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Navigating the Shift: Transition of Firms and Users from Servitization to Digital Servitization using Grounded Theory Approach

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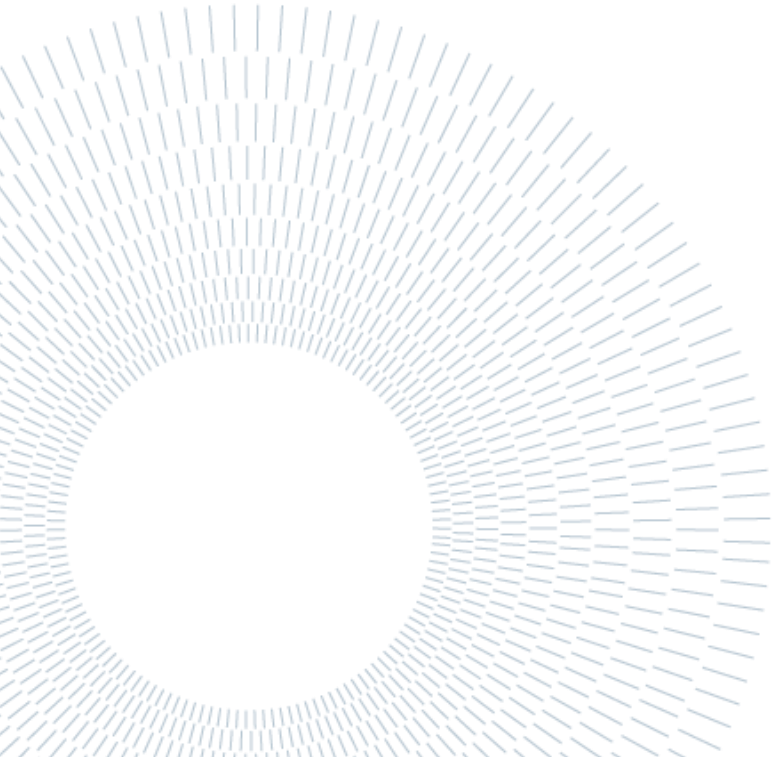


Abstract

The business environment is undergoing a significant transformation driven by rapid advancements in digital technologies and evolving consumer expectations. This shift has prompted manufacturing firms to move from a product-centric to a service-centric business model, a process known as servitization. With the rise of digital technologies such as the Internet of Things (IoT), Big Data, Artificial Intelligence (AI), and Cloud Computing, this transition has evolved into Digital Servitization (DS). This thesis, titled "Navigating the Shift: Transition of Firms and Users from Servitization to Digital Servitization Using Grounded Theory Approach," provides a comprehensive review of this transition, aiming to develop an integrated framework that guides firms and its customers through the complexities of digital servitization.

The study employs a Grounded Theory (GT) methodology to systematically review and analyze relevant literatures and reports. Through open, axial, and selective coding of 17 key documents, the research identifies major themes and relationships in the digital servitization domain. Key findings highlight the critical role of technology integration and strategic shifts in driving digital servitization. Advanced technologies facilitate real-time data analytics, connectivity, and automation. The strategic shift towards a service-centric model enhances customer engagement and creates recurring revenue streams.

Despite extensive research on servitization, significant gaps remain in empirical studies focused on digital servitization and the integration of customer perspectives. This thesis addresses these gaps by proposing a comprehensive framework that integrates servitization and digitalization, providing practical solutions and strategies for firms. The framework emphasizes the importance of continuous innovation, organizational readiness, and regulatory compliance in ensuring the successful implementation of digital servitization initiatives.

This research contributes to both academic knowledge and practical applications, offering valuable insights for business leaders, academics, and policymakers. The proposed framework serves as a practical reference for firms navigating the transition to digital servitization. In conclusion, this thesis advances the understanding of the complex transition from servitization to digital servitization, providing a robust foundation for future research and practical implementation in the digital economy.

Key-words: Digital Servitization, Servitization, Digital Transformation, Technology Integration, Strategic Shift, Customer Engagement, Grounded Theory.

Abstract in italiano

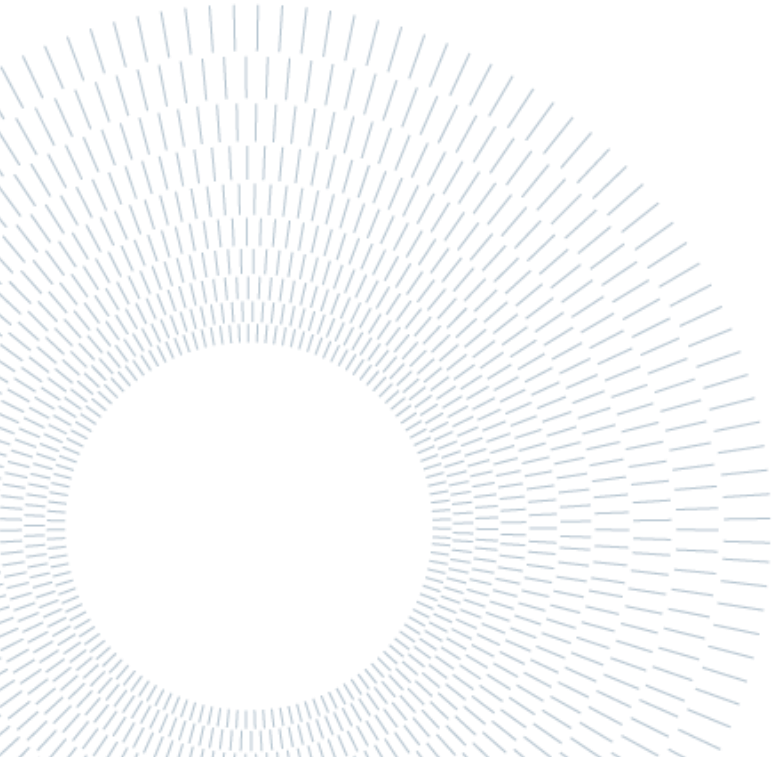
Il contesto imprenditoriale sta attraversando una trasformazione significativa guidata dai rapidi progressi delle tecnologie digitali e dall'evoluzione delle aspettative dei consumatori. Questo cambiamento ha spinto le aziende manifatturiere a passare da un modello di business incentrato sul prodotto a uno incentrato sul servizio, un processo noto come servitizzazione. Con l'avvento delle tecnologie digitali come l'Internet delle cose (IoT), i Big Data, l'Intelligenza Artificiale (AI) e il Cloud Computing, questa transizione si è evoluta nella Servitizzazione Digitale (DS). Questa tesi, intitolata "Navigating the Shift: Transition of Firms and Users from Servitization to Digital Servitization Using Grounded Theory Approach", fornisce una revisione completa di questa transizione, con l'obiettivo di sviluppare un quadro integrato che guidi le aziende e i suoi clienti attraverso le complessità del digitale. servitizzazione.

Lo studio utilizza una metodologia Grounded Theory (GT) per rivedere e analizzare sistematicamente letterature e rapporti rilevanti. Attraverso la codifica aperta, assiale e selettiva di 17 documenti chiave, la ricerca identifica i principali temi e relazioni nel dominio della servitizzazione digitale. I risultati principali evidenziano il ruolo fondamentale dell'integrazione tecnologica e dei cambiamenti strategici nel promuovere la servitizzazione digitale. Le tecnologie avanzate facilitano l'analisi dei dati in tempo reale, la connettività e l'automazione. Il passaggio strategico verso un modello incentrato sui servizi migliora il coinvolgimento dei clienti e crea flussi di entrate ricorrenti.

Nonostante le ricerche approfondite sulla servitizzazione, permangono lacune significative negli studi empirici focalizzati sulla servitizzazione digitale e sull'integrazione delle prospettive dei clienti. Questa tesi affronta queste lacune proponendo un quadro completo che integra servitizzazione e digitalizzazione, fornendo soluzioni pratiche e strategie per le aziende. Il quadro sottolinea l'importanza dell'innovazione continua, della prontezza organizzativa e della conformità normativa nel garantire il successo dell'implementazione delle iniziative di servitizzazione digitale.

Questa ricerca contribuisce sia alla conoscenza accademica che alle applicazioni pratiche, offrendo preziosi spunti per leader aziendali, accademici e politici. Il quadro proposto funge da riferimento pratico per le aziende che affrontano la transizione verso la servitizzazione digitale. In conclusione, questa tesi promuove la comprensione della complessa transizione dalla servitizzazione alla servitizzazione digitale, fornendo una solida base per la ricerca futura e l'implementazione pratica nell'economia digitale.

Parole chiave: Servitizzazione digitale, Servitizzazione, Trasformazione digitale, Integrazione tecnologica, Cambio strategico, Coinvolgimento del cliente, Grounded Theory.



Contents

Abstract ..... **iii**

Abstract in italiano ..... **iv**

Contents ..... **vii**

1 Introduction **1**

1.1. Objectives 2

1.2. Scope and Approach 3

1.3. Research Questions 3

1.4. Rationale and Relevance 4

2 Theoretical Background **6**

2.1. Historical Context and Evolution of Servitization 6

2.2. The Intersection of Servitization and Digitalization 7

2.3. Complexities and Challenges of Digital Servitization 8

2.4. Customer Co-creation in Digital Servitization 9

2.5. Role of ICTs and Industry 4.0 in Digital Servitization 9

2.6. Analysis of Different Methodologies Used in Previous Research 11

2.7. Identifying the Gaps 12

3 Methodology for Grounded Theory **16**

3.1. Scope of the Review 17

3.2. Selection Criteria 17

3.3. Data Analysis 18

4 Findings **22**

4.1. Technology Integration 27

4.2. Strategic Shift: From Product-Centric to Service-Centric 29

4.3. Customer Engagement: Co-creation of Value 31

4.4. Operational Efficiency: The Backbone of Digital Servitization 32

4.5. Capability Development: Building the Foundations for Digital Servitization 34
4.6. Challenges: Navigating the Complexities of Digital Servitization 35
4.7. Environmental Benefits: Promoting Sustainability through Digital Servitization 37
4.8. Economic Impact: Driving Financial Performance through Digital Servitization 38
4.9. Intervening Conditions: Key Factors Influencing Digital Servitization 40
4.10. Governance and Integration: Ensuring Seamless Operations in Digital Servitization 41
4.11. Digital Servitization Paradox 42
5 Proposed Model 45
5.1. Creating a Coding Paradigm 46
5.1.1. Causal Conditions 46
5.1.2. Context 48
5.1.3. Intervening Conditions 49
5.1.4. Action/Interaction Strategies 50
5.1.5. Consequences 51
5.2. Snapshot of Relationships between the Themes 52
5.3. Grouping Categories into Coherent Framework 53
5.4. Holistic View of the Model 54
5.4.1. Dynamic Interactions 55
5.4.2. Long-Term Sustainability 55
5.4.3. Implementation and Benchmarking 55
6 Discussion 57
6.1. Answer to the Research Questions 57
6.1.1. Research Question 1: How do manufacturing firms effectively navigate the transition to digital servitization, and what factors influence the success of this transformation? 57
6.1.2. Research Question 2: How do users (stakeholders) perceive and adapt to the changes brought about by digital servitization, and what factors influence their adoption and satisfaction? 58
6.2. Recommendations for Stakeholders 59
7 Threats to Validity and Mitigation Strategies 61
7.1. External Validity 61

7.2. Internal Validity 61
7.3. Construct Validity 62
7.4. Reliability 63
8 Conclusion and Implications 64
8.1. Conclusion 64
8.2. Implications for Theory and Practice 64
9 Identification of Gaps and Future Research Directions 66
9.1. Identification of Gaps 66
9.2. Future Research Directions 67
Bibliography 69
A Appendix A 72
A.1. List of selected 17 papers. 72
A.2. List of papers referred 73
A.3. Limitations and Unavoidable Biases 74
A.4. Example of Excerpts 75
B Appendix B 78
B.1. Code weight Statistics 78
B.2. Packed Code Cloud with Themes 78
B.3. Homepage of Dedoose software 79
B.4. List of all the Child Codes 80
List of Figures 83
List of Tables 84
List of Abbreviations 85
Acknowledgements 86

1 Introduction

Rapid advances in digital technologies and new consumer demands are remaking the business landscape as we know it. Given the emphasis of Servitization in recent years, the business environment is constantly undergoing strategic shifts. Accordingly, companies - especially in the manufacturing sector are now placing as much significance on services as they are on products to gain a competitive advantage. This strategic transformation from a product-centric to a service-centric business model is known as "Servitization". The onset of digital technologies such as IoT, Big Data and Cloud Computing have hastened this changeover creating a new paradigm: Digital Servitization (DS). The intent of this thesis, "Navigating the Shift: Transition of Firms and Users from Servitization to Digital Servitization taking a Grounded Theory Approach" was to create an overview on this nuanced shift.

Servitization as a concept evolved over the course of the 1980s, however, it became more prominent amongst product-based firms and research community in response to the groundbreaking work conducted by Baines [1]. As companies like Nike and Siemens have shown, they have successfully transformed their business model to incorporate services (like the customization of shoes) alongside core products. But the combination of products with additional services and business model redesigning have become more complex due to the integration of digital technologies. [2], [3], [4].

The thesis statement is compelling as it examines the overarching relationship between servitization and digitalization. The convergence of the two, while each can alternatively be adopted on its own, has paved the way for Digital Servitization - a transformative new notion that spans various aspects of both business models and organizational structures as well as value creation processes[2]. This thesis hypothesizes that Digital Servitization (DS) is not a simple adoption of digital technologies such as IoT, AI or Cloud Computing, but requires an entirely new value creation logic through servitization process. Service designers play a pivotal role in bridging strategy, technology and change management to navigate the organization through a smooth transition into service-oriented business operating model.

This thesis intends to fulfil an identified research gap in the literature by providing a comprehensive overview on how digitalization is leading companies to migrate from classic servitization towards a new era, yet unexplored which authors coin it as digital Servitization, through Grounded Theory as qualitative analysis method. This study also explores drivers of this transition, generate some valuable insights into the

strategies and practices that underpin successful digital servitization, and contribute to both academic knowledge and practical applications in this area.

1.1. Objectives

The objectives of this study are focused on navigating the transition of firms and customers from Servitization to Digital Servitization which aims to explore the evolving dynamics as companies and their customers shift towards digital servitization models. Furthermore, it constructs a comprehensive practical framework for enabling the transition of firms and users from the conventional servitization to digital servitization by employing Grounded Theory based literature review. The framework is based on the emerging concepts that are identified in the qualitative data analysis (Grounded Theory). These objectives provide the framework of the research with the aim to address the research gap between Servitization and Digital Servitization.

This study has focused on the journey of servitization to digital servitization in the context of firms and customer transitions due to the change happening on that landscape and it aims to explore the new path as how companies are slowly but surely adopting technological advancements with understanding and redefining their strategy for transformations. This article aims to meet the following goals through a grounded reasoning perspective in its literature review:

1. **Advancing the Academic Niche through Grounded Theory**: Use Grounded Theory as an inductive tool to find and develop the emerging concepts specific to Digital Service economy. A key principle of Grounded Theory is the emergence of important concepts during analysis and not established a priori. This objective will provide new dimensions of the transition process and shed more light on the academic knowledge hidden within the realm of digital servitization and their impacts on firms as well as customers. The common objective is reviewing for theoretical advancement of a subdomain. The distinguishing feature of Grounded Theory is its inductive premise, it allows for the salient concepts to emerge from the literature. The inductive nature of the grounded theory approach allows for the discovery of key concepts during the analytic process surrounding a particular substantive area, not as predetermined deductions.
2. **Determine Key Drivers and Enablers of Digital Servitization via Emergent Concepts**: A discovery of primary factors that drive the transition to digital servitization, which is found in the means of emergent concepts appearing & identified by Grounded Theory. The factors may include technological advancements like the IoT, Big Data, AI and Cloud Computing, but also strategic transformations as customer-centrism, data-driven decision-making or agile innovation. This objective will also investigate the organizational

enablers including digital skills, change management competencies and co-opetition which are necessary for firms to transition successfully to digital service -enabled strategies.

3. **A holistic model for digital servitization**: Summarize the relevant findings from the literature review to establish a comprehensive actionable model for assisting companies and customers in transitioning from servitization to digital servitization. The framework will revolve around the emerging core phenomenon and the themes/categories which will be derived from the research process providing an integral picture of the transition landscape. This framework, by its delineation, will be used as a reference by organizations looking for a methodical approach to leverage digital technologies and create differentiation in the way the customer value can be enhanced, operational cycle time improved and competitive advantage sustained.

1.2. Scope and Approach

This thesis examines the transition from traditional servitization to digital servitization, focusing on how to shift, and the implications for businesses and their stakeholders. The topic was addressed by applying Grounded Theory for literature reviews, considering relevant research in academic databases (e.g., Google Scholar, Scopus and ScienceDirect), research gateways and online libraries. Through the grounded theory approach, I aim to offer valuable insights for manufacturing firms navigating the complexities of digital servitization, while shedding light on the user experience and its implications for the successful adoption of digital services. As usual in Grounded Theory studies, data collection and analysis were iterative and interleaved. Although in conventional Grounded Theory, direct empirical data (interviews with firms and their customers particularly in digital Servitization field) is used, I however, used existing Literature reviews and academic papers as the main sources of data, due to difficulty in acquiring direct empirical data. I followed the paper "Using grounded theory as a method for rigorously reviewing literature" by Wolfswinel J. as the blueprint for my methodology. This method analyses these documents thoroughly to extract relevant information and develop a grounded understanding of the transition process The purpose of this review lies in the insight from the integration between digital technologies with servitization and more specifically, what it is as a source for business model innovation, reorganization and value creation processes.

1.3. Research Questions

The convergence of digital technologies and servitization has given rise to a new paradigm in manufacturing: Digital Servitization. This phenomenon, while promising

significant benefits, presents a complex landscape of challenges and opportunities for both firms and their customers. To answer the research questions, I followed a systematic and rigorous approach to carrying out a literature review through a Grounded Theory approach to reach a thorough and theoretically relevant analysis of this topic. To navigate this landscape, this study is guided by two pivotal research questions:

Research Question 1: How do manufacturing firms effectively navigate the transition to digital servitization, and what factors influence the success of this transformation?

This question forms the foundation of the investigation, seeking to unravel the complexities inherent in the shift from product-centric to service-centric business models in the digital age. I dive into the strategic, operational, and technological challenges faced by manufacturing firms as they embark on this transformative journey. Through a comprehensive analysis of existing literature and case studies, I aim to identify the critical success factors and drivers that enable firms to effectively integrate digital technologies, reconfigure their value chains, and develop the necessary capabilities to thrive in the digital servitization landscape.

Research Question 2: How do users (customers and stakeholders) perceive and adapt to the changes brought about by digital servitization, and what factors influence their adoption and satisfaction?

This question shifts the focus to the users of digital services, recognizing their pivotal role in the success of digital servitization. I explore how customers and other stakeholders perceive the value propositions offered by digital servitization and the factors that influence their adoption of these new service models. By examining user experiences, expectations, and satisfaction levels, this thesis aims to uncover the key drivers of user acceptance and identify potential barriers to adoption. This understanding is crucial for firms seeking to design and deliver digital services that meet the evolving needs and expectations of their customers.

1.4. Rationale and Relevance

The rationale for this review is rooted in the growing importance of digital technologies in transforming traditional business models. Digital servitization represents a critical evolution in how companies create and deliver value, making it highly relevant to today's business environment. Understanding this transition is essential for manufacturing firms seeking to remain competitive and innovative. The insights provided by this review are particularly valuable for business leaders,

policymakers, and academics interested in the intersection of technology and service-oriented business models.

This literature review is relevant to a wide range of potential readers, including business leaders, academics, and policymakers. For business leaders, the insights provided can inform strategic decisions and operational improvements. Academics can build on the theoretical framework presented to further explore the nuances of digital servitization. Policymakers can use the findings to support the development of regulations and policies that foster innovation and competitiveness in the digital economy.

The next sections provide a theoretical background on servitization and digital servitization (many others do exist, but the focus is specifically on these) before detailing the methodology employed to investigate the transition chapter 3; chapter 4 present the findings, chapter 5 gives a model for the transition, and later discussed the theoretical and practical implications. The thesis aims to answer this research gap by providing a comprehensive investigation that will serve as a guide for the journey from servitization to digital servitization in an attempt to equip manufacturing firms with needed capabilities to understand and manage this essential transformation while serving as a compass for managing the dominant transformation facing manufacturers within the context of a digital economy.

