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Digitization of B2B After-Sales Processes

An investigation of the supplier and customer perspective in the context of the digitalization of after-sales processes and emerging opportunities

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Abstract

Digitization of B2B After-Sales Processes. An investigation of the supplier and customer perspective in the context of the digitalization of after-sales processes and emerging opportunities

Today, industrial B2B manufacturers face a rapidly changing environment, exacerbated by increasing globalization and associated shifts in the competitive landscape. Digital transformation and the emergence of new innovations and technologies are forcing companies to rethink their business models and offerings to integrate digital services to strengthen competitive advantages. Suppliers are becoming more deeply involved in customer processes through digital after-sales services, with the aim of exploiting efficiencies. Following the servitization transformation, companies intend to change their purpose from focusing on the pure physical product to becoming a service provider with emphasis on value creation and the capture of the customer.

To investigate how customer and supplier perspectives agree and what requirements each side has for digital after-sales services, exploratory qualitative research was conducted with customers and suppliers by means of one-on-one interviews. The thesis aimed to assess the status, progress, and future possibilities of implementing digital after-sales services and business models based on them. Research shows that the far-reaching establishment of product-accompanying services with strong connectivity and customer-centricity is primarily relevant. Disruptive business models still require a mind-shift and organizational readiness on the part of both customers and suppliers. In principle, digitization in after-sales interaction is beneficial and should be steadily advanced to make customer processes as well as further developments at the supplier level more efficient and well-founded through the analysis of real data. Overall, this thesis outlines important aspects that need to be considered while developing digital service innovations to deal with customer demands appropriately.

Keywords: Servitization, Digital After-Sales Services, Predictive Maintenance, Remote Monitoring, Digital Interaction, Digital Service Innovation, Digital Service Innovation Process

Kurzreferat

Digitalisierung von B2B-After-Sales-Prozessen. Eine Betrachtung der Anbieter- und Kundenperspektive im Kontext der Digitalisierung von After-Sales-Prozessen und der sich daraus ergebenden Chancen

Industrielle B2B-Produktionsbetriebe sehen sich heutzutage mit einer sich schnell verändernden Umwelt konfrontiert, verschärft durch die zunehmende Globalisierung und die damit einhergehenden Verschiebungen in der Wettbewerbslandschaft. Der digitale Wandel und die Entwicklung neuer Innovationen und Technologien treiben Unternehmen dazu, ihre Geschäftsmodelle und Angebote zu überdenken und digitale Dienstleistungen zu integrieren, um Wettbewerbsvorteile zu stärken. Dabei werden die Anbieter durch digitale Serviceangebote stärker in die Kundenprozesse eingebunden, um Effizienzsteigerungen zu erzielen. Im Zuge der Servicetransformation beabsichtigen Unternehmen, sich von einem reinen physischen Produktanbieter zu einem Dienstleister mit Schwerpunkt auf der Wertschöpfung und -schaffung beim Kunden zu wandeln.

Um herauszufinden, inwieweit Kunden- und Lieferantenperspektive ineinandergreifen und welche Anforderungen beide Seiten an digitale After-Sales Services haben, wurde eine explorative qualitative Forschung mit Kunden und Lieferanten dieser in Form von Einzelinterviews durchgeführt. Ziel der Arbeit war es, den aktuellen Stand, den Fortschritt und die zukünftigen Möglichkeiten der Umsetzung von digitalen After-Sales Services und darauf basierenden Geschäftsmodellen herauszufinden. Die Untersuchung zeigt, dass vor allem die weitreichende Etablierung von produktbegleitenden Dienstleistungen mit starker Konnektivität und Kundenzentrierung relevant ist. Disruptive Geschäftsmodelle erfordern nach wie vor ein Umdenken und Schaffung nötiger Rahmenbedingungen von Unternehmen, sowohl auf Kunden- als auch auf Anbieterseite. Grundsätzlich wird die Digitalisierung der Interaktion im After-Sales als vorteilhaft angesehen und sollte stetig vorangetrieben werden, um Kundenprozesse sowie Weiterentwicklungen beim Lieferanten effizienter und, durch die Analyse von realen Daten, fundierter zu gestalten. Somit zeigt diese Arbeit wichtige Aspekte auf, die bei der Entwicklung digitaler Serviceinnovationen zu beachten sind, um den Kundenanforderungen angemessen zu begegnen.

