Extrinsic factors that encourage adoption. These incentives are actions or decisions from the services provider that in turn can make the user more willing to adopt a service. The incentives can impact on the farmers' attitude and mindset of the product-service offering. For example, if the service provider gives clear communication about the benefits gained from a product-service offering this removes elements of risk associated with not knowing if and how the product will generate benefits for the farmer. Avoiding risk is important to the interviewed farmers because according to them it is hard to measure if it is financially appropriate and beneficial to adopt a service. Therefore, this type of incentive from the service provider can improve the user mindset and attitude of a product-service offering.

These incentives also have an impact on the provisions of a service i.e., the delivery of a service. This is because combining the incentives with appropriate characteristics of technology could have larger significance on the user's attitude as well as on the impacts the user gains from a service. Thus, the following research propositions was formulated.

RP3: Extrinsic incentives from the service provider have the ability to influence the attitude and mindset of cattle farmers.

Moving on to the user domain, attitudes and mindset refers to the farmers internet in technology, trust in service provider and technology. The attitudes and mindset that a farmer have is placed before the necessary impact that product-service offering needs to have according to the farmers. The reason it is placed before is because farmers' attitudes and mindset can work as a blockade for reaching the impact of a service as well as adopting it. Consequently, the provider's incentives and the intrinsic characteristics does not matter if the user generally has a bad attitude towards the service provider or its product-service offering. In the extreme case of a farmer who has distrust in technology, digital solutions will not even be considered and in order to reach a positive impact in the three areas other ways will instead be considered. This

attitude was expressed by one of the interviewed farmers who lacked an interest in technology because he found it to be time consuming and therefore often sought to find other alternatives. Thus, the attitude and mindset of the farmer can be influenced and changed by the provider domain but if that is not the case then the user lacks the necessary trust or interest to adopt a product-service offering.

This aligns with researchers Brax an Jonsson (2009) findings regarding the importance of understanding the targeted customers personal experiences and Rexfelt and Hiort Af Ornäs (2009) statement that this can reduce uncertainties for the user. Furthermore, the user can offer feedback regarding the product-service offering which has the possibility to influence how the provider domain chooses to operate for example by adjusting the intrinsic characteristic. Which in turn aligns with Eng an Quaia (2009) research concerning continuous learning for the service provider, as this allows them to recognize uncertainties and expand the knowledge about the product even more.

The contextual factors located to the left are more associated and affect the service provider and the factors to the right have a larger impact on the user. The industry specific digital ecosystem refers to data standards and how different providers can integrate their product-service systems. On the user side, the farmers' network is located which is associated with how farmers have the ability to include each other's perceptions since they generally have a lot of trust towards one another. Government policies and regulation lies in the entire section as this affects the entire agriculture industry. Internet and GPS structure lies in the middle since it affects both the user and provider. This is because the internet and GPS infrastructure is required for certain product-service offerings that are developed by the provider. In turn the user needs to have necessary connection or internet to be able to use the product-service offering. Therefore, this system of factors is not just limited to the user and the service provider but also by the preconditions associated with each farm as well as the legal and digital context within the agriculture industry. This in turn brings us to the last research proposition.

RP4: Contextual factors affect both the delivery and adoption of product-service offerings for cattle farmers in the agriculture sector and in other areas sensitive to such factors.

By looking at how the factors influencing user adoption for IoT products in the agriculture sector relate to each other one can see that the factors depend on each other in some ways. Thus, there is a need to understand in a holistic way how the factors that influence user adoption relate to each other. Similarly, there is a need to holistically reconfigure business models to ensure alignment of different dependencies and allow optimal outcomes in customer value (Frank et al., 2019; Kohtamäki et al., 2019). This in turn brings us the next question that aims to understand how to consider the previously mentioned factors in a business model context.

6.3 Factors Considered in a Business Model Context

This section is directly related to RQ2**:** Based on the previous research questions, how can IoT providers in the agricultural sector consider these factors while transitioning to a service focused business model? The findings of this study show that there are multiple changes to the business model that a service provider can employ based on the suggestion of the interview farmers. It is however important to know that these findings do not imply that all service providers that offer IoT products must adopt all the following changes in order to stay relevant. As previously mentioned in this report, sometimes contextual factors influence actions and

choices that of course need to be considered before implementing the suggested changes. Given that this study focuses on the user perspective this creates incentives to focus on the blocks that have larger external impact rather than internal processes within the business. Therefore, more attention will be given to the following blocks: value proposition, key partners, key resources, key activities, customer relationships and channels.