2 Theoretical Background

2.1. Historical Context and Evolution of Servitization

While product-centric models had long dominated manufacturing strategies, a novel philosophy began to emerge in the latter half of the 1980s which reframed business logic. Dubbed "servitization" by Vandermerwe and Rada, it promoted a metamorphosis in core priorities, moving companies from singular item provision toward integrated offerings designed to maximize user benefit. This reorientation enabled enterprises to carve out competitive edges in maturing sectors no longer defined by merchandises alone. Through solutions engineered for client results rather than just production outputs, firms found ways to stay one step ahead of intensifying competition by fulfilling higher-level needs with holistic solutions.

In the early days, servitization was mainly dictated by saturated markets and local market needs. Manufacturers found that integrating their product offerings with services would add further value for customers and create customer relationships lasting into the future. The Power by the Hour models arose from such considerations as well. In effect, Rolls-Royce sold engine hours rather than more engines. This form of servitization points up how services can be used to improve the selling proposition and guarantee loyalty from buyers over life-long or even through results-based contracts.

The seminal work by Baines et al. (2009) provided a comprehensive framework for understanding servitization. Their research underscored that servitization is rooted in the transformation of a company from focusing on its product-centric offerings towards a service-centric approach, necessitating an overhaul of organizational culture, processes and capabilities. Baines and his colleagues identified various levels of servitization, ranging from basic after-sales services to advanced services like performance-based contracts and outcome-based solutions. The case studies have clearly pointed out the requirement of new abilities and incorporating sectors into the heart company tactic for servitization.

Digital technologies have changed the servitization landscapes, and digital servitization is a new term that was coined. Technologies such as Internet of Things (IoT), Big Data, Artificial Intelligence (AI), Cloud Computing have made it possible for companies to offer advanced services they could not offer previously. Real-time monitoring, predictive maintenance, and performance optimization can be realized

using these technologies leading to better delivery of services and increased operational efficiency.

Digitalization and Business Model Transformation

Spurred on by the COVID-19 pandemic, which has greatly increased firms turning to digitalization-based strategies; companies are now entering a new age of efficiency and innovation [4]. It is a transformation that goes far beyond simply moving information and task work to digital form; it means re-examining business processes end to end (both within the firm and across firms) with new digital tools, including IoT, Big Data, and Cloud Computing. These technologies are used not only to improve operational efficiencies but also catalyze a paradigm shift aiming at fundamentally altering the form of business models. This shift demands a different approach to value creation, delivery and capture - redefining how organizations function and how they interact with customers [5].

2.2. The Intersection of Servitization and Digitalization

Digital servitization represents the convergence of servitization and digitalization. This new paradigm leverages digital technologies to transform traditional product-service offerings into smart, connected solutions that provide continuous value to customers. Studies by [6], [7] and [8] highlight how digital servitization enables firms to develop new business models, such as subscription-based services and outcome-based contracts, which focus on delivering value through continuous service improvement and customer engagement.

The merger of servitization and digitalization mark a profound transformation in what it means for companies to connect with value creation. Servitization involves moving from a product-based business model towards one that focuses on delivering outcomes as services. This transformation is further facilitated with digitalization being the right enabler for a more profound customer needs understanding, data gathering and analysis, service delivery improvement [9].

The servitization paradigm specifies new application of Information Communication Technologies (ICTs) to obtain more information on customer needs and support the collection and exchange of data [3]. The combination of both, is Digital Servitization (DS) which has been introduced as a new paradigm by Paschou [8]. The DS stands for the convergence of digital technologies with services-oriented business models, which better reposition companies to offer deeper more integrated and value-driven outcomes.

Key Theoretical Contributions:

1. **Service-Dominant Logic (S-D Logic)**[10]: proposed the Service-Dominant Logic, which posits that value is co-created through interactions between providers and customers. This perspective shifts the focus from the exchange

of goods to the exchange of services and the co-creation of value, aligning closely with the principles of servitization.

2. **Resource-Based View (RBV)**: The Resource-Based View emphasizes the importance of developing unique capabilities and resources that provide competitive advantages. In the context of servitization, this involves building service capabilities and integrating them with product offerings to create differentiated value propositions.
3. **Dynamic Capabilities**[11]: Introduced the concept of dynamic capabilities, which refers to a firm's ability to adapt and reconfigure its resources and capabilities in response to changing environments. Digital servitization requires firms to develop dynamic capabilities that enable them to leverage digital technologies and continuously innovate their service offerings.

2.3. Complexities and Challenges of Digital Servitization

Digitalization-enabled Servitization (DS), as an advanced and multiple dimensions model which dramatically rebuilt the features of business models especially for firms that are shifting to provide digital-enabled services (e.g. DHL). The rapid digitalization changes not only how products are created and how services offered, but also how organizations have evolved [3], [4]. Servitization Business Logic - this is part of DS where the change in servitization business logic as opposed to just need or want fulfillment, will be far more than the sum of its individual parts.

DS complexities can be seen in the larger picture of Industry 4.0, bringing enumerable technologies like IoT, AI and blockchain etc. They are able to disrupt the entire possibility of DS strategy They are not only revolutionary, but they also come with real-time and intelligent capabilities which play a major role in maximizing the potential of DS strategies [12]. Organizational complexity increases as manufacturers move from basic services (maintenance, repair) to more advanced services based on two-way platforms or similar offering. Digitalization, on the other hand, adds even more complications to this transformational journey.

The existing literature [3], states that servitization is a transformative journey for manufacturing firms. Digitizing this journey adds another level of complexity, requiring new skills, capabilities and organisational structures. Even though DS has the potential to be a useful construct, the lack of a clear framework leads to a fragmented understanding of the concept and makes cross-study comparisons challenging [8].

This thesis addresses this gap by investigating the construct of DS in response to the existing ambiguity surrounding this phenomenon. The lack of theoretical inconsistency in what makes up DS may mean that understanding of, rather than

learning about, DS is fragmented and difficult to reach a consensus on across studies and domains, which ultimately undermines the accumulation of knowledge. To the best of my knowledge, few literature reviews published so far that are part of broader investigation into the theme of DS e.g. [6], [7], [13]. While a few reviews have taken a perspective on the influence of certain digital technologies like IoT, distance monitoring and large data on Servitization, others have purported to characterize this paradigm or consolidate the diversity in the literature of these two domains. However, this study differs slightly in its objectives, aiming to map how digitalization transforms product companies in their transition toward services.

2.4. Customer Co-creation in Digital Servitization

Customer co-creation is a critical component of digital servitization, emphasizing the active involvement of customers in the development and delivery of services. This collaborative approach leverages the capabilities of digital technologies to facilitate real-time feedback, customization, and value co-creation. Customers are not merely passive recipients of services but active participants who contribute to the innovation process, enhancing the overall value proposition [3].

Customer co-creation in DS is significant due to several reasons. It enables a personalized service experience, resulting in customer satisfaction and loyalist ship. Additionally, the data collected will also help improve service offerings on an ongoing basis. An iterative process of co-creation that guarantees the continuous relevance and alignment of services with customer needs preserves long-term customer engagement and success.

2.5. Role of ICTs and Industry 4.0 in Digital Servitization

Digital servitization is an emerging trajectory in which the convergence of Information and Communication Technologies (ICTs) and the ideals of Industry 4.0 play a part. These technologies allow old-school manufacturers to become the champions of digital delivery and transition from product-centric models to service-oriented paradigms. ICTs support the infrastructure and components of developing smart, connected services that create value from high-impact digital mechanisms.

ICTs cover a wide array of digital gadgets and technological platforms that aid in the gathering, processing, storage and sharing of information The Internet of Things (IoT), Big Data, Artificial Intelligence (AI) and Cloud Computing are the critical ICTs in a digital servitization context. Take the Internet of Things (IoT) example; this is a world where you are connecting physical devices over a network and these devices can collect and exchange data. This is essential not only for Predictive Maintenance but also for monitoring the equipment by providing valuable insights and tailor-made solutions for a much-invested area - Products & Services. For example, in the

manufacturing sector, IoT-enabled machinery can provide real-time data on performance and maintenance needs, enabling companies to offer predictive maintenance services that reduce downtime and improve efficiency [14], [15]

Big Data and data analytics play a pivotal role in processing the vast amounts of data generated by IoT devices. These technologies help businesses to understand the performance of their operations and gain visibility on their customers, which in turn help them make informed decisions and design strategies. Significantly, companies that can analyze vast datasets which are using this information to streamline their operations, improve the customer experience, and create new service offerings. Studies by [16] suggest that advanced data analytics could reshape service provision through more efficient and effective means of providing genuinely wise, evidence-informed interventions to better guide orientation and production.

More intelligent decision-making processes and the pre-determined analysis made by Artificial Intelligence (AI) continue to make digital servitization even more productive. AI algorithms can recognize patterns, forecast results and allocate resources, increasing the efficiency of operations and quality of services. For example, AI-powered solutions can enhance the performance of supply chain management by focusing on reducing operational costs through customized service offerings which in turn enhances customer satisfaction [12].

Cloud Computing provides the scalable storage and computing power necessary to manage and analyze large datasets efficiently. Cloud platforms support the deployment of digital solutions and services, facilitating seamless integration across the enterprise. The flexibility and scalability offered by cloud computing enable firms to quickly adapt to changing market conditions and customer demands, ensuring continuous service improvement and innovation [17].

Technology like IoT capitalizes on core Industry 4.0 principles, including the incorporation of digital technologies into manufacturing production capabilities, which only serves to enhance servitization further through utilizing it as a driver. At the other end of the spectrum, a potentially useful way of thinking about Industry 4.0 is that it encompasses technologies like AI, robotics, IoT and advanced data analytics which better connect manufacturing systems and make them smarter. This integration allows the development of smart factories, which simply means that machines and systems can communicate with each other and work together without human intervention to improve production methods and offer their customers high-quality services.

2.6. Analysis of Different Methodologies Used in Previous Research

Servitization and its various forms like digital servitization, are complex transformational processes that have been examined through many theoretical lenses using a diverse set of methodologies. Complementary strengths and insights are achieved with these methodologies, where the overall benefit lies in obtaining a complete picture of how companies move through the traditional manufacturing into integrated digital-enabled product service systems.

Case Studies

Case studies are widely used in servitization research to offer rich, in-depth, contextual analyses of how individual firms implement servitization and digital servitization strategies. This method also enables capturing the nuances and contextual elements important for the adoption, implementation and efficacy of these strategies in organizational settings. For instance, [2] conducted case studies on multinational corporations such as Siemens and Nike, examining their strategies for integrating digital technologies with service offerings. Also, by closely analyzing these companies, the researchers were able to pinpoint both what worked and what did not as others followed suit in trying to make similar transformations. Case studies are especially interesting in this respect since they can yield highly processual and nuanced insights into servitization that cannot be obtained through more aggregated, quantitative data.

Surveys and Interviews

Surveys and structured interviews are widely used to gather quantitative and qualitative data from industry practitioners, providing broader insights into the experiences and strategies of a larger sample of firms. The McKinsey report "Prepare now for the future of Industrial Services" [15] utilized surveys to collect insights from executives on their experiences with digital servitization. These approaches enable the researcher to capture a breadth of opinion and experience, identify emerging norms and measure the incidence of certain practices/outcomes. While surveys might be able to provide statistically relevant information, interviews offer deeper insights into the motivations, challenges and strategies of industry leaders. The combination of these methodologies provides a rich insight into how firms across two sectors perceive and implement digital servitization.

Systematic Literature Reviews

Systematic reviews of literature, as those performed by Kohtamäki et al. (2019), are the review papers that offer an exhaustive account of the current state-of-the-art on servitization and digital servitization research. Systematic reviews gather, appraise and combine the findings of multiple research studies in order to identify common trends, uncertainties and new directions for research. They are meant to synthesize the

evidence, identify what we know and what opinions differ, and try to tease apart as clear a picture as possible so that further research has a solid base to build upon. In this context, they are particularly valuable in identifying what is known in the field now and where work should be directed next, as well as informing policymakers and practitioners about the current evidence base.

Quantitative Analysis

Quantitative methods, including statistical analyses and big data analytics, are employed to identify patterns and insights from large datasets. For example, Tronvoll et al. (2020) used quantitative analysis to examine sensor data from IoT devices, identifying patterns that inform predictive maintenance strategies. These methods allow researchers to test hypotheses, measure constructs and relationships, and make generalizable claims. Quantitative analysis is uniquely suited to reveal trends and correlations that qualitative methods alone cannot. Rigorous testing of theories and models leads to strong and reliable evidence for or against particular claims about digital servitization.

Grounded Theory

Grounded theory is a useful methodology for this kind of explorative research as it aims to develop theoretical frameworks based on empirical data, especially as digital servitization phenomena are emergent. This approach entails rounds of data collection and analysis iteratively, enabling the theories to "emerge from the data" rather than being super-imposed a priori. An appropriate research method to investigate complex and evolving processes may be grounded theory since grounded theory demands researchers to stay alert and flexible about new findings as data collection is in progress. Researchers can create a more subtle and context-bound framework of digital servitization by empirically grounding their theories. However, there is a notable gap in the application of grounded theory to digital servitization, which this thesis aims to address.

2.7. Identifying the Gaps

The transition from servitization to digital servitization is a complex and multifaceted process that has been explored in various studies. However, despite the growing body of research, several gaps remain in the literature. This section identifies these gaps and discusses how this thesis aims to address them through the development of a new model or framework.

While there is a significant amount of research on servitization, studies specifically focusing on digital servitization are relatively scarce. Existing literature often combines the concepts of servitization and digitalization without diving into the unique aspects and challenges while transiting to Digital Servitization (DS). Although [7] and [8] provide a point of convergence between digitization and servitization, still

very little indeed known about how firms navigate this transition in practice. Yet, the distinctive challenges and tactics related to digital servitization have not been adequately addressed in extant research.

Insufficient Exploration of Customer Perspectives

Numerous research has primarily considered the viewpoint of the firm employing digital servitization, often neglecting the customer's or stakeholder's viewpoint. Understanding how customers perceive and adapt to digital servitization is crucial for developing effective strategies. More research is needed to explore customer engagement, satisfaction and co-creation in the context of digital servitization. Sjödin et al. [18] argue that customers should be asked to participate in building digital services, but evidence is still rare.

Lack of Comprehensive Frameworks

There are some conceptual models by Chirumalla [12], or by Kamalaldin [16] available for servitization and digital transformation but none that integrate these two important concepts. Many of the existing models examine servitization or digitalization but do not take a holistic perspective of the term "Digital Servitization". Such a gap seems evident in the understanding of how digital technologies can be effectively integrated into servitization strategies [2], [3]. A more coherent framework that encompasses the two dimensions and elaborates their implications is required to assist firms through successful digital servitization.

Challenges and Barriers to Implementation

The literature acknowledges the challenges and barriers to digital servitization, such as organizational resistance and regulatory constraints. However, there is limited research on practical solutions and best practices to overcome these challenges. More opportunities for future studies will provide practical insights and implementable strategies in firms that are moving towards Digital Servitization. The current literature generally identifies concerns yet does not give specific strategies to get rid of these.

Sustainability and the Environmental Footprint

Although quite recent research field, analysts have talked about sustainability in some global scientific documents on digital servitization topic, it still calls for further studies. More research is needed to evaluate how far digital servitization encourages sustainability goals and which practices are contributing to environmental outcomes [2]. The integration of sustainability within digital servitization strategies can provide substantial benefits; nevertheless, empirical findings on this are limited.

Lack of Grounded Theory Applications in Digital Servitization

Given its flexibility and nuance, grounded theory has obvious potential relevance to the digital servitization literature, although in practice there are few examples of it being applied. Most of the previous research employed case studies, surveys, and

quantitative analyses to study diverse dimensions of digital servitization. This gap implies that the potential of grounded theory in truly understanding the processes and structure of digital servitization within organizations has not been adequately exploited.

Several reasons may account for the absence of Grounded Theory studies in this area. The first of these is that grounded theory, being an emergent and iterative process, is frequently more time- and resource-consuming than the more immediate answers to be had from perhaps simpler methodologies. Moreover, the uncharted and complex nature of digital servitization as an intellectual landscape may make it tough to frame coherent research questions fit for initial grounded theory development.

Addressing the Gaps: How this Thesis Addresses the Gap:

This thesis aims to address the identified gaps in the literature by developing a comprehensive framework for the transition from servitization to digital servitization. The following approaches are employed to address the gaps:

1. **Analysis:** By conducting a grounded theory approach, this thesis provides detailed insights into how firms navigate the transition to digital servitization. The analysis of 17 documents, including industry reports and academic studies, ensures a robust empirical foundation for the proposed framework. This approach addresses the scarcity of empirical studies specifically focusing on digital servitization and offers a rich, data-driven understanding of the phenomenon.
2. **Incorporating Customer Perspectives:** This research emphasizes the importance of customer engagement and satisfaction in Digital Servitization. By analyzing customer-centric strategies and co-creation practices, the thesis provides a balanced view that includes both the firm's and the customer's perspectives. This approach fills the gap of insufficient exploration of customer viewpoints, offering insights into how customers perceive and adapt to Digital Servitization.
3. **Developing a Comprehensive Framework**: The outcome is a proposed theoretical framework that combines servitization and digitalization. The framework aims to incorporate the peculiarity of digital servitization and provide a comprehensive perspective to guide firms' and the customers' understanding of unexploited chances through digital technology advancements. By combining both concepts, the framework provides a cohesive strategy for digital servitization, addressing the lack of comprehensive models in the literature. Through these contributions, the research enhances the understanding of digital servitization and provides valuable guidance for firms transitioning from traditional servitization to digital servitization.

As we transition to the methodology section, the subsequent chapter will detail the research design, data collection, and analysis methods used to develop the theoretical framework. The methodology outlines how the grounded theory approach was applied to the 17 documents analyzed, ensuring a systematic and rigorous investigation of Digital Servitization.

3 Methodology for Grounded Theory

This thesis aims to conduct an extensive exploration of the transition from servitization to digital servitization. The review includes a comprehensive analysis of relevant studies from reputable sources, including academic databases, research gateways, and online libraries. The following sections outline the methodology used for the literature review, focusing on the scope, data sources, selection criteria, and analysis approach.

A Grounded Theory (GT) methodology has been used in this study to analyse the literature related to digital servitization. Grounded Theory (GT) is a form of qualitative research method that involves a structured process for collecting and analyzing data to develop theories based on the data itself. In this paper, GT is applied to a well-defined literature corpus about digital servitization to surface the main themes, concepts and relationships across the domain. They also allowed for the discovery of new insights that in turn led to a deeper understanding of the phenomenon, helping build or refine theory.

Wolfswinkel, Furtmueller, and Wilderom (2013) described a five-stage iteration cycle in the GT literature review approach known as Define, Search, Select, Analyse and Present [19]. All the stages consist of multiple steps, and these steps help the researcher to follow a clear and transparent mechanism so as to maintain rigor and reproducibility. I have used the aforementioned GT approach by Wolfswinkel with adaptations suitable to my thesis (table 3.1). So few terms were changed; "Define" as "Scope of the Review" which also included the "Search" subsection, further "Analyse" was broken down into two parts as "Data Analysis" which includes "Open coding" and "Findings" show the "Axial coding", "Selective coding" was sheltered under "Proposed Model".

The following table summarizes the Grounded Theory (GT) literature review process:

Table 3.1 Five-stage grounded-theory method [5]

Number	Task
1. Define	
1.1	Define the criteria for inclusion/exclusion
1.2	Identify the fields of research
1.3	Determine the appropriate sources
1.4	Decide on the specific search terms

2. Search	
2.1	Search identified databases and sources
3. Select	
3.1	Refine the sample
4. Analyse	
4.1	Open Coding
4.2	Axial Coding
4.3	Selective Coding
5. Present	
5.1	Represent and structure the content
5.2	Structure the article

3.1. Scope of the Review

The scope of the review is determined by inclusion and exclusion criteria, to select articles relevant for synthesis. This entails defining the research domains, publication venues and time period of the literature to capture. Given the interdisciplinary nature of digital servitization, this study encompasses a wide range of fields, including industrial marketing, operations management, information systems, and strategic management. The timeframe for the literature search is set from 2017 to 2024 to capture the evolution of the field since the emergence of key concepts like servitization and digitalization.

Further, particular search terms were determined to address correctly the breadth and depth of the subject of the research topic. These search terms include "digital servitization," "digital transformation," "servitization," "servitization," "digital servitization," (and) (or) "digital transformation", (and) “customer”, “user perspective” "Industry 4.0," "Internet of Things," "big data," "artificial intelligence," and other related terms.