Keywords: Digitale After-Sales Services, Vorausschauende Wartung, Fernüberwachung, Digitale Interaktion, Digitale Dienstleistungsinnovation, Digitaler Dienstleistungsinnovationsprozess

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List of Abbreviations & Symbols

AI	Artificial Intelligence
AR	Augmented Reality
AS	After-Sales Service(s)
B2B	Business-to-Business
B2C	Business-to-Consumer
CRM	Customer Relationship Management
CUS	Customer
e.g.	exempli gratia; for example
ERP	Enterprise Resource Planning
et al.	et alia; and others
ICT	Information and Communication Technology
I	Interviewer
i.e.	id est; that is
inc.	incomprehensible
IoT	Internet of Things
KPI	Key Performance Indicator
MVP	Minimum Viable Product
NSD	New Service Development
p.	page(s)
pos.	position
PSS	Product-Service System(s)
QR code	Quick response code
SUP	Supplier
S-D logic	Service-dominant logic
VR	Virtual Reality
XaaS	Everything as a Service

1 Chapter of Introduction

The first main chapter introduces the focus of the research by elaborating on the research background as a basis for the development of the research question and introduces the objectives of the master thesis.

1.1 Background & Problem Statement

The megatrend toward digitization takes place in many areas of a company, facilitating processes, pursuing increased efficiency, and changing the role of the manufacturer. A growing number of businesses are embracing digitization, transforming their activities and, in turn, the way they interact and maintain relationships with customers.[1] A variety of new technologies are transforming previously established processes and enabling new ways of aligning organizational structures, collaborations, product-related services, as well as subsequent business models.[2] Offering additional services to the delivery of the physical product is therefore becoming increasingly important as customer expectations rise. This enables companies to gain a market advantage and differentiate themselves by offering added value.[3] In this context, the term servitization emerges, particularly among industrial manufacturers, to describe the transformational shift from a purely product-oriented company to a service provider.[4] These services can be exemplified by more sophisticated customer service and facilitated repurchases.[5]

In recent years, the after-sales area has transformed, highlighting the strategic importance of service delivery and the necessity to meet customers' expectations of having a direct point of contact within the company.[6] Dombrowski et al. (2020) emphasize that it is essential for industrial manufacturers to develop their after-sales processes, accordingly, in the wake of digitization to exploit the potential. This can then lead to more efficient processes, but also the creation of new digital business models. New market entrants, especially, are often concerned with advanced digital, mostly platform-based, sales and service options. In this context, customers expect innovative concepts, particularly for interaction with the manufacturer, but also the improvement of their processes and use of products that require the application of new technologies.[7] In that respect, Rodríguez et al. (2020) argue, that complete digitization of service processes in B2B is impossible due to the great importance of personal interaction and its complexity.[8] Giese and Igou (2020) surveyed B2B companies and found that increasing customer satisfaction, realizing revenue potential, and achieving cost benefits were the three

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[1] Mattila; Yrjölä; Hautamäki 2021.
[2] Tronvoll et al. 2020, p. 293.
[3] Ahlers et al. 2021, p. 310; Dombrowski; Fochler; Malorny; et al. 2020, p. 1, 6; Homburg; Schäfer; Schneider 2016, p. 44; Kretzschmar et al. 2017, p. 15; Oliva; Kallenberg 2003, p. 160; Ritter; Pedersen 2020, p. 180.
[4] Baines et al. 2009, p. 554.
[5] Cáceres; Guzmán 2015, p. 362; Dombrowski; Fochler; Malorny; et al. 2020, p. 1; Hildenbrand; Gebauer; Fleisch 2006, p. 73.
[6] Dombrowski; Fochler; Malorny; et al. 2020, p. 125.
[7] Dombrowski; Fochler; Malorny; et al. 2020, p. 311–315.
[8] Rodríguez; Svensson; Mehl 2020, p. 10.

most common reasons for digitizing AS.[9] In 2018, one-third of Austrian industrial manufacturers had at least one form of digital service that is supported by data as Industry 4.0 develops. As a result, new business models are evolving, which at this point, already account for seven to eight percent of revenue. The trend is particularly popular among companies with a technical focus, such as the automotive and mechanical engineering sectors.[10]

There is tremendous potential in the digitization of AS that goes far beyond traditional options such as support hotlines or on-site maintenance services. Different new possibilities, such as the use of bots or machine learning are emerging and are the first pillars for further innovative solution approaches including predictive maintenance, data analytics, or app-based services.[11] For companies in industrial manufacturing, the orientation toward service provision is an essential step to remain attractive to customers and competitive in the market.[12] In this context, the consulting company Deloitte (2020) found that manufacturers are still unaware of the potential of digital services as they still put their focus on differentiating themselves with technology and new product development. However, platform-based services, service networks, and subscription- or usage-based business models are already strategically significant and in demand and will continue to be so in the future.[13]