First, having an appropriate *value proposition* that goes in line with what the users find of essence is important for companies trying to compete with incumbent companies. Based on the interviewees comments the following value proposition is suggested: Delivering a user-friendly product-service offering that is uniquely designed based on the farm's needs with clear communication of how it positively impacts animal welfare, financial position and working conditions of a farm.

Second, having valuable *key partners* with well-established within the agriculture industry is of importance because according to the farmers they have the most trust in those companies. Well established companies offer extensive service packages and have a lot of customers. which creates an opportunity for other service providers to create products that are compatible with their offerings. Especially for other comparably smaller companies such as the case company that can remain competitive on the market by making sure that their product can be a part of a larger service system. Additionally, having strategic reference users is of essence because of how important network is in the agriculture sector. These reference users can offer feedback on the development of the product based on actual need and they can also use their network to spread positive perceptions about a product-service offering.

Third, based on the interviewees and answers regarding what *key resources* they expect from a service they want competent personnel that know how to develop software that can be integrated in other companies' software systems. Furthermore, the interviewees expressed a need for efficient customer service which speaks to the importance of having capable ICT (information and communication technology) as a tool to perform customer service. The importance of ICT is also acknowledged by Kowalkowski et al. (2013) who presents that ICT creates better conditions for the execution of services at the same time as it also improves communication in service focused business strategies.

Fourth, the interviewees mentioned multiple *key activities* that could be done as an incentive for adopting a service. However, in this section the most talked about and relevant to a business model will be presented. The following are key activities that are important to the users: customer support, occasional manual service, developing user-friendly products, noticeable software updates and R&D where the user can be involved and offer feedback.

Fifth, *customer relationships* need to allow for clear communication from the service provider but also feedback from the user. The interviewed farmer values customer support and service which indicates the need for a somewhat deeper relationship where farmers could express their concern and recessive help if needed. Furthermore, according to the interviewees each farm is unique and in turn requires a tailed solution based on these needs. Consequently, this suggests that the farmers value a relationship with the service provider where they have the room to communicate their needs. This could be done by having a salesperson visit a farm which allows the customer to state the specific need in their environment and in turn the salesperson can offer a tailored solution.

Lastly, *channels* to some extent depend on having effective information and communication technology (ICT) become important which was mentioned in earlier sections. This is because customer support and service is valued by customers and therefore the provider needs ICT that is easy for the user to handle. Furthermore, according to interviewees they receive information about new technology through the following: exhibitions, union meetings, farmers media, advisors from well established companies and from the farmers' network. This indicates that communication and marketing should go through the above-mentioned channels.

7.
Conclusions

This chapter includes concluding remarks about the research, its managerial and theoretical implications as well as suggestions for further research. Its purpose is to tie the different parts of the entire study together and to eventually connect back to the purpose.

7.1 Concluding Remarks

The uncertainties regarding the customers' willingness to adopt a service focused offering and the research gaps in the servitization literature generates a need to contribute to the understanding of this area of research. Therefore, this study set out to provide insights regarding how the case company and similar companies within the industry can transition into a service focused business. This by understanding how the business model of companies providing agricultural IoT products can become more service focused, considering preconditional and mediating factors that influence the servitization potential from a user perspective. This was conducted by applying case study design and with the help of semi structured interviews with Swedish farmer owners and one farm manager with farms that varied in size.

Based on the empirical findings, secondary data from the case company and other service providers in the industry, it can be concluded that there are multiple factors that influence user adoption of an IoT product-service offering for cattle farmers. First, some factors concern the impact of such offerings on animal welfare, working conditions and financial benefits. Second, the attitude and mindset of the farmers also impacts their willingness to adopt a service, such as their personal interest in technology, trust in service providers and technology. An interesting finding relating to this is that trust in a service provider is very much dependent on the conditions of the industry, in this case financial conditions. Third, there are factors relating to the intrinsic characteristics of an offering, including the hardware as well as service and software-related factors that also impacts user adoption of a service. Fourth, extrinsic factors such as actions from the service provider have the possibility to influence the user adoption of a service. These include clear communication of benefits, payment-related actions and different types of interactions between service provider and user. Fifth, contextual factors regarding access to cellular connection, government policies and regulations and the farmer's network have an impact on user adoption of product-service offerings, this in combination with the capability of the provider to integrate software and systems with the industry specific digital ecosystem.