3.2. Selection Criteria

The search stage involves systematically searching identified databases and sources using the defined search terms. This study utilizes reputable academic databases such as Science Direct, Scopus, and Google Scholar to ensure a comprehensive coverage of the relevant literature. The search process may necessitate revisiting and refining the search terms and inclusion criteria as new relevant articles are discovered. By using the keyword search for "servitization," "digital servitization," (and) (or) "digital transformation", (and) “customer”, a total of 236 results were obtained. After

excluding duplicates, the initial search produced 176 results from all the databases combined. Proceeding with the next step, the list of potentials was narrowed down, keeping only peer-reviewed papers in English and only papers on relevant thematic topics around business, management, and technology considering keywords and abstracts were selected. This step resulted in a sample of 34 studies. As the third step, the articles' abstracts were reviewed, and their overall relevance to the topic was assessed, further narrowing down our sample to 26 studies. Subsequently, all the papers were thoroughly read, and another 11 articles were excluded based on relevance, incorrect categorization and inter-coder reliability check. Finally, a manual search tracking of reports, articles and papers was performed, and one more report from McKinsey was identified, bringing the final number of publications included in the sample to 17.

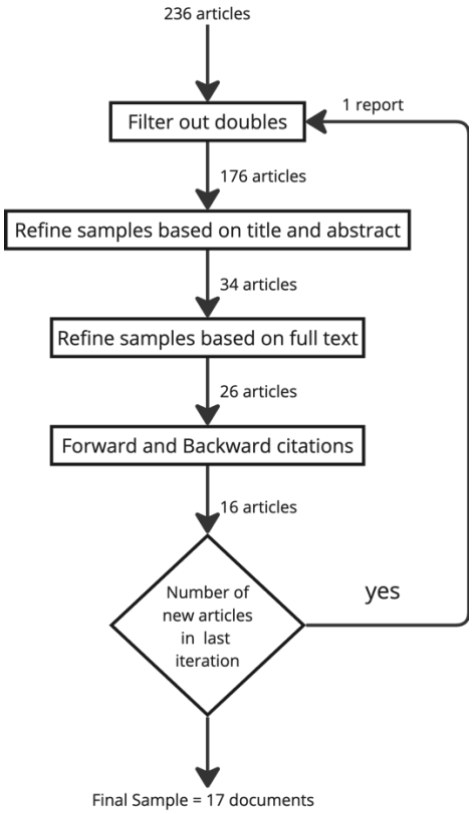


Figure 3.2 Selection Criteria

3.3. Data Analysis

The Analysis phase is the heart of the Grounded Theory (GT) literature review process. This stage involves applying the principles of open coding, axial coding, and selective coding to the selected articles. The software used for this coding process is 'Dedoose', a collaborative, intuitive, and cloud-based cross-platform app designed for analyzing qualitative and mixed methods research with text, photos, audio, videos, spreadsheet

data, and more. The data is in the form of published papers rather than the documentary evidence coming from the customary open-ended interview; ethnographic observational notes or conversational analysis coded transcripts. The corpus of papers searched for and selected in a systematic review provides the best existing evidence about a narrow topic for which this literature review is conducted.

Open Coding Process

Open coding is an important initial stage in the process of GT analysis which comprises reading the articles in order to identify and label key concepts as well as themes that arise from the data. Open coding provided an exhaustive set of codes that define the crucial components involved in the transition from servitization to digital servitization. These codes form the basis of further analysis and eventually in the development of the model.

Open Coding with Dedoose

Dedoose is a versatile software tool used for qualitative and mixed-methods research, facilitating the coding and analysis of text data. For this thesis, Dedoose was employed to highlight relevant text segments, create excerpts, and assign open codes. This tool's collaborative and intuitive nature made it ideal for systematically organizing and analyzing the extensive data set. Following a search of publications on the topic, 16 academic papers along with 1 industry report from McKinsey & Company were selected based on the aforementioned criteria to be used in the review as detailed in the Scope of the Review section. Appendix A.4. gives examples of the excerpts and appendix B.3. gives an overview of the software.

The steps in the open coding process:

1. **Creation of excerpts:** Each line of every document was read thoroughly and then Dedoose was used to highlight relevant text segments in each study document, thus creating the excerpts. These segments, referred to as excerpts, captured critical information, themes, and concepts related to the transition from servitization to digital servitization. A total of 154 excerpts were created from the selected documents.
2. **Open Coding:** Texts were carefully read and highlighted line by line. The process involved conceptualizing and articulating the often hidden aspects of these excerpts noted as relevant during the close reading of the documents. Each excerpt was assigned one or more sub-codes representing the underlying concepts and themes. This process was iterative, with codes being refined and adjusted as new insights emerged. A total of 579 sub-codes were generated from the 154 excerpts. Appendix B.4. gives a list of all the child-codes assigned to the excerpts. Later the codes were categorized according to the type of content they were related to.
3. **Merging Child/Sub-codes into Parent Codes**: To reduce redundancy and increase the comprehensiveness of the data, related child/sub-codes were either

consolidated or grouped together. Subsequently, codes referring to photos and textual descriptions (i.e. not directly related to servitization) were abandoned. Single-instance codes, semantically unrelated to the rest, were also excluded. For example, the sub-codes 'product-centred to service-oriented,' 'product to service migration,' and 'product-service combinations' were all categorized under the parent code 'Product to service shift.'

Here is an example of open coding:

Document: Moving from servitization to digital servitization: Identifying the required dynamic capabilities and related microfoundations to facilitate the transition by Koteshwar Chirumalla, Luna Leoni, Pejvak Oghazic.

Indicative Excerpt: *"Successful transitioning towards digital servitization requires carefully rethinking resources, organizational structures and processes, work practices, infrastructure, culture, and value chains or ecosystems (Bustinza et al., 2015, 2018; Kohtam¨ aki et al., 2019; Kohtam¨ aki et al., 2021; Sklyar et al., 2019a; Kolagar et al., 2022; Chirumalla, Reyes, & Toorajipour, 2022)"*.

Indicative Parent Codes: Successful Transition, Digital Servitization, Rethinking Process, Organisational Structures, Work Practices, Value Chain, Ecosystems.

To illustrate how frequently different codes appear across all the selected documents I have used Code count x Media chart (Figure 3.3). It shows the distribution of codes across various sources, which can highlight the emphasis of certain themes or topics in different documents. On the X axis lies the number of codes and on Y axis are the documents used for coding. The figure is directly taken from the 'Analyse' part of Dedoose software, used for qualitative analysis.

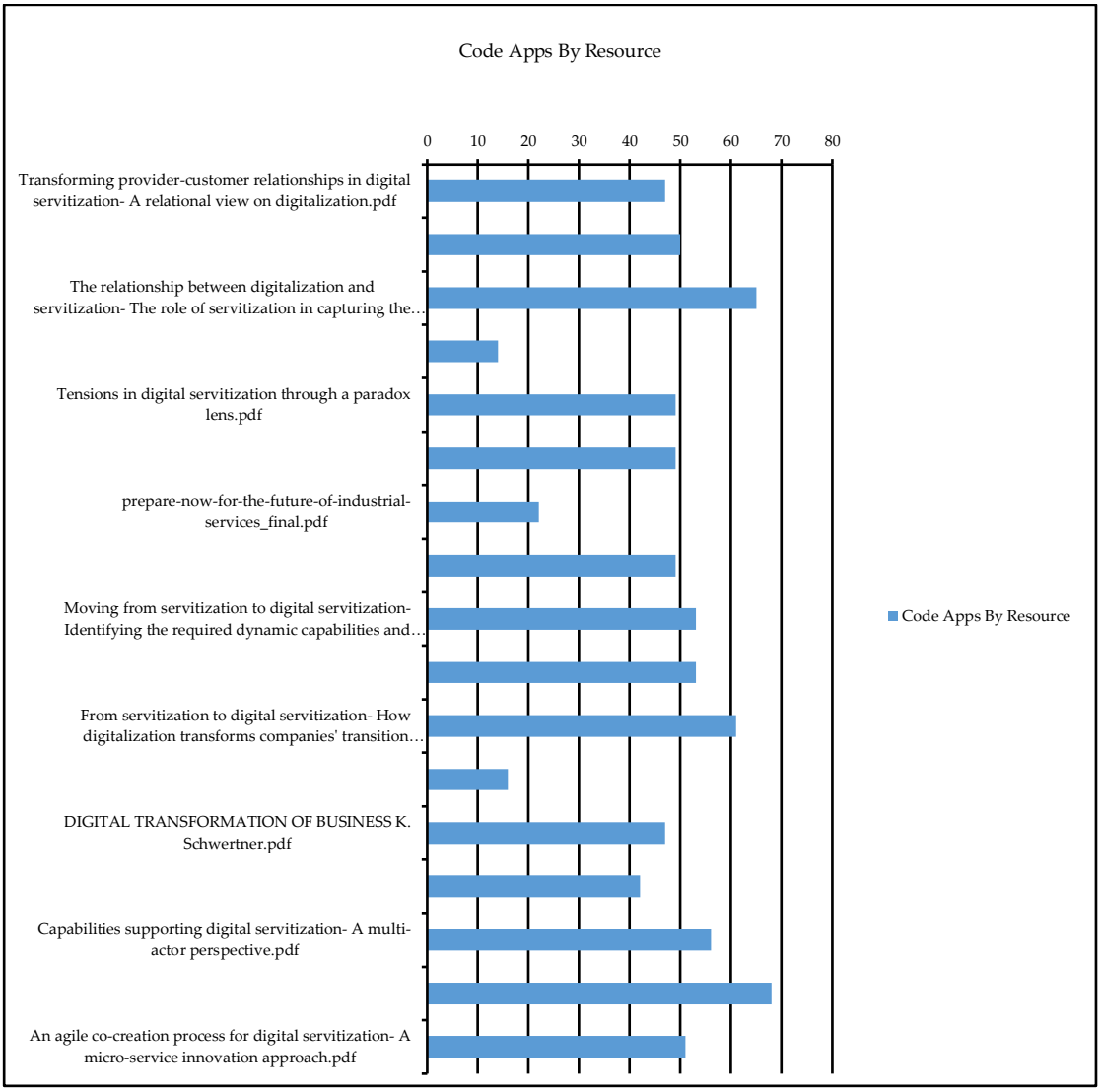


Figure 3.3 Code Count x Media

4 Findings

After the initial open coding phase, the next step in the Grounded Theory approach was axial coding. This stage involves putting back together parts of the data that were broken into pieces in open coding to help understand relationships and build an integrated framework on or around the core phenomenon. The axial coding focused on establishing relationships between the concepts and categories. The relationships were identified by causal conditions, context, intervening conditions, and consequences. The data i.e. the open codes were exported from Dedoose to spreadsheet and then by analysing and deducing back and forth, the axial process was carried out in the text document due to the ease of working in .docx format.

To give a quick overview of the most prominent codes in the dataset I have used a 'Packed Code Cloud' as visual representation (figure 4.1). It is useful for highlighting the most frequently occurring themes in the research.

Figure 4.1 Packed Code Cloud

The steps in axial coding process:

1. **Reviewing Open Parent Codes**: The first 579 open child codes of the 154 excerpts were independently reviewed and combined into parent-codes. The purpose for this reviewing process is to catalog the themes that were prevalent throughout. The codes themselves were exported from 'Dedoose' into a spreadsheet. Systematically each code was reread for any potential association to other codes.
2. **Grouping Related Codes**: Codes that were related were consolidated into broader categories. This step comprised developing patterns and relationships among the codes, which were subsequently organized into categories that correspond to higher-level themes. Table 4.1 lists all the major themes identified with its presence in relevant documents as well the parent codes present altogether.
3. **Identifying Relationships:** The causal conditions, context and consequences of each theme were identified. Later, these themes were put through the same action i.e. causal conditions, context, intervening conditions, action/interaction strategies and consequences for selective coding.

Table 4.1 Grouping of the codes into major themes/categories

Theme/Category	Documents	Open parent codes
1. Technology Integration	Digital Servitization in Manufacturing, McKinsey Report, Transforming Provider-Customer Relationships, Procurement 4.0, Servitization 4.0, Digital Transformation of Business, AI-Enabled CBMI, Tensions in Digital Servitization, Mechanisms for Developing Operational Capabilities, Sustainability-as-a-Service	IoT, Big Data, AI, Cloud, Digital Platforms, Data Analytics, Digital Solutions, Cloud Computing, Smart Components, Sensors, Data Streams, Connected Products, Autonomous Solutions, Optimization Solutions, Embedded Digital Components, Intelligent Functionalities, Remote-First Service, Real-Time Tracking, Digital Solutions

2. Strategic Shift	Digital Servitization in Manufacturing, McKinsey Report, Digital Transformation of Business, Transforming Provider-Customer Relationships, Tensions in Digital Servitization, Servitization 4.0, Mechanisms for Developing Operational Capabilities, Procurement 4.0	Product to service shift, Business model innovation, Customer-centric strategies, CAPEX to OPEX shift, Service-oriented engagement, Outcome-based service, Transformational processes, New business models, Process transformation, Technology-Enabled Service, Commercial Models
3. Customer Engagement	Digital Servitization in Manufacturing, McKinsey Report, Transforming Provider-Customer Relationships, Procurement 4.0, AI-Enabled CBMI, Tensions in Digital Servitization, Digital Transformation of Business	Continuous feedback, Integrated partnerships, Co-creation, Customer loyalty, Interactive communication, Real-time feedback, Long-term commitment, Customer needs, Customer satisfaction, Value co-creation, Customer behavior, Customer interactions, Customer Expectations, Seamless Interaction
4. Operational Efficiency	Digital Servitization in Manufacturing, McKinsey Report, Transforming Provider-Customer Relationships, Procurement 4.0, Servitization 4.0, AI-Enabled CBMI, Tensions in Digital Servitization, Digital Transformation of Business	Enhanced processes, Supply chain efficiency, Integration of units, Seamless implementation, Resource efficiency, Operational integration, Data-driven decisions, Maintenance efficiency, Predictive analytics, Performance optimization, Automation and Data Management

5. Capability Development	Digital Servitization in Manufacturing, McKinsey Report, Transforming Provider-Customer Relationships, Procurement 4.0, Mechanisms for Developing Operational Capabilities, Digital Servitization: How Manufacturing Firms Can Enhance Their Capabilities, AI-Enabled CBMI, Tensions in Digital Servitization	Digital capabilities, Building digital capabilities, Developing new skills, Acquiring digital solutions, Intelligent products, Digital platforms, Analytics capabilities, Knowledge management, Continuous innovation, Digital learning, Value realization, Value optimization, Talent Management, Workforce Evolution
6. Challenges	Digital Servitization in Manufacturing, McKinsey Report, Transforming Provider-Customer Relationships, Procurement 4.0, Sustainability-as-a-Service, Digital Transformation of Business, Tensions in Digital Servitization	Data security, Interoperability, Governance challenges, Balancing control and flexibility, Data sharing, Data monopoly, Risk management, Implementation challenges, Organizational tensions, Professional identity, Performance priorities
7. Environmental Benefits	Servitization 4.0, Sustainability-as-a-Service, AI-Enabled CBMI, Digital Transformation of Business	Sustainability, Reduced energy consumption, Reduced environmental impact, Circular business models, Sustainable value creation
8. Economic Impact	McKinsey Report, Digital Transformation of Business, Servitization 4.0, AI-Enabled CBMI	New revenue streams, Competitive advantages, Long-term growth, Profitability, Market valuation, Revenue generation, Economic value, Financial performance, Revenue Capture

9. Intervening Conditions	Digital Servitization in Manufacturing, McKinsey Report, Procurement 4.0, Sustainability-as-a-Service, Tensions in Digital Servitization	Organizational readiness, Culture, Regulatory environment, Technological infrastructure, Strategic alignment, Organizational identity, Operational challenges, Stakeholder collaboration
10. Governance and Integration	Digital Servitization in Manufacturing, McKinsey Report, Transforming Provider-Customer Relationships, Procurement 4.0, Sustainability-as-a-Service, AI-Enabled CBMI, Tensions in Digital Servitization	Balancing control and flexibility, Integration of units, Enhanced governance, Strategic alignment, Relationship management, Governance mechanisms, Data governance, Organizational integration

To give visualization of appearing codes consistency and display the presence of different codes across the excerpts, I have used 'Code Presence' heat map (Figure 4.2). It's useful for identifying which codes are consistently appearing and which are less common. The code presence diagram visually represents the occurrence and distribution of various codes across the 17 documents analyzed in this study. This heat map, directly taken from Dedoose, provides an intuitive overview of which concepts are present in which documents, highlighting the density and spread of the codes.

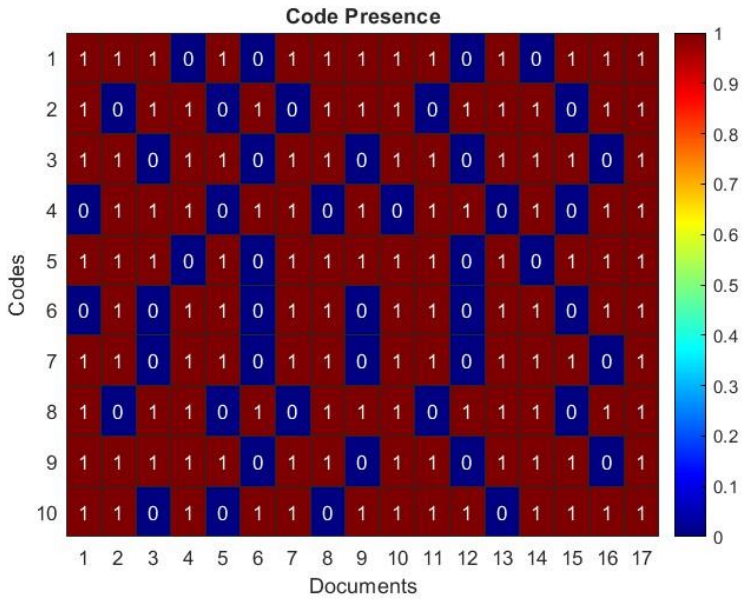


Figure 4.2 Code Presence heat map

The X-axis represents the 17 documents selected for analysis. Each number from 1 to 17 corresponds to a specific document (Refer to Appexdix A for list of documents ordered serially). Y-axis represents the 10 different codes that were identified during the open coding process (Table 4.1). The colour scale on the right side of the diagram ranges from blue to red. **Blue (0)**: Indicates the absence of a particular code in a given document. **Red (1)**: Indicates the presence of a particular code in a given document. This analysis can guide further research by identifying well-covered topics and revealing gaps that might need more attention.

The 10 themes which are the main categories emerged from axial coding and their occurrence is explained below. The Digital Servitization Paradox is addressed at the end which arises when integrating digital technologies into the servitization strategies.

4.1. Technology Integration

The shift from traditional servitization to Digital Servitization (DS) is not just being evolutionary, but a revolution. This is a change that has been driven and catalyzed by deep digitalization of the manufacturing and service processes. According to the latest research, "The digital wave, including IoT (Internet of Things), big data, cloud computing and other cyber-physical systems have changed the way organizations are structured and how firms collaborate and think". Following are the few selected indicative excerpts and the codes used for the excerpt.

- Indicative Excerpts:

  "The digital wave, including the Internet of Things (IoT), big data, cloud computing platforms, and other cyber-physical systems, has fundamentally altered how equipment is built and maintained and, consequently, how organizations are structured, and how they collaborate and think."

  "Digital servitization has been defined as the transformation in processes, capabilities, and offerings within industrial firms and their associated ecosystems to progressively create, deliver, and capture increased service value arising from a broad range of enabling digital technologies, such as the Internet of Things (IoT), big data, artificial intelligence (AI), and cloud computing."

- Indicative Parent Codes:

  Enabling Digital Technologies, Digital Wave, IoT, Big Data, Cloud Computing, Cyber-Physical Systems, Organizational Structures, Collaboration, Connected Products, Autonomous Solutions, Optimization Solutions, Embedded Digital Components, Intelligent Functionalities.

As the excerpts clearly convey that this convergence of technologies – IoT, big data analytics, AI, and cloud computing, have created endless new avenues for the firms

and aiding them in progressing to create, deliver and capture more service value. A new landscape has emerged because of the age of "Connected Products", "Autonomous Solutions" and "Intelligent Functionalities" - terms that signify a move away from product-centred systems to service-oriented ecosystems with data and digital connectivity at their core.

The Causal Conditions for Technology Integration is the need for **Data-driven Insights**. The key point of this integration is the need for data-driven insights with the help of technology. The need to remotely connect/monitor firm offerings endows real-time data insights and analytics proficiency, making digital technologies an immutable part of servitization strategy. In an era where customers demand personalized, proactive, and efficient services, manufacturers are turning to data and digital tools to meet these expectations, enhance customer value, and secure a competitive advantage.

A central underpinning of this data-forward strategy is the Internet of Things (IoT) and the widespread network of devices as well as sensors. By enabling a continuous flow of data from machinery, it provides the foundation for predictive maintenance, process optimization, and a deeper understanding of real-world product usage. Big data and data analytics take the center stage in here, extracting patterns, trends and correlations out of this vast data to influence decisions- making and drive operational efficiencies.

The Artificial Intelligence (AI), further amplifies data analytics. Insights, on the other hand, are processed by AI algorithms, able to discern into patterns, forecast outcomes and basically take decision-making actions. AI is used all aspects of operational efficiency, from streamlining operations to predicting when maintenance is required to minimizing downtime. Meanwhile, cloud computing provides the robust infrastructure required to manage and analyze massive datasets, while also enables the seamless deployment of digital solutions and services across the enterprise.

Embedding technology into digital servitization is not a uniform approach. It is a product of a constantly changing mix of elements such as industry-specific pre-requisites, the volatile business environment, and the continuous speed at which technology evolves. The **Dynamic Interplay of Industry and Technology** is the context for technology integration taking place. The manufacturing sector - with its intricate supply chains and varied customer needs - requires custom digital solutions to solve the functional challenges it faces and accommodate the tastes of individual customers.

Additionally, technology is changing so rapidly that you have to keep up with the new tools and platforms if you want to sustain the competitive advantage. This represents a complex area in which manufacturers need to navigate the intersection between internal capabilities and external partnerships. Instead, this is exemplified by the finding *"if a potential partner has the digitalization capabilities that the company is missing, the firm would typically be engaged in redefining what their business relationship would look*

like," an extreme example for how technology integration should be seen within a holistic framework of how the manufacturing ecosystem operates together.

The consequences of technology integration are a **Transformative Impact on Businesses and Customer Value**. The impacts of incorporating digital technologies in servitization are broad and driving. This digital transformation has led directly to the rise of Product-as-a-Service (PaaS) models, whereby customers subscribe to outcomes instead of buying products. This will require manufacturers to reposition their value propositions to center on continuous value delivery and nurturing enduring customer relationships.

Furthermore, vast amounts of data are being created by IoT devices and processed by AI algorithms, driving a tide of innovation powered by data. This new information can be the basis for innovative service concepts for manufacturers, to reduce costs or even personalize customer experiences. In addition, digital servitization also enables and encourages collaboration throughout the entire value chain - suppliers, partners, and customers alike. The data and insights sharing environment leads to value co-creation, driving the development of more cohesive customer-focused solutions.

Competitive choices (Operations)-Digital technologies automate mundane tasks, enables optimal use of resources and facilitates predictive maintenance by increasing operational efficiency and agility. The results are cost reductions, less risk of downtime, and a better ability to respond rapidly to demand shifts in the market. In addition, digital servitization enables manufacturers to provide customized and pre-emptive services with ease, leading to an improved customer experience. This, in turn, drive customer loyalty and a stronger brand reputation.

4.2. Strategic Shift: From Product-Centric to Service-Centric

This transformative wave of digital servitization is changing the manufacturing paradigm from a conventional product-centric approach to providing services in a customer-centric, service-oriented models. This strategic change will alter the way businesses see themselves, their products and their interactions with customers. As put forth in a recent study, *"Many manufacturing companies are adopting servitization as a competitive business strategy to offer product-service combinations"*. Digitalization and Industry 4.0 fully integrated accelerated this trend, enabling to create and provide comprehensive solutions for future products and customer needs. This is further exemplified by the following excerpts.

- Indicative Excerpts:

  "Digitalization is viewed as a source of future competitiveness due to its potential for unlocking new value-creation and revenue-generation opportunities. To profit from digitalization, providers and customers tend to move away from transactional product-

centric models to relational service-oriented engagement. This relational transformation is brought about through digital servitization."

- Indicative Parent Codes:
  Product-Service Combinations, Servitization as Business Strategy, Product-Centric to Service-Oriented Migration, Service-Oriented Engagement, Customer-Centric Strategies, CAPEX to OPEX Shift, Outcome-Based Service, Transformational Processes, New Business Models, Process Transformation

The Causal Conditions are **Market Forces** and **Customer-Centricity.** This strategic pivot to as-a-service business model is driven by competition in a very crowded market and keep up with the changing expectations of customers who increasingly seek personalized experiences with measurable outcomes. With digital technology adoption on the rise, the competition to provides unique services and value-add is also ramping up. Together with the customer demand for more total solutions and not only products, this drives this transformation from being a transactional models to relational, service-based engagements in manufacturing. Often termed the "relational transformation," this shift involves transitioning from CAPEX to OPEX models with a focus on outcome-based service offerings.

The success of this strategic move depends on a range of factors-especially industry specific characteristics, market maturity and competitive landscape. Hence, it is important to **navigate the context of Industry Landscape**. The change will be gradual and incremental in industries with long product lifecycles and high customer switching costs. On the other hand, industries experiencing rapid technological advancements and disruptive innovations might require a more radical shift. Maturity of the market and competitive landscape also differentiate. In mature markets with intense competition, a faster shift to service-centric models is often necessary to maintain or gain a competitive advantage. In addition, organizational readiness and cultural alignment are critical. The companies that have a culture of innovation and customer obsession are likely to transition through this more successfully.

The Consequences of Strategic Shift give rise to a **New Era of Customer Engagement and Value Creation.** The shift from a product-centric to a service-centric model reshapes operations, customer interactions, and overall business performance. One of the most significant outcomes is increased customer engagement. Through refocusing on benefits and relationships, manufacturers can build a stronger connection to the customers they serve - which can result in increased customer satisfaction, loyalty and advocacy. Manufacturers that provide bundled solutions and add-ons (value-added services) differentiate themselves from competitors and improve their position in the market, gaining higher profitability. This shift often opens new revenue streams through subscription-based models, outcome-based contracts, etc. In addition to this, by concentrating on the overall value potential of a product over its life cycle,

manufacturers will be able to deploy resources more efficiently and minimize waste- an important step for anyone looking to increase sustainability within their business and contribute positively to the new wave of more sustainable and circular economy.

4.3. Customer Engagement: Co-creation of Value

Moving towards digital servitization requires manufacturers to change how they interact with their consumers at their core. Traditional transactional relationships are fading, and a new era has begun to emerge with customer engagement, being collaborative and interactive. Real-time interaction and feedback enabled through platforms and digital technologies also facilitate in co-creation of value. The following excerpts explain clearly the co-creation logic.

- Indicative Excerpts:

  "Digital servitization tends to create closer provider–customer relationships characterized by co-creation logic, long-term commitment, and greater investment in the relationship."

  "To achieve digital service-led growth, a firm and its network need to make three interconnected shifts: (1) from planning to discovery, (2) from scarcity to abundance, and (3) from hierarchy to partnership. Organizational identity, de-materialization, and collaboration play a key role in this transformation."

  "Digitalization is transforming ecosystems and value chains in manufacturing companies, changing how these companies interact across firm boundaries upstream or downstream, improving supplier and customer interactions, and enhancing data acquisition, warehousing, big data analytics, and implementation."

- Indicative Parent Codes:

  Continuous feedback, integrated partnerships, co-creation, customer loyalty, interactive communication, real-time feedback, long-term commitment, customer needs, customer satisfaction, value co-creation, customer behavior, and customer interactions.

Increased use of digital platforms and technologies has transformed how customers interact with businesses. These changes inevitably result in the repetition of tasks, and the time it takes for actual feedback. Feedback loops enable continuous monitoring of customer needs and preferences which in turn, helps to resolve customer issues quickly resulting in service improvement. In addition, advanced data analytics and AI yield detailed insights into customer behaviour to help service providers in designing personalized service offerings and proactive engagement strategies. Hence, the Causal Conditions for Customer Engagement are the role of **Digital Platforms and Technologies.**

The Conditions in which this theme is embedded are the **Industry Dynamics and Organizational Culture.** Different dimensions influence the context of customer engagement in digital servitization. For instance, in the case of B2B settings, perhaps, there can be deeper collaboration and co-creation of value, or for B2C settings it can be all about personalization and convenience. Developing customized engagement strategies is all about getting to know the customer base and what they need or want. Second, a customer-centric culture that prizes collaboration and feedback is essential also the digital capabilities to use technology for better rates of engagement.

Manufacturers can achieve huge rewards from increased customer engagement. Involvement of the customer in design and delivery tends to derive higher satisfaction from the customer's perspective. Customers who feel valued and heard, bring their loyalty driving repeat business and positive word-of-mouth. Developing a sense of partnership and co-creation helps to establish critical long-term relationships that are an asset for ongoing growth and success. Moreover, engagement serves as a conduit of customer feedback that can be instrumental in improving and innovating products and services as well. Therefore, the **consequences are Positive Outcomes of Enhanced Customer Engagement.**

To truly leverage the power of deeper customer engagement, manufacturers need to be asking themselves, how does the product and service lifecycle support the customer-specific needs. This means soliciting feedback, enlisting customers in design and then delivering tailored or customized offerings. Moreover, integrated partnerships are a must and not solely based on conventional transactions. Customers and manufacturers should work together in developing and implementing solutions for evolving needs; the approach enables shared ownership and mutual benefits. **Customer-Centric Strategies and Integrated Partnerships** are the Intervening Conditions.

Digital technologies and a shift in approach are enabling improved customer engagement, which can ultimately make or break digital servitization. Putting the customer first, working together and using digital tools, manufacturers can build better businesses based on closer relationships resulting in sustainable growth.

4.4. Operational Efficiency: The Backbone of Digital Servitization

The shift to digital servitization necessitates a significant enhancement in operational efficiency for manufacturing firms. This is driven by the integration of advanced digital technologies, the optimization of processes, and the implementation of predictive maintenance strategies. Operational efficiency is not just about cost reduction; it's also about maximizing resource utilization, streamlining supply chains, and improving overall productivity. The aforementioned is explained by the excerpts:

- Indicative Excerpts:

  "Advanced service-oriented business models based on IoT technologies allow firms to: reduce operating costs, generate additional revenue, maintain a long-term business relationship with customers, increase resource utilization, and assess the risks of current product or service provision."

  "Integration of servitization and digitization typically results in the provision of digital services embedded into physical products, which can help to enable Base (e.g., IoT-enabled spare part ordering), Intermediate (e.g., maintenance enhanced by predictive analytics) and Advanced services (e.g., condition monitoring for availability-based contracts)."

- Indicative Parent Codes:

  Enhanced processes, supply chain efficiency, integration of units, seamless implementation, resource efficiency, operational integration, data-driven decisions, maintenance efficiency, predictive analytics, performance optimization.

Integration of Digital Technologies and Predictive Maintenance contribute to the occurrence of Operational Efficiency**.** This integration of digital technologies including IoT, AI, big data analytics, and cloud computing are key drivers of operational efficiencies from a digital servitization perspective. These technologies allow frictionless transactions, operational integration and data-centric decision making that result in performance tuning. Second, through easy-to-understand data analytics and AI solutions that can help us predict the failure and allow us to plan preventive maintenance in advance, enhancing operational efficiency and cost-effective tasks.

Operational efficiency in the context of digital servitization is achieved through the optimization of business processes and the integration of supply chains. Improving productivity comes down to better workflows and eliminating inefficiencies as quickly and efficiently as possible in accordance with best practices. Digital platforms can automatically help in coordinating between units for real-time tracking, inventory management and operations of supply chain activities. **Process Optimization and Supply Chain Integration** are the contexts in which operational efficiency takes place.

While the Consequences of Operational Efficiency are **Resource Efficiency and Reduced Costs.** Improved Operational Efficiency with Big Resource Efficiency and Cost Savings Rationalizing the utilization of resources and reducing wastage is one of the most significant impacts, thanks to digital technologies providing an outstanding level of control over the resources. Predictive maintenance also reduces the need for expensive emergency repairs, and optimized processes & integrated supply chains lower overall costs of operation, thus increasing profits and competitiveness as well.

Manufacturers can gain significant operating performance through the integration of advanced technologies and refining processes and supply chains. These

improvements not only save money and increase efficiency in resource usage, but they are also an important factor for the overall success and sustainability of the company.

4.5. Capability Development: Building the Foundations for Digital Servitization

The transition to digital servitization requires firms to develop strong digital capabilities. This is not only about acquiring tangibles, but also developing the skills and knowledge to use it successfully. For firms to sustain continuous innovation, developing capabilities is essential to maintain that competitive edge. This is further proved by the excerpts.

- Indicative Excerpt:

  "The greater the alliance partners' investment is in inter-firm knowledge-sharing routines, the greater the potential will be for relational rents. They define knowledge-sharing routines as a regular pattern of interactions between companies that allow specialized knowledge to be transferred, recombined, or created."

  "The proposed agile co-creation model provides insight into the phases, activities, and organizational principles of a micro-service innovation approach. Relational teams that pool knowledge from providers' and customers' strategic, technological, and operational areas are crucial to ensure successful cooperation and governance for agile co-creation."

- Indicative Parent Codes:

  Digital capabilities, dynamic capabilities, building digital capabilities, developing new skills, acquiring digital solutions, intelligent products, digital platforms, analytics capabilities, knowledge management, continuous innovation, digital learning, value realization, value optimization.

Integration of Digital Technologies and Skill Development are the factors that contribute to Capability Development**.** The development of digital capabilities is driven by the need to integrate advanced digital technologies and build the necessary skills to utilize them effectively. The increased adoption of technologies like IoT, AI and Big Data Analytics and Cloud computing is essential to Digital Servitization. These technologies make it easier to develop smart products, digital platforms and advanced analytics making higher operational performance and customer compassion. At the same time, in order to use such digital tools, it is essential for professionals to learn new skills and competencies. That means developing deep capabilities in data analytics, AI and digital platforms and fostering a learning culture.

Organizations must be prepared to adopt and integrate new technologies, with the necessary infrastructure, resources, and cultural mindset for digital transformation. It also involves leadership commitment to drive digital initiatives and capability development.

Digital capabilities can take a long time to build, so effective knowledge management practices are also important to keep and maintain these capabilities as part of an organization. It involves setting up systems for capturing and transferring knowledge across the organization, encouraging collaboration among diverse stakeholder groups, and driving ongoing learning and innovation. Hence, **Organizational Readiness and Knowledge Management** are key in the context of developing capability.

The consequences are **Value Realization and Continuous Innovation,** stronger Digital Capabilities drive greater results- especially in value realization and continuous innovation. As a result, firms can extract more value from their digital investments such as process improvements, richer customer experiences and possibly new revenue streams by selling innovative digital solutions. In addition, strong digital capabilities can help firms innovate continuously to remain ahead of market trends and technological advances. This promotes initiative culture where new ideas are frequently created and applied to maintain the advantage.

4.6. Challenges: Navigating the Complexities of Digital Servitization

A move to digital servitization brings significant rewards but it also comes with many obstacles for manufacturing firms. Across these, challenges include concerns about data security, the problems of connected systems that do not interoperate effectively, and governance issues that can undermine effective implementation. Navigating these complexities effectively is the most important step toward unlocking the full potential of digital servitization.

- Indicative Excerpts:

  "There are significant challenges associated with cloud, mobile, social, and big data initiatives. The survey suggests that the primary risks preventing their wider adoption are data security issues, lack of interoperability with existing IT systems, and lack of control."

  "Digital servitization also has inherent challenges that must be identified and handled properly, such as centralization versus decentralization or cybersecurity. The planning and implementation of digital servitization produce clashes between digital and non-digital means and various interests in the business network. Due to its increased complexity, digital servitization increases the governance-related challenge of balancing control and flexibility."

- Indicative Parent Codes:

  Data security, interoperability, governance challenges, balancing control and flexibility, data sharing, data monopoly, risk management, implementation

challenges, organizational tensions, professional identity, and performance priorities.

The main challenges regarding digital servitization are related to **Data Security and Interoperability Issues**, which are the main causal conditions. These factors influence the extent to which digital technologies are adopted and incorporated. In an era of digital platforms and analytics, users rely on digital platforms. Hence, security is critical to protect sensitive data. The risk of data breaches and cyber-attacks poses a major threat to operational integrity and customer loyalty. While integrating multiple digital systems/platforms, there is a likelihood of having interoperability issues. Having a foundation for systems to communicate with one another and work in harmony requires protocols that are standardized and technologies that can work together. Digital solutions would be able to deliver only part of their effectiveness without this interoperability.

As the excerpts convey, effective **Governance Mechanisms** and comprehensive **Risk Management** strategies are essential to address the challenges of digital servitization. Establishing robust governance frameworks is necessary for managing data security and interoperability issues. These frameworks should include data-sharing policies, control mechanisms, and compliance with regulatory standards to ensure secure and efficient operations. Implementing thorough risk management strategies helps mitigate the potential risks associated with digital transformation. This involves identifying vulnerabilities, assessing their impact, and developing contingency plans to address them. Effective risk management balances control and flexibility, which is important for digital solutions.

Potential Barriers and the **Need for Robust Solutions** are the direct consequences. Overcoming challenges related to digital servitization is essential to eliminate issues related to implantation and frame strong solutions for it. Data security, interoperability and governance challenges represent considerable barriers to the successful deployment of digital servitization strategies. Each of these barriers can slow down projects, increase costs, and reduce the impact of digital initiatives. To tackle these obstacles, enterprises will need to invest in aggregate solutions that ensure secure data, interoperability, and efficient governance and risk management. Creating solutions involves taking a proactive stance, constant innovation and interdisciplinary work across organization layers. These initiatives are key to ensuring the overcoming of potential barriers and leveraging the full potential of digital transformation in the manufacturing sector.

4.7. Environmental Benefits: Promoting Sustainability through Digital Servitization

The move to digital servitization results in significant environmental gains and reshapes the way firms affect production and extract value. Businesses adopting sustainable policies and circular business models will be able to substantially reduce environmental impact, thus aiding in both regulatory requirements, but also catering to the expanding markets that demand sustainability; all while promoting energy efficiency and promotion of sustainable value creation. *"AI-enabled circular business models (CBM) present a unique opportunity to facilitate new business paradigms and unlock hidden value, revenue, and sustainability"* as the excerpts suggest.

- Indicative Excerpts:

  "The benefits related to the environment, such as the reduction in energy consumption and environmental impact, are also enhanced through digital servitization."

  "The ability to digitally reimagine the business is determined in large part by a clear digital strategy supported by leaders who foster a sustainable culture able to change and invent the new."

- Indicative Parent Codes:

  Culture of change, sustainability, reduced energy consumption, reduced environmental impact, circular business models, sustainable value creation.

The changes with respect to environmental gains in digital servitization are brought about by means of **Adoption of Sustainable practices**, and by **Circular Business Models** (CBMs). Integrating sustainable practices into manufacturing processes—such as using renewable energy sources, optimizing resource usage, and implementing energy-efficient technologies—helps reduce waste, minimize resource consumption, and lower carbon footprints. Coupling with this, Circular Business Models concentrate more on the recycling, reusing and remanufacturing in order to facilitate resources to be kept in constant play. This aims to generate and derive value from materials using waste as a resource, thus extending the lifecycle of products and materials while reducing the requirement for new raw materials.

Regulatory support and growing **Market demand** for sustainable practices provide the basis (context in which it operates) for environmental benefits in digital Servitization. Government regulations and policies play a crucial role in encouraging sustainable practices. These regulations might be for zero-emissions requirements, renewable-energy credits and requirements for sustainable resource management. There is also a growing consumer and business demand for sustainable products and practices. As consumers increasingly reward companies that show environmental credentials with their business, firms are adopting more eco-friendly practices.

Sustainable practices and circular business models can promote several sustainability benefits through digital servitization. Sustainable practices and circular business models can thus vastly reduce the environmental impact of manufacturing operations. This results in environmental conservation and ultimately the firms are participating in waste management, emission reduction as well as intelligent use of resources. Furthermore, energy-efficient technologies and practices can reduce energy consumption significantly. It is also reflective of a reduction in associated operational costs, as well as represents a lower contribution to plant-based carbon emissions. Hence, the consequences are many **Positive Environmental Outcomes**. If the environmental benefits of digital servitization are to be fully realized, manufacturers should act upon market pressures for sustainability and use regulatory triggers. Following government-approved laws and schemes that support sustainability can be a streamlined pathway to follow eco-friendly practices. The next major push for environmental change is in the form of regulations that promote more renewable energy, and resource management that supports sustainability. Also, firms should build their strategies to be in sync with the growing consumer and business demand for sustainability. This means meeting regulatory requirements as well as going beyond the call of eco-consumer duty.

4.8. Economic Impact: Driving Financial Performance through Digital Servitization

Digital servitization fundamentally alters the economic landscape for manufacturing enterprises, providing new revenue opportunities, increased competitive strengths and long-term growth. Firms can leverage digital technologies and improve their financial performance, market valuation and profitability substantially. This is further highlighted by the following excerpts.

- Indicative Excerpts:

  "To survive in the current competitive context, characterized by numerous and rapid changes, manufacturers are adopting servitization as a business strategy to meet consumers' renewed needs, thereby attaining sustainable competitive advantages."

  "Companies where big data, cloud, mobile, and social technologies are critical parts of the infrastructure, these technologies are, or will soon be profitable on average, had higher revenues."

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

- Indicative Parent Codes:

New revenue streams, competitive advantages, long-term growth, profitability, market valuation, revenue generation, economic value, financial and non-financial performance.

Digital servitization has two key drivers of its economic impact - another feature which is twofold: the **Competitive Advantage** gained through digitization and **New Revenue generation**. The aforementioned drivers are the main causal conditions. Adopting digital servitization strategies allows firms to differentiate themselves from competitors by enhancing operational efficiency, customer engagement, and innovation. The integration of digital technologies provides a significant competitive edge, as highlighted in the McKinsey report. Moreover, Digital Servitization allows the development of new and innovative business models and services which help in generating new revenue streams like subscription-based services, outcome-based contracts or even new digital solutions to serve changing customer demands.

The economic advantages of digital servitization can materialize only if large capital is invested in digital technologies and infrastructure (e.g., IoT, AI, advances analytics, and cloud computing). It is vital to enable new service offerings, and thus business models. In addition, companies should have a strong position in the market to respond efficiently to the transformations of digital servitization. It requires deeper mastery of market trends, customer preferences and competitive dynamics to harness digital capabilities in a manner that captures market share. **Financial Investment** and **Market Positioning** are the context in which Economic Impact is embedded.

Digitally servitizing a business is what leads to many of the desired economic results. Operation efficiency can improve new revenue streams, as well as customer engagement driving higher profits. The economic outcomes are lower costs per case and improved margins through digital transformation (as described in the Mckinsey report). Furthermore, digital servitization success increases a company's market value. The ability to generate consistent revenue through innovative services and improved operational performance is highly valued by investors, leading to higher stock prices and market capitalization. In short, the consequences are **Increased Profitability** and good **Market Valuation**. To fully realize the economic benefits of digital servitization, manufacturers must focus on both financial investment and strategic market positioning. Key to retain competitive advantage and achieving long-term growth is continuous investments in digital strategies, technology and infrastructure. Firms need to allocate resources strategically to support digital initiatives and innovations. Moreover, successful market positioning incorporates the use of digital capabilities to satisfy customer needs and outpace competition. Getting this right takes a profound knowledge of market dynamics and the ability to pivot as necessary.

4.9. Intervening Conditions: Key Factors Influencing Digital Servitization

The successful implementation of digital servitization strategies is heavily influenced by a range of intervening conditions. These include internal factors such as organizational readiness and culture, as well as external factors like the regulatory environment and technological infrastructure. Understanding and managing these conditions is crucial for the effective adoption and integration of digital servitization within manufacturing firms as indicated in the following excerpts.

- Indicative Excerpts:

  "Successful transitioning towards digital servitization requires carefully rethinking resources, organizational structures and processes, work practices, infrastructure, culture, and value chains or ecosystems."

  "Many manufacturers rely on complementary capabilities from the service triad (manufacturer, intermediary, and customer actors), creating a multi-actor collaboration to provide digitally servitized offers."

  "Three key industrial customer challenges related to procuring digital innovations: evaluating the value of digital solutions, prioritizing digital investment across organizational silos, and incentivizing supplier-driven digital innovation."

- Indicative Parent Codes:

  Organizational readiness, culture, regulatory environment, technological infrastructure, strategic alignment, organizational identity, operational challenges, stakeholder collaboration.

The implementation of digital servitization is shaped by various **Internal** and **External factors** that can either facilitate or hinder progress, which are also the causal conditions for the occurrence of Intervening Conditions. Internal Factors include organizational readiness and culture play a significant role in the successful adoption of digital servitization. Companies that are prepared for digital transformation, with a culture that embraces innovation and change, are more likely to achieve success. External factors include the regulatory environment and technological infrastructure. Compliance with regulations and having access to advanced technological infrastructure are essential for smooth implementation.

This is applied, in a partnering mode, to the field of digital servitization, considering **Stakeholder Involvement** and the **Regulatory Environment**. As digital servitization is concerned, it requires cooperation not only from the stakeholders but also from the suppliers and not to forget the regulatory authorities without whose support a successful implementation of the servitization is an arduous task. This partnership is a way for all to get together and share the same vision with one another. Adhering to regulatory requirements and standards is important for compliance and operational

efficiency. Understanding and navigating the regulatory environment helps firms avoid legal issues and ensures smooth implementation.

Managing the intervening conditions effectively leads to the **Successful Adoption** and **Integration of Digital Servitization Strategies** giving positive outcomes. Addressing internal and external factors helps in the smooth adoption of digital servitization strategies. Firms that are organizationally ready and operate within a supportive regulatory environment are more likely to succeed. Effective stakeholder collaboration and compliance with regulations ensure that digital servitization strategies are well-integrated into the firm's operations. This integration leads to enhanced operational performance and better alignment with business goals.

4.10. Governance and Integration: Ensuring Seamless Operations in Digital Servitization

Effective governance and integration are crucial for the successful implementation of digital servitization strategies. As manufacturing firms transition to digital servitization, they must establish robust governance structures and ensure the seamless integration of digital technologies across various units. Balancing control and flexibility are essential to maintain strategic alignment and enhance operational efficiency.

- Indicative Excerpt:

  "Digital servitization also has inherent challenges that must be identified and handled properly, such as centralization versus decentralization or cybersecurity. The planning and implementation of digital servitization produce clashes between digital and non-digital means and various interests in the business network. Due to its increased complexity, digital servitization increases the governance-related challenge of balancing control and flexibility".

  "By adopting digital servitization, several changes in the manufacturer's business model can happen. One such change is that the offering of digital servitization demands a complex system of interrelated capabilities that may be hard to find in a single company. The complex nature of digital solutions requires the integration of software, hardware, network, and service concepts that usually are beyond the capabilities of single manufacturers."

- Indicative Parent Codes:

  Balancing control and flexibility, integration of units, enhanced governance, strategic alignment, relationship management, governance mechanisms, data governance, organizational integration.

The need for **Strategic Alignment** and **Efficient Governance** were found to be the primary factors driving the necessity of improving governance and integration in

Digital Servitization. Directly managing strategic alignment across the entire organization to ensure that all units are in support of one another to deliver on the overall digital strategy is key to success. It allows all the steps for the company to act in a cohesive and coordinated manner, with all provided evening gear towards servitization. Additionally, efficient management practices need to be in place to manage the digital technologies integration and alignment of every process with strategic goals of the organization. This requires direct communication, budgeting decisions, and a system of controls to track outcomes that enable digital initiatives to be executed so that they provide business value.

To facilitate effective governance and integration, the establishment of robust Governance Structures and the implementation of comprehensive Data Governance practices are a must. This is the context in which Governance and Integration operates. These frameworks set out accountabilities, responsibilities and control mechanisms ensuring that they align with the corporate objectives yet maintain accountability and transparency at the same time. Also, a set of successful data governance strategies is required to provide proper verification and secure its use. These responsibilities, around data standards, stewardship and sensitive information protection all feed into trustworthiness, without which digital services cannot perform as intended.

When governance and integration are effectively managed, several positive outcomes emerge. Robust governance structures enable firms to maintain control over their digital transformation initiatives. This is done while allowing the flexibility to adapt to changing market conditions and technological advancements. This balance is crucial for sustaining innovation and responsiveness in a dynamic digital landscape. Also, the proper integration of digital technologies ensures seamless operations. This integration enhances coordination, reduces redundancies, and improves overall operational efficiency. Briefly stating, the consequences are **Balanced Control**, **Flexibility** and **Seamless operations**.

4.11. Digital Servitization Paradox

The digital servitization paradox refers to the complex, often contradictory dynamics that firms face when integrating digital technologies into their traditional servitization strategies. This paradox is characterized by the simultaneous existence of conflicting yet interrelated elements that create cognitive and emotional tensions within organizations. Understanding and managing these tensions are crucial for successful digital servitization.

Paradox Theory

As coined by Smith and Lewis (2011), offers a framework for understanding these opposite aspects. Paradoxes are "opposing yet interrelated components that exist concurrently and persist throughout time". These factors can seem logical when alone

but appear irrational or inconsistent when compared. For example, the exploration versus exploitation strategy illustrates this contradiction—while both strategies are reasonable individually, their simultaneous adoption can generate sizeable organizational strains.

As stated by [20], these paradoxical strains depict the anxiety originating from the perception of competing demands and the initiatives to administer them. They can be experienced individually, within teams, or across the entire organization. Even though paradoxes persist over time, they regularly stay latent until distinct contextual conditions, could be new chances or resource shortage, surface them. Comprehending these changing organizational contexts is important in understanding paradoxes and their related strains.

Paradoxes are categorized into four groups by Dimitrijeva [20] based on the competing demands they produce: learning, belonging, organizing, and performing. Learning tensions arise from the need to balance exploiting existing knowledge with exploring new knowledge. Belonging tensions involve reconciling individual identities with group identities. Organizing tensions stem from efforts to integrate and separate entities within structures and processes. Performing tensions contrast short-term and long-term goals and strategies.

While paradoxes can create organizational challenges, they can also be sources of creativity, innovation, and long-term sustainability. Recognizing and effectively overseeing these competing demands is key to harnessing the positive implications of paradoxes.

Paradoxically, servitization often generates conflicting demands due to integrating services into established product-focused businesses. Coined by Gebauer, the "service paradox" highlights that substantial service investments do not always yield sufficient returns, as reinforced by Cenamor [21] and Li [22]

More perplexingly, researchers like Kohtamäki explored the "digitalization paradox" within servitization, describing challenges of deriving adequate returns on digitalization efforts, compounding servitization complexity [7]. Studies by Kohtamäki, Einola, and Rabetino explicitly applied paradox theory, identifying competing demands in learning, belonging, organizing, and performing through servitization. For instance, learning tensions balance customizing solutions while efficiently manufacturing products [7] [23]. Belonging tensions develop customer focus while maintaining an engineering mindset. Organizing tensions integrate services into product divisions. Performing tensions innovate service solutions versus exploiting product innovations.

Adopting a dynamic, processual perspective considers manufacturers' varying contexts and objectives throughout their servitization journeys. This perspective aids comprehending how paradoxical tensions emerge, interact, and can be managed over time.

Combining Baines' servitization stage model with Smith and Lewis' paradox categories could develop an integrated framework guiding managerial interventions through recommendations reflecting specific challenges encountered across servitization stages. This framework provides structure for understanding the paradoxical demands manufacturers face.

Indeed, firms transitioning to digital servitization must navigate contradictory demands. While technologies enable innovative services, their integration creates complexities. To start, servitization elevates the importance of customization yet digitization drives standardization. Similarly, a focus on outcomes and use shifts risks to the provider, conflicting with product-centric value chains. Further, data sharing intended to improve customer experience challenges established boundaries. As such, the path is uncertain. However, acknowledging these tensions is key. With clear-eyed assessment of tradeoffs, opportunities emerge. Temporary compromises can establish cooperative frameworks for coproduction. And new programs test transformations before firm-wise implementation. This reduces the disruption while building competencies. Most importantly, customer-centricity helps align digitization with organizational purpose [16]. Through perceptive management of digital servitization paradoxes, firms harness its promise to transform industry and deliver enduring value.

This paradox is particularly relevant in the context of my proposed model, which outlines the transition from traditional servitization to digital servitization, highlighting the interplay between technology integration, strategic shifts, action/interaction strategies, and the resulting consequences as explained above.

5 Proposed Model

The phases of selective coding which binds different categories with one another to establish an exhaustive theoretical understanding regarding digital servitization were carried out. Throughout this process, constant comparative analysis is carried out continuing until theoretical saturation is reached, indicating that no new relevant concepts or relationships emerge from the data. A coding paradigm was developed (like the paradigm used in axial coding) to structure the model consisting of all the key themes which arose from axial coding.

I used the code co-occurrence matrix (Figure 5.1) to understand the relationships between different themes identified in the axial coding. It provides a detailed view of how various concepts are interconnected, helping to reveal underlying patterns and insights that can inform the development of a theoretical framework or a model. Both the rows and columns represent the same set of codes. The intersection of a row and a column indicates the co-occurrence of the corresponding codes. The values in the cells represent the frequency of co-occurrence of the two codes at the intersection. Higher values indicate more frequent co-occurrence, while lower values or zeros indicate infrequent or no co-occurrence. The Diagonal values (where a code intersects with itself) has values that represent the total number of occurrences of that code. While these cannot be used for co-occurrence analysis they provide a sense of the prevalence of each code. The off-diagonal cells are more interesting, they represent how codes appear together often. It helps to gain an insight into correlations existing between and amongst the various themes.

High values in the off-diagonal cells mean that certain themes are frequently discussed together. For example, if the cell where "Technology Integration" intersects with "Capability Development" has a high value, it means that the discussions around *technology integration* often mention *"the development of new capabilities"*. Conversely, low or zero values show that certain themes rarely or never appear together, suggesting these themes are not commonly linked together. Another example of high code co-occurrence is *Customer Engagement and Customer Satisfaction.*

	Technology Integration	Strategic Shift	Capability Development	Customer Engagement	Operational Efficiency	Economic Impact	Customer Satisfaction	Challenges	Governance and Integration	Intervening Conditions
Technology Integration	13	7	9	8	12	8	9	7	10	8
Strategic Shift	7	12	8	7	8	8	9	8	9	7
Capability Development	9	8	11	9	9	7	9	8	9	6
Customer Engagement	8	7	9	13	8	8	9	7	9	8
Operational Efficiency	12	8	9	8	14	9	9	8	10	9
Economic Impact	8	8	7	8	9	10	8	7	8	6
Customer Satisfaction	9	9	9	9	9	8	12	8	10	9
Challenges	7	8	8	7	8	7	8	11	9	7
Governance and Integration	10	9	9	9	10	8	10	9	13	8
Intervening Conditions	8	7	6	8	9	6	9	7	8	11

Figure 5.1 Code Co-occurrence Matrix

5.1. Creating a Coding Paradigm

The coding paradigm was developed to structure the framework and identify the relationships of the themes to the core phenomenon i.e. Digital Servitization.

- **Causal Conditions**: These are the factors that contribute to the occurrence of the core phenomenon of digital servitization.
- **Context**: The specific conditions within which the phenomenon is embedded.
- **Intervening Conditions**: Broad structural conditions that influence the core phenomenon.
- **Action/Interaction Strategies**: Strategies used to manage or respond to the phenomenon.
- **Consequences**: Outcomes of the action/interaction strategies.

5.1.1. Causal Conditions

Technology Integration

Technology integration is one of the corner-stones in the blueprint for transition to digital servitization. It includes the use of cutting-edge technologies like IoT, Big Data, AI, Cloud Computing, Digital Platforms and Data Analytics. Such technologies allow real-time data analytics, connectivity and automation, which are key for improving service delivery and operational efficiency. As highlighted in the McKinsey Report and by Sjödin et al., “IoT enables real-time data collection and monitoring, essential

for predictive maintenance and process optimization (McKinsey report, 2022; Sjödin et al., 2020)."

By helping companies understand what works (and what hasn't worked) in the past, whether it is related to operational performance or customer behavior, or market trends that are influencing everything from product development to sales techniques; Big Data analytics is fostering a push-and-pull relationship with businesses and consumers so that they can make better-informed decisions and ultimately customize their services around individual customer needs. Kamalaldin et al. Big Data driving service enhancements and customer experiences. "Big Data analytics provides insights into operational performance, customer behavior, and market trends,"[16]

In manufacturing, sensors of IoT fetch data about functioning of machinery to AI to predict when it should be due for maintenance and bring down the unplanned downtime and costs it incurs. It is important as technology has enabled this and it forms the framework for digital servitization. The digital servitization paradox encapsulates the conflicting yet interrelated challenges that firms face when integrating digital technologies into their servitization strategies. For example, while IoT and Big Data analytics provide valuable insights for predictive maintenance and process optimization, their implementation can create organizational tensions. These tensions arise from the need to balance the exploitation of established knowledge with the exploration of new, frame-breaking knowledge. Similarly, the strategic shift towards service-centric models may conflict with existing product-centric mindsets, creating challenges in aligning organizational goals and fostering a culture of innovation. Understanding and managing these paradoxes are essential for leveraging the benefits of digital servitization and achieving long-term success.

Strategic Shift

A strategic shift is essential for aligning organizational goals with digital servitization initiatives. Firms need to have or develop that innate ability to make this strategic shift when transiting to DS. This second theme in the framework is a major shift from product-centric models to service-centric models that are part of a long-term and strategic transformation. That involves business model, customer-centric strategies, and moving from CAPEX to OPEX. Digital Servitization in Manufacturing and the McKinsey Report emphasize how companies are increasingly going beyond the simple sale of products to deliver complete service packages that include maintenance, updates, and support.

"Moving from selling products to offering comprehensive service solutions that include maintenance, updates, and support" (Digital Servitization in Manufacturing, McKinsey Report) highlights a significant trend in the industry, where companies are shifting from merely selling products to offering comprehensive service solutions. As a result, deeper and longer-lasting customer relationships are formed that enhances value delivered. The shift to service solutions is changing the game - by reframing

business models to deliver ongoing customer value and performance beyond the initial sale, focused on the outcomes customers get and keep. For example, firms in the industrial machinery vertical bundle full-service solutions with maintenance and software updates that are designed to increase customer satisfaction and loyalty. Also the excerpt "Strategic shifts involve rethinking business models to focus on services and outcomes rather than products" (Digital Transformation of Business) states that businesses are rethinking and redefining their business models. The new approach prioritizes offering services that accompany the products, ensuring that customers receive continuous value and support beyond the product/service purchase. This might include things like after-sales service, consulting, and personalized solutions

Therefore, the inclusion of superior technologies and strategic rethinking for optimizing services are the crucial factors which can lead to transformational causal links for digital servitization model. By building on these elements - service offerings, operational efficiencies and customer relationships - businesses can create change that generates lasting transformation in the digital era. The framework, with its causal conditions, sets out a systematic guide for companies to transition effectively through this from servitizing the traditional model to a fully digital offering.

5.1.2. Context

Industry Context

Manufacturing & Automotive industry – Highlights the layered aspects of Digital Servitization. The manufacturing sector, having to contend with intricate supply chains and multiple different customer needs, demands digital solutions tailored to the very specifics of industry requirements. This complexity is well articulated in an exclusive excerpt from the McKinsey Report on Servitization 4.0: "The manufacturing industry, with its complex supply chains and diverse customer needs, necessitates tailored digital solutions". This necessity for industry-specific digital experiences that can ease these industry challenges is a strong rationale for personalized digital servitization. The nature of digital servitization strategies is influenced by industry-specific requirements such as real-time supply chain visibility, predictive maintenance and effective resource management. This way, by providing custom-made solutions, manufacturers can meet the specific needs for both operations and customers which in turn results in increased efficiency & productivity as well as competitiveness. This custom way of doing things not only assists in order operations but also provides additional services helping a company to stand out in the marketplace.

Market Environment

The market is a volatile and highly competitive field where regular innovation is needed along with high efficiency going hand in hand. Given how quickly technology is changing, if companies want to stay ahead of the competition, then they need to adjust and adopt new tools and platforms. This necessity is highlighted in the

McKinsey Report on Digital Transformation of Business, which notes, “The rapid pace of technological innovation necessitates continuous adaptation and adoption of new tools and platforms to remain competitive in the market.” The uptake of digital transformation company-wide may vary significantly depending on market dynamics such as competition and innovation pressure. To stay in the game, businesses not only have to keep pace with technology but also incorporate it into their offerings and operations. The desire to move towards digital transformation is fueled by the need to accelerate customer and market responsiveness (e.g., software development iterations, time-to-market), customer satisfaction measures, and internal implementation efficiencies. As a result,the market environment is key in the development of digital servitization approaches, driving companies to constantly evolve and adapt in order to outcompete its peers.

5.1.3. Intervening Conditions

Organizational factors

Readiness and culture are critical at enabling the digitised servitization landscape. Indeed, "Organizational readiness and culture are key enablers of the successful deployment of digital servitization," according to McKinsey Report on Digital Servitization in Manufacturing. This means that a company’s internal environment significantly affects its ability to adopt and succeed with digital initiatives. This includes having the right technical architecture in place, ensuring that digital initiatives are aligned with business goals and a readiness to invest in new technologies. In the interim, a culture must arise that fosters innovative, life-long learning and flexibility. This depends on the openness of the employees to change and the extent to which they engage, which are crucial in overcoming resistance and thus ensuring a smooth transition. Thus, both organization-wide readiness and a supportive culture of digitalization among the top management are vital to enable successful adoption of servitization measures in a digitized format so that they can be carried out for an extended timeframe.

Regulatory Environment

It is another key intervening condition that has a significant impact on the strategies and actions of firms moving towards digital servitization. "Industry regulations and standards have a powerful guiding influence on the new servitization-based digital strategies and actions of firms," expressed reports such as Servitization 4.0 and Sustainability-as-a-Service. Regulatory compliance refers to the practice that some organizations follow to ensure they meet certain legal requirements with regards to data security, privacy, environmental regulations, and industry-specific standards. The nature and enforcement of these regulations though, can lend a helping or a restraining hand to the uptake of digital servitization. E.g. stricter regulations may require more investment in compliance technologies and processes, while supportive

regulations may drive innovation and adoption of digital solutions. As a result, mapping and managing the regulatory terrain is crucial for firms seeking to implement digital servitization strategies successfully and compliantly. This includes keeping up to date with regulatory changes and adjusting business practices accordingly to meet the ever-changing standards. This way, companies can make sure their move towards digital servitization is legally compliant and effective from above, grasping up the potential of digital technologies while downslides are covered in terms of legal infringements. That is why the regulatory environment can act as a double-edged sword which either expedites or slows down digital transformation.

5.1.4. Action/Interaction Strategies

Capability Development

Capability development is an essential stratagem for digital servitization which includes building digital capabilities, up-skilling workforce / developing new skills and acquiring digital solutions. The McKinsey Report on Digital Servitization in Manufacturing along with Transforming Provider-Customer Relationships and Procurement 4.0 states that, "Building digital capabilities is necessary for implementing and sustaining digital Servitization". As a result, to effectively migrate towards digital servitization, an organization hence needs to build strong digital competencies. This requires substantial investments into digital infrastructure, such as improved software and hardware, coupled with staff training programs designed to enable employees to use these new tools proficiently. Various reports of operational capability development focus on "Training programs on new digital tools and technologies are necessary for developing operational capabilities." These courses train the workforce with digital knowledge to perform and also use such digital interventions effectively. This skill development is a game changer for the digital servitization landscape. In the absence of appropriate digital skills and infrastructure, enterprises will not be able to realize or maintain their digital servitization strategies. Therefore, investing in capability development is critical for the success of digital servitization to innovatively service, improve operational efficiency and maintain a competitive position.

Customer Engagement

It is another crucial strategy in digital servitization, which entails regular feedback, co-creation, integrated partnerships and creating customer loyalty. According to the McKinsey Report on Digital Servitization in Manufacturing, "Customer engagement is one of the most important factors for creating a window onto what customers need and thereby offering value-added services." Companies can better understand their customers through interaction giving them a better experience that meets more specific needs and wants. This way of engaging can be further augmented with digital platforms for real-time feedback and co-creation with customers. As noted by Sjödin

et al. in “Using digital platforms to gather real-time feedback and co-create solutions with customers increases engagement and satisfaction”[18]. The idea is to give customers an opportunity to participate in the development of solutions that best meet their needs, by incorporating their views and preferences into the final solution. Digital servitization is a difficult concept to understand, however, customer engagement can significantly impact digital servitization and in return enhance customer satisfaction and loyalty. Building long-term loyalty companies can use their customers' feedback. to solve problems, improve offerings, and spot trends early. Focusing strategy on customer engagement this way adds value to customers and transforms it a more digital age sustainable, resilient business model. Hence, firms and the stakeholders need to invest in this pivotal strategy.

5.1.5. Consequences

Operational efficiency

It is a major aspect of implementing Digital Servitization, influencing improved processes, streamlining supply chain processes, smooth execution and unification across multiple organizational dimensions. One of the first benefits of digital servitization identified by the McKinsey report on DS in manufacturing, transforming Provider-Customer relationships, Procurement 4.0 and Servitization 4.0 is improving operational efficiency. Cost reduction, resource utilization and service much better. Firms can do this using innovative digital tools and technologies that help them run efficient operations on a lean scale with minimal resource wastage. A real-life example is the adoption of predictive maintenance for assorted objectives [18], to decrease downtime and enhance machine reliability. This can be done by predictive maintenance which uses data analytics to predict when a piece of equipment is likely to fail, then to schedule a repair in advance and avoid unplanned downtime and unexpected costs. Better operational efficiency goes a long way towards the success of digital servitization as it is linked to cost savings, better utilization of resources and successful service provision that are keys to maintaining a competitive advantage in the market.

Environmental Benefits

Digital servitization also has major environmental perks like sustainability and eco-friendly infrastructure to save energy and lessen carbon footprints. One recent example in both Servitization 4.0 and Sustainability-as-a-Service: "Digital servitization can lead to significant environmental benefits by promoting sustainable practices and reducing resource consumption”. Companies can leverage digital technologies to optimize energy use and minimize waste, thus contributing to environmental sustainability [17]. The use of digital technologies in these areas can significantly improve the environmental impact of a company. Firms need to invest in smart systems that can facilitate smarter use of energy. Sustainability is a significant outcome

that impacts digital servitization. Companies that adopt sustainable practices not only contribute to environmental conservation but also address eco-conscious consumers and stakeholders, which ultimately increases the brand reputation.

Economic Impact

The economic impact of digital servitization involves new revenue channels, gaining competitive advantages, sustainable growth drivers, higher profit margins, and better market capitalization. Digital servitization generates business opportunities as per the McKinsey Report on Digital Transformation of Business and Servitization 4.0 ", "Digital servitization creates new economic opportunities by enabling innovative service offerings and improving operational efficiency". As highlighted by Kamalaldin et al this transformation enables companies to experiment with monetization strategies like subscriptions services that bring in stable recurring revenues [16]. By shifting from traditional product sales to service-oriented models, companies can generate consistent income and build stronger customer relationships. Improved operational efficiency and new service offerings give companies a real competitive edge that places them well in the market. In summary, the economic effect of digitization continuing over time and being compounded is one of undisrupted growth which creates greater profitability, and higher market valuation.

Digital Servitization Paradox

The Digital Servitization Paradox refers to the counterintuitive situation where significant investments in digital technologies and servitization do not always lead to the expected increases in profitability and business performance. In the proposed model, digital servitization is driven by two primary causal conditions: **Technology Integration** and **Strategic Shift**. Technology Integration involves leveraging advanced technologies. The Strategic Shift, on the other hand, involves moving from a product-centric to a service-centric business model. This shift requires rethinking business models to focus on services and outcomes, ensuring continuous value and support to customers. While integrating advanced technologies is essential, it requires significant investment in developing the necessary capabilities. Companies may struggle to build these capabilities quickly enough to fully leverage the new technologies, leading to a mismatch between technology potential and actual performance improvements. Similar happens when firms move to service-centric model. This shift can create tensions within the organization as it requires changes in culture and business models etc. These changes can be difficult to implement and may face resistance, which may lead to hindering customer engagement and satisfaction.

5.2. Snapshot of Relationships between the Themes

Technology integration drives capability development, leading to operational efficiency and enhanced customer engagement. Strategic shifts towards service-centric

models further enhance Customer Engagement, resulting in higher Customer Satisfaction and Economic Impact. Intervening conditions such as organizational readiness and regulatory compliance influence the success of these strategies, ensuring seamless operations and strategic alignment. Governance and Integration challenges address balance control and flexibility. Digital Servitization Paradox encompassing the inherent tensions and contradictions when integrating digital technologies into the service strategies.

5.3. Grouping Categories into Coherent Framework

The identified categories and their relationships were organized into a coherent theoretical framework that explains the core phenomenon of digital servitization. Digital servitization consists of intrinsically interconnected categories and relations that are initiated by the transition from servitization to digital servitization. In order to make the transition effective, a well-defined tabulation of these themes into a framework is needed. This framework presents a systematic conceptualization of the heart of the digital servitization phenomenon and therefore offers useful inputs for both scholars and practitioners alike.

At the heart of this framework is **technology integration**, which involves the incorporation of advanced technologies such as the Internet of Things (IoT), Big Data, Artificial Intelligence (AI), Cloud Computing, Digital Platforms, and Data Analytics. A **strategic shift** from a product-centric to a service-centric model is also a fundamental component of this framework. This shift involves rethinking and innovating business models to focus on services and outcomes rather than solely on products. Technology Integration and Strategic shift are grouped under causal conditions which directly affects the transition to DS. **Customer engagement** is another critical element within the framework. By focusing on customer-centric strategies and continuously engaging with customers through digital platforms, companies can gather real-time feedback and co-create solutions that meet their specific needs. **Capability development** is directly driven by technology integration. Companies must invest in building digital capabilities and developing new skills among their workforce to effectively implement and sustain digital servitization. Customer engagement and Capability Development are grouped under Action/Interaction strategies. **Operational efficiency** is a significant consequence of technology integration and strategic shift. It is achieved through optimized processes, improved supply chain efficiency, seamless implementation, and the integration of various organizational units. The framework includes **Environmental benefits** as an important outcome of digital servitization. By promoting sustainable practices and reducing resource consumption, companies can achieve significant environmental benefits. The **economic impact** of digital servitization includes new revenue streams, competitive advantages, long-term growth, profitability, and increased market valuation**. Customer satisfaction** is also included in the framework which is the

consequence of economic impact and customer engagement. These four themes, i.e. operational efficiency, Environmental benefits, Economic impact and customer satisfaction are grouped together as consequences.

5.4. Holistic View of the Model

The framework below (figure 5.2) provides a holistic perspective on digital servitization by encompassing a wide range of interconnected factors that are critical to the transformation process. This approach ensures that no single aspect is considered in isolation. By understanding how elements such as technology, strategy, capabilities, and customer engagement interact, organizations can develop more comprehensive and effective strategies. For example, enhancing operational efficiency through technology integration must be aligned with strategic shifts in business models to fully realize the benefits of digital servitization. This model also recognizes the digital servitization paradox, which encompasses the inherent tensions and contradictions that firms face when integrating digital technologies into their service strategies.

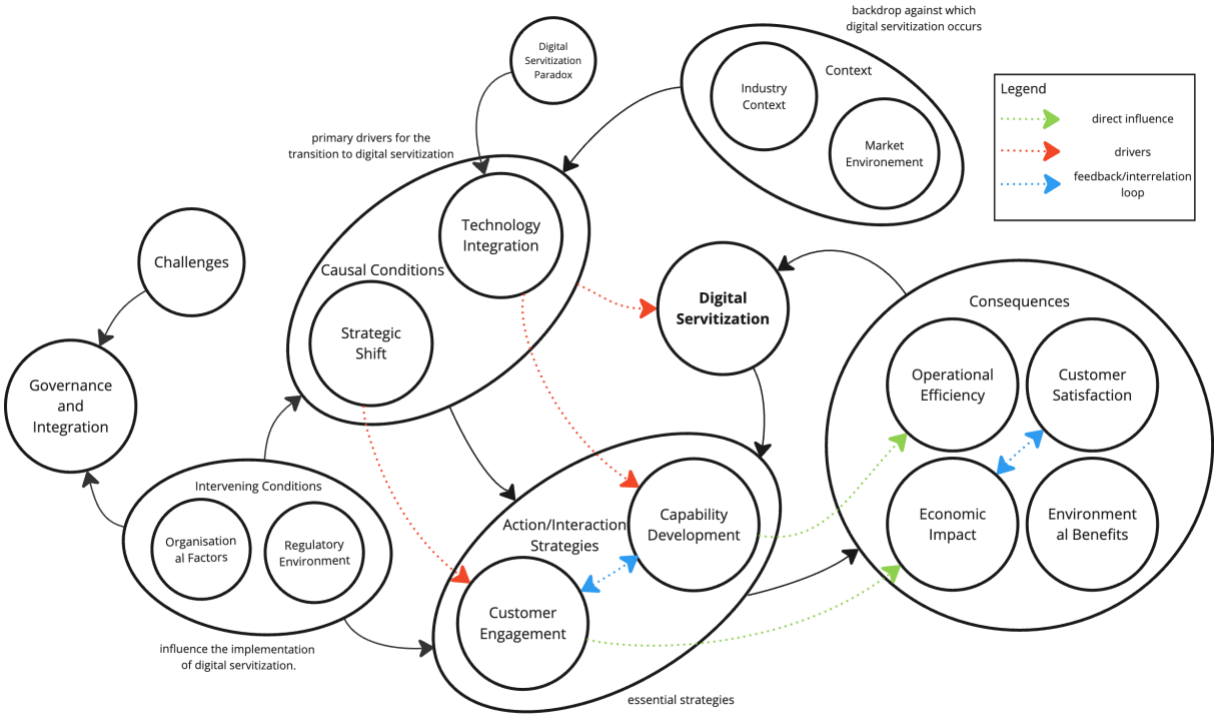


Figure 5.2 Proposed Model

This paradox is rooted in the complexities of balancing short-term and long-term goals, integrating new technologies with existing processes, and managing the

competing demands of innovation and operational efficiency. The framework effectively integrates major themes like Technology Integration, Strategic Shift, and Customer Engagement, ensuring a cohesive approach to Digital Servitization.

5.4.1. Dynamic Interactions

Feedback Loops

Feedback loops are an integral part of the framework, particularly within the domains of Customer Engagement and Capability Development. Continuous customer feedback is essential for refining service offerings and ensuring they meet evolving customer needs. For example, using digital platforms to gather real-time customer feedback allows companies to make swift adjustments to their services. Similarly, ongoing employee training programs ensure that the workforce remains adept at using new technologies thus, creating a cycle of continuous improvement.

Adaptive Framework

The framework's adaptive nature allows it to remain relevant in the face of changing market conditions, technological advancements, and regulatory updates. This flexibility is crucial for organizations to maintain a competitive edge. For instance, as new technologies emerge, the framework can be adjusted to incorporate these innovations, ensuring that companies do not lag behind the trend of digital servitization.

5.4.2. Long-Term Sustainability

Given that the framework is adaptive according to the needs of firms, this model can sustain and act as a blueprint for firms who seek the transition. This model has long-term implications. The framework emphasizes the dual focus on economic and environmental sustainability. This coordination strengthens not only a firm's market standing but also connects with more general sustainability objectives. As one example, the application of IoT devices working with data analytics in energy management has enabled partners to achieve large reductions in operational expenses and environmental footprint.

5.4.3. Implementation and Benchmarking

The framework provides a roadmap for companies pursuing digital servitization. It covers key steps and considerations in the successful implementation of its principles, including technology adoption, strategic realignment, capability building and customer engagement. For example, a specific implementation roadmap could include stages regarding the assessment of technological preparedness, staff training, re-orientation of business models traversing into feedback loops with customers.

The framework can be used to benchmark a company's progress against industry best practices. By comparing their strategies and outcomes with those of leading organizations, companies can identify gaps and areas for improvement. This benchmarking process helps in refining strategies to achieve better results. For example, a manufacturing company can benchmark its predictive maintenance practices against industry leaders to identify potential enhancements.

6 Discussion

This chapter addresses the research questions, recommendations for stakeholders/customers who are transitioning to use services related to digital Servitization. This section also includes the testing of the developed hypothesis.

6.1. Answer to the Research Questions

6.1.1. Research Question 1: How do manufacturing firms effectively navigate the transition to digital servitization, and what factors influence the success of this transformation?

Based on the methodological approach followed and the proposed model, several key factors contribute towards the navigation of firms to DS.

1. **Technology Integration:** Firms must invest in the technologies and build the necessary infrastructure to support their implementation. This requires a strategic approach to technology adoption and integration.
2. **Strategic Shift:** Organizations need to rethink their business models to focus on delivering value through services rather than just products. This requires leadership commitment and a clear vision for the future.
3. **Capability Development:** Building new skills and capabilities within the organization is essential for sustaining Digital Servitization. Hence, firms should invest in capability development programs to enhance their digital competencies and ensure that their workforce is equipped to handle new technologies and processes. Developing robust change management strategies helps address resistance to change, ensuring that the transition to digital servitization is smooth and well-received by all stakeholders. Effective communication, training, and support are essential components of successful change management. Companies that manage change effectively can mitigate resistance and ensure a smoother transition to new digital processes [24]
4. **Operational Efficiency:** Enhancing operational efficiency through process optimization, predictive maintenance, and efficient resource allocation is a key benefit of digital servitization. So, organizations must focus on improving their operational processes to reduce costs as well as improve productivity. This

involves adopting lean practices and leveraging data analytics for better decision-making.

5. **Intervening Conditions:** Factors such as organizational readiness, cultural alignment, and the regulatory environment influence the adoption of DS. Firms need to assess their readiness for digital transformation and create a supportive culture that embraces change. Additionally, understanding and complying with industry regulations are crucial for smooth implementation.
6. **Governance and Integration:** Addressing governance and integration challenges is essential to balance control and flexibility, ensuring seamless operations and strategic alignment. Hence, firms must establish effective governance and integration mechanisms. This will result in co-ordination as well as maintain strategic alignment across the organization.
7. **Monitor and Evaluate Performance:** Regularly review and monitor the performance of digital service initiatives from the KPIs. This approach helps discover where improvements can be made, and also ensures benefit arising from them will actually be achieved. Taking a proactive stance like this allows for these timely adjustment and optimization activities to become a part of the overall effectiveness of digital servitization work.

6.1.2. Research Question 2: How do users (stakeholders) perceive and adapt to the changes brought about by digital servitization, and what factors influence their adoption and satisfaction?

The research also explored the user perspective, focusing on how customers and stakeholders perceive and adapt to Digital Servitization.

1. **Customer Engagement:** Enhancing customer engagement through continuous feedback, co-creation, and integrated partnerships is crucial. Personalized services and real-time feedback mechanisms lead to a better understanding of customer needs and the delivery of value-added services. Firms should prioritize customer engagement strategies to build strong relationships and foster loyalty. This involves using digital platforms to facilitate communication and collaboration with customers.
2. **Customer Satisfaction:** Customer satisfaction improves when firms focus on personalized, outcome-based services that meet specific needs and expectations. Delivering high-quality, tailored services is key to achieving customer satisfaction. Firms need to gather and analyze customer feedback to continuously improve their offerings.
3. **Economic Impact:** Digital servitization creates new revenue streams and competitive advantages, positively affecting customer perceptions and satisfaction. Organizations should explore new business models and pricing strategies to generate consistent revenue and enhance customer value.

4. **Challenged and Governance:** Identifying and managing challenges, such as technological complexity and data privacy concerns, is essential. Effective governance structures support successful service delivery. Firms need to address potential challenges and establish governance frameworks to ensure data security and regulatory compliance.

6.2. Recommendations for Stakeholders

Based on the findings, users (stakeholders) can take the following actions to adapt and thrive in the context of digital servitization.

1. **Embrace Change and Innovation:** In order to smoothly transition from servitization to digital servitization, users, customers and stakeholders should take several strategic steps. First and foremost, they should keep on avoiding being set in their ways and instead, embrace the need for change and innovation. This means being open to new technologies and new ways of working that service providers come up with. It also means adopting IoT-enabled products, AI-driven solutions and cloud-based services.
2. **Active Engagement with Providers:** Stakeholders should participate in co-creation and feedback processes with service providers by sharing insights, providing feedback, and collaborating on service development. This active involvement ensures that the services provided are tailored to specific needs, significantly enhancing service quality and customer satisfaction.
3. **Focus on Skill Development and Training:** Investing in training and skill development is essential to build the necessary competencies for utilizing new digital services effectively. By developing digital skills, users can maximize the benefits of digital servitization.
4. **Leverage Data for Decision-making:** Users should utilize data analytics tools provided by service providers to gain insights into their operations and make informed decisions. Data-driven decision-making can lead to better operational outcomes and strategic advantages, as Big Data and analytics enable users to optimize performance and predict future trends [15].
5. **Establish Strong Partnerships**: Forming key partnerships with your providers is important as you work to build lasting relationships of mutual trust and gain. Better Communication - stronger partnerships create a culture of continuous, two-way communication. Collaborative relationships should be established between providers and customers in order to build a well-functioning digital servitization ecosystem that enables both parties to collaborate towards shared objectives.
6. **Address Privacy and Security Concern:** In addition, users will have to enter into agreements with providers that robust data privacy and security safeguards may be implemented. To build trust and comply with regulations it is essential to take good care of data security. A proactive

stance to these concerns mitigates the danger of leaking data or other security issues, thus protecting vital information and maintaining a healthy digital ecosystem.

7 Threats to Validity and Mitigation Strategies

This chapter describes the potential threats to the validity of the study and outlines strategies to mitigate them, following the guidelines by Wohlin et al. (2012). The validity of a study is important to make certain that the findings are robust, credible, and generalizable. In this context, I have examined the threats to external validity, internal validity, construct validity, and reliability. Understanding and addressing these threats is essential to enhancing the trustworthiness of the research outcomes.

7.1. External Validity

External validity refers to the extent to which the results of this study can be generalized beyond the specific context of the firms that participated in digital servitization. One major threat to external validity in this study is the representativeness of the sample. Not only is the study primarily reliant on literature reviews and case studies which talk about Digital Servitization and corresponding themes, it also risks that these examples are not representative of the wider population of firms; this is particularly true for firms at different stages of digital servitization or still awaiting adoption. The findings of this study maybe too optimistic or biased towards successful implementations, they may not be applicable to other contexts.

To navigate this threat, steps should be taken to ensure that the selected literature and case studies involve a wide range of industries and firm sizes. The study can then offer a variety of contexts and experiences, making its findings more generalizable. By analyzing industries across the board, it is possible to uncover common factors and strategies applicable to all sectors. In future research, empirical studies involving a wider sample of firms in various industries should be considered to check the findings and so make them more generalizable. This approach will help in understanding the nuances and variations in digital servitization practices across different organizational and industry contexts.

7.2. Internal Validity

Internal validity concerns the accuracy of causal inferences and the identification of factors that might actually be responsible for the observed outcomes. A substantial

threat to the internal validity of this study is confounding variables not considered in analysis: Economic conditions, organizational culture and technological infrastructure might influence the outcome of Digital Servitization. These unconsidered variables might be the real causes of the observed successes and challenges, rather than the factors identified in the study.

Another threat to internal validity is the challenge of establishing clear causal relationships between the identified factors and the success of digital servitization. The reliance on qualitative data, in this case, the literature can make it difficult to definitively determine causality. To address these threats, the study should conduct data collection in form of interviews, etc. to identify potential confounding variables and account for them in the analysis. Triangulation, which involves combining qualitative data with quantitative methods such as surveys and statistical analysis, can also strengthen causal inferences. Future research might base conclusions on longitudinal studies. Not only would they provide a stronger test of causation, but even more significantly they could help disentangle all these different influences affecting what actually happens when a company transits from Servitization to Digital Servitization.

7.3. Construct Validity

Construct validity pertains to the extent to which the constructs analyzed in the study accurately represent what the researcher intended to study. One potential threat to construct validity is the misinterpretation of constructs. Researchers and subjects might understand (or interpret) the terms and constructs used in this study–such as digital servitization, technology integration and strategic shift differently. This would lead to discrepancies in comprehension and use of these concepts. Ensuring that the constructs are clearly defined and consistently understood is crucial for maintaining the integrity of the study.

To mitigate this threat, the study should provide clear and precise definitions of key constructs at the beginning of the research. This would help to ensure that all participants and researchers have a common understanding of the terms being used. Constructs should also be checked by professionals and academic peers to make sure they really reflect their intended meanings. Although this is more difficult for qualitative research, it is equally necessary to keep refining the constructs during an iterative feedback process based on preliminary analyses with experts in the field. And as constructs evolve, new insights are gained.

7.4. Reliability

Reliability concerns the extent to which the results of the study are consistent and replicable by other researcher. This qualitative research subjectivity creates an opportunity for bias that might affect the consistency and credibility of findings. Different researchers may see the same qualitative data differently, inviting diverse results.

To increase the reliability of a study, it is important to have multiple researchers code the data independently and then to compare their results. Doing so minimizes personal biases and ensures a high degree of agreement among coders. The study must try for at least 90% overlap between the coding results in order to obtain consistent findings. Additionally, by presenting a detailed account of research methods, including data collection, coding strategy and analytical techniques, others can follow or replicate your work. The same is achieved through software packages such as Dedoose, which standardizes the procedure for coding qualitative data and thereby reduces observer bias: this further improves the reliability of the results.

By identifying and taking various steps to reduce these threats to validity, the study aims to present findings which are robust of necessary. This chapter offers several mitigation strategies which can help boost the overall informativeness, precisions and reproducibility of the research, adding greater depth to the field of digital servitization. Future research should build on these findings, using a variety of methods and wider samples to further validate and extend the theoretical and practical insights contained in the present study.

8 Conclusion and Implications

8.1. Conclusion

The transition from traditional servitization to digital servitization represents a significant shift in how manufacturing firms and other industries approach their business models and service offerings. This thesis, titled "Navigating the Shift: Transition of Firms and Users from Servitization to Digital Servitization using Grounded Theory Approach," aimed to provide a comprehensive review and develop a framework that addresses this complex transformation. Through an extensive literature review and the application of Grounded Theory, I have identified key themes, concepts, and relationships that underpin the successful implementation of digital servitization.

The research has shown, the critical role of Technology Integration and Strategic Shift in driving Digital Servitization. Advanced technologies such as IoT, Big Data, AI, Cloud Computing and Digital Platforms are the necessary foundation for creating new digital capabilities. These technologies provide opportunities for predictive maintenance, and process optimization, and provide valuable insights into operational performance, customer behavior, and market trends. The strategic shift from product-centric to service-centric models further enhances customer engagement and satisfaction by offering comprehensive service solutions.

This thesis also discusses several shortcomings in current studies, especially the absence of empirical research on digital servitization and an overall approach that combines servitization with digitization as well as practical guidance to get around difficulties or remove barriers. In addressing those gaps, this study produces a solid framework that can help companies to leverage digital technology in improvement of their service provision, achieve operational efficiency and create longer-lasting relationships.

8.2. Implications for Theory and Practice

The implications of the findings on theory and practice in digital servitization are substantial for this thesis. The study makes theoretical contributions by offering a holistic model that integrates technology integration, strategic shift, capability development and customer engagement. The rational for focusing on this framework is to add value to existing literature by drawing out the implications of advanced

digital technologies on service innovation through digital servitization. This framework extends existing literature by highlighting the critical role of advanced digital technologies and the necessary strategic transformations that firms must undergo to achieve successful digital servitization.

From a theoretical perspective, this study highlights the relevance of a holistic perspective considering the interplay between digital servitization elements. This suggests that future studies explore these relationships more thoroughly by using both qualitative and quantitative methods of investigation. The framework that emerged from this study will lay the groundwork for further research which can empirically test, revise and improve the understanding of how DS might ideally be done across different industries. The framework offers a significant contribution to academic research by providing a structured model that can be further tested and refined. It serves as a basis for empirical studies exploring the effectiveness of digital servitization strategies across different industries. Researchers can use the framework to investigate how various elements interact and influence the success of digital servitization initiatives.

In a practical sense, this study lends direction to manufacturing organizations intending to embark on digital servitization. The framework provides a clear roadmap for firms to follow, highlighting the need for investing in advanced technologies, developing new capabilities, and adopting customer-centric business models. This framework is a tool that firms can use to assess where they stand with respect to these dimensions, understand the gaps that exist, and help them enter into a strategic planning process for enhancing their servitization efforts. Moreover, the accent on customer engagement and satisfaction implies firms must work in creating broader relationships with their customers, using digital tools to capture client voice feedback and co-create value. This holistic view not only helps in understanding the complexities of digital servitization but also provides practical guidelines for effective implementation, making it valuable for both academic research and practical applications.

9 Identification of Gaps and Future Research Directions

9.1. Identification of Gaps

Despite the great progress in examining and infusion of digital servitization, there are still several gaps that should be need further studying. A particularly crucial gap is the integration challenges faced by enterprises when they incorporate digital technologies into their servitization strategies. The benefits of such integration, including enhanced operational efficiency and new service offerings, are well-documented, the specific technical, organizational, and cultural barriers that impede effective adoption remain under-investigated. For example, the complexity of aligning legacy systems with new digital platforms, the resistance to change within organizations, and the need for new skill sets are challenges that require deeper investigation to provide actionable insights for practitioners.

Another gap in the literature is the impact of digital servitization across different sectors. Most existing research concentrates on the manufacturing industry, leaving a significant knowledge gap with respect to how digital servitization operates in areas such as healthcare, education and retail. Each of these sectors has its own peculiar features and problems, so the effects from adopting digital service provision will differ in nature and scale for every industry. A thorough understanding of digital servitization requires perspective that cuts across industry to identify commonalities and differences between its application and results.

In addition, there has been a lack of long-term studies examining digital servitization. Most of today's research takes a snapshot approach, the long-term impacts and sustainability of digital strategies can only be understood through longitudinal research, tracing development of digital servitization within firms for extended periods. Such studies could show how dynamic transformation is of a nature that changes with time, what phases there are in turning point and why some digital servitization initiatives evolve successfully over long periods while others fail.

The customer perspective on digital servitization also remains sparsely explored. Though ample discussion has appeared in the literature on technical and organizational aspects of digital service provision, it is imperative to grasp how customers perceive these changes and adapt to them. Insights into customer

behaviours, expectations, and the value they derive from digital services can inform more effective service design and delivery strategies. A research focus on customer experience and satisfaction with digital service provision will fill this gap in the literature. It will also further serve advocacy for digital transformation efforts with an eye toward user needs.

A further topic needing more attention is the economic and environmental impact of digital servitization. Though the economic benefits, such as new income flows and gains in competitiveness, are often talked about, there is a gap of quantitative research on how big these benefits actually are. Similarly, digital service provision's effects on the environment, both positive (e.g., reduced resource consumption through efficiency improvements) and negative (e.g., more electronic waste), have not been researched fully. Addressing this gap requires a balanced evaluation of digital servitization's contributions to sustainability.

Finally, what needs a deeper study is the regulatory and ethical aspects of digital servitization. Digital servitization brings with it extensive data collection and analysis demands. Issues such as data privacy, AI's use of ethics and how security are increasingly prominent year by year. Research that addresses these regulatory and ethical challenges can provide guidelines and frameworks to ensure that digital servitization is implemented responsibly and sustainably.

9.2. Future Research Directions

Building on the identified gaps, future research should aim to provide a deeper understanding and practical guidance on several key areas of igital Servitization. Detailed case studies of integration difficulties are essential. Such studies should focus on organizations that have successfully integrated digital technologies into their servitization strategies. By identifying good practices, common traps and solutions for integration barriers, such research will be valuable for many companies beginning their own digital transformation journey.

Expanding scope of research across multiple industries would yield a more comprehensive understanding of Digital Servitization's impact. This way we can see how digital servitization is generally faring in many diverse sectors; healthcare, education and retail being just a few examples. Industry-specific challenges and possibilities emerge when digital servitization is examined across different sectors. Comparison between industries can reveal the inputs and shared aspects of digital servitization which then paves the way to differentiated service strategies in each sector.

Conducting longitudinal studies is crucial in order to understand the prolonged effects of digital servitization. If successful, such research will paint the process of digital transformation at every juncture, as well as how durable the digital strategies remain

and what factors bring long-term success or failure. Longitudinal research can also uncover the dynamic interactions between technology, organization, and market conditions, offering a more nuanced view of digital servitization.

Focusing the digital servitization on the customer's point of view, can enhance the user satisfaction with digital transformations. Future research should be oriented towards asking how people perceive digital services and adapt to them, what value they find in these experiences as well as how customers' experiences might be improved. Knowing the needs and tendencies of one's customers guides design and deliverance towards the successful, meaningful digital services that make their customers feel satisfied thus, increasing loyalty.

Research is also needed to gain an understanding of the economic and environmental impacts of digital servitization. Studies that measure the financial benefits such as cost saving or revenue generation together with environmental consequences like energy use can provide balance in evaluating digital servitization. This method can help firms optimize their digital strategies from the standpoints of both economic performance and sustainable development.

To address the regulatory and ethical considerations of digital servitization is also imperative. Research should also focus on developing frameworks and guidelines to ensure that data privacy, security, and ethical use of AI are upheld in digital servitization practices. By addressing these concerns, future research can contribute to the responsible and sustainable implementation of digital technologies in servitization.

In closing, it is only by addressing these gaps and taking up the challenges outlined above that we can hope to advance both the theoretical understanding of digital servitization and its practical implementation guidelines. Addressing these gaps and pursuing the suggested research directions will not only advance the theoretical understanding of digital servitization but also provide practical insights and guidelines for firms seeking to navigate this complex transition. This comprehensive approach will not only improve the effectiveness, durability and moral scruples of digital servitization enterprises in general contributing to the broader goals of innovation and competitiveness in the digital economy.

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A Appendix A

A.1. List of selected 17 papers.

The list is arranged in serial order with reference to the code presence heat map.

Serial Number	Name of document
1.	Digital servitization in manufacturing: A systematic literature review and research agenda
2.	Prepare now for the future of industrial services by McKinsey
3.	Transforming provider-customer relationships in digital servitization: A relational view on digitalization
4.	Procurement 4.0: How Industrial Customers Transform Procurement Processes to Capitalize on Digital Servitization
5.	From servitization to digital servitization: How digitalization transforms companies' transition towards services
6.	Digital Transformation of Business
7.	Artificial intelligence enabling circular business model innovation in digital servitization: Conceptualizing dynamic capabilities, AI capacities, business models and effects
8.	Tensions in digital servitization through a paradox lens
9.	Capabilities supporting digital servitization: A multi-actor perspective
10.	Consolidating digital servitization research: A systematic review, integrative framework, and future research directions
11.	Moving from servitization to digital servitization: Identifying the required dynamic capabilities and related microfoundations to facilitate

	the transition
12.	Transformational shifts through digital servitization
13.	From servitization to digital servitization: How digitalization transforms companies' transition towards services
14.	Digital servitization: Crossing the perspectives of digitization and servitization
15.	Paradoxes in servitization: A processual perspective
16.	The relationship between digitalization and servitization: The role of servitization in capturing the financial potential of digitalization
17.	The Palgrave Handbook of Servitization

A.2. List of papers referred

This included the documents which were not cited but helped in the construction of the thesis

Serial Number	Name of document
1.	Sustainability agencing: The involvement of stakeholder networks in megaprojects
2.	Behind the scenes of digital servitization: Actualising IoT-enabled affordances
3.	The effects of complementarity of knowledge and capabilities on joint innovation capabilities and service innovation: The role of competitive intensity and demand uncertainty
4.	Adaptive marketing capabilities, dynamic capabilities, and renewal competences: The "outside vs. inside" and "static vs. dynamic" controversies in strategy
5.	Open sustainability: Conceptualization and considerations

6.	How to get great research cited
7.	The adoption of technological innovations in a B2B context and its impact on firm performance: An ethical leadership perspective
8.	UNISON framework of data-driven tripartite evolutionary game-based knowledge sharing decision for digital servitization
9.	Servitization as an alternative business model and its implications on product durability, profitability & environmental impact
10.	Industrial service innovation: Exploring the transformation process to digital servitization in industrial goods companies
11.	Challenges of servitization: A systematic literature review
12.	Meta-model of servitization: The integrative profiling approach

A.3. Limitations and Unavoidable Biases

Despite the contributions, this study has several limitations that need to be acknowledged. First, the reliance on literature reviews and case studies from firms that have successfully implemented digital servitization may introduce a selection bias. The findings may be overly optimistic and may not fully capture the challenges faced by firms that struggle with digital transformation. This limitation affects the generalizability of the results, as the experiences of successful firms might not be representative of the broader population.

Second, the qualitative nature of the study, while providing rich insights, also poses challenges in establishing clear causal relationships between the identified factors and the outcomes of digital servitization. Future research could address this limitation by employing mixed-method approaches, combining qualitative insights with quantitative data to strengthen causal inferences.

Additionally, there is a risk of construct validity threats, where the terms and concepts used in the study might be interpreted differently by different stakeholders. Efforts were made to provide clear definitions and seek expert validation, but some degree of variability in understanding is unavoidable. Finally, researcher bias is an inherent risk in qualitative research. Although measures such as inter-coder reliability and detailed methodological descriptions were employed to mitigate this risk, the subjective nature of qualitative data analysis means that complete objectivity cannot be guaranteed. Overall, while this study provides valuable contributions to the field of digital servitization, these limitations highlight the need for continued research to validate

and expand upon the findings. Future studies should aim to include a more diverse range of firms, employ longitudinal designs, and use mixed-method approaches to build a more comprehensive and generalizable understanding of Digital Servitization.

A.4. Example of Excerpts

These examples are taken as direct output from the Dedoose software.

1. Title: Moving from servitization to digital servitization- Identifying the required dynamic capabilities and related microfo...

Codes Applied: Servitization as a Business Strategy Product-Service Combinations Digitalization Industry 4.0 Digital Servitization

Excerpt Range: Page 1: 943-1305

Many manufacturing companies are adopting servitization as a competitive business strategy to offer product- service combinations. The ongoing shift to digitalization and Industry 4.0 provides novel opportunities and bene◎ts to industrial ◎rms in this regard, and researchers termed the adoption of digital technologies to servi-tization as "digital Servitization".

2. Title: The relationship between digitalization and servitization- The role of servitization in capturing the financial poten...

Codes Applied: Digitalization Transition Smart Products IoT Industrial Internet Shifting Capability Requirements Manufacturing Struggles

Excerpt Range: Page 1: 3015-3238

transition towards digitalization,smart products, the Internet of Things (IoT), and the industrial internethas been shifting the capability requirements for manufacturing com-panies that reportedly struggle in this transitionn

3. Title: The relationship between digitalization and servitization- The role of servitization in capturing the financial poten...

Codes Applied: Transforming Ecosystems Data-Based Value Chains Interaction Across Boundaries Supplier Interactions Customer Interactions Data Acquisition Warehousing Absence of Tensions Implementation Mitigating Value Leakage Higher Levels of Digitalization Nonlinear U-Shaped Effect Interaction Effect Company Performance

Excerpt Range: Page 1: 4066-4367

Digitalization is transforming ecosystems and value chains inmanufacturing companies, changing how these companies interactacross the rm boundaries

upstream or downstream, improving sup-plier and customer interactions, and enhancing data acquisition,warehousing, big data analytics, and implementation

4. Title: From servitization to digital servitization- How digitalization transforms companies' transition towards services.pdf

Codes Applied: Business Model Innovations Servitization as a Business Strategy Digital Servitization Radical Change Key Challenges

Excerpt Range: Page 1: 1166-1503

Servitization and digitalization are two business model innovations that have affected product companies. From the convergence of these two trends, digital servitization emerged as a novel concept. Digital servitization pushes product companies to radically transform their business model, creating new challenges for its implementation.

5. Title: Digital-servitization-in-manufacturing--A-systematic-_2020_Industrial-Market.pdf

Codes Applied: Service Delivery and Business Models Digital Servitization Facilitation by Digital Technologies Digital Integration in Service Delivery

Excerpt Range: Page 1: 4159-4354

product-centric companies introduce digital technolo-gies to increase service delivery e◎ciency and the value of product-service o◎erings while simultaneously changing processes and businessmodels

6. Title: Transformational shifts through digital servitization.pdf

Codes Applied: Digitalization for Service GrowthStrategic Organizational Shifts Overemphasis on Technology

Excerpt Range: Page 1: 885-1193

Manufacturers increasingly look to digitalization to drive service growth. However, success is far from guar-anteed, and many rms focus too much on technology. Adopting a discovery-oriented, theories-in-use approach,this study examines the strategic organizational shifts that underpin digital servitization.

7. Title: Transformational shifts through digital servitization.pdf

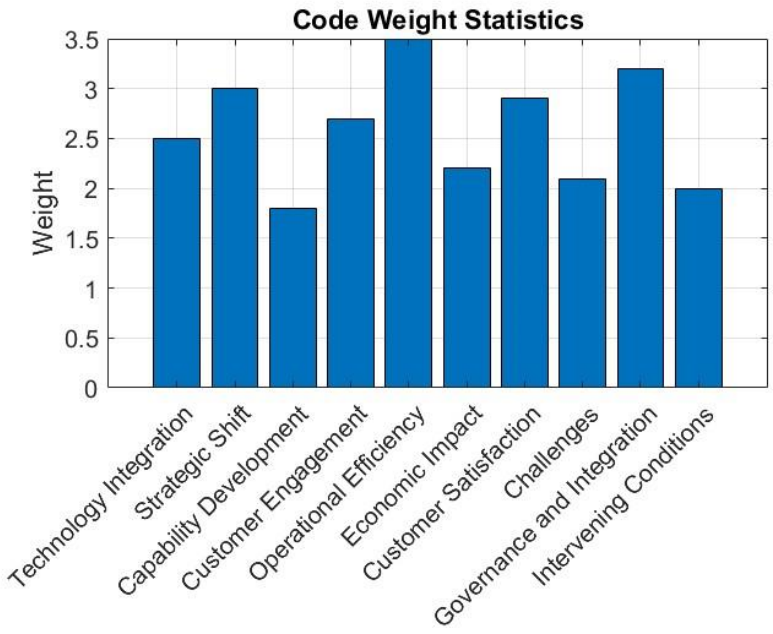
Codes Applied: Radical Change Identity Transformation Digital Technology Company Operations Alteration

Excerpt Range: Page 1: 5733-6065

Navarch's digitalservitization transformation entailed a radical change in the rm'sidentity and self-perception of its core business and operations. Thistransformation positioned the rm as a “digital technology company,”and employees began to perceive the rm as “completely dependent onconstantly developing new digital technology.

B Appendix B

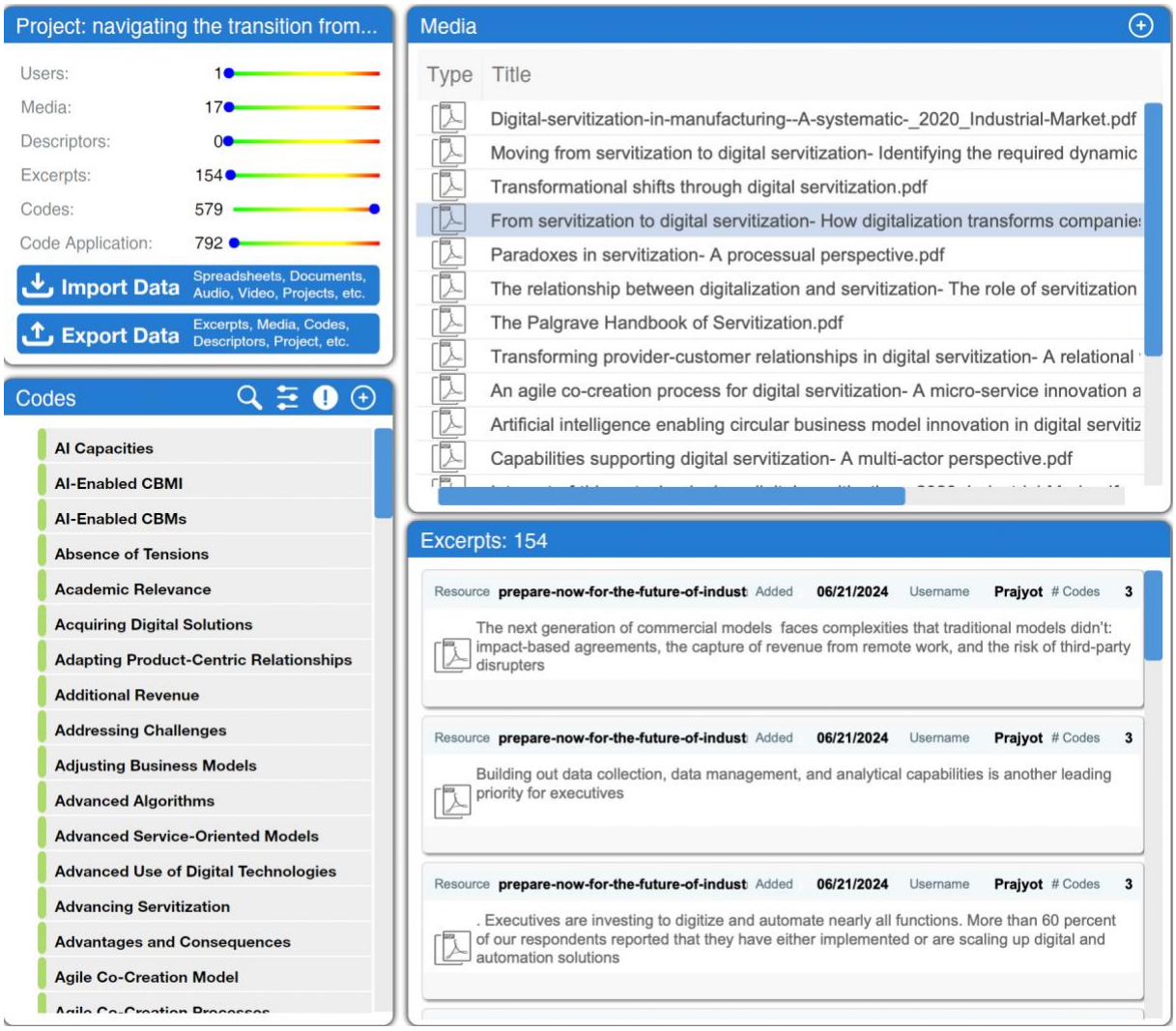
B.1. Code weight Statistics



B.2. Packed Code Cloud with Themes

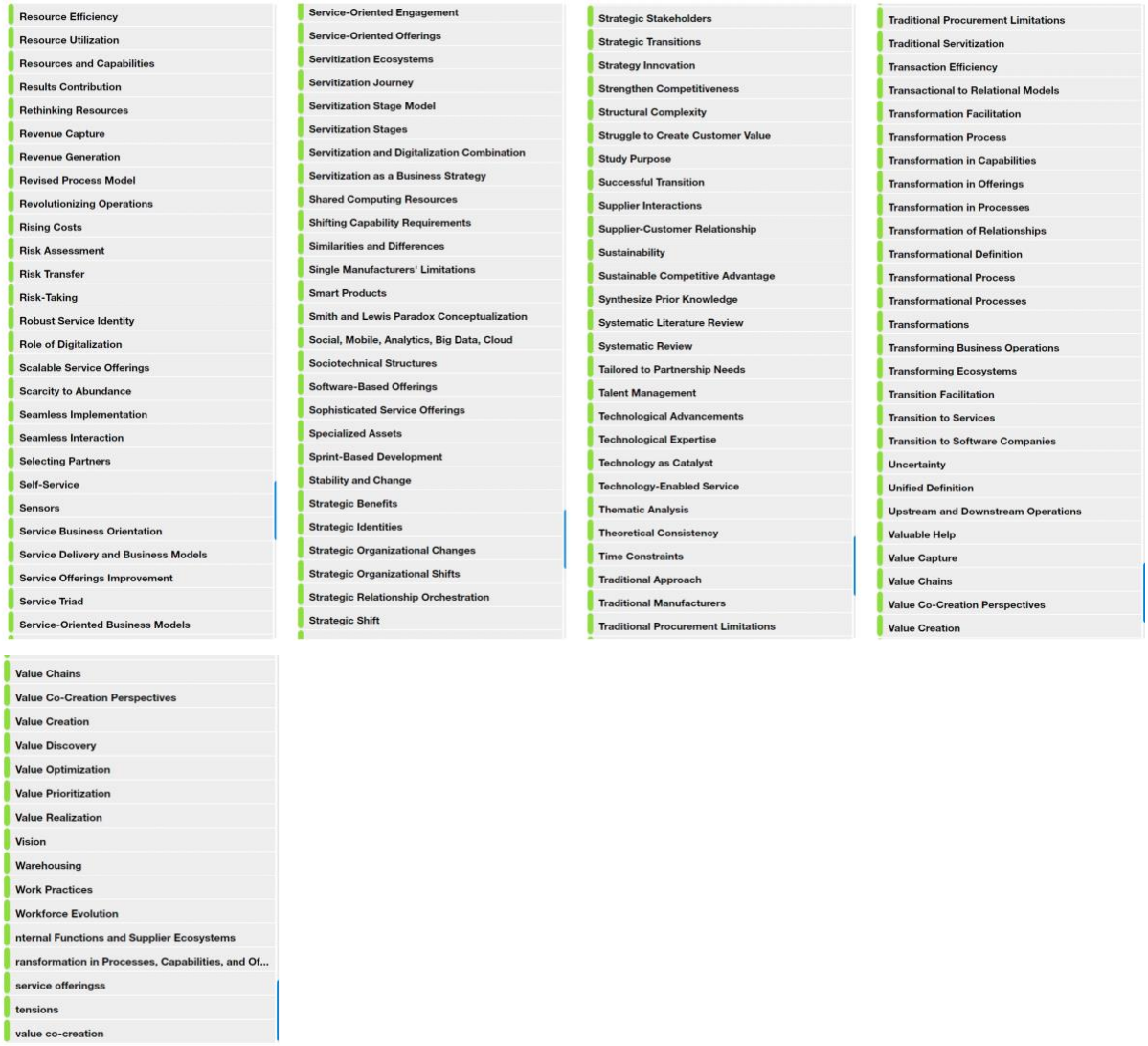
B.3. Homepage of Dedoose software

Overview of number of excerpts and open child codes.



B.4. List of all the Child Codes

Implementation
Implementing Micro-Services
Improved Decision-Making
Incentivizing Innovation
Increase in Studies
Increased Profits
Increased Revenues
Increased Service Value
Increasing Use of IoT
Incremental Investments
Industrial Firms
Industrial Goods and Services
Industrial Internet
Industrial Manufacturers
Industrial Services
Industrial Sustainability
Industry 4.0
Influencing Dimensions
Information Superabundance
Information and Communication Technologies
Infrastructure
Initial Exploration
Innovation Process Adjustments
Innovation through Digitalization
Innovative Combinations
Insufficient Digitalization
Intangible and Uncertain Solutions
Integrated Systems
Integration of Digital Technologies
Integration of Servitization and Digitization
Integration of Software and Hardware
Integration with Customer Technologies
Interaction Across Boundaries
Interaction Effect
Interaction Patterns
Interactions
Interactive Communication
Interfirm Transactions
Intermediaries
Intermediate Services
Internal Functions and Supplier Ecosystems
Interorganizational Tensions
Interplay
Interplay Between Dimensions
Interplay of Products, Services, and Software
Intraorganizational Tensions
Investment in Digital Services
Investment in Relationships
IoT
IoT Impact on Business Models
IoT Opportunities
IoT and Service-Based Models
IoT, Big Data, AI, Cloud Computing
IoT-Based Models
IoT-Driven Transformation
Joint Input
Key Capabilities
Key Challenges
Key Suppliers
Knowledge Management
Knowledge Pooling
Knowledge Transfer and Recombination
Knowledge-Sharing Routines
Lack of Clarity
Lack of Control
Lack of Interoperability
Leadership Support
Learning Paradoxes
Learning Tensions
Learning by Doing
Leveraging Capabilities
Leveraging Digital Technology
Limited Empirical Data
Limited Profit Gains
Limited Resources
Long-Term Commitment
Long-Term Relationships
Maintenance Capabilities
Managing Tensions
Manufacturer-Customer Relationships
Manufacturers' Strategies
Manufacturing
Manufacturing Struggles
Mapping Opportunities
Market Segments
Market Valuation
Merging Goods and Services
Methodological Approaches
Microfoundations
Minimal Management Effort
Minimize Downtime
Mitigating Value Leakage
Mixed Outcomes
Motivations
Multi-Actor Collaboration
Network Concepts
Network Transformation
Networks
New Business Models
New Business Opportunities
New Capabilities
New Challenges
New Offerings
New Processes, Software, Systems
New Products and Services
New Relational Perspective
New Revenue Streams
New Roles
New Sources of Value
New Ways of Working
Non-Financial Performance
Nonlinear Performance Link
Nonlinear U-Shaped Effect
Novel Procurement Practices
Novel Service Offerings
Offering Transformation
On-Demand Network Access
Operating Cost Reduction
Operational Efficiency
Operations Alteration
Opportunities for Servitization
Optimization Solutions
Optimizing Customer Operations
Optimizing Supply Chain
Orchestrating Relationships
Organizational Identity
Organizational Implications
Organizational Principles
Organizational Silos
Organizational Structures
Organizing Paradoxes
Organizing Tensions
Outcome-Based Service Provider
Outcome-Oriented
Overarching Principles
Overemphasis on Technology
Paradox Theory
Paradox of Organizing
Paradoxical Tensions
Paradoxical Transformation
Partnership Governance
Perceptive Capacity
Performance Priorities
Performing Paradoxes
Performing Tensions
Phases and Activities
Physical Assets to Services and Solutions
Planning and Implementation
Platform Strategy
Platform-Based Coopetition
Positive Performance Effect
Positive Performance EffectsText Segment 7:
Potential Servitization Exploitation
Potential Sustainability Impacts
Power Relationships
Practical Relevance
Predictive Analytics
Predictive Capacity
Prescriptive Capacity
Prioritizing Digital Investment
Process Transformation
Process-Oriented
Processes
Processual Perspective
Procurement 4.0 Definition
Procurement 4.0 Process Model
Product Delivery Capabilities
Product Development
Product Expertise Development
Product Performance
Product and Service Integration
Product and Service Units
Product-Centered to Service-Centered
Product-Centric to Service-Centric
Product-Centric to Service-Oriented Migration
Product-Oriented
Product-Service Combinations
Product-Service Systems
Production Efficiency
Professional Identity
Profitability
Profitable Revenue
Profitable Servitization
Profound Change
Profound Effect
Promoting Innovation
Provider Benefits
Qualitative Research
Radical Business Model Transformation
Radical Change
Radical Changes
Radical Shift in Logic
Range of Paradoxical Tensions
Rapid Changes
Rapid Development of Digital Technologies
Rapid Provisioning
Rapid Technological Change
Real-Time Data Analysis
Real-Time Feedback
Real-Time Tracking
Recent Research Stream
Reconfiguration of Resources
Reduce Costs
Reduced Environmental Impact
Refining Internal Processes
Relation-Specific Digital Assets
Relational Teams
Relational Transformation
Relational View Theory
Relationship Management
Relevance of Innovations
Remote Diagnostics
Remote Optimization Service
Remote-First Service
Research Gaps
Research Infancy


Resource Efficiency
Resource Utilization
Resources and Capabilities
Results Contribution
Rethinking Resources
Revenue Capture
Revenue Generation
Revised Process Model
Revolutionizing Operations
Rising Costs
Risk Assessment
Risk Transfer
Risk-Taking
Robust Service Identity
Role of Digitalization
Scalable Service Offerings
Scarcity to Abundance
Seamless Implementation
Seamless Interaction
Selecting Partners
Self-Service
Sensors
Service Business Orientation
Service Delivery and Business Models
Service Offerings Improvement
Service Triad
Service-Oriented Business Models
Service-Oriented Engagement
Service-Oriented Offerings
Servitization Ecosystems
Servitization Journey
Servitization Stage Model
Servitization Stages
Servitization and Digitalization Combination
Servitization as a Business Strategy
Shared Computing Resources
Shifting Capability Requirements
Similarities and Differences
Single Manufacturers' Limitations
Smart Products
Smith and Lewis Paradox Conceptualization
Social, Mobile, Analytics, Big Data, Cloud
Sociotechnical Structures
Software-Based Offerings
Sophisticated Service Offerings
Specialized Assets
Sprint-Based Development
Stability and Change
Strategic Benefits
Strategic Identities
Strategic Organizational Changes
Strategic Organizational Shifts
Strategic Relationship Orchestration
Strategic Shift
Strategic Stakeholders
Strategic Transitions
Strategy Innovation
Strengthen Competitiveness
Structural Complexity
Struggle to Create Customer Value
Study Purpose
Successful Transition
Supplier Interactions
Supplier-Customer Relationship
Sustainability
Sustainable Competitive Advantage
Synthesize Prior Knowledge
Systematic Literature Review
Systematic Review
Tailored to Partnership Needs
Talent Management
Technological Advancements
Technological Expertise
Technology as Catalyst
Technology-Enabled Service
Thematic Analysis
Theoretical Consistency
Time Constraints
Traditional Approach
Traditional Manufacturers
Traditional Procurement Limitations
Traditional Procurement Limitations
Traditional Servitization
Transaction Efficiency
Transactional to Relational Models
Transformation Facilitation
Transformation Process
Transformation in Capabilities
Transformation in Offerings
Transformation in Processes
Transformation of Relationships
Transformational Definition
Transformational Process
Transformational Processes
Transformations
Transforming Business Operations
Transforming Ecosystems
Transition Facilitation
Transition to Services
Transition to Software Companies
Uncertainty
Unified Definition
Upstream and Downstream Operations
Valuable Help
Value Capture
Value Chains
Value Co-Creation Perspectives
Value Creation
Value Chains
Value Co-Creation Perspectives
Value Creation
Value Discovery
Value Optimization
Value Prioritization
Value Realization
Vision
Warehousing
Work Practices
Workforce Evolution
nternal Functions and Supplier Ecosystems
ransformation in Processes, Capabilities, and Of...
service offeringss
tensions
value co-creation

List of Figures

Figure 3.1 Selection Criteria 18
Figure 3.2 Selection Criteria 18
Figure 3.3 Code Count x Media 21
Figure 4.1 Packed Code Cloud 22
Figure 4.2 Code Presence heat map 26
Figure 5.1 Code Co-occurrence Matrix 46
Figure 5.2 Proposed Model 54

List of Tables

Table 3.1 Five-stage grounded-theory method [5] 16
Table 4.1 Grouping of the codes into major themes/categories 23

List of Abbreviations

AI - Artificial Intelligence

CBMI - Circular Business Model Innovation

CAPEX - Capital Expenditure

DS - Digital Servitization

GT - Grounded Theory

ICT - Information and Communication Technology

IoT - Internet of Things

OPEX - Operational Expenditure

ROI - Return on Investment

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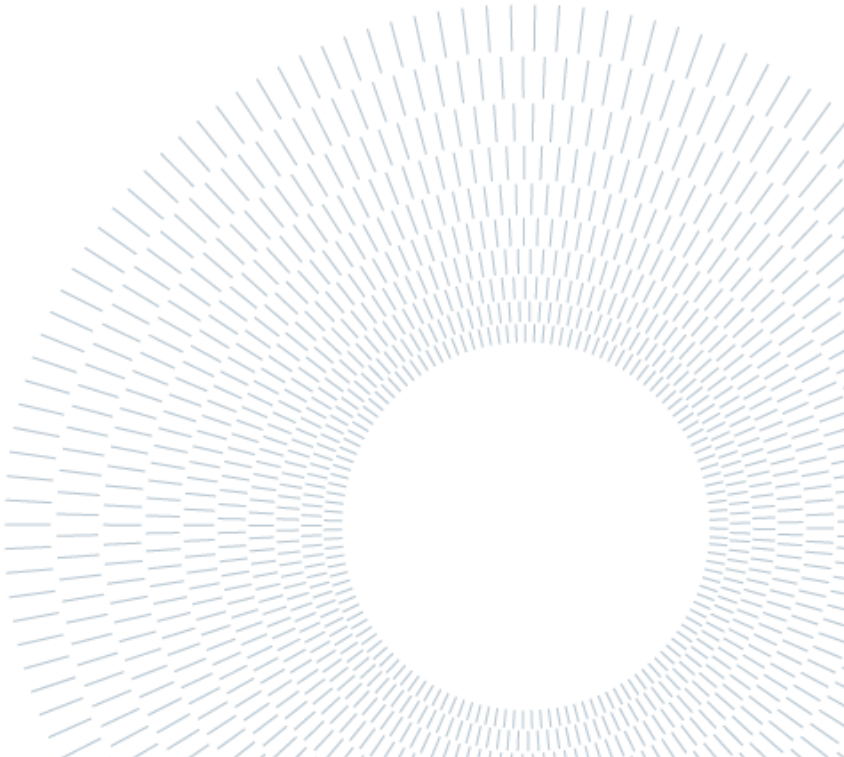
Prajyot Ramesh Hemade

July, 2024