The fundamental issue identified is that processes are digitized in the direction of the customer without thoroughly exploring the customer's needs and preferences. This poses risks since every customer has a different perception and expectation regarding the right mix of digital and personal interaction with the manufacturing company. In addition, Baines et al. (2009) state that manufacturers need to consider the value to the customer of the service they offer to be successful, and therefore emphasize the need for further research.[14] This is confirmed by Rayburn, Anderson, and Fowler (2020), who stress that the failure of service offerings is often due to a lack of investigation of customer requirements.[15] It is important to note the so-called service paradox, i.e. the high level of investment by providers in expanding the range of services, but the lack of a corresponding increase in revenues, which is to be avoided.[16] Apparently, existing studies mainly examine the provider's perspective alone rather than in combination with the customer, and this is where the research gap is identified. Moreover, it is a field of research that needs to be further explored due to its timeliness and relevance, especially regarding the digitalization of AS and appropriate digital service innovation processes.[17]

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[9] Giese; Igou 2020, p. 8.
[10] Zahradnik et al. 2018, p. 22–23.
[11] Biesel; Hame 2020, p. 19; Deloitte 2020, p. 9, 12–15; Kretzschmar et al. 2017, p. 7.
[12] Bruhn; Hepp; Hadwich 2015, p. 135; Deloitte 2020, p. 10.
[13] Deloitte 2020, p. 8, 10.
[14] Baines et al. 2009, p. 11.
[15] Rayburn; Anderson; Fowler 2020.
[16] Gebauer; Fleisch; Friedli 2005, p. 14.
[17] Baines; Lightfoot 2014, p. 22; Gebauer et al. 2008, p. 392; Osterrieder 2021, p. 11; Troilo; De Luca; Guenzi 2017.

1.2 Research Question

The above-mentioned circumstances surrounding the trend of digitization in industrial manufacturers' B2B after-sales processes lead to the aim of investigating how customers perceive these changes and which aspects are or are not in line with their demands and expectations. This means finding out whether there are different views and approaches on the topic of digitization that pose a certain challenge within supplier and customer relationships, or whether they coincide. Therefore, the following research question, underpinned by sub-questions, forms the focus of the master's thesis.

How do after-sales services and repeat purchases qualify for digitization, and to what extent is in-person interaction necessary to strengthen customer potential in industrial manufacturing B2B companies?

a) *What are customers' expectations regarding the adoption of digital tools instead of direct personal interaction in the field of after-sales services and repurchasing?*

b) *What are the influences on customer expectations that make digitization of after-sales processes beneficial?*

c) *Which after-sales processes are best suited for digitization from the perspective of industrial manufacturing B2B companies?*

d) *Which of the after-sales and post-purchase areas are already digitized in industrial manufacturing B2B companies or are intended to become so?*

e) *Which after-sales processes are particularly suitable for digitization from the perspective of the customer and ought to be implemented as a matter of priority in industrial manufacturing B2B companies?*

For the sake of clarity, interaction in this context is understood as every possible touchpoint between customer and supplier regarding the after-sales area, be it during service development or service execution, personal or digital communication, or digital or physical access to products. In addition, processes are about services and repurchase opportunities for the customer, implying that services always refer to the after-sales area.

1.3 Research Objectives

The recently increasing relevance of the use and integration of services in industrial manufacturing B2B companies is a frequently studied topic in existing scientific literature.[18] Especially in times of great change, it is crucial to be prepared and proactive in responding to market conditions. As the COVID-19 crisis has shown, material resources are not permanently available and companies need flexible and quickly implementable new approaches, such as a digital service offers.[19] The aim of this work is therefore to identify starting points for future

[18] e.g. Baines et al. 2009; Coreynen; Matthyssens; Van Bockhaven 2017; Gebauer; Fleisch; Friedli 2005; Kowalkowski; Gebauer; Oliva 2017; Lerch; Gotsch 2015; Oliva; Kallenberg 2003.
[19] Wellener et al. 2020.

necessary implementations and requirements for digital services, but also their innovation process. The objectives are as follows:

- Providing an overview of the current digital AS landscape in industrial B2B manufacturing companies to derive open potentials.
- Identifying customer expectations of the digital AS and the context of the issues to be addressed.
- Investigating the extent to which the AS can be digitized to ensure acceptance on both sides.
- Identifying necessary additions or adaptations to service innovation processes to fit them into the realm of digital AS for industrial B2B manufacturers.