Furthermore, these factors are all related and can impact each other. Extrinsic incentives from the service provider can have an impact on the provisions of a service and the feedback from users has the possibility to alter the intrinsic characteristic of the product-service offering. Moreover, there are underlying contextual factors that can have an impact on the factors that influence user adoption. Therefore, it can be concluded that user adoption is not just limited to the user and the service provider but also by the preconditions associated with each farm as well as the legal and digital context within the agriculture industry. In addition, the findings of this study show that there are multiple changes to the business model that a service provider can employ based on the suggestion of the interview farmers. The suggestions are linked to the

following areas of a business model: value proposition, key partners, key resources, key activities, customer relationships and channels.

Finally, the empirical findings of this study shows that even in traditional, fundamental sectors such as agriculture, digital technologies are very much present. Farmers view each other as colleagues operating for the greater good of the entire industry, and farmer associations where experiences and knowledge is shared are common. Aligning with the organization of the customer base, firms that seek to succeed in this industry as technology providers might benefit from fostering collaboration.

7.2 Managerial Implications

This study offers several implications for the case company and similar service providers within the agricultural sector. The findings have generated insights on what factors and their interplay that influence user adoption of product-service offers. Furthermore, these factors have been placed in a business model context to provide guidance of where these factors have an impact as well as how providers of IoT supported services can leverage these factors in a business model. In addition, the findings offer insight to farmers' general attitude towards digitalization and product-service offerings which is helpful for many service providers within the agriculture sector. This generates insights regarding in which direction the sector is moving and if the farmers mindsets are aligned with the service providers. Hence, the findings can inspire ideas for the continuation of this digital development in a way that optimizes value for both parties.

Moreover, because the findings of this study come from a user perspective, this has given cattle farmers a unique opportunity to describe what product-service offerings should include in order to benefit the farmers. We also show the importance for providers to continuously listen to farmers' needs and ideas and strategically do so with influential farmers to facilitate successful service adoption. Since servitization and digitalization are increasing phenomena in the agriculture sector, providers should also consider the broader digital ecosystem of the industry. Additionally, farmers are a fundamental building block of the studied sector as well as society in general. Therefore, it is important that the servitization evolves in a manner that generates benefits for the farmers.

7.3 Theoretical Implications

Based on the findings of this study – illustrated in Figure 4 – the following four research propositions were formulated which communicates the theoretical implication of this study: **RP1:** In the context of cattle farming, a service that has an impact on animal welfare, financial positions and working conditions has a higher chance to be adopted. **RP2:** The intrinsic characteristics of technology should generate the impact that is necessary according to the users and incorporate user feedback. **RP3:** Extrinsic incentives from the service provider have the ability to influence the attitude and mindset of cattle farmers. **RP4:** Contextual factors affect both the delivery and adoption of product-service offerings for cattle farmers in the agriculture sector and in other areas sensitive to such factors.

Consequently, in relation to previous research this study has contributed to the field of servitization in several regards. First, this study offers in-depth research on one specific technology, in this case IoT products which was found to be lacking in previous research (Favoretto et al., 2022). Second, concerning the adoption of new innovation there has been a

large focus on services that are technology intensive and a lack of research regarding "goods-related services" (Rexfelt and af Ornäs, 2009; Catulli, 2012). Thus, applying focus to goods-related services such as IoT products this study adds to the lack of research in that area.

Third, the findings offer insight as to what factors are included in the process of transitioning IoT products to services and how these factors relate to each other. Previous research has expressed a need to investigate such factors in order to better understand the processes of transition from product to services (Oliva, 2016, as cited in Kohtamäki et al. 2021, p. 16). In addition, the findings from this study provide user perspective on the field of servitization which according to previous research was needed for greater understanding of the field (Brax & Jonsson, 2009; Forkmann et al., 2017; Raddats et al., 2019). Therefore, investigating users' view on product-service offerings and how it generates valuable understating for service providers contributes to a more holistic perspective on servitization in the agriculture sectors.

