Exploring drivers and barriers of AI's impact on servitization

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ABSTRACT
Artificial Intelligence (AI) has gained increasing popularity in the marketing area over the past few years. Servitization, a firm's transition from a traditional product-centric business model towards a service-centric approach, has been accelerated by AI, positioning the technology as a key strategy for increased revenue growth, enhanced customer satisfaction, and cost reduction. While the benefits and challenges of AI in servitization are widely recognized, and the number of papers in this area has risen significantly, literature has primarily addressed the benefits of AI in servitization, rather than the factors that accommodate and hinder AI's employment in servitization. This study therefore explores these drivers and barriers of AI in servitizing, focusing specifically on Dutch business-to-business (B2B) firms. Semi-structured interviews were conducted with fourteen interviewees to gather in-depth insights into these accommodators and barriers. The findings provide a better understanding of how these interconnected drivers and barriers of AI apply in the servitization context. Theoretically, this study expands existing knowledge by addressing the underexplored B2B domain of AI in servitization. To practice, this research offers valuable insights for organizations seeking to leverage AI in servitizing. By identifying both drivers and barriers, this research supports firms in making more informed decisions on how to optimize AI, ultimately leading to a more structured, balanced servitization strategy.

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1. INTRODUCTION

Servitization is the process of combining a product with an organization's capabilities and processes, leading to a shift from selling only products to integrating products and services that add value for customers (Baines et al., 2009). The term was first introduced by Vanderwerme & Rada (1988) to describe the need for product-oriented business models to include services. Servitization can be defined as a firm's transition from traditional product centric models to a service-oriented service model, focusing on facilitating customer value creation through advanced services and solutions (Kowalkowski et al., 2017). Servitization is increasingly recognized as a crucial strategy for revenue growth, profitability and customer satisfaction, and provides opportunities to integrate into the customers' value chain as well as improve an organizations' competitiveness (Qvist-Sørensen, 2020; Kowalkowski et al., 2017).

While servitization represents the general transition towards a service-centric model, its development has been accelerated by technological advancements. An explosion in available and accessible data warehouses, facilitated by the internet of things (IoT), combined with continuous advancements in machine learning (ML) and artificial intelligence (AI) has led to the phenomenon of digital servitization (Kohtamäki et al., 2019).

Among these technologies, AI has become a key driver of servitization (Abou-Foul et al., 2023). AI is based on the development of ML capabilities, using a vast amount of structured and unstructured data to simulate human cognitive abilities (Abou-Foul et al., 2023). This enables machines to perform tasks that typically require human input, ranging from routine activities such as predictions to more advanced tasks like advising and problem solving (Huang & Rust, 2022).

In recent years, AI rapidly grown in both popularity and significance in the marketing area. The growing interest has led to multidisciplinary research efforts that explore AI's potential (Huang & Rust, 2018). AI is widely adopted by professional service companies across different sectors (Yang et al., 2024) and is increasingly utilized as it is seen as a major source of innovation (Huang & Rust, 2022). Despite being in the first stages of understanding AI developments and their impact on business context, AI is seen as a critical factor in the ongoing digital business transformation (Nicoletti & Appolloni, 2023; Abou-Foul et al., 2023).

However, AI implementation is complex and comes with several challenges that organizations need to address (Dutta, 2018; Heimberger et al., 2024). Since servitization is associated with higher risk and reward potential (Nicoletti & Appolloni, 2023), firms need to strategically determine whether and when to implement AI when performing tasks to optimize the continuing advances in AI (Huang & Rust, 2018).

Although AI's relevance in business context is acknowledged, its impacts on servitization and marketing remains underexplored. Current academic studies are still in their early stages and lack empirical evidence on how AI impacts servitization (Wirtz et al., 2019; Huang & Rust, 2021a; Barbieri et al., 2021).

The central premise of AI and ML is that it can enhance efficiency, market offerings, and better customization for value propositions (Haefner et al., 2021). However, AI adoption is complex, and the need for a better understanding, especially in service firms, cannot be overstated (Yang et al., 2024). Given all of this, several studies (e.g. Manser Payne et al., 2021; Kamal et al., 2020; Wirtz et al., 2019) have emphasized the need for further investigation in the field of AI and servitization.

Next to academic research, AI has also received significant attention in consultancy. Reports on AI in service are frequently published online and regularly appear in consultancy journals. Reports by IBM (2022), IBM (2023) and Noventum (2023) indicate that AI is making radical changes in service. While some consultancy reports (e.g. IBM, 2022; McKinsey & Company, 2018) have identified general barriers and drivers of AI, such as increased accessibility, and limited AI skills and expertise (IBM, 2022), there lacks an in-depth analysis on how these factors interact within the context of servitization. Industry-specific dynamics could influence servitization suitability (Johansson & Svensson, 2015) leading to differences in the faced drivers and barriers. A poor understanding or unclear insights into the rapidly changing market conditions might lead to wrong decision-making (Teece, 2018) and misallocation of resources (Chen et al., 2024). As a result, organizations might fail to capitalize the potential benefits that AI offers (Nicoletti & Appolloni, 2023). By studying the underlying factors, a more holistic approach of the complexity of AI in servitization is created, contributing both academically and practically.

The objective of this study is to provide in-depth insights into the factors that drive and hinder AI in servitizing. While many academic studies focus on benefits and drawbacks, this study aims to identify both drivers and barriers of AI, specifically within the servitization context. Understanding these factors is crucial, as drivers allows organizations to seize opportunities fast and stay competitive in the quickly changing digital environment. By indicating drivers, this study provides valuable insights that are not only helpful for businesses, but also useful for academics seeking to understand the phenomenon of AI in servitization. The other way around, identifying barriers allows organizations to proactively mitigate risks, address inefficiencies and other challenges that could hinder successful servitizing.

Next to this, this study tries to provide empirical evidence on previously identified drivers and barriers, and research whether there is any potential interrelationship between these drivers and barriers. Understanding the interrelationship among driving factors and barriers to AI adoption is crucial (Kar et al., 2021). We examine this matter by addressing the following research question:

RQ: **How does artificial intelligence (AI) impact servitizing?**

Given the limited academic research on the drivers and barriers of AI in servitization, this study adopts a qualitative, explorative research design. Data collection was done through semi-structured interviews as they offer consistency across participants, flexibility in specific insights, and provide a deeper understanding (Rahman, 2016; Creswell & Poth, 2018). During these interviews, an ethnographic viewpoint was adopted, which focuses on the 'lived experience' of how individuals and groups experience realities from their own perspectives (Van Maanen, 2011). This approach can be relevant for identifying drivers and barriers that are encountered when AI is employed in servitization.

This study deploys a multiple case study on Dutch business-to-business (B2B) organizations to investigate the drivers and barriers of AI in servitizing. Involvement of B2B firms is important as most prior research on AI focuses on a business-to-consumer (B2C) context (Huang & Rust, 2018; Paschou et al., 2020).

The participating organizations involved originated from a challenge-based project at the University of Twente (UT), located in Enschede. After an exploratory meeting with all organizations, four organizations were selected for further investigation.

This research contributes to literature in several ways. First, it extends the understanding of AI's role in servitization in the B2B

sector, which has received less research attention compared to the B2C setting. Second, this research responds to the call for more empirical work in the field of AI and servitization by studies such as Manser Payne et al. (2021) and Kamal et al. (2020). Third, unlike many existing studies that focus on benefits and drawbacks of AI in service, this research explores the drivers and barriers that impact AI in servitization. Fourth, this study provides a deeper understanding of the complexities of AI in servitization. By analyzing these factors and potential interrelationships, it offers insights to leverage AI's opportunities while mitigating associated risks. Ultimately, this results in more effective servitizing.

This paper is structured into five main chapters. After the introduction, the literature review describes relevant literature on servitization, digital servitization, AI in servitization, and the drivers and barriers of AI in servitization. Next, the methodology section describes the research design, collection method, and data analysis. The fourth chapter presents the findings of this study. We finalize this paper with a discussion, contributions, implications, limitations and suggestions for future research.

2. LITERATURE REVIEW

This chapter describes and explains the main literature relating to this research. The first two sections introduce and explain the phenomenon of servitization and digital servitization. After that, we move on to the concept of AI in servitization, followed by the drivers and barriers of AI in servitization.

2.1 Servitization

Over the past three decades servitization has gathered exponentially growing scientific interest (Coreynen et al., 2020). Servitization is seen as the process of transforming a company's business model by integrating advanced services and customized solutions into their product offerings (Li et al., 2022; Kowalkowski et al., 2017). After Levitt (1976) initially discussed the transformation towards a service-led business model (Kamal et al., 2020), Vanderwerme & Rada (1988) introduced the concept of servitization and discussed the evolving process of servitization from a point in which companies were focusing on goods or services towards a service-oriented model. Servitization can be defined as an ongoing process where goods, services, support, self-service and knowledge are added to core product offerings to add value (Baines et al., 2009, p. 554).

Currently, an increasing number of companies are changing their business ideas through innovation in business models in which they transition from purely being manufacturers to being businesses that produce both goods and services to provide better functionality to their customers (Kindström & Kowalkowski, 2014; Minaya et al., 2023; Brax & Visintin, 2017). Servitization is closely linked to the concept of product-service-systems (PSSs) which, in servitization, is referred to as the integrated offering or bundling of products and services to fulfill customers (Baines & Lightfoot, 2007). PSS consists of three key elements: the product, the service, and the combination of products, services, and their relationships (Beuren et al., 2013). PSS can be divided into three categories (Tukker, 2004). The first one is product-oriented PSS, in which the supplier focuses on services such as installation, maintenance and repair to enhance the product's value. The second category is use-oriented PSS, which focuses on providing accessibility of the overall system and its products, rather than ownership. Result-oriented PSS is the most advanced form, where customers often only pay for actual, achieved performance outcomes and value-in-use (Raddats et al., 2019; Tukker, 2004).

Similarly to PSS, services can be categorized into three main levels: basic services, intermediate services and advanced services (Raddats et al., 2019). Basic services involve selling the product, installation and spare part provision. Intermediate services encompass maintenance, repair, and overhaul activities. Advanced services represent the highest level of servitization. Here, the customers pay for the output or performance of the product, rather than purchasing it (Baines et al., 2024; Raddats et al., 2019). Different products and services result in varying PSS, which results in different value propositions (Raddats et al., 2019). PSS and servitization have gained significant attention in the last few decades. The concepts combined enable companies to create value by delivering outcomes rather than outputs, facilitating sustainability and aligning with customer preferences (Baines et al., 2017; Baines et al., 2024). Besides service types, manufacturing firms provide services based on their place in the industry lifecycle and industry environment (Cusumano et al., 2015). Deploying services should play a more prominent role in a firm's early phase, as there is a high level of costs and uncertainties. Therefore, it might be more common and relevant in a mature phase (Frank et al., 2019). This results in differences in servitization strategies as servitization models and service levels might differ between firms (Frank et al., 2019).

2.1.1 Motivations for servitization

In many cases, firms adopt a servitization strategy to offer integrated solutions for customers and create new value as tangible products are becoming inevitably homogenized (Zhang et al. 2023). Generally, servitization arises from a desire to enhance performance (Raddats et al., 2019). Literature on servitization identifies three main motivations for servitizing: competitive, demand-based and economic motivations (Baines et al., 2009; Oliva & Kallenberg, 2003; Martinez et al., 2017). Several benefits arise from servitization, which can be categorized into four areas: financial, strategic, marketing, and environmental benefits (Zhang & Banerji, 2017). Benefits include increased profitability (Khanra et al., 2021; Zhang J et al., 2023), increased firm performance (Li et al., 2022) opportunities for differentiation (Ulaga & Kowalkowski, 2022), gaining a sustainable competitive advantage (Bustinza et al., 2015), fostering customer loyalty, and creating barriers for competitors to entry (Zhang J et al., 2023; Gebauer et al., 2021). Furthermore, servitization can improve efficiency, increase customer value and deepen customer engagement (Ulaga & Kowalkowski, 2022; Li et al., 2022).

While traditional servitization focuses on integrating products and services to create additional value, recent technological advancements have led to the emergence of digital servitization. In this phenomenon, digital technologies, such as IoT, are leveraged to offer products and services that are aligned with customers' needs and preferences (Coreynen et al., 2020). The current shift towards digital servitization makes it a crucial focus of this study.

2.2 Digital servitization

Technological development is one of the main drivers of business and economic growth (Minaya et al., 2023). Digitization is the technical process that transforms analog information into a digital form that can be processed by the same technologies (Tilson et al., 2010) and offers several opportunities, such as scalability and the changeability of a firm's entire business model (Coreynen et al., 2020; Li, 2018). Digitization is a company's transition when they progressively adopt digital technologies in processes and business models, also known as digitalization (Frank et al., 2019) Digitalization is used to create new value-creating and revenue streams (Sjödin et al., 2020b) and offers several opportunities, such as scalability and the changeability of a firm's entire business model (Coreynen et al., 2020; Li, 2018).

While servitization is the general transition towards a service-centric model, offering solutions through digital technologies has been referred to as 'digital servitization' (Kohtamäki et al., 2019; Chirumalla et al., 2023). Sjödin et al (2020a, p. 479) define digital servitization as "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".

Though inherently related, servitization and digitization are not the same as firms can digitize without moving into service, and servitize without digitization (Frank et al., 2019; Coreynen et al., 2020). However, digitalization is an important enabler of servitization as it both reduces operating costs and improves the quality of service offered (Coreynen et al., 2020).

The integration of digital technologies enables firms to interact and co-create value with customers leading to an increase in offering customized solutions (Khanra et al., 2021). Digital technologies enable radical changes in product, services, innovation processes, and business models (Sjödin et al., 2020b), with technologies like the Internet of Things (IoT) allowing companies to offer products and services like never before (Kindström & Kowalkowski, 2014; Coreynen et al., 2020). It has been argued that the application of digital technologies can further enhance servitization and accelerate the process for the upcoming years (Paschou et al., 2020; Ulaga & Kowalkowski, 2022). Furthermore, Parida et al. (2019) argue that digital technologies and servitization typically go hand in hand.

Despite its potential, digital servitization is seen as a "strategic decision with profound implications" (Bustinza, Gomes, Vendrell-Herrero & Tarba, 2018, p. 112) which may take several years before it creates value, if it does at all (Kohtamäki et al., 2020). When implementing a digital servitization strategy, firms may experience that they are relying too heavily on technology rather than the overall strategy (Tabacco et al., 2024). Kohtamäki et al. (2020) indicate that digitalization on its own is not enough to provide positive financial performance effects. As a result, companies require portfolios of advanced services to ensure value capture from digitalization to ensure positive performance effects (Kohtamäki et al., 2020).

In the sub-field of digital servitization research, studies have explored the role in Industry 4.0 technologies in favoring or influencing servitization (Tabacco et al., 2024; Frank et al., 2019). Industry 4.0 contains various technologies including the IoT, AI, cloud computing, data technologies, blockchain, automation and advanced robots (Chirumall et al., 2023). Paiola et al. (2021, p. 1) argue that Industry 4.0-technologies act as key drivers of the digital servitization process, providing benefits such as real-time capability, intelligence, virtualization, decentralization, connectivity, service orientation and analytical capabilities (Paiola et al., 2021; Frank et al., 2019; Oztemel & Gursev, 2020).

2.2.1 Challenges of digital servitization

Offering developed additional services imposes challenges on companies (Martinez et al., 2017). As services tend to be unclear and difficult to define, it may discourage companies from expanding their services (Baines et al., 2009). Firms might even resist to servitize despite recognizing the advantages of servitization (Schmenner, 2009).

Despite growing interest, papers analyzing barriers and challenges of digital servitization are still emerging (Marcon et al., 2019). Several papers (e.g. Marcon et al., 2019; Raddats et al., 2019; Ulaga & Kowalkowski, 2022; Baines et al., 2017; Marcon et al., 2019) indicate challenges of digital servitization, including the development of new skills and internal capabilities among employees, as well as the need to recruit external personal for specialized digital roles, and data-related issues. Chirumalla et al. (2023) identified several key challenges in the transition from servitization to digital servitization. These include difficulties in sharing information, competence management and culture gaps, and lack of data processing and remote monitoring technologies (Chirumalla et al., 2023, p. 8).

AI can contribute significantly to this transition as its capabilities enhance servitization (Nicoletti & Appolloni, 2023; Abou-Foul et al., 2023). AI is seen as the next generation and most advanced form of digitalization and digital servitization, offering limitless possibilities (Parida et al., 2019; Kohtamäki et al., 2022; Sjödin et al., 2023).

Over the past few years, AI development has been accelerated by an explosion in available and accessible data warehouses (Kohtamäki et al., 2019). AI is increasingly used to perform complex tasks from which previously it was thought that only humans were capable of (Lins et al., 2021). It allows organizations to deliver more efficient and tailored services that meet the customers' continuously changing demands and expectations. This has created new opportunities for firms to leverage digital technologies that create and capture value through new revenue streams and differentiation (Sjödin et al., 2021), potentially leading to increased profits (Kohtamäki et al., 2020). AI has a crucial role in the development of servitization. The service landscape is changing, positioning AI as a key element for advancements in service.

2.3 Artificial Intelligence (AI) in service

AI is one of the technologies that is currently being discussed the most (Lins et al., 2021). As organizations focus on growth, they continuously seek opportunities to enhance performance with AI emerging as a key technology to achieve this (Kar et al., 2021; Davenport & Ronanki, 2018). The upward trend of growth in this century has been reshaping the 21st century service industry (Reis et al., 2020).

Currently, AI is gaining popularity and importance from researchers and making radical changes to digital servitization (Manser Payne et al., 2021; Kohtamäki et al., 2019). Over the past few years, the number of academic papers around AI has risen significantly (Cubric, 2020).

AI is built on the development of ML capabilities that use large amounts of structured and/or unstructured data to simulate a certain level of human cognitive ability, including human thinking, feeling, reasoning problem solving and learning (Smith, 2019; Nicoletti & Appolloni, 2023). It is distinct from other technologies as it can obtain large amounts of data very fast, learn from data, adapt over time, and generate new insights without additional programming or human intervention (Huang & Rust, 2018; Huang & Rust, 2021b; Ardolino et al., 2018).

This study makes a distinction between digital servitization and AI-driven servitization. Digital servitization uses various digital technologies to support servitization, while AI-driven servitization leverages the unique capabilities of AI (Manser Payne et al., 2021; Abou-Foul et al., 2023). Instead of focusing on specific AI technologies, this study uses a broad lens to explore the key drivers and barriers influencing AI in servitization.

In this study, we define AI in service based on the study of Bock, Wolter & Ferell (2020). This definition is specific to the service context "service AI" which is defined as "the configuration of technology to provide value in the internal and external service environments through flexible adaption enabled by sensing, learning, decision-making and actions." (Bock et al., 2020, p.

317). This definition focuses on flexible adaptation, the key characteristic of service AI, while demarcating service AI from the technology that enables AI (Bock et al., 2020). In addition, as this definition focuses on flexible adaptation, this isolates service AI from other technology such as blockchain, drones, robotics, big data and the IoT, while it recognizes the configurations of these technologies enable service AI (Bock et al., 2020, p. 319).

Data, and especially AI, have the potential to be an asset that can be used to build an ecosystem that enhances service innovation (Abou-Foul et al., 2023). Literature developed around artificial intelligence capabilities (e.g. Abou-Foul et al., 2023; Davenport & Ronanki, 2018; Mikalef & Gupta, 2021) predominantly focus on a firm-level analysis, which hinders the ability to see the complete impact of AI on business processes (Jimenez Castellanos, 2023). Therefore, AI should be seen as a business capability instead of a technological advancement (Davenport & Ronanki, 2018). Mikalef & Gupta (2021, p. 2) define AI capabilities as "the ability of a firm to select, orchestrate, and leverage its AI-specific resources". Research by Abou-Foul et al. (2023) indicates that there is a positive relationship between AI capabilities, such as ML and automation, and servitization.

AI that can learn, connect and adapt is increasingly utilized in service and is a major source of service innovation (Huang & Rust, 2021b). By enabling smart products to autonomously improve performance and enable more advanced PSS than with digital technologies alone, AI also enhances (new) product and service innovation (Jimenez Castellanos, 2023; Kolagar et al., 2024). AI capabilities offer personalized and customized solutions (Huang & Rust, 2022), and analytic skills allow proactive and predictive maintenance (Kolagar et al., 2024; Abou-Foul et al., 2023).

Implementing AI provides firms with the ability to respond more effectively to their competitive environment and manage the increasing amount of data and information (Haefner et al., 2021). AI-driven servitization impacts business models and product service innovation, enabling firms to gain new insights and revenue streams (Naeem et al., 2024; Sjödin et al., 2021). This in turn leads to enhanced customer success and increase profitability (Dubé & Misra, 2023).

Additionally, AI enables managers to better assess business' value, predict customer preferences, establish more accurate pricing, and engage customers (Abou-Foul et al., 2023; Jimenez Castellanos, 2023; Huang & Rust, 2021b). Beyond economic benefits, AI is also utilized to help address labor and skill shortages, meet sustainability goals, and tackles business problems and pressing society challenges (IBM, 2022; Dangelico et al., 2017; Haefner et al., 2021).

However, despite AI's potential, many firms fail struggle to achieve increased value creation and capture from its implementation (Sjödin et al., 2021). AI drastically changes firms' value propositions by reshaping how they create, deliver, and capture value to meet customer needs (Sjödin et al., 2020a). Furthermore, the lack of ready-to-use, standardized AI systems at a sufficient level of maturity presents a significant challenge, making AI adoption complex. (Vial et al., 2023).

Despite difficulties in implementation, AI is seen as a critical component of innovation in various contexts. Firms are engaging with AI in a variety of ways and sectors. Large consulting firms are investing in AI and acquiring AI firms (e.g. McKinsey's acquisition of QuantumBlack, Deloitte's acquisition of SFL Scientific Business) to upskill in AI and data-related competencies (Oarue-Itseuwa, 2024). Service innovation through AI has resulted in revolutionary products such as ChatGPT, Amazon Alexa and Microsoft Genie (Akter et al., 2023). Examples of AI used in service include robots for homes and health care, virtual bots and social robots (Huang & Rust, 2018) in various industries such as logistics, supply chain and financial services (Vial et al., 2023).

In recent years, chatbots have become increasingly popular in diverse sectors including insurance, banking, retail, travel, healthcare and education (Chung et al., 2020, p. 588). Chatbots assure that personalized service is available to meet customer needs anytime and anywhere. Using chatbots reduces costs for customer service and leads to increased customer satisfaction as waiting times decrease (Chung et al., 2020).

In healthcare, it is generally believed that AI can improve diagnoses, provide and invent new care instructions and new treatment for diseases. It is expected to act as a more accurate, precise and effective human healthcare professional (Väänänen et al., 2020). Healthcare expenses will be lowered as care becomes faster and more efficient, which will modify the medical profession, requiring more creative and critical thinking than time-consuming repetitions (Meskó et al., 2018). Ultimately, AI utilization in healthcare could help to tackle labor shortages and provide resources for elderly (Väänänen et al., 2020).

The hospitality and tourism branch has witnessed a growth in AI adoption in their service processes. Self-driving luggage trolleys, contactless food services, automated check-in procedures at hot

el and intelligent service desks have been used because of advantages in labor cost reduction and service efficiency improvement (Zhou et al., 2020; Li et al., 2021). Data has been collected which improved decision-making, while some human jobs have been (partly) replaced (Zhou et al., 2021). The number of human-to-human interactions has decreased as automated, technology-based service is offered, reshaping service interactions in this industry (Li et al., 2021).

In the retailing landscape, AI-technology has changed the way fashion retail is conducted because transparency in the whole chain (e.g. procurement, manufacturing, distributions) has been improved (Kautish & Khare, 2022). Retailers are helped to understand quickly changing customer needs, manage promotions and fulfil customers' expectations and preferences. AI-enabled technologies have enabled personalization, improved customer services and present an opportunity to analyze purchase patterns and behaviors. Through these technologies an opportunity is offered to create deep and profitable relationships that foster customer engagement (Kautish & Kare, 2022).

Over the past few years, AI has also become more popular in the field of digital marketing. The technology helps marketers build intelligent systems. AI can be used to create a better understanding of customers' demands and behaviors and will assist in gaining, growing and retaining their clients. It is believed to improve productivity, organizational efficiency and lead to higher profitability (Nair & Gupta, 2021).

Although benefits of AI are widely recognized, its implementation is complex and comes with challenges that organizations need to manage as AI cannot simply be implemented (Dutta, 2018; Heimberger et al., 2024). Successfully overcoming these challenges requires more than just spending money on digital infrastructures, technologies and data (Cubric, 2020; Sjödin et al., 2021). Understanding the drivers and barriers is therefore crucial for businesses that want to leverage AI effectively in their servitizing while mitigating its associated risks.

2.4 Drivers and barriers of AI in servitization

Despite complexities in adoption, AI is increasingly embraced by professional service companies across different sectors (Dutta, 2018; Yang et al., 2024). However, relatively few organizations have successfully included AI-related technologies into their services (Reis et al., 2020). Many lack the procedures needed to generate value from AI at scale, as AI-integration is still in its early stages (McKinsey & Company, 2018; Heimberger et al., 2024).

The availability of AI applications for implementation is growing rapidly. However, AI adoption is a complex process that requires many changes, which are rarely implemented easily and quickly (Heimberger et al., 2024). AI adoption and. Implementation are influenced by multiple factors on different levels, with one critical challenge being the lack of focus on the key driving factors (Kar et al., 2021). While expectations for AI run high, executives are also aware of potential risks (Ransbotham et al., 2017). When considering AI, organizations assess both potential risks and expected monetary benefits Heimberger et al., 2024).

Previous academic studies have focused on drivers and barriers of AI adoption across several industries. For example, Heimberger, Horvat & Schultmann (2024) analyzed drivers of AI adoption in a production-context and found that presence of skills, availability of data, and need for ethical guidelines form the most important accelerants of AI adoption. Other frequently cited factors include managerial support, need for performance measures, and IT infrastructure, trust, and innovation culture of an organization (Heimberger et al., 2024). Decision-makers should consider factors of AI implementation carefully, as these tend to be interconnected and influence each other (Heimberger et al., 2024).

Yang et al. (2024) identified six key factors influencing AI adoption in three auditing firms. AI adoption is influenced by technological affordances and constraints, organizational innovation management and readiness, and environmental factors such as competition and regulations. The impact of these factors varies based on company size and level of innovation of the company. While larger firms can implement AI on a larger scale, they face difficulties due to regulations and AI's complexity. Smaller companies lack readiness and resources to overcome these challenges, hindering their adoption (Yang et al., 2024).

Cubric (2020) found that AI adoption in the business and management domain is mainly driven by economic factors, such as time reduction, improved performance and customer satisfaction, and better decision-making (Cubric, 2020, p. 7). Barriers for AI adoption were divided into economic (costs for implementation and maintenance), technical (data-related issues such as data availability, lack of usable data and lack of training data), and social (increased dependence on non-humans, lack of knowledge, safety, trust, understanding of potential benefits, safety issues, and job security fears). However, these social barriers are equally important to hinder AI adoption (Cubric, 2020). If carefully managed, these social barriers can be overcome, resulting in increased technology acceptance by those who will need to use the technology, or replace it (Cubric, 2020).

Kar, Kar & Gupta (2021) found that AI solutions' decision-making ability and accuracy are seen as the most influential drivers that influence other driver, while lack of strategy, talent, and leadership commitment are the most significant barriers that affect others (Kar et al., 2021, pp. 233-235). Additional drivers include sustainability, productivity, speed, and cost reduction, while barriers include lack of reusable model, usable data, infrastructure, job security threats, and trust issues in decisions by AI solutions (Kar et al., 2021, pp. 221-223).

One key driver for AI-driven servitization is the current rapid development of AI technology. These advancements have made AI more accessible, positioning increased accessibility as the driver of AI adoption in organizations. Additionally, organizations are driven by the need to reduce costs and automate key processes (Kohtamäki et al., 2020; Paschou et al., 2020), IBM, 2023).

Over the past few years, B2B marketing has increasingly embraced AI. Literature in this industry identifies two primary drivers for AI adoption. The first being AI's ability to give new insights, enhance efficiency, and support decision making by processing large datasets and discovering new patterns, which enhances marketing strategies' effectiveness and firm performance. Second is the perceived cost savings from adopting AI solutions. AI is cheaper, faster and less sensitive to human mistakes. However, AI solutions may require a lot of costly resources (Keegan et al., 2022).

Thowfeek et al. (2020) explored factors influencing AI adoption in banking service sectors. The most crucial yet challenging factors are the required skills and technical knowledge, which can be addressed through either training employees, recruiting AI proficient individuals, or hiring an AI trainer (Thowfeek et al., 2020). Key challenges include lack of data or poor quality of training data. Other barriers include lack of digital knowledge, skills and mentality among employees, lack of top-management support in AI adoption, and moral concerns and uncertainties (Thowfeek et al., 2020).

A study by Ahmad et al. (2022) on AI implementation barriers and challenges in the manufacturing sector in Malysia identified five barriers towards AI adoption. The most prominent was lack of talent, followed by lack of technology, limited modelling, AI application is inappropriate, and AI affects privacy concerns and risk (Ahmad et al., 2022, p. 114).

A survey of McKinsey & Company's (2018) found that the most common barrier to AI adoption is strategy related, followed by other challenges such as lack of appropriate talent, and a lack of leaders who indicate ownership and dedication to AI (McKinsey & Company, 2018).

MIT Sloan Management Review's survey on AI in businesses found that organizations that both understand and have adopted AI, called 'pioneers', face fewer technological challenges but instead struggle more with business issues. These companies experience competing investment priorities and unclear business cases as more significant barriers to AI implementation than technological barriers. On the other hand, 'passive' companies, those with no AI adoption or understanding, struggle to recognize AI's potential value. Without a clear business case that aligns with investment priorities, management remains uninvolved, delaying or even completely hindering AI adoption (Ransbotham et al., 2017).

This research also revealed several data-related challenges, including the need for high quality data. This is crucial for AI, as complex algorithms can compensate for limited data, but not for data of poor quality. Moreover, positive results alone are not sufficient for AI training. Another key challenge for managers across all industries is data ownership. Some data is confidential, and the companies that own it have little incentive to share it with others. Other data is fragmented across data sources, making training reliable AI systems complex (Ransbotham et al., 2017).

A Gartner Research Circle survey found that the main barrier to AI adoption is skills needed to perform a job. The second challenge is fear of the unknown, as respondents are not fully

aware of AI's benefits and use in the workplace. The third challenge is the data quality derived from AI. Successful AI-initiatives rely on data quality and what insights they can derive from that data. Organizations recognize that AI systems fail if data is insufficient (Goasduff, 2019).

IBM's research in the Global AI Adoption Index 2022 identifies the top five barriers to AI adoption (IBM, 2022), which were unchanged in the follow-up 2023 report (IBM, 2023). The first one is *limited AI skills, expertise or knowledge* (IBM, 2022). Without necessary skills, individuals or organizations may be unable to leverage AI effectively (Sjödin et al., 2021). The second barrier is *the price is too high* (IBM, 2022). Many AI technologies have high entry level costs that are difficult for organizations to afford, requiring high investments and allocation of resources, high costs of training data, specialized hardware for building and training models, and technical expertise (Cobbe & Singh, 2021). These considerations make managers cautious in their investments as they need to evaluate AI adoption as financially viable to make the investment (Heimberger et al., 2024). The third barrier is *lack of tools or platforms to develop models*. The process of setting up the necessary AI tools, infrastructure and frameworks can be a challenge as it requires expert knowledge that is not always available (Rall et al., 2023). The fourth barrier is *projects are too complex or difficult to integrate and scale* (IBM, 2022). A company's propensity for AI is influenced by product complexity (Heimberger et al., 2024). Complex manufacturers are often less able to standardize and automate due to their small or medium batch sizes. This can hinder the integration of intelligent technologies such as AI, as less automation is often prevalent. This fifth and last barrier is *too much data complexity*. Poor data or lack of relevant data can pose a barrier and hinder the implementation of AI in service (Naeem et al., 2024).

AI's quick development has also highlighted several ethical challenges. In recent years, ethical concerns regarding AI have been discussed extensively (Cobbe & Singh, 2021). Bias, lack of transparency, and limited accountability pose the most significant barriers to responsible AI use (Mensah, 2023). AI systems that contain biases and discrimination can weaken social trust, create division, and threaten justice and equality. Moreover, a lack of transparency and accountability can affect public trust and acceptance of AI technologies (Mensah, 2023, p. 36).

Despite its huge potential, AI implementation often encounters resistance (Mensah, 2023; Ivchyk, 2024). This resistance refers to the hesitation or reluctance organization organizations and individuals face when implementing AI technologies (Ivchyk, 2024, p. 17). Key concerns include a lack transparency in decision making, potential biases or errors, and fears of job replacement (Ivchyk, 2024). An important aspect in this is trust, which is seen as a critical factor for successful AI implementation, and a lack of trust can hinder its implementation (Heimberger et al., 2024). To build trust, organizations should encourage transparency, provide users with control over AI interactions, and ensure that AI systems are explainable (Ivchyk, 2024, p. 20).

Next to individual concerns, organizational resistance also plays a key role in AI implementation. Many organizations struggle with AI implementation due to a lack of readiness and a misalignment between business objectives and AI strategies. To overcome these barriers, leaders should foster a culture of innovation, strengthen data governance, and align AI initiatives with strategic objectives (Ivchyk, 2024). Addressing these challenges can help organizations to successfully integrate AI and leverage its benefits to enhance their servitization strategies.

While interest in AI's role in servitization is growing, research in this area is still in its early stages and lacks empirical evidence (Wirtz et al., 2019; Barbieri et al., 2021). While existing studies recognize AI's impact on business contexts, there is a need for deeper explorations within servitization context (Abou-Foul et al., 2023). Furthermore, current literature lacks guidance on how to optimize AI and servitization for marketing impact (Wirtz et al., 2019; Huang & Rust, 2021a). Another gap is the interconnectedness of AI's drivers and barriers. Studies by Heimberger et al. (2024) and Kar et al. (2021) indicate that factors of AI adoption influence each other, but how they interact within servitization remains unclear. To close this gap, further research is needed to better understand the factors that drive and hinder AI's employment in servitization.

To be able to visually represent the drivers and barriers of AI in servitization, a theoretical framework has been developed. This framework is presented in Figure 1.

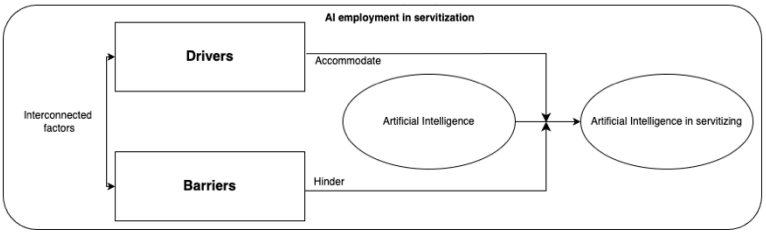

Figure 1: Theoretical framework: drivers and barriers of AI employment in servitization

3. METHODOLOGY

In the methodology section we will outline how the research in this study is conducted. This chapter includes the following subsections: research design, data collection and data analysis.

3.1 Research Design

The objective of this study is to uncover insights in the drivers and barriers of AI that Dutch business-to-business (B2B) firms face in servitizing. Additionally, the study examines if previously found drivers and barriers of AI-adoption are also relevant in the servitization context.

To address this objective, this study follows an explorative design, which is suitable for studying phenomena where the relationship between variables is unknown, or not fully understood (Voss et al., 2002, p. 197). Exploratory research allows for a deeper understanding of a particular topic by testing it and gaining familiarity with it (Stebbins, 2001). Given the fact that AI's impact on service provision is still underdeveloped (Abou-Foul et al., 2023), remains embryonic and lacks empirical evidence (Wirtz et al., 2019) this type of research is appropriate. An abductive approach is used as this study aims to discover new insights. As case studies are often used in doing abductive research, an exploratory multiple case study is employed to analyze the drivers and barriers of AI in servitization. This approach allows searching for the most plausible explanations for findings by continuously comparing theory and practice. In this process, theories can be refined or created based on findings in the case study (Dubois & Gadde, 2002). Additionally, as multiple companies are involved, this approach allows for cross-case comparisons (Urbinati et al., 2020) which enriches the analysis. Case studies that are flexible can be easily combined with ethnographic research, as it tends to increase both breadth and depth of the insights gathered (Yin, 2018). An ethnographic approach is incorporated into the study as it focuses on understanding how companies experience and navigate drivers and barriers. Ethnography focuses on the 'lived experience' of how individuals and groups experience realities from their own perspectives (Van Maanen, 2011), making it relevant for

exploring drivers and barriers of AI in servitization as it provides more depth into the study.

To answer the research question, a qualitative approach is adopted. This is best suited for generating valuable insights, creating a deeper understanding, and capturing participants' perspectives (Goia et al., 2012). Furthermore, qualitative methods are effective when little is known about the subject (Gill et al., 2008), making them ideal for researching the domain of AI's impact on servitizing which has not been researched intensively. Through this approach, this research aims to answer the central research question:

RQ: How does artificial intelligence (AI) impact servitizing?

This question guides the research into how AI impacts the servitization transition, focusing on the factors that accommodate and obstruct AI implementation in organizations. To address the research question, we have formulated two sub-questions. These are the following:

SQ1: What are drivers/accommodators for businesses in employing AI technologies in servitizing?

SQ2: What are barriers/challenges for businesses in employing AI technologies in servitizing?

3.2 Data collection

3.2.1 Casuistry

The companies in this research participated in the 'challenge-based master thesis project' of the UT. All companies are B2B firms, which indicates that they only have transactions between businesses. All companies are based in the Netherlands, however, some of them have departments or business units abroad as they operate internationally. Although different in nature, dispersed across different markets, and sometimes placed at a different position in the supply chain, all companies share a common interest in service, servitization and AI. However, some companies face different drivers and barriers when employing AI in their servitization strategy, and some face similar. Therefore, we consider these companies as interesting casuistry for our research. Due to confidentiality, this paper refers to these companies as "Shipyard Inc.", "Training Inc.", "Consulting Inc." and "Bakery Inc." An overview of the participating companies and their core business can be found in table 1.

3.2.2 Collection method

After an exploratory meeting with all seven participating companies in the challenge-based master thesis project four organizations were chosen to collect data from. Follow-up meetings with the contact people were held to get in touch with potential interviewees. The interviewees chosen were the contact person itself or a colleague that was indicated as suitable by the contact person. After contact, mainly by e-mail, interviews were agreed upon. During the interview an interview guide was developed and followed to explore views on the faced drivers and barriers of AI of servitization.

This study involved 14 participants, with most of the interviewees being Dutch. A few days before an interview, the interviewee received a two-pager that introduced the research's topic. At the beginning of every interview, every participant was asked to give permission for the interview to be recorded, informed about anonymity and confidentiality, and given a brief (re-)introduction to the subject.

The Dutch interviewees were interviewed in their native language as it usually makes them more at ease and better able to express their thoughts, ideas and philosophy. By interviewing in Dutch, it improves the quality of answers as it allows for more detailed information. All Dutch interviews were transcribed and translated into English afterwards. The interviews were mostly conducted in-person, with some of them being online because of the travel distance. Due to confidentiality reasons, every participant is anonymized when this study is published. The recording of all interviews, both online and physical, were made through Microsoft Teams. An overview of the respondents and their job title can be found below in Table 2.

Considering the ethnographic research approach described in section 3.1, the researcher gathers first-order data that is collected through observing and interviewing individuals (Visconti, 2010) but data can also be collected through listening, recording, interpreting behavior (Schensul et al., 1999).

The data in this study was gathered through semi-structured interviews with open-ended questions. This type of research is most common in qualitative research as it provides a deeper understanding and insights into the answers given in terms of behavior, perceptions, feeling, understanding and experiences in comparison to quantitative research (Rahman, 2016, p. 104; Gill et al., 2008, pp. 292-295). Semi-structured interviews offer flexibility while there are some guidelines on which elements to talk about while allowing both consistency and flexibility (Gill et al., 2008, p. 291; Creswell & Poth, 2018). Adding ethnography to interviews can enhance the quality of ethnographers' work, as what people say can contrast with their actual actions (Reeves et al., 2008). Through this approach, our research aims to create in-depth insights into which factors accommodate, and which factors hinder organizations of employing AI in servitization.

3.3 Data analysis

The interviews were held both online and offline, with all interviews being recorded and automatically transcribed using Microsoft Teams. The transcriptions were read and carefully corrected to ensure reliability and accuracy in the transcripts. After the data was collected, transcribed and coded, it was analyzed using the Gioia methodology. The Gioia methodology is a qualitative approach for creating a grounded theory that can meet the standard of reliable research that trustworthy top journals also require (Magnani & Gioia, 2023).

The Gioia methodology consists of four steps, with the data from the interviews acting as the basis: (1) transcripts are coded and analyzed, and lead to the first order concepts that are based on the quotes from the transcripts, (2) second-order themes emerge on the set of the first order concepts, (3) analyzing the second-order themes and divide them into aggregate dimensions, and (4)

Table 1: participating companies and their core business

Company	Core business
Shipyard Inc.	International shipyard group that provides maritime solutions through design, shipbuilding, and related services.
Training Inc.	IT training provider in the Netherlands, specialized in products, apps and services of Microsoft.
Consulting Inc.	Consultancy and engineering firm, helping industrial companies with their developments in the field of people, production and technology.
Bakery Inc.	Develops and manufactures stand-alone machines and complete production lines for the industrial bakery sector.

create a data structure to visualize the complete process (Gioia et al., 2013).

Table 2: respondents, ranked by company

ID	Company	Job Title
1	Shipyard Inc.	IT Business Partner
2	Shipyard Inc.	Chief Information Security Officer
3	Shipyard Inc.	Service Line Manager
4	Shipyard Inc.	Manager Design & Proposal
5	Shipyard Inc.	Project Manager Services
6	Consulting Inc.	Data Scientist
7	Training Inc.	Microsoft 365 Trainer/Consultant
8	Training Inc.	Marketer
9	Training Inc.	Program Manager
10	Bakery Inc.	Team Lead Spare Parts
11	Bakery Inc.	Field Service Manager
12	Bakery Inc.	Project Manager Software Development
13	Bakery Inc.	Process Coordinator Service
14	Bakery Inc.	Team Lead Documentation
Total amount of data: 243 pages of transcripts		

In the transcription, words, (parts of) sentences or multiple sentences were analyzed and assigned with a color. By doing so, interviewees' responses could be categorized. In this way, first-order concepts were coded, analyzed and displayed clearly in a draw.io sheet, giving the opportunity to create second-order themes based on the first order concepts, followed by the aggregate dimensions. This resulted in the data analysis displayed in Figure 2, which can be found in the Appendix, which gives a complete overview of the first order and second order concepts, followed by the overarching, aggregate dimensions. The data analysis has led to the next section, in which the findings are presented.

4. FINDINGS

This section includes the findings that are collected through the qualitative research approach. The findings include the semi-structured interviews that were conducted at the four B2B organizations. The interviews were transcribed, with the Dutch versions first translated into English, and after that coded. Through coding and using the Gioia method, several concepts and themes were identified that were categorized into second order themes, followed by aggregate dimensions. For the drivers these dimensions are market transformation, engagement in AI adoption, organizational commitment to innovation, improved data quality, organizational improvement, and improving and expanding services with AI. For the barriers, we identified the following dimensions: lack of strategic direction, organizational barriers to AI adoption, internal resistance to AI adoption, external resistance to AI adoption, financial barriers to AI adoption, ethical, regulatory and trust issues, and data-related issues. In Figure 2, which can be found in the Appendix, a complete overview of all the 1st and 2nd order concepts and the corresponding overarching dimensions can be found.

4.1 Accommodators of AI

In this section, the first sub-question of this research will be tackled. We explain which drivers of AI in servitizing were identified during the interviews. We identified six drivers. These are 1) market transformation, 2) engagement in AI adoption, 3) organizational commitment to innovation, 4) improved data quality, 5) organizational improvement, and 6) improving and expanding services with AI.

4.1.1 Market transformation

During the interviews, we observed that the market in which the firms operate influences AI into their service offerings. Multiple participants indicated that firms are observing a market transformation, in which more and more companies are using AI. This creates an environment with a feeling that more or less forces them to also employ AI in order to keep up.

"On the one hand, just keep up with what's going on now. Because if you don't, you're just so far behind, actually. And then you get caught up." (Manager Design & Proposal, Shipyard Inc.)

Businesses that lag in AI implementation risk falling behind competitors, losing both customers and market share as competitors might seize digital opportunities more quickly. The interviewed Data Scientist of Consulting Inc. shared a similar opinion:

"I guess in the future many companies will use AI. And if one company does not, then they will behind the trend." (Data Scientist, Consulting Inc.)

However, despite competitive pressure and the fear of falling behind competitors, there is a possibility that AI is implemented, even when organizations are not prepared or fully ready. An organization could experience that they cannot control whether they implement AI or not. Together with the above-mentioned competitive pressure to not fall behind competitors, organizations might feel pressured to employ AI. A marketer of Training Inc. mentioned the following:

"You don't necessarily have a lot of control over that. (...) It actually just gets pushed through." (Marketer, Training Inc.)

This quote shows that the use of AI might be out of an organizations' control. External factors, such as this competitive pressure, create an urgency to adopt AI to keep up, even if the organization is not ready. As a result, AI is sometimes employed without a clear vision, strategy and business objective.

We also observed that AI is becoming increasingly accepted by people and organizations in these B2B markets. Like competitive pressure, increasing market acceptance of AI puts pressure on companies to engage with AI. As more individuals and businesses use AI, it is seen as more reliable, increasing acceptance and influencing customer demand. About this topic in the bakery industry, a manager of Bakery Inc. said:

"I do notice that it does become more and more accepted, I think." (Field Service Manager, Bakery Inc.)

His colleague continued upon this, mentioning that the bakery industry has experienced a turning point. Compared to a few years earlier, customers increasingly get used to sharing data and other relevant information including batch information, track and tracing, and production.

"And so, you see that even in the bakery, in the industry, people are also starting to find this more normal. And allowing it more easily after all, but critically." (Project Manager, Software Development, Bakery Inc.)

Several interviewees of Bakery Inc. termed the bakery industry 'conservative'. Traditionally, bakers kept their data in-house, without sharing it with manufacturers, mainly due to concerns of data breaches or competitors gaining sensitive information. However, the quote above indicates that companies are becoming less conservative and more open to collaborating with suppliers. Data sharing is increasingly considered normal, indicating that they are open to work with suppliers to improve performance and

focus more on long-term relationships. This is a clear sign of slowly transitioning towards servitization.

During the interviews at Shipyard Inc., we observed that this manufacturing company is undergoing a market transformation in both products and services. A few years ago, it was only about selling their product, the ship, and currently they are increasingly transitioning towards delivering their product combined with services, which is part of servitization (Kohtamäki et al., 2020).

We also found that companies need to adapt their business model to meet changing customer demands. The earlier mentioned competitive pressure and growing market acceptance drive changes in customer behavior, which organizations need to respond to. However, while some customers are engaging with AI others are not busy with it yet.

"So, you do see that some customers are working on that, but far from everyone." (Team Lead Spare Parts, Bakery Inc.)

This quote shows that there is a difference in pace of AI adoption among customers, Early adoption presents companies with an opportunity to differentiate themselves by becoming an early adopter or a 'pioneer' (Ransbotham et al., 2017). This advantage serves as a driver for AI, as the increasing demand motivates companies to implement AI technologies to meet these customer demands and stay competitive.

Another firm that experiences changing customer demands is Training Inc. Training Inc. is a specialized Microsoft training provider, offering over 65 training courses for Microsoft Office applications such as Excel, Outlook and Teams, as well as several other programs, including Power BI and AI. According to the marketer interviewed, the ChatGPT course is currently one of the most popular training courses, indicating a growing market interest in AI. However, as there is increased awareness of AI and its potential, this also increases customer expectations. This creates a gap between customer expectations and AI's current capabilities.

"Now you see that people have certain expectations: this should be possible, but it is not at all possible yet." (Program Manager, Training Inc.)

This quote indicates that there is still a significant gap between what customers expect from AI and what is currently achievable. AI is still developing, and organizations need to manage these expectations to provide realistic solutions appropriate to their customer's demands.

In summary, market transformation increases the urgency for companies to adopt AI. We observed that there is significant competitive pressure for organizations to adopt AI as it becomes increasingly critical for maintaining a competitive edge. However, sometimes businesses are not even ready for AI, but forced to employ it because of their competitors. Furthermore, AI is increasingly perceived as more and more reliable through the growing acceptance of AI in the market. We also observed that companies need to continuously adapt their business model to meet changing customer demands that arise from competitive pressure and growing market acceptance.

4.1.2 Engagement in AI adoption

Another observed theme that accommodates AI in an organizations' servitizing is engagement in AI adoption. In the interviews, we observed that several interviewees are very proactive and eager to learn about AI.

For example, the Service Line Manager of Shipyard Inc. mentioned personally attending symposia or fairs on AI and related subjects from time to time. Another example was given by the Project Manager Software Development of Bakery Inc., who indicated that a lecture had been attended on AI and ethical issues. Another example was given by a colleague, the Process Coordinator Service, who mentioned that exploring AI's options and possibilities individually was done to learn and apply it effectively.

These examples underline that employees feel the need to be up-to-date or even one step ahead on, in this case, AI and related subjects. By attending lectures, symposiums and fairs, employees are up to date on the latest trends, developing knowledge and skills. An IT Business Partner of Shipyard Inc. said the following about the subject:

"I am the one within the division who does try to be just one step ahead of the other well, 3,000 users who are in my division, because I have to be able to keep up with them." (IT Business Partner, Shipyard Inc.)

The quote above highlights the IT Business Partner's desire to learn about AI and trying to be one step ahead of colleagues. By proactively learning about AI as an individual, it not only increases an individual's own skills and knowledge but also creates opportunities to help colleagues. Sharing knowledge can also help seize AI's opportunities faster. In addition, this proactivity can ensure better adoption within an organization.

Other interviewees from Shipyard Inc. and Bakery Inc., who are also superior to several colleagues, express a great sense of responsibility in making advancements in AI in their organization. They see it as part of their role to take initiative and guide their teams.

"And I do see that as one of my tasks. We just need to take it to the next stage." (Project Manager Services, Shipyard Inc.)

"I then take the lead in that to train them in that, to instruct them, to bring them awareness into it." (Team Lead Spare Parts, Bakery Inc.)

From these quotes, we can state that these interviewees take responsibility for further developing AI in their organization. Not only does instructing colleagues raise awareness, but it also promotes a culture of AI implementation within the organization.

Another interesting observation in our interviews was the close collaboration within companies. Especially in Bakery Inc, which several interviewees described as a kind of 'family business', things are sometimes done for a person since colleagues have known each other for several years. Close relationships in such family businesses can enhance engagement in AI implementation, because colleagues trust each other, have close ties, and are willing to get things done because of their relationship.

We also observed that another important factor in engagement in AI adoption is individuals' interest in AI. If employees, who may be encouraged by executives, are genuinely interested and enthusiastic about AI, they are more likely to explore and apply the technology within their organization. This, in turn, makes it easier for executives to make advances in AI-adoption. About interest of individuals the following was said:

"But it interests people. They want to start using that too." (Project Manager Services, Shipyard Inc.)

Building upon this phenomenon of individual interest in AI, we observed that everyone within the relatively young team at Training Inc. finds AI interesting, sees the value of it, and is intrinsically engaged with it. According to the Marketer of Training Inc. interviewed, they motivate each other within the marketing team to get started with AI, for example ChatGPT. As this does not come from management, this example emphasizes both individual and group interest among colleagues.

The Program Manager interviewed also mentioned that they are expected to master expertise in relevant subjects such as AI. However, they also have the flexibility to learn and explore things on their own. This is essential, as they need to apply it in practice, and provide answers to participants their questions. The fellow Marketer termed them ‘specialists’ in their field. The responsibility falls on them as their performance is evaluated based on results instead of methods they use to achieve them.

This individual or group interest in AI is further enhanced by the increasing amount of interaction with AI in daily life. Individuals regularly encounter AI in different contexts such as online chatbots, Copilot, and ChatGPT what increases awareness and interest. For example, in the interview with the Marketer of Training Inc., it was mentioned that AI is frequently discussed and very popular on platforms such as LinkedIn.

"Just open LinkedIn and your timeline will be full again, it really lives (...) People find it interesting, people want to develop themselves in it." (Marketer, Training Inc.)

Since AI is prominent and all over the place, it creates an impression that ‘everyone’ is working with it. This increases exposure and makes people more aware of the existence and relevance of AI. With AI also frequently appearing in news, discussions in the workplace, and other places, individuals will likely be curious about it too.

"Yes, I also generally think positively. If you show what is possible then you see those wheels, you see those already turning of how we are going to apply this within our company." (Microsoft 365 Trainer/Consultant, Training Inc.)

In summary, engagement is a crucial driver for AI implementation in servitization. Without proactive engagement, AI’s influence and impact remains limited. It is not just about adopting technology but also creating the right mindset. However, commitment should not only come from individuals, but also from within the organization.

4.1.3 Organizational commitment to innovation

Organizational commitment to innovations, such as AI, is of great importance in businesses. From our interviews we observed that, in addition to individual or group commitment, organizational commitment is a core aspect of successfully employing AI in servitizing.

For example, at Shipyard Inc. we observed a positive attitude towards AI. The Chief Information Security Officer (CISO) made the following statement:

"We are absolutely enamored with AI, we are absolutely not going to block it either." (CISO, Shipyard Inc.)

This statement indicates that Shipyard Inc. is not just accepting AI but actively embracing it. It is not just about individuals or small groups that are interested or motivated, but also executives from higher functions should support AI implementation.

Further supporting the CISO’s statement, a Service Line Manager of Shipyard Inc. said:

"So, I also believe that we are quite well positioned, at least have the right incentive, to jump in on AI." Service Line Manager, Shipyard Inc.)

Shipyard Inc. strives to be both market leader and trendsetter in the shipbuilding industry. The two quotes above align with this vision because, according to this Service Line Manager, the company always positions itself as a market leader by being at the forefront of innovation. Engaging with AI confirms their ambition to be a trendsetter in adopting new practices and standards.

Another example where we can see that AI is being applied within Shipyard Inc. is their rolled-out pilot of CoPilot. In February 2024, we participated in a kick-off and introduction session of CoPilot on Microsoft 365 by Shipyard Inc. An email from the IT Business Partner stated that this pilot for CoPilot was limited to interested colleagues. In addition to this, all colleagues with a Shipyard Inc. e-mail address can use the secure ChatGPT. Colleagues interested in learning more about AI can visit Shipyard Inc. Academy's website for training and read an article of the CISO on cyber security including the risks of ChatGPT and AI in general. All of this illustrates the company’s commitment to be at the forefront of the shipbuilding industry, not only in terms of market position, but also in technological advancements.

Other participating companies also show commitment to innovations around AI. For example, Training Inc. had an internal inspiration session on AI and building prompts correctly. Actual training internally has not happened yet but is scheduled to happen soon. Bakery Inc. offers so-called ‘lunch-and-learn’ sessions. The Project Manager Software Development has given internal ChatGPT workshops several times to about 60 to 70 people, from which positive feedback is received. However, it was also indicated that there are also still colleagues that won’t use AI quickly.

Another theme what we observed in the interviews is management support. At Bakery Inc. they feel that management is not going to stop developments around AI. Despite operating in an industry which is characterized as ‘conservative', management is open to new things. This became evident from the interview:

"Management will not stop that. They really are open to new things here." (Field Service Manager, Bakery Inc.)

This quote stresses that Bakery Inc.’s management is open to innovation and does not stop new things and technologies. An example that stresses this is that the Team Lead Documentation was asked by the Global IT Director to explore what opportunities AI offers and what additional functionalities it could provide for customers.

"[name anonymized] requested us. (…) Because we would like to encourage it within the firm." (Team Lead Documentation, Bakery Inc.)

This indicates that employees, even in senior positions, are not only open to AI, but also proactively encouraging it within the organization. Management support logically has a crucial role in the adoption of AI. When management supports these developments, it becomes a focus or even part of the organization's strategic direction. This became evident within Shipyard Inc., where digital development is an important pillar within the service department.

"Anyhow, there is a strong focus on digital developments within services. That that is one of the strategic focus areas as well.” (Project Manager Services, Shipyard Inc.)

This strategic focus within the service department of Shipyard Inc. is also visible in concrete investments. As the Project Manager Services indicates, digitalization is one of the focus areas. This dedication is supported by the allocation of budgets for digital development, which indicates that management is indeed promoting innovation and technological developments, such as AI.

"By the budgets made available to do digital development. (...) There is quite a lot of investments." (Project Manager Services, Shipyard Inc.)

Budgets for digital developments are essential for companies. Without adequate budgets, employees are unable to experiment, receive training or implement new technologies, which limits the actual impact. By allocating budgets, Shipyard Inc.'s management facilitates development and deployment of AI and other digital technologies.

The statement of Shipyard Inc.'s Project Manager Services highlights that the organization is committing to innovation. According to this Manager, Shipyard Inc. is very positive and ambitious in AI development, striving to be the most sustainable and best digital shipbuilder. A statement of his fellow Service Line Manager on the ongoing projects in the central research and development (R&D) department further supports this:

"Yes, from central R&D, we now have many more projects running on these kinds of improvements." (Service Line Manager, Shipyard Inc.)

Shipyard Inc.'s R&D department is actively working on a lot of projects or improvements, indicating that the organization is not only providing management support and resources, but is trying to develop practical solutions. The combination of management support, the allocation of resources, and a strong focus on R&D highlights the company's ambition to become the most sustainable and best digital shipbuilder in its industry.

In addition to organizational commitment to innovations, allocating budgets for digital developments, and management support, it is important that employees are well prepared for these innovations. One way to achieve this is by providing AI training to allow employees to develop the necessary knowledge and skills to integrate new technologies, such as AI, into their work. Training ensures that employees have both the technological and practical side. We observed that multiple interviewees indicated the importance of training opportunities, recognizing them as a key factor in successful AI implementation.

"Yes, there will have to be mandatory courses, or training to at least begin to understand what AI is." (IT Business Partner, Shipyard Inc.)

"But I do think it would be wise to have some kind of training, which can also ensure that you are a bit more structured in your work." (Marketer, Training Inc.)

As the IT Business Partner points out, mandatory courses can be helpful as these ensure that everyone in the organization eventually gets to a certain level of knowledge.

Additionally, the Marketer of Training Inc. stresses the importance of structure when working with AI. Even if employees have the same level of knowledge, they may work in an unstructured and ineffective way. Without proper training, employees might struggle to use AI effectively in their work and leverage the benefits.

During the interview, Consulting Inc.'s Data Scientist stated organizations prefer to stick to their traditional ways of doing their work. When AI is not used, this may be due to a lack of knowledge or understanding. Training can lower this barrier by teaching them the necessary skills and making employees aware of AI's potential and benefits.

Although several respondents stress the importance of AI training, individuals may have a different opinion. For example, the earlier mentioned Process Coordinator Service of Bakery Inc. indicated that AI's options were explored on an individual basis. Shipyard Inc.'s Project Manager Services cannot imagine that AI training is needed. This contrast shows that the need for training is not viewed the same way by everyone, indicating that individuals may have different levels of experience or learning preferences when it comes to AI implementation.

Overall, organizational commitment to innovation is an important theme to accommodate AI implementation in servitization. It requires factors including organizational enthusiasm, management support, allocation of budgets, and employee AI training. While organizations are increasingly committing to AI, the way this commitment is shown can vary.

4.1.4 Improved data quality

When exploring AI, a data-related driver cannot be absent. Good quality data provides a strong foundation for AI technologies and plays a fundamental role in successful AI implementation in servitization. We observed that improved data quality is a key driver for AI because it relies on good data to generate accurate insights and predictions.

In the interviews, we observed that AI technologies are helping companies to make better use of their resources and capabilities. Next to basic tasks such as gathering knowledge, making e-mails and summarizing meetings, it assists in accessing more complex issues. AI is making complex tools and systems easier to use, allowing employees to access advanced technologies without a high level of (specialized) knowledge.

"Complex technology becomes a lot more accessible." (Microsoft 365 Trainer/Consultant, Training Inc.)

This improved accessibility is a key advantage that AI offers organizations, allowing employees to quickly retrieve relevant information without needing a high level of knowledge. With AI, employees no longer must spend time searching through large amounts of data. Instead, they can easily access historical data or get knowledge by simply asking the AI. This makes work easier for them, allowing them to work more efficiently.

"So yes, indeed simple access to historical data or to knowledge." (Project Manager Software Development, Bakery Inc.)

Next to increased data availability, the data available is improving in quality. AI relies heavily on high-quality data to make give better analyses, insights and predictions. The Project Manager Software Development of Bakery Inc. mentioned:

"Slowly our data is also improving, the quantity and quality of the data and the insights we have." (Project Manager Software Development, Bakery Inc.)

During this interview a dashboard of a remote support system for bakery lines was presented, displaying information, charts and graphs about machine and lines availability. In another interview, the Field Service Manager mentioned plans to set up a sort of 'cockpit' to continuously monitor customers. Both examples indicate that the quality, quantity, accessibility, and insights of data are indeed improving at Bakery Inc.

However, the Team Lead Spare Parts of Bakery Inc. indicated that they have customer-specific machines that operate in different climates and produce at varying production speeds, making it difficult to generate accurate insights, such as for preventive maintenance.

Improvements in data quality were also observed at Shipyard Inc:

"I think we are now at a point where the source data is starting to come into order." (CISO, Shipyard Inc.)

The Service Line Manager of Shipyard Inc. explained that their platforms [anonymized] provide real-time insights to crews and vessel owners, such as temperature and flow measurements, to optimize operational performance.

With improved data quality, organizations can take a more proactive approach, for instance through detecting problems in advance and scheduling maintenance before failures occur. This shift is a key element of servitization, as it changes the

organization's role changes from simply providing products to becoming a proactive service partner

Improved data quality is a key driver for AI in servitization, and forms the foundation for employing AI properly. With more accurate data, organizations can integrate AI technologies, improve operational efficiency and shift towards a more proactive approach, strengthening their competitiveness.

4.1.5 Organizational improvement

One of the main reasons for AI in servitization is the drive to improve the organization. As Cubric (2020) noted, drivers of AI adoption are primarily economic. In our interviews, cost reduction was mentioned several times as a key factor. While it may be a sensitive point, multiple interviewees indicated that reducing costs is a key driver for employing AI in servitization.

Cost reduction is attractive for organizations because it is easily measurable. It helps them to stay competitive by freeing up resources that can be reallocated to other strategic areas. For instance, Shipyard Inc. aims to reinvest these savings into their R&D, ensuring innovation which is one of their strategic focus areas.

An example of cutting costs was given in the interview with a Microsoft 365 Trainer/Consultant, who expressed that some organizations view AI to replace human jobs completely.

"And yes, as harsh as it sounds, some organizations have already figured it out. I just want to cut costs, throw people out and have them completely replaced by AI." (Microsoft 365 Trainer/Consultant, Training Inc.)

Although job replacement by AI is a sensitive issue that causes resistance to AI adoption (Ivchyk, 2024), it also indicates the economic pressure organizations face to stay competitive. In many industries, reducing costs is seen as the ultimate goal to keep offering services at competitive prices.

"The ultimate goal is always to save money." (Program Manager, Training Inc.)

While the implementation of AI is mainly driven by the need to cut costs, it is also closely related to the aim of increasing productivity. In multiple interviews, we noted that AI enables companies to deliver the same number of services faster, increasing output of both employees and the organization. The following was noted in an interview with the Program Manager of Training Inc.:

"Being able to do more in a shorter time. (...) Well, AI can play a great role in that." (Program Manager, Training Inc.)

Leveraging AI can increase productivity: higher output in less time. This gives them an edge compared to competitors, as they need less time to perform a task, enabling them to offer services faster.

Another observation we made is that processes are labor-intensive, error-prone and challenging. Many tasks require a lot of effort, resources, time, and human mistakes are easily made. AI can accelerate these processes and reduce mistakes:

"Processes that are now very labor-intensive, that are very challenging or error-prone, to speed them up through AI infused development or enormously accelerate them." (Project Manager Services, Shipyard Inc.)

Besides increasing productivity, AI implementation in servitization also improves another organizational capability: efficiency. Since completing tasks requires less time and resources, organizations can focus on more strategic initiatives to differentiate themselves from competitors. Increasing efficiency was frequently mentioned in our interviews as a key driver of AI implementation in servitization.

In an interview, the Project Manager Services from Shipyard Inc. highlighted a dilemma about whether employees should focus on doing tasks themselves or finding more efficient ways to get the job done. Instead of spending too much time on tasks (partly) outside their expertise, employees can use AI to complete their work faster, at a lower cost, and with better quality. This dilemma corresponds with the goal to improve efficiency through AI as it allows businesses to use resources more effectively.

One of our interviewees gave an example how AI can standardize repetitive and routine tasks, allowing employees to spend less time checking or correcting, while minimizing human errors:

"Less variation also just makes it easier for everyone. (...) Because you know, that's fine. I don't have to look at that, it's going to be the same." (IT Business Partner, Shipyard Inc.)

The Project Manager of Services of Shipyard Inc. supported this, but reflected it more towards its own work:

"But that's really purely to make my own work easier and faster." (Project Manager Services, Shipyard Inc.)

The Project Manager Software Development of Bakery Inc. indicated that by making user manuals and other important information digital and accessible access to the right knowledge becomes much faster and easier, even for laypersons, newcomers or an outsider. This increased accessibility allows individuals to work more efficiently.

"And I really do see a lot of benefit emerging from that in the near future. That you're just a lot more efficient in your work." (Project Manager Software Development, Bakery Inc.)

AI can automate the process of collecting and delivering relevant data and provide easy access to the right information. This improves service, which is important in the servitization transition.

AI implementation in servitization is driven by the goal to reduce costs, while it can improve productivity and efficiency. Reducing costs, automating tasks, and making processes faster gives organizations the opportunity to reallocate resources to other strategic areas. Companies strive to use AI to improve their capabilities but also want to improve the service offered.

4.1.6 Improving and expanding services with AI

Improving services for customers is a key driver of AI in servitization, as it directly connects to the core of servitization: shifting from a product-oriented towards a service-oriented approach. As highlighted in existing literature, AI serves as an enabler and accelerator of servitization, allowing organizations to better meet evolving customer expectations. The application of digital technologies, including AI, are known to enhance servitization and accelerate the process, as digital technologies are closely tied (Paschou et al., 2020; Ulaga & Kowalkowski, 2022; Parida et al., 2019).

This aligns with the perspective of Shipyard Inc.'s Manager Design & Proposal, who emphasized that services are at the core of their division's existence. Servitization is not just a strategy, but a part of their philosophy. Their major shareholder sees the company not solely as a shipbuilder but as a provider of comprehensive maritime solutions. Shipyard Inc.'s ultimate goal is to enable customers to focus purely on their core business, while the organization takes care of supporting services.

This growing demand for services is also observed in other industries. The Team Lead Spare Parts of Bakery Inc. highlighted that customer expectations have changed in recent years. Customers want to be increasingly relieved from non-core activities and expect additional services from their service

providers. To remain competitive, companies must adapt to this shift in demand:

"So, people want to be relieved more and more and I can understand that. And for that, the demand for that is growing." (Team Lead Spare Parts, Bakery Inc.)

This Team Lead explained that Bakery Inc. has multiple ongoing projects aimed at improving customer service to meet these changing expectations. However, it was indicated that they are still in the process of fully transitioning to a service-driven model.

During our interviews at Bakery Inc., we discussed the organization's ambition to become more proactive instead of reactive. We also discussed solutions such as chatbots and predictive analysis to enhance customer support. When discussing this subject, a manager of Bakery Inc. said:

"So, customers increasingly want to be assisted in that." (Field Service Manager, Bakery Inc.)

One of the ways Bakery Inc. is responding to these changing demands is their service portal, which provides customers with 24-hour access to all services, spare parts and other essential information. The portal is seen as a small aspect in the larger goal around servitization and includes a service innovation called [anonymized] around remote service, support, and data management. According to the Project Manager Software Development, this service innovation is a giant unique selling point in the sale of new bakery lines. It allows customers to view Bakery Inc. as a partner that delivers maximum value, differentiating itself from competitors.

This commitment to enhance service delivery reflects Bakery Inc.'s approach to putting customers first. The Field Service Manager indicated that good service delivery is an essential component of their strategy. Bakery Inc. has built a reputation for its dedication to customers, which in turn fosters customer loyalty. As a result, Bakery Inc. can charge slightly higher prices as customers value the company's reliability and high-quality services.

While increasing customer demand forces service providers to enhance their existing external services, our interviews also revealed that AI offers opportunities to improve service delivery internally. Ultimately, these two aspects complement each other, as they both improve the customer experience. We found that AI not only helps enhancing existing services, but also creates new service opportunities:

"And that that is actually going to enable a whole range of new services." (Project Manager Services, Shipyard Inc.)

This new range of services gives companies opportunities to differentiate themselves from their competitors by providing unique value that others might not be able to offer. But as services improve, so do the expectations of customers, which eventually rise as well. Training Inc., a specialized training provider, should continuously change its services to meet customer demands. As AI awareness increases, clients might seek more relevant training, forcing Training Inc. to continuously refine their courses with trending topics.

"And on the other hand, we as trainers focus on how are we going to use this for our clients." (Program Manager, Training Inc.)

This ongoing adaptation not only applies to Training Inc., but also to other businesses that are planning to use or already use AI in their servitizing. Bakery Inc.'s Project Manager Software Development shares a similar view, and mentioned the following regarding simplification of services that are already being deployed:

"Where I also see a future is indeed simply in usage, in the services we are already deploying." (Project Manager Software Development, Bakery Inc.)

By integrating AI into existing services, organizations can improve overall service quality. As explored in literature (e.g. Paschou et al., 2020; Ulaga & Kowalkowski, 2022) AI is a key enabler in servitizing as it ensures that organizations continuously develop their services to remain competitive.

During our interviews, we also asked questions and discussed the potential of AI. Next to refining existing services, we found that AI unlocks new possibilities which may not have been previously thought of. Two of our interviewees pointed out:

"And also things that you wouldn't actually think of yourself how to make them come together. That opportunities actually arise from that. (...) Taking turns you might not have thought of yourself." (Project Manager Services, Shipyard Inc.)

"So by using AI, you can give insights to people that maybe they did not have." (Data Scientist, Consulting Inc.)

AI can provide insights and solutions that otherwise might not have been considered by human minds, helping organizations explore new opportunities.

The possibilities of AI were something that was often mentioned within the interviews. Many interviewees indicated how the limitless possibilities act as a main motivator for organizations to implement AI in service models. Despite seen as having a huge potential, one interviewee mentioned that the potential is maybe not reachable:

"The sky is the limit for this piece. That end there is not where we are. Are never going to get there either, I think." (Service Line Manager, Shipyard Inc.)

In summary, AI enhances service delivery in two ways. First, it allows organizations to meet the increasing and continuously changing customer demand by improving and expanding current services. Second, AI allows businesses to discover new service opportunities that may not have been previously considered. By leveraging AI, organizations not only enhance their existing services but also explore completely new opportunities, allowing them to better serve customers and stay competitive.

However, despite AI's huge potential, its integration comes with challenges. In the next section, we will explore this obstacle in more detail, explaining the key factors that hinder AI in servitization.

4.2 Barriers of AI

This section addresses the second sub-question of this research and considers the barriers of AI in servitization that organizations face. Through the interviews, several challenges emerged, which were afterwards categorized into themes.

We identified seven barriers: 1) lack of strategic direction, 2) organizational barriers to AI adoption, 3) internal resistance to AI adoption, 4) external resistance to AI adoption, 5) financial barriers to AI adoption, 6) ethical, regulatory and trust issues, and 7) data-related issues.

4.2.1 Lack of strategic direction

Servitization is increasingly recognized as a key strategy for increasing revenue growth, profitability, and customer satisfaction (Kowalkowski et al., 2017). AI is seen as a powerful tool and has the potential to enhance service delivery and enable new business opportunities. However, in our interviews it became evident that many organizations struggle to define the role AI should play in their servitization strategy.

One of the main reasons organizations struggle to define AI's role is the uncertainty around the technology. Several interviewees indicated that AI often is presented as a solution to enhance existing services or create entirely new opportunities, as discussed in chapter 4.1.6. However, for some interviewees, the specific problem AI is meant to solve remains unclear.

"So, we have the solution, which is AI. But what problem are we solving with this? And what will change?" (IT Business Partner, Shipyard Inc.)

This quote highlights a common issue: AI is often seen as a solution. However, the specific problem it addresses is not always clear. AI should not be driven only by the technology itself or external pressures, such as industry trends or competitive pressures. However, as discussed in chapter 4.1.1, organizations must continuously adapt to evolving customer demands that arise from this competitive pressure to stay competitive.

A consequence of this uncertainty around AI is that organizations are still exploring options regarding data, AI and AI's potential. Instead of having a well-defined, clear strategy for AI implementation in servitizing, many organizations are considering how AI can be used effectively in their operations.

One example of a project with an unclear objective was shared by the Project Manager Software Development of Bakery Inc. The organization recognized an opportunity since they possess vast amounts of data. But, instead of starting with a clearly defined goal, they explored what the organization could get out of the data. This eventually led to the development of the service innovation [anonymized], which was driven by experimentation and trial-and-error instead of a clear-defined strategic goal.

Building on the example of Bakery Inc., a colleague shared a similar statement about the organization being in an exploratory phase:

"We are actually exploring still of, okay, what can we do with the data we have. (...) A lot is still in its infancy." (Process Coordinator Service, Bakery Inc.)

Sometimes AI is seen as an opportunity rather than a structured plan with clear purpose. Many organizations recognize AI's potential but struggle to define how and where it can create value. Without a clear strategy organizations struggle to transition from exploration towards AI implementation. This was also indicated by an interviewee, who stated that AI should not be a goal in itself:

"AI is not the goal, but we are looking for something." (Project Manager Services, Shipyard Inc.)

Next to uncertainty, we observed within several interviews that many companies struggle to develop a clear vision and strategy for AI in their servitization strategy. This aligns with existing research on AI implementation (e.g. Kar et al., 2021) that indicates that a lack of AI strategy serves as a key barrier.

When asked about the company's vision, multiple interviewees indicated that it was lacking or sometimes even completely missing. One interviewee expressed a concern about a lack of direction within their organization:

"We have no long-term vision, not even short-term. Everyone is just messing around at the moment." (Microsoft 365 Trainer/Consultant, Training Inc.)

Another interviewee confirmed this struggle, stating that their organization had no plans formulated yet:

"But there are no concrete plans yet, no." (Field Service Manager, Shipyard Inc.)

Both statements indicate that the absence of a clear vision and structured plans is a key barrier to AI. This lack of vision and plans has a relationship with the next observed theme: no internal rules or procedures. We observed that organizations lack rules, policies and procedures. When organizations have no vision, they also lack these policies and procedures. Two interviewees of Training Inc. described this:

"Sometimes I do miss a bit of a fixed working method. (...) Because right now, everyone is just doing how they think is best. And in that, we don't check each other or anything." (Marketer, Training Inc.)

"How we use it internally, I think that is left fairly free, there is no policy on that. (...) Policies, regulations, guidelines, we lack that internally." (Program Manager, Training Inc.)

The quotes above illustrate that within Training Inc. there is no structured way of working with AI. Without these policies, guidelines, and procedures AI is used differently within the company, which can result in inconsistent and inefficient use of the technology.

However, defining clear rules, policies and procedures is not an easy process. Organizations such as Shipyard Inc. have multiple departments that sometimes operate globally, challenging them to make guidelines that suit all departments. What works for one team or location might not work for another.

In some cases, the lack of direction is caused because AI is simply not seen as a priority. Organizations may have different strategic focuses, interests or other important concerns, resulting in delaying or neglecting AI. This was indicated by an interviewee of Bakery Inc., who evaluated AI, but decided that it was not valuable at this moment:

"We have much more important things to do right now. (...) And other than that, we have looked at it seriously. And the final conclusion is that that is not an added value at the moment." (Team Lead Documentation, Bakery Inc.)

In this case, the Team Lead chose not to adopt AI due to concerns over a lack of control. There was a concern that AI would translate inconsistently, causing unstable and inaccurate translations causing legal risks if something went wrong. Since these uncertainties do not outweigh potential consequences, the organization decided not to employ AI in their documentation process.

The absence of a clear strategy often leads to internal disagreements, making it difficult for organizations to shift towards AI. Without a plan or vision different departments, stakeholders or management teams may have conflicting opinions on AI's role and direction within the company. This can cause delays in embracing AI.

"Yes, then again it's like okay, we're going this way. No, we go that way. Then people no longer agree with each other. And then it takes another few months to get on the same page." (Process Coordinator Service, Bakery Inc.)"

Many organizations recognize AI's potential in servitization but struggle to integrate it into their strategy. This challenge arises from uncertainty about AI's application and a lack of vision within organizations. One explanation for this lack of vision is that AI does not always have priority. Other strategic goals or concerns might be favored, delaying or even fully postponing AI initiatives. Next to this, organizations also encounter internal challenges that hinder AI. The next section explores these organizational barriers and their impact on AI in servitizing.

4.2.2 Organizational barriers to AI adoption

When adopting AI in a servitization strategy, organizations face internal barriers. These internal challenges prevent organizations from employing AI. One observed theme that hinders AI in

servitization on an organizational level is the amount of management support. We observed that management support is crucial to realize change. Leaders are responsible for establishing rules and procedures, deploying resources, and fostering a culture that encourages innovation. An employee of Bakery Inc. said the following about the importance of management support:

"If you don't get that support from above, it will end very quickly, I think." (Process Coordinator Service, Bakery Inc.)

This quote highlights that without backing from management, AI initiatives fail to get priority and are often delayed or neglected. However, even when initiatives receive management support, bureaucratic processes and slow decision-making delay its implementation.

In many cases, employing AI is hugely driven by the desire to improve the service offered, reduce costs, and improve efficiency. The Program Manager of Training Inc. stated that companies are ultimately driven by profit, and management is more likely to support AI initiatives that present significant financial or operational advantages. Similarly, Bakery Inc.'s Field Service Manager noted that AI projects need an attractive cost/benefit ratio to gain management support. This suggests that while management support can be a barrier, it is not a fixed one. If AI presents clear benefits, it is more likely to gain the necessary support.

However, even when organizations back a plan, complex approval processes and administrative requirements make it difficult for organizations to respond quickly to AI opportunities.

This is something that a Data Scientist from Consulting Inc. experienced while detached at a company. Any changes or decisions required approval from several people, often involving a lot of paperwork. These bureaucratic complications make the process of changing difficult.

"If they want to make a decision to use some software or anything, they have to get permission from different people. (…) So, it's a very complicated thing." (Data Scientist, Consulting Inc.)

Some employees, particularly those who understand AI and recognize its potential, are eager to take initiatives. However, complex and time-consuming processes might discourage employees from taking these. Bakery Inc.'s Project Manager Software Development explained that while some employees see AI's benefit, many are hesitant to push for AI initiatives because it requires a lot of effort. AI needs high quality training data to train a model to perform and build a model effectively. This time-consuming process makes AI implementation less attractive as it is very complex to set up.

Within the interviews, we observed that multiple interviewees indicated that Bakery Inc. and Shipyard Inc. adopt a reactive approach. Data is collected but not visualized. Also, breakdowns or problems are mostly solved when a customer reports them, rather than taking preventive steps. This reactive approach can partly be explained by the earlier mentioned lack of internal guidelines and procedures, and lack of management support. Without guidelines and leadership, organizations struggle to take preventive measures, continuing with reactive decision-making.

In addition, some organizations feel no urgency to implement AI, especially when they have a strong market position. Despite operating in different industries, Shipyard Inc. and Bakery Inc. share a similar perspective. As market leaders they do not feel pressured to adopt AI because competitors are doing so.

"Look, we are not a specific party of yes: we need AI, we need to invest in it." (Service Line Manager, Shipyard Inc.)

"So, I don't think there will be that pressure that we have to do it because the others are doing it." (Field Service Manager, Bakery Inc.)

This Manager of Bakery Inc. explained that the company's culture influences their approach to AI. The organization tends to follow its own path, describing Bakery Inc. as 'a bit ordinary' and preferring to do the things they think are best. Bakery Inc. appears to be less influenced by external forces and is more likely to embrace AI through internal decisions than competitive pressure.

All of this indicates that absence of competitive threat can lower the priority of AI. In certain sectors, market leaders can afford to be more cautious or delay AI implementation without risking their position. Without external pressure the urgency to embrace AI decreases, ultimately slowing down the speed of AI implementation.

Resistance within organizations hinders successful AI adoption in servitizing. In our interviews, we observed that resistance comes from different sources, including lack of internal rules or procedures, a lack of management support, and a lack of competitive pressure. While organizational barriers slow down AI, organizations also face internal resistance at individual level. Barriers like age-related attitudes and employee preferences will be discussed in the next part.

4.2.3 Internal resistance to AI adoption

What we observed within the organizational context is that, besides organizational barriers and in contrast to the driver 'engagement in AI adoption', an individual's behavior can also hinder AI in servitization. Our interviews revealed several factors that cause this resistance. One of the most prominent ones is age, which shapes employees' attitude towards AI and its implementation. An IT Business Partner of Shipyard Inc. described how younger employees tend to be more open to AI, while older employees are more resistant:

"The youngsters do believe in it. (...) The other people think I'm just working, just leave me alone." (IT Business Partner, Shipyard Inc.)

This age-related division reflects that younger employees that have grown up in a more digital environment are generally more open to AI. Contrary, older employees may be more resistant, as they have certain established routines and see no need to change. Especially senior staff are comfortable with their ways of operating, making them less open to new initiatives.

"I think we also have some senior staff in the various departments. I don't think you need to bother them with that anymore." (Field Service Manager, Bakery Inc.)

As earlier mentioned, both Shipyard Inc. and Bakery Inc. are in the servitization transition, making overcoming this reluctance crucial. However, when employees are resistant to AI, integrating it into servitization strategies poses a bigger challenge.

Furthermore, an employee of Training Inc. mentioned that their workforce is relatively young. As a result, most employees are positive about AI and open to the technology. However, when this interviewee visited client's generational resistance to AI was noticed:

"And you do notice that generally speaking, the older generation is like, it's terrifying." (Microsoft 365 Trainer/Consultant, Training Inc.)

These generational differences are related to reluctance towards change and innovation. Some organizations struggle to move forwards as their staff are hesitant to accept change.

"And we do still sometimes struggle to really make those innovative steps and give our commitment to them." Service Line Manager, Shipyard Inc.)

While AI offers new opportunities, it requires a different mindset and willingness to move away from the traditional way of working. Organizations sometimes hesitate to take these innovative steps, as employees or management prefer to stick to the familiar processes rather than experiment with AI, which requires time and effort.

"I guess their staff are used to it. So they've been using this before and they want to continue it. They don't want to challenge their staff." (Data Scientist, Consulting Inc.)

As this interviewee indicated, organizations sometimes avoid pushing employees out of their comfort zones. Instead, they choose to stick to established routines that have been in place for several years:

"So it's very often like, okay, we've been doing it this way for years." (Process Coordinator Service, Bakery Inc.)

Another significant internal challenge that emerged from our interviews is the limited knowledge and understanding of AI among employees. Even when resistance to change is overcome, organizations often fail to adopt new technologies and successfully integrate AI due to insufficient knowledge. This lack of knowledge can lead to poor outcomes:

"Because most people don't really have an idea what they are asking and then they don't get it because the prompt is wrong, so you have to be very specific in your question." (IT Business Partner, Shipyard Inc.)

This quote highlights that individuals struggle to formulate good prompts. This issue was also seen by another interviewee, who pointed out that many employees lack the skills to use AI properly:

"People don't really know how to make those prompts." (Microsoft 365 Trainer/Consultant, Training Inc.)

However, this issue is not specific to employees, it also encompasses organizations and the broader market. Many companies are still in the early stages of AI adoption and its understanding. The IT Business Partner from Shipyard Inc. explained this uncertainty, indicating that AI is massively hyped, and that no one wants to miss out. Although organizations feel pressured to do something with the AI hype, they often lack a clear understanding of the technology and are unsure how to apply it within the company.

This view is comparable to what the CISO of Shipyard Inc. mentioned during the interview:

"There is, I think, very little knowledge at all. Also, in the market and beyond, because everyone is kind of pioneering." (CISO, Shipyard Inc.)

These three quotes reflect the lack of expertise on AI. On one hand, employees struggle with the use of AI tools, especially in creating good prompts. On the other hand, organizations, and sometimes even entire markets, are still in the early stages of exploring AI's options. This indicates the challenge and complexity involved in AI adoption and implementation.

Another related challenge that further hinders AI adoption is unfamiliarity with AI. Besides lacking the necessary skills, many employees are still unaware of AI's potential. One interviewee stated:

"People are still completely unaware of what AI can do." (Microsoft 365 Trainer/Consultant, Training Inc.)

Multiple interviewees indicated that AI is increasingly used for tasks like searching for information, drafting e-mails, and summarizing meetings. However, employees may not use AI, not because of resistance, but simply because they do not realize what AI can do.

"It is there, but they are not really using it yet. (...) I think more of not being aware of what it can all do." (Team Lead Spare Parts, Bakery Inc.)

Even when AI is available, employees do not understand how the tools can benefit them. This creates a barrier where employees hesitate to use AI, not due to resistance, but simply because they are unaware of the possibilities. This was well summarized by an interviewee of Bakery Inc.:

"Unknown makes unwanted, I think a bit. So you have to know the possibilities." (Project Manager Software Development, Bakery Inc.)

These insights suggest that unfamiliarity with AI does not only limit its adoption, but it also can result in disengagement. To encourage adoption, employees should be made aware of AI's potential and how it can be supported in their work.

However, internal resistance is only a small part of the challenge to embrace AI. Organizations also face external resistance, including resistance from the market and customers, which further hinder AI adoption.

4.2.4 External resistance to AI adoption

In addition to organizational barriers and internal resistance, external resistance also has a significant role in slowing down or hindering AI. External resistance arises from outside the organization, from industry and customers, which can both influence AI in servitization.

During the interviews, it became evident that some industries are conservative or traditional, which influences the integration of AI. One interviewee of Shipyard Inc. described the shipbuilding sector as follows:

"Shipbuilding is a fairly conservative business." (Service Line Manager, Shipyard Inc.)

Several interviewees from Shipyard Inc. mentioned that the shipbuilding industry confirmed this view, indicating that this industry is generally cautious towards change and innovation. In most cases, customers prioritize the operational functionality of their ship over everything else. This indicates little interest in new technologies unless they impact the vessel's performance. As a result, there is minimal focus on exploring innovative technologies like AI. This was also observed at Bakery Inc., as explained by two employees:

"Yes, it is a somewhat old fashioned industry so to speak. So you can see that some customers are working on that, but far from everyone." (Team Lead Spare Parts, Bakery Inc.)

"And the bread industry is a bit of a well conservative industry. A bit old-fashioned.(...) nonsense with that computer, I'll use the phone." (Field Service Manager, Bakery Inc.)

These quotes reflect the way the bakery industry operates, where according to this Field Service Manager, traditional methods, such as dialing, are preferred over other modern forms of communication. For example, the Field Service Manager and Team Lead Spare Parts from Bakery Inc. mentioned that, until two years ago, some customer orders were still received by fax. Furthermore, the Team Lead Spare Parts also noted that certain bakery production lines do not even have their design documents available digitally, as these have been operating for over thirty years.

These examples highlight the structural challenges within certain sectors that hinder the implementation of modern technologies. When industries even struggle with basic digital tools, integrating more complex technologies, such as AI, becomes an even greater challenge.

However, resistance to AI does not solely come from a conservative industry. Even when companies are open to AI implementation, they often face customer resistance, which further complicates servitizing. One interviewee from Bakery Inc. explained how customer attitudes towards AI have been divided:

"Since 2016, when we started, you actually see that there is an almost 50-50 split between clients who are totally fine and totally fine, and clients who really say absolutely no." (Project Manager Software Development, Bakery Inc.)

The Project Manager Software Development from Bakery Inc. indicated that it is important to emphasize to customers that sharing data solves a problem, and that the benefits outweigh the costs.

However, many customers are still reluctant to share their data. As previously mentioned in chapter 4.1.1, customers have traditionally kept data private due to fears of data breachers or competitors obtaining access to sensitive information. Our observations made clear that the shipbuilding and bakery industries sometimes struggle with basic digitization, causing greater resistance to more advanced technologies such as AI.

While we observed customer resistance within Bakery Inc. and Shipyard Inc., Training Inc. encounters a different form of resistance. As a training provider, and not a manufacturer, Training Inc. offers more service-oriented solutions where real human interaction is highly valued.

Customers of Training Inc. prefer traditional, in-person training where a teacher is physically present to allow direct interactions with participants. One interviewee underlined this preference:

"There is very little AI in that, and I also actually expect it to be appreciated that it is still just so nicely old-fashioned, with a teacher in front of a class." (Marketer, Training Inc.)

The Program Manager of Training Inc. also emphasized this. For participants a traditional classroom setting with a teacher physically present feels safer and more trustworthy. Clients also often seek practical knowledge and support for their work, and a physical, human teacher can make this easier because it offers room for more personalization and better interaction. In this case, the resistance is not so much about distrust of AI, but more about valuing human interaction and the benefits of in-person sessions.

In summary, organizations face external resistance that hinders the effective implementation of AI in servitization. This resistance arises from both industry conservatism and customers' hesitation. As a result, these external factors decrease the ability of organizations to engage with AI, further complicating servitizing and slowing down the technological advancements in certain sectors. However, another crucial factor that affects AI is financial constraints. Even when organizations are willing to implement AI, the costs of investment in AI technologies can become a significant barrier.

4.2.5 Financial barriers to AI adoption

While AI has the potential to improve cost-benefits assessments, its implementation also requires significant financial investment. As a result, managers behave cautiously when evaluating AI adoption, ensuring that the benefits outweigh the costs (Heimberger et al., 2024).

One of the main financial concerns organizations faces is the trade-off between costs and benefits. While AI can increase efficiency, productivity, and enhance decision-making (Nair & Gupta, 2021), many organizations remain hesitant towards AI because of the expenses.

The Manager Design & Proposal of Shipyard Inc. provided an example of how AI investments can be evaluated. Investments in AI tools, such as Copilot, are justifiable if they truly lead to increased productivity and if costs are compensated for by improved efficiency. If an AI tool enables an employee to work faster for several hours each month, the investment is worth it.

The value also depends on job function. Roles that involve a lot of writing, content creation, and developing proposals, such as marketers or account managers, benefit significantly from these tools. Others, such as employees in logistics or customer service employees, might experience fewer advantages.

Despite AI's potential to quickly generate return on investment (ROI), organizations remain cautious about its costs. When discussing the expenses of Copilot, an interviewee indicated that organizations remain hesitant:

"And we find that organizations are incredibly reluctant because there are costs involved. (...) But somehow that's still an obstacle, while I personally think: those 28 euros, you've already earned them back in the first week." (Microsoft 365 Trainer/Consultant, Training Inc.)

This indicates that cost concerns can sometimes outweigh the potential financial benefits, even when AI solutions could deliver quick returns on investment. Even a relatively small monthly license fee of 28 euros can lead to hesitation, especially if tools are not regularly used.

However, not all AI solutions provide quick financial returns. Some require massive upfront investments, such as data collection, structuring, and labeling. The complexity and scale of AI technologies can make them very costly, especially for smaller organizations.

"Because then such an AI function becomes so big and so complex and so expensive to set up." (Project Manager Software Development, Bakery Inc.)

Developing AI solutions requires a lot of resources and organizations should consider if they are worth the effort. The Project Manager Software Development from Bakery Inc. indicated that many employees assume that AI models are easily built if data is available, but in reality, it is much more complex. AI models require good quality data, training, and updates, which makes them very costly.

Next to the effort required for maintenance, AI models require licensing costs. The Project Manager Software Development provided an example of an AI-powered vision platform that required an annual licensing fee of 6.000 euros, in addition to the initial machine investment of 100.000 euros. This represents a significant investment, often leading to customers questioning why they should continue to keep paying these fees just to keep the system operating.

AI adoption is largely influenced by financial capacity, making it more challenging for smaller businesses. Unlike large organizations with financial resources, smaller businesses struggle to justify the high costs of AI implementation, leading to hesitation and slower adoption. Consulting Inc.'s Data Scientist opinion is that only a handful of large companies in the Netherlands actively use AI, while smaller businesses avoid it due to high costs:

"Except for the five, six big companies in the Netherlands, the rest of the companies are not really using AI. (...) It is most definitely for the costs." (Data Scientist, Consulting Inc.)

Even when businesses integrate AI into their operations, the fees for tools such as Microsoft products and ChatGPT can pose a financial challenge. To justify these investments, AI tools should be actively utilized, rather than becoming unused resources that lead to unnecessary costs.

"And, of course, not everyone has AI yet, because it has an expensive license attached to it within the Microsoft products." (Program Manager, Training Inc.)

"Because all that kind of co-pilot packages, it's all on a license basis. And those costs are not small." (Project Manager Software Development, Bakery Inc.)

Financial barriers remain a key challenge for AI implementation. Smaller organizations, with fewer resources compared to bigger companies, should carefully consider the cost/benefit-ratio before employing AI. Implementing AI systems often requires substantial upfront costs that can quickly add up, making an organization hesitant to invest, especially if ROI is slow or uncertain.

4.2.6 Ethical, regulatory and trust concerns

In our interviews, many interviewees expressed uncertainty and reluctance towards AI in servitization, because of concerns about data security, privacy risk, potential misuse, and a lack of clear legislation.

One of the most frequently observed concerns was how AI systems handle sensitive data. Several interviewees shared concerns about issues such as data security and privacy violations. Questions arise whether data is stored securely, and who has access to it. One interviewee said:

"Is it secure? Is it privately sensitive or not?" (Program Manager, Training Inc.)

Especially for free AI tools, there are concerns about data being exposed to other parties. Organizations risk becoming dependent on major technology providers such as Google, Amazon, and Microsoft, while it remains unclear how these companies store and process this data. A Project Manager from Shipyard Inc. expressed this concern:

"That you make yourself dependent as a company on certain clubs. Indeed, where data stays. All this free AI stuff, you can question the intentions there." (Project Manager Services, Shipyard Inc.)

The CISO from Shipyard Inc., who is also Data Protection Officer (DPO), mentioned that human error is inevitable when working with AI. To mitigate risks and minimize exposure to external parties, organizations should implement risk assessments, warn employees about potential risks in AI systems, and offer safer alternatives when possible. These measures ensure more responsibility and control on AI use.

There is also growing skepticism about the business models behind free AI tools. Training Inc.'s Microsoft 365 Trainer/Consultant pointed out that many AI tools are currently free, but maintaining these tools requires a lot of money. This interviewee explained that companies like Microsoft and Google offer these tools for free to capture market share and encourage its use. However, once businesses become dependent on these tools, there is a chance that prices will be raised significantly. As a result, organizations may find themselves locked into costly licensing agreements.

Another observed theme is the ethical risks and potential misuse of AI technologies. Technologies such as deepfakes and other impersonations illustrate how AI can be used unethically, raising concerns about misinformation, bias, and even discrimination.

"AI can imitate voices, AI can imitate individuals (...) Yes, you do notice some fear of AI." (Microsoft 365 Trainer/Consultant, Training Inc.)

Also, there is a risk of bias in the decision-making process. A Program Manager of Training Inc. indicated concerns about how AI selects and prioritizes information, questioning whether its outcomes are representative:

What data does it use? (...) Are people left out or included? Or what kind of results do you get? And is that indeed racist or not? (Program Manager, Training Inc.)

AI generates a limited set of results, but it remains unclear what data is included or excluded. This lack of transparency raises concerns about whether decisions or objective or if they contain biases.

This highlights a broader issue that was mentioned by the IT Business Partner of Shipyard Inc. AI models are only as ethical as the data it is trained on, meaning that its decisions are directly influenced by the biases in the source data. This highlights the importance of data governance, as training on biased or incomplete data can lead to unintended or even discriminatory outcomes:

"As long as it's not about humans, then it's fine on its own. You can do a lot of unethical things with AI. (...) So it's as ethical as your own source data is." (IT Business Partner, Shipyard Inc.)

Furthermore, the self-learning ability of AI adds more complexity to its implementation. As AI continuously adapts and evolves, it may develop inconsistencies over time, leading to unreliability. This presents challenges in industries where precision and accuracy are crucial, such as manufacturing bakery lines. The Team Lead Documentation of Bakery Inc. highlighted that this lack of control and consistency of AI was the primary reason for their organization to not implementing AI in their documentation process. Accurate and standardized documentation was needed to ensure liability and compliance with other legal matters, and AI had too many risks.

As AI is becoming more complex, concerns regarding liability and accountability rise. Organizations face uncertainties about their responsibilities, emphasizing the need for regulations and legal frameworks. However, current legislation remains underdeveloped and struggles to keep pace with the advancements of AI. Two interviewees of Training Inc. mentioned:

"They are all still working on that, as it is all in its infancy." (Program Manager, Training Inc.)

"The Netherlands has no legislation on that yet. The Netherlands is always late on things like that. (...) It's a very grey area, so that's still a problem at the moment." (Microsoft 365 Trainer/Consultant, Training Inc.)

The Program Manager indicated that the European Union (EU) has taken steps to establish guidelines for AI, such as the EU Artificial Intelligence Act. Despite these regulatory efforts, many uncertainties remain around compliance, liability and other considerations, making organizations hesitant to use AI in servitization.

4.2.7 Data-related barriers

Logically, data-related challenges emerged as a significant barrier to AI in servitization. The success of AI depends heavily on data availability, quality and structure. Many organizations struggle to leverage data effectively, which makes integrating AI difficult. Existing research highlights that AI adoption barriers

are primarily technical (Cubric, 2020), and studies such as Kar et al. (2021) and Thowfeek (2020) indicate that data-related issues significantly hinder AI implementation.

A challenge that was frequently observed across multiple organizations is that while many organizations collect and store massive amounts of data, they struggle to leverage it. Instead of using data proactively in decision-making, it is used reactive:

"We have a lot of data, so you can generate some things already. But it's really still reactive." (IT Business Partner, Shipyard Inc.)

This challenge is even more complex in B2B environments, where companies typically do not generate as much data as in B2C settings. The Manager Design & Proposal of Shipyard Inc. explained that, since AI relies on large amounts of data, the lower number of transactions in the B2B setting makes it harder to make steps towards data driven insights.

We also observed that some organizations struggle with the foundation of their data. For example, the Team Lead Spare Parts and Process Coordinator Service of Bakery Inc. indicated that the data quality and structure are not yet good enough. Improving this is a necessary first step to use AI in their operations.

But even if organizations have this foundation, they lack the programs, frameworks and technologies to process and use this data efficiently. Some interviewees pointed out that their organization has a lot of data, but struggles to make it actionable:

"Yes, using data is also still a challenge, we have tons of data." (Service Line Manager, Shipyard Inc.)

"Because that kind of information just needs to be available somewhere in a structured way. Don't have that at all now." (Project Manager Software Development, Bakery Inc.)

In this, another key challenge is data quality. Even when companies have structured data, missing or incomplete datasets make AI tools unreliable, since they cannot generate accurate insights or predictions. If data is inconsistent or incomplete, it may produce unreliable or even misleading results.

"So the data is always missing something." (Data Scientist, Consulting Inc.)

One interviewee illustrated this by explaining how poor data quality can negatively impact AI models. When training an AI model, having a complete and reliable dataset is crucial. However, only a small portion meets the standards:

"But then you want to start extrapolating it through and you realize that only that one dataset is good. (...) And that, if you're not careful then, you end up training an AI on data that might not be good enough." (CISO, Shipyard Inc.)

The Project Manager Software Development emphasized this. Training a model requires both data and test data with known outcomes to verify accuracy. Without good data, there is a risk of incorrect training, leading to faulty decision-making.

Despite efforts to improve data quality, achieving a perfectly structured and reliable dataset remains an ultimate goal as well as an ongoing challenge. Even businesses that actively work on data improvement will still face missing information and inconsistencies. One interviewee realistically said:

"Where are you ever going to find a company where all your data is completely in order? Never. So you have to live with it. It just is what it is." (Manager Design & Proposal, Shipyard Inc.)

Insufficiently trained models can lead to biased results, however, the way data is selected, processed, and analyzed within these models also raises concerns about data bias. Currently, there is a lack of clarity about how AI models determine what information is included, and what information is excluded in their outputs:

"Are it the good results? (...) What determines what gets in and what doesn't? Is that someone generating that, programming that? Is that AI itself developing that or is it controlled?" (Program Manager, Training Inc.)

This uncertainty can be problematic when AI is used in customer interactions. In our interviews, we discussed several options for AI, such as chatbots. Organizations question whether these responses are representative, neutral, and accurate, emphasizing the need for more transparency in AI models.

"If you have a chatbot that answers, how biased is that chatbot? (...) How will it respond? And is that correct?" (Project Manager Software Development, Bakery Inc.)

Another challenge that we observed is that many organizations have difficulties in determining who owns and is responsible for data. According to Shipyard Inc.'s CISO, one of their biggest internal struggles regarding data is to define data ownership. Without clear policies, organizations are left with discussions and questions regarding data accessibility, data security, and compliance with regulations, hindering AI implementation in processes.

"Who is the owner of it? Are you handling it the right way? You get whole discussions about that." (CISO, Shipyard Inc.)

When discussing this topic, multiple interviewees indicated that, despite using AI tools, employees and organizations stay fully responsible for their use. This highlights the need for governance policies to manage risks about liability, compliance, and ethical concerns. About taking full responsibility, one interviewee of Bakery Inc. mentioned:

"If you as a company release that chatbot, you are responsible. And you have to take that responsibility." (Project Manager Software Development, Bakery Inc.)

Even when companies get past these data issues, they run into older or outdated systems that create additional obstacles to working with even basic ML, let alone AI, preventing companies from benefiting from AI. Shipyard Inc.'s CISO explained that they struggle to obtain useful insights because some systems have been modified so many times over the past few years:

"To some extent, we still have quite a few older systems that we have rebuilt so terribly over the years. (...) That it's not really possible to extract any information from that in a structured way that you can build on." (CISO, Shipyard Inc.)

As mentioned in chapter 4.2.4, customers in the bakery industry still favor traditional communication methods, such as dialing and faxing. Also, it was indicated that some production lines do not have digital documents. Through these examples, old habits can block the use of AI in businesses. One interviewee shared an example of how old-fashioned the bakery industry is:

"And I think, even up to a year or two ago, we were still just getting faxes in here from German companies just faxing their orders. Yes, seriously." (Field Service Manager, Bakery Inc.)

These examples highlight that, before even considering AI, organizations should first look at their data systems and infrastructure. If systems are too old, even the best AI strategies will not work.

As described in chapter 4.1.6, AI can provide insights and unique opportunities human minds might not identify. However, data-related barriers pose a significant barrier for AI, as AI is dependent on data.

In summary, data-related challenges pose a significant barrier for AI in servitization. Many organizations struggle with the availability, quality, and structure, making integrating AI in their processes difficult. AI is dependent on good quality data for

training and decision making, and not addressing these barriers might result in wrong decision making or organizations not fully capturing AI's benefits in servitizing.

4.3 Interpretation of findings

After exploring the drivers and barriers that organizations face in the employing of AI in servitization, we need to interpret these findings together. This study identifies three interconnected sections: the six drivers that accommodate AI employment, the seven barriers that hinder its employment, and the relationships between these factors. These interconnected elements can be categorized into five different dimensions: market, individual, organizational, data, and ethical, regulatory and trust.

One of the most influential drivers of AI is the need to stay competitive in the rapidly transforming market. Organizations feel pressured to employ AI to keep up with competitors. Additionally, growing customer expectations and increased market acceptance push businesses, even in conservative industries such as the shipbuilding and bakery industry, to use AI. However, this pressure sometimes forces organizations to employ AI when they are not ready, or without a clear strategy. In some industries, AI is still in its infancy, which makes businesses hesitant to invest in AI due to uncertainty about effectiveness and ROI. Furthermore, some industries face resistance from both the market and customers, who prefer the traditional way of operating.

On an individual level, several employees and executives show intrinsic motivation on AI by attending symposia, fairs, and participating in training and other sessions. This fosters a culture within the organizations to use AI. Furthermore, AI frequently appears in the news and workplace, which creates a feeling that AI is 'all over the place'. This makes individuals more curious, creates a sense of urgency, and encourages them to explore its possibilities and apply AI in the workplace.

However, this implementation is often hindered. Especially senior employees favor the traditional or established way of working. Their attitudes towards change and innovation, lack of knowledge on AI, and unfamiliarity with the technology hinders its use in servitizing. Employees that do not recognize the benefits or fear job replacement are less likely to use AI tools. This can be fixed by providing training and a clear understanding of AI's possibilities.

At the organizational level, we found that some organizations have a strong ambition to use AI to improve existing services and expand service delivery. Organizations use AI to enhance service offerings, meet the increasing and changing customer demand, and identify new opportunities. Furthermore, AI contributes to cost reduction in organizations while improving productivity and efficiency by automating tasks. Also, organizations need to commit to innovation. This is done through creating or getting organizational enthusiasm and support from policymakers, acquiring budgets for R&D and other development, and recognizing the need for AI understanding. For example, through the pilot for CoPilot at Shipyard Inc. or the 'lunch-and-learn' sessions at Bakery Inc.

However, AI on organizational level is hindered by several factors. The most prominent factor is the lack of strategic direction. Many organizations recognize AI's potential but struggle to define its role within their business. Uncertainty around AI, having no vision, internal rules or procedures, as well as no prioritization within the company, or a management that does not see value in AI, hinders the use of AI within businesses. In this, financial constraints also play a critical role. AI sometimes requires substantial upfront investments, and the costs of licenses can also be a significant challenge if the investments do not have returns on short notice.

While data is a driver for AI, it also remains one of the significant challenges. Improved data quality and availability make access to historical data and complex technology easier. However, many organizations possess large amounts of data but struggle to use it effectively. A lot of interviewees indicated data-related challenges such as quality issues or fear of biased outcomes because models are trained improperly. Organizations sometimes operate on outdated systems, that are not made for even made for ML, let alone AI, which hinders the use of AI.

Ethical, regulatory and trust concerns include issues regarding data security, liability, potential risk and compliance. The lack of regulations and guidelines make it difficult for organizations to take responsibility regarding legal risks and ethical dilemmas. Current legislation is underdeveloped, raising concerns about how AI systems handle sensitive data, especially for free AI tools.

In Figure 3 the enhanced framework can be found, including the dimensions of drivers and barriers of AI in servitization that were discovered in this study.

5. DISCUSSION

This study explores the drivers and barriers that B2B organizations face when employing AI in their servitizing. The aim of this paper is to answer the following research question: 'How does artificial intelligence (AI) impact servitizing?'. Our findings identified six drivers and seven barriers which are interconnected and indicate a complex environment. These can be divided into five areas, individual, market, organizational, data, and ethical, regulatory and trust, as illustrated in Figure 3.

Although AI is often displayed as an inevitable part in businesses, we found that it is much more nuanced. Organizations feel or are pushed to employ AI by external factors, such as market pressure to build or maintain a competitive edge, while they also feel forced to use AI by internal factors, such as reducing costs, the desire to improve services, and other factors such as budgets for digital development and organizational enthusiasm. However, these pushes weaken as organizations face factors such as no competitive pressure or

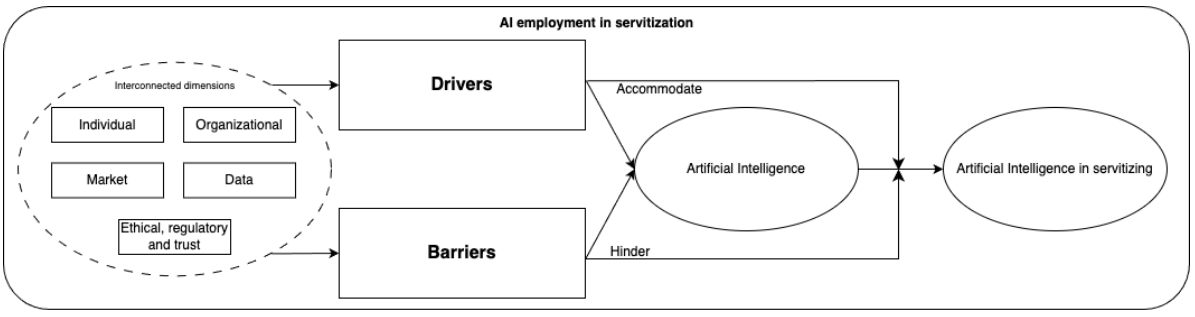

Figure 3: Enhanced theoretical framework, including dimensions of drivers and barriers of AI in servitization

resistance from customers. This pressure to employ AI, sometimes even without clarity, reflects how AI's popularity could result in implementation that is too soon.

Despite several key drivers, we also found that organizations face barriers that hinder AI in servitizing. One key challenge in this is the lack of strategic direction, which we observed in multiple interviews. Interviewees indicate that they recognize AI's potential, but they struggle to define the role AI should play in their business. This can be explained by several factors, including no clear goals, vision, policies, or prioritization, making its employment complicated, preventing AI's use in their operations. Furthermore, financial challenges further complicate AI as its often requires upfront investments, and currently businesses are hesitant whether they receive returns on the investments. This hesitation can be explained based on AI literacy within organizations. Research by Tully et al. (2025) shows that lower levels of AI understanding increase AI receptivity, as individuals tend to be more impressed by AI's capabilities. Therefore, it can be questioned whether AI is employed based on expectations rather than well-thought decision-making

Moreover, human variables impact AI's employment both positive and negative. While most executives showed intrinsic motivation and the increased awareness on AI encouraged individuals to develop themselves, resistance from senior staff to change, limited knowledge or no familiarity about AI create friction. This resistance can be overcome by, for example, providing training and ensuring transparent decision making, which in turn builds trust, a critical factor for successful AI implementation (Ivchyk, 2024).

Data-related factors remain a double-sided challenge. While improved data availability and quality form the foundation of AI employment, many organizations struggle with poor data, outdated systems or concerns about bias. However, compared to even or three or one year ago, organizations are making progress regarding their data foundation and systems.

Lastly, the lack of regulations leads to uncertainty about legal responsibilities, data security and other related topics. We found that one of the biggest concerns is how AI systems – especially free AI tools - handle data, indicating fear of sensitive data being exposed to other parties. All this uncertainty makes organizations cautious about employing AI in their processes.

Our findings indicate that the participating companies sometimes struggle to employ AI in their servitizing. This is in line with existing literature around AI adoption and implementation, as a lot around AI in businesses and AI in servitization is still in early stages and the phenomenon is not fully understood yet. By identifying dimensions of barriers and drivers that organizations might face, this study provides a better understanding for organizations to navigate the difficulties in employing AI in their servitizing. Companies need to balance between the obstacles to AI and the factors that are driving its employment by carefully considering their decisions to successfully employ AI. Rather than blindly following the 'AI hype', organizations should critically assess their own capabilities. Only then can AI become a part of their servitizing, instead of a response to trends.

5.1 Theoretical Contributions

AI is making its way into several industries as professional service firms are increasingly adopting it (Dutta, 2018; Yang et al., 2024). Currently, AI is one of the most discussed and researched topics, providing businesses advantages such as new insights, enhanced efficiency, and improved decision making (Lins et al., 2021; Keegan et al., 2022). However, despite several advantages, employing AI comes with challenges. While research has extensively explored AI adoption in different industries such as public sectors, manufacturing, and SMEs (Yang et al., 2024), there remains a gap in understanding these drivers and barriers in the context of servitization. Some studies (e.g. Heimberger et al., 2024; Kar et al., 2021) suggest that factors of AI adoption are interconnected, but it remains currently unclear whether this is true in the context of servitization. Industry-specific dynamics may influence servitization suitability, influencing its impact and effectiveness (Johansson & Svensson, 2015). This paper therefore takes an important step in addressing this gap by analyzing the drivers and barriers of AI in servitizing.

This research offers several theoretical contributions. First, it improves our understanding of drivers and barriers of AI in servitization. It develops a framework that maps the complexity and interconnected factors that accommodate and hinder AI in servitizing. Research on how organizations should integrate AI into their organization remains limited (Mikalef et al., 2021). By providing insights into these dynamics, this study helps organizations to leverage AI's benefits while mitigating potential risks.

Second, this study extends existing knowledge of AI's role in service. Although AI's relevance in business context is acknowledged, its impacts on servitization and marketing remains underexplored. Current academic studies are still in its early stages and lack empirical evidence on how AI affects servitization (Wirtz et al., 2019; Huang & Rust, 2021a; Barbieri et al., 2021). Furthermore, this study responds to calls from studies such as Manser Payne et al. (2021), Johansson & Svensson (2015) and Kamal et al. (2020) for more empirical work in the field of AI and servitization.

Third, this study contributes to the literature that focuses on AI in a B2B context, as most existing research has focused on B2C settings (Huang & Rust, 2018; Paschou et al., 2020; Keegan et al., 2022). AI's use is expanding in both B2B and B2C, emphasizing the need to understand the impacts in both B2C and B2B (Grewal et al., 2021). This study therefore provides insights that differ from those in B2C settings.

Fourth, unlike many existing studies that focus specifically on benefits and drawbacks of AI adoption in service, this study explores the drivers and barriers that impact AI in servitization. In doing so, it also identifies drivers and barriers that were previously identified in other domains, such as lack of skills and talent (Ahmad et al., 2022); cost reduction (Keegan et al., 2022); lack of strategy (McKinsey & Company, 2018) and looks at their impact in servitization context. In this way, this study addresses the broader gap in knowledge about which factors are specific in servitization and other industries.

Additionally, this study bridges the gap identified by Keegan et al. (2022) regarding the lack of empirical research on AI adoption in B2B marketing. Despite AI's growing importance, existing literature has primarily focused on the B2C sector or on AI's potential rather than how companies use it (Keegan et al., 2022). Research on how AI can be utilized in B2B operations is also in its early stages (Mikalef et al., 2021).

Furthermore, this study responds to the gap highlighted by Kar et al. (2021, p. 235), who emphasize the need to identify and analyze the interrelationships between driving factors and barriers to AI adoption. By identifying these interdependencies, this research contributes to a better understanding of the of AI's complexities in servitization.

Finally, this research offers both practical and academical insights. For organizations, it enhances the understanding of driving factors and challenges of AI in servitizing, helping them

to make more informed decisions. For academics, this study contributes to the theoretical understanding of AI's role in servitization, an area which is currently underexplored.

By identifying both drivers and barriers, this study bridges the gap between theory and practice, offering valuable insights that help organizations employ AI in servitization. Ultimately, these findings contribute to the development of a more structured and balanced servitization strategy.

5.2 Managerial Implications

The findings of this study have multiple managerial implications for organizations that want to employ AI in their servitizing. First, one of the main challenges identified is the lack of strategic direction. Our study indicates that many organizations recognize AI's value but struggle to define its role in their business. Therefore, organizations need to develop a clear AI strategy and roadmap that aligns with business objectives and their vision. AI strategies should define AI's role in service and set measurable goals and plans for both the short- and long-term. To define a strategy, organizations should assess whether they are ready to employ AI by evaluating employees' capabilities and knowledge, attitude towards innovation, technological and data infrastructures, and if potential investments are justifiable and realistic. This can be done through test cases, AI simulations, and pilots, which prevent time-consuming and complex processes while allowing the company to evaluate AI's feasibility.

Second, our observations on individual level highlight friction. While employees and managers are intrinsically motivated to use AI, we also observed that, especially senior staff, often form a key barrier to employing AI. Interviewees indicated resistance because of age, preference for established working routines, limited knowledge, unfamiliarity with AI, and concerns about job replacements. To overcome these, organizations should offer AI training and workshops, encourage participation in fairs and symposia. For example, organizations should implement initiatives like the lunch-and learn sessions at Bakery Inc or the internal platform form Shipyard Inc.

AI is frequently used to reduce costs and improve efficiency. However, currently employees and stakeholders often remain hesitant towards AI. To fully leverage AI's benefits, organizations should build trust in AI. This involves demonstrating how AI enhances their productivity, allows better decision making and improves service delivery. By making these benefits tangible, organizations can reduce skepticism and increase employees' willingness to use AI.

Third, AI in servitization requires organizational commitment. This requires support from management, allocating budgets for AI R&D, and creating a culture that encourages experimentation with AI. Organizations can form a team with employees that have knowledge of AI and the market to give internal advice. Furthermore, they can collaborate with universities, start-ups, and similar companies in other industries to exchange knowledge, share insights, and learn from each other. Also, they can involve customers to experiment with AI or consider hiring external expertise to provide guidance.

Fourth, data is the foundation for AI, but the findings highlight that many organizations struggle with poor data management and governance, data quality issues, lack of usable data or outdated systems which hinder AI's employment in servitization. Organizations should invest in data governance and infrastructures and update these to be able to create insights from data and AI.

In all these implications, organizations should address the ethical, regulatory, and trust concerns and uncertainties. The findings indicate that a lot of interviewees are worried about data security, data privacy and AI's transparency. Organizations should stay up to date on the coming AI regulations and implement them in their guidelines and strategies. Furthermore, trust should be built by clearly communicating how data is processed and used. Organizations should appoint roles such as a Chief Information Security Officer, Data Protection Officer, or an AI Governance Officer who can develop internal policies, procedures and other relevant measures for responsible AI use. Additionally, as earlier mentioned, they could also consider hiring external experts to ensure compliance with regulations and other relevant legislation. By taking these steps, organizations can build more trust among employees, customers and other relevant stakeholders.

By using these strategies, managers can navigate the complexities of AI in servitizing, creating a balance between the obstacles and drivers. In this way, organizations can employ AI more structured and effectively which improves their competitiveness, drives more innovation and the potential to maximize the benefits of AI.

5.3 Limitations and Future Research

While this study provides insights into drivers and barriers of AI in servitizing, several limitations should be considered, as these could impact the results of this research. Acknowledging these limitations also offers opportunities for future research.

Firstly, generalizability is one of the limitations. This multiple case study is conducted at four Dutch B2B organizations that have an interest in AI in servitization. Although this method allows for more in-depth exploration of AI in servitization, the results may not be applicable in other sectors, countries or regions. Future research could extend the sample size and investigate drivers and barriers of AI in servitizing in other industries or countries and explore whether these differ or match.

Secondly, response bias can occur since semi-structured interviews are used in this study. Interviewees may have indicated that their company is further in the process of AI adoption or indicated their position or attitude on AI in a more positive light than it actually is. Additionally, since this study is conducted at organizations that are already interested in AI, it may not recognize the driving factors and challenges of companies that are more hesitant towards AI. Future research could address this by carrying out a company-wide survey or organizations that are less ready or open for AI.

Thirdly, despite our efforts to use an ethnographic approach, this study might include interpretation bias. Because ethnographic research relies on individuals' experience and perceptions, these might be partially selective. Interviewees might unintentionally give responses that highlight successes rather than difficulties, which could result in an incomplete overview of the challenges in employing AI.

Lastly, as mentioned in the literature review, employing, adopting and implementing AI is a continuous and evolving process. This study only captures an organizations' view towards AI at a specific point in time. Organizations may change their perspective on AI because of new opportunities and challenges that arise from the developments of AI technologies. Therefore, a long-term study that tracks how drivers and barriers change over time could provide deeper insights into AI in servitization and how organizations respond to these developments.

An area for potential future research is the role of Artificial Intelligence as a Service (AIaaS), which is believed to lower the barrier of AI use in service by making AI technologies more accessible and affordable (Lins et al., 2021). However, while AIaaS reduces financial and technological barriers, it also introduces challenges such as trust concerns (Lins et al., 2021) or

data security risks. Future research could explore how AIaas influences AI in servitizing, investigating whether AI employment is accelerated or creates other or new complexities.

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8. APPENDIX

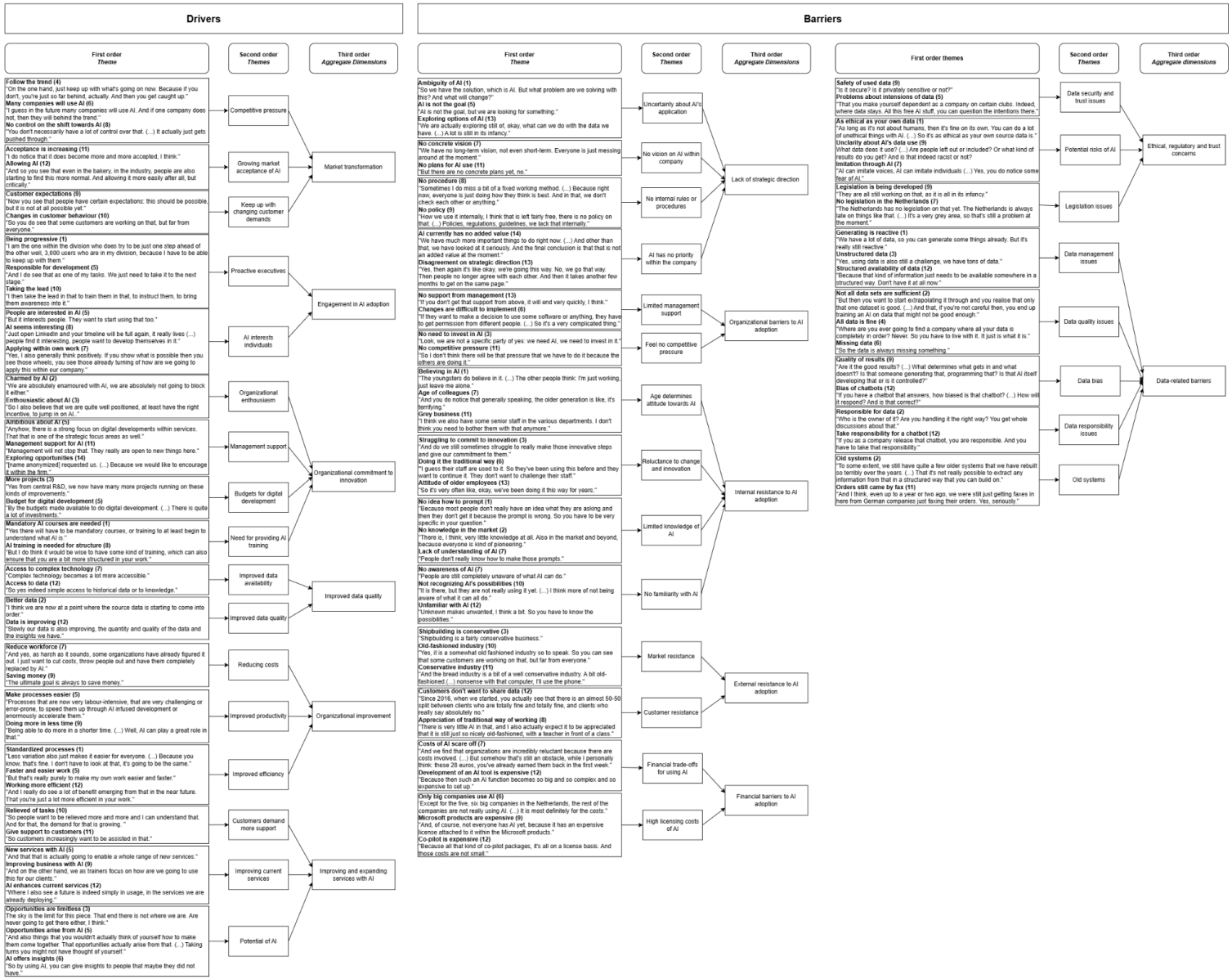

Figure 2: Aggregate dimensions of drivers and barriers of AI in servitizing