1.4 Research Methodology

A comprehensive review of literature in the areas of servitization, service innovation models, and after-sales services in the context of digitalization is conducted first. This is done to consolidate the already existing theoretical foundations and to create a common basis for understanding concepts and substance necessary for the further exploration of the topic.[20]

Since the field of research is not thoroughly covered by literature, an empirical investigation is to be carried out, focusing on an explorative qualitative research approach. Overall, this indicates that literature and qualitative research are examined to draw conclusions and point out similarities or differences. Moreover, the collected information is to be analyzed and interpreted by the author.[21] The evaluation is carried out according to Mayring's qualitative content analysis, including uniform coding methods supported by software.

Qualitative semi-structured interviews are conducted with internationally active industrial manufacturing B2B companies based in Austria. On the customer side, interviews are conducted with industrial companies that use such digital services in the after-sales area or are interested due to their innovative orientation. In this context, the theoretical foundation serves as the basis for deriving the interview guideline. This methodological approach was chosen because personal interaction with respondents in terms of their willingness to participate is critical to achieving the research objective.[22]

1.5 Target Group

Based on the dynamic transformation mentioned above and the need for the integration of services in industrial manufacturing, companies from this sector are considered the target group of the thesis. These are internationally active B2B companies in industrial manufacturing that offer digital services in the after-sales phase, or intend to do so. The main focus is on large and medium-sized companies that have a certain market presence and customer base,

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[20] Saunders; Lewis; Thornhill 2016, p. 70.
[21] Bell; Bryman; Harley 2019, p. 356.
[22] Saunders; Lewis; Thornhill 2016, p. 393–394.

as the thesis is aimed at existing customers. Furthermore, the B2B sector was chosen because simplified globalization is pushing companies to expand their range of offers to include value-creating services and to implement new business models. This is done because offering complementary services post-purchase is of great importance when there is a certain dependency or intended long-term customer-supplier-partnership. In addition, cross and up-selling opportunities become more attractive.[23] Above all, customer, and thus revenue potential increases when AS meets customer expectations.[24] For this reason, this master thesis deals with the perspective of the manufacturer, henceforth also referred to as the "supplier" or "provider", as well as companies that demand services from suppliers, hereinafter also referred to as "customers".

1.6 Structure of the Thesis

This thesis is divided into six main chapters with corresponding subchapters. The first chapter gives a brief introduction to the research objective and the underlying problem, including an outline of the research question and the methodology. In the second chapter, the theoretical foundations are laid out to provide a mutual understanding of the existing research on the topic, focusing on servitization, digital service innovation processes, industrial B2B after-sales, and customer integration. The third chapter deals with the empirical approach of the paper, explaining the chosen research methodology and data analysis as well as detailing the interview process. This is followed by the presentation of the results in chapter four. The fifth chapter discusses the key findings, and answers the targeted research questions. It also provides insights into the practical implications, and concludes with limitations and an outlook on further research opportunities. The sixth chapter contains a brief general conclusion in respect to the conducted research.

[23] Cohen; Lee 1990, p. 55; Hofbauer; Hellwig 2016, p. 320, 331; Giese; Igou 2020, p. 15; Reusche; Reichert 2017, p. 99; Rodríguez; Svensson; Mehl 2020, p. 3; Shokouhyar; Shokoohyar; Safari 2020, p. 1.
[24] Deloitte 2020, p. 5, 7.

2 Theoretical Foundation

As an introduction to the topic, a description of the issue of service transformation and the orientation of B2B companies that are pushing for greater integration, or the transition to a solution or even sole service providers is given. New service innovation and various process models, a key component of the thesis, is likewise discussed here. Finally, after-sales services in the industrial business environment are elaborated. Particular attention is paid to digital services and their potential, which also includes new business models and the perspective of the customer.

2.1 Digital Service Transformation

The following section presents selected relevant issues in service research in the field of industrial manufacturing. The focus here is on the effects of digitization on service provision and digital service innovation processes. To explore the customer aspect, emerging approaches such as the co-creation of service values and business relationships are considered in greater detail.

2.1.1 Characteristics of Industrial B2B Services

Preliminary, aspects of industrial B2B services are considered to allow a uniform understanding and to distinguish them from B2C services, which are widely distributed in the private sector. Kotler and Keller (2016) provide a basic definition of services, describing them as "any act or performance that one party can offer to another that is essentially intangible and does not result in the ownership of anything. Its production may or may not be tied to a physical product".[25] Industrial services differ from others in that they are generally offered and provided in conjunction with the physical product. This results in a service system, with services such as maintenance and repair being classified as industrial services.[26]

Industrial manufacturing companies must consider their target audience and the market environment when developing services. B2C markets require different approaches than B2B, which has substantial implications for the design of the service environment. Customer service in the B2B sector is completely different and has far greater significance and scale than in a B2C constellation. In general, the sales and marketing activities diverge, reflecting the diverse needs of the customers. B2B relationships pursue the goal of generating value for both sides. Here, reference can be made to the products offered as well as the corresponding service.[27] Moreover, B2B services are aimed at a company that procures goods and services either for its production or for resale. For example, these may be machines, equipment, or raw materials that require certain services.[28]

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[25] Kotler; Keller 2016, p. 184.
[26] Schuh; Gudergan 2016, p. 8.
[27] Lilien; Grewal 2012, p. 3–4.
[28] Homburg; Schneider 2001, p. 589; Kreutzer; Rumler; Wille-Baumkauff 2015, p. 13; Voeth; Loos 2012, p. 373.

In addition, B2B customers have a greater lifetime value, as the general intention is to build long-term relationships and therefore have a significant impact on the overall company revenue. This results from the fact that B2B companies face a smaller number of customers and often deal with different business areas. The services and the longer life of the products are particularly important here. These customers often have multiple contacts and decision-makers within the buying company and act more rationally than B2C buyers. This is related to the goals associated with the purchase for the company.[29] Moreover, excellent customer care strengthens customer loyalty, as the interaction between supplier and customer is reinforced and generally intensified by tailored services. Hence, customer service activities have a major impact on the repurchase propensity of products and services, but require the acquisition of specific new competencies and resources to achieve this.[30]

To define the general framework for digital services, it is necessary to identify their elementary characteristics. Scholars generally recognize them as intangibility, heterogeneity, inseparability, and perishability.[31]

- **Intangibility** refers to the impalpability or perceptibility of services, i.e., they are not materially tangible and have more the character of a performance or an endeavor. It is usually only possible to assess the performance of a service innovation based on customer feedback.
- **Heterogeneity** explains that services are not fully standardized, as they are tied to the desired outcome, the performance of the actors involved, and the participation of customers. In addition, the environment, the individual service provider, and the different contexts make fulfillment more dynamic.
- **Inseparability** highlights the simultaneous consumption and provision of the service, as they are sold before production takes place.
- **Perishability** denotes the impossibility of storage or resale, as opposed to material products.[32]

Services are therefore multidimensional and carry a certain complexity since the customer is involved in any case and performance frequently takes place in the purchaser's sphere. This, in turn, allows a higher level of customization and provider-customer collaboration, which builds on the heterogeneity of service provision.[33]

2.1.2 Servitization

As Levitt noted back in 1972, all businesses are in the service sector, more intensively in some industries, and less so in others. Especially when it comes to high-tech products, customer service is indispensable and ascribes an essential role to the service offers of industrial

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[29] Kleinaltenkamp; Jacob; Plötner 2015, p. 21–22; Kreutzer; Rumler; Wille-Baumkauff 2015, p. 13–16; Kuß; Kleinaltenkamp 2016, p. 34; Lilien; Grewal 2012, p. 3.
[30] Kindström; Kowalkowski 2009, p. 157; Nezami; Worm; Palmatier 2018.
[31] Moeller 2010, p. 362; Randhawa; Scerri 2015, p. 29.
[32] Moeller 2010, p. 362; Randhawa; Scerri 2015, p. 29–30.
[33] Randhawa; Scerri 2015, p. 30.

manufacturers.[34] Since the early 1990s, servitization has gained prominence in theories of innovation, especially in the 21st century scientific literature.[35] In the past, services were rather treated as a "necessary evil" to better market goods, with the product at the center of value creation. However, the tide has turned, and services function as tactical tools and are offered as an integral part of the physical product.[36]

Service development is increasingly becoming a strategically important issue for manufacturing firms. Particularly given the constantly growing competition, a certain degree of differentiation is essential to retain and win over customers with their gradually heterogeneous demands.[37] Therefore, there is a trend towards integrating and adapting services into the primary business activity, as they offer customers added value aligned to the product range. The phenomenon of servitization in industrial manufacturing refers to the