Lastly, from a farmer perspective there are still a lot of opportunities for improving digital technologies and servitization in the agriculture sector. Accordingly, the interviewees stated that the digital development has been substantial in recent years, and they believe that the sector will continue on this trajectory. Hence, this empirical research about digital servitization connected to the agriculture sector has the potential to have a crucial impact on the future development of the sector.

7.4 Recommendations for Further Research

The limitations and finding in this study open avenues for further research in this area. One limitation with this research is that it only includes interviews with Swedish farmers. Although some secondary data is presented regarding international user statistics of the empirical case company's application, this is not enough to answer research questions from the perspective of a different country. Therefore, it is suggested to study a larger sample that includes farmers from different countries to get a more in-depth answer to the research question. Furthermore, this would also allow for a comparison between the countries and a plan on how to adapt the business model in a way that accurately meets the expectations of each country. Another option that would bring value to this study's purpose is to conduct a multiple case study to be inclusive of more perspectives from both users and providers.

Moreover, in general farmers expressed hesitancy in buying from startups which causes need for further investigations regarding how new entrepreneurs should best enter the agriculture sector. This is because startups and their innovations can have an essential impact on the continuous development of the agriculture sector.

Additionally, and in relation to presented research propositions of this study, **RP1** presents an avenue for further investigation. This arises from the lack of clarity regarding the relative importance of different impacts and whether the number of required impacts varies depending on factors such as the predominant occupation of the interviewees (e.g., if they are crop farmers). Consequently, additional research is warranted to explore the necessary impacts based on farmer type and to determine if any one impact holds greater significance, potentially overriding others. **RP2** is also suggested to be studied further. This could be done by adding the perspective of service providers as this would allow for a comparison on what intrinsic characteristics of technology are possible in the eyes of the service provider and the user. This

would provide an understanding of how intrinsic characteristics of technology can be optimized to maximize value for both parties. Similar benefit-to-cost perspectives is relevant for **RP3**, which could be investigated further by studying the impact of extrinsic influencing factors on service providers profitability.

Lastly, **RP4** opens opportunities for additional research. First, since this study focuses on user adoption, it remains unclear how contextual factors impact the development of product-service offerings by providers. Second, there is a need for research that can facilitate an understanding of how contextual factors affect other types of farmers.

8.
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Appendix

Interview Guide

Introduction of interviewers and interviewees.
Introduction of subject and the study.
Inform about confidential handling.
Ask for consent to record the interview.

Initial questions:

Tell us about yourself and your farm.
How long have you worked as a farmer?
What is the size of your farm and the number of animals?
When did you start using IoT products from Luda.Farm? (If they do.)

Digital maturity amongst farmers:

In your opinion, has agriculture become more digitalized and more dependent on digital technology?
What is your personal view on this development?
Have you implemented digital technology on your farm or are you planning to?
Why? Can you tell me more, can you give some examples?
What digital technologies do you apply on your farm?
What is the reason for this? Have you gotten much use out of these products?

From what sources do you get information about new technology that can be used in your farm and agriculture? (Industry magazines, associations, consultants, etc.)

Are you actively looking for new ways to apply digital technologies to your farm – how?

Payment/purchase behavior/business model:

From which players/vendors do you buy your (operational support) equipment today and why?
How do you pay for your current products?
What is your preferred payment option when purchasing these types of products? why?

- Immediately
- Invoice
- Partial payment
- Subscription system

How many subscription or subscription-based services do you use today? (Mobile subscription? Service agreement? Apps?)

What is your inclination to use and order subscription-based products/services?
why? Eventual follow up: Or do you want to pay a larger sum in advance?

What would it take for you to switch to a subscription-based solution instead of a larger one-time purchase?

- Installation consultation
- Customer support
- Availability
- Maintenance/service
- Trial period

Circularity from servitization:
What is your view on recycling and buying/using used products?

If the product is guaranteed to perform as well as a new product, would you choose to buy a used product instead of a new product for your farm? Why/why not?

Additional final questions:
Do you have any additional questions?
Do you wish to be anonymous in the essay?
Can you recommend other farmers who may consider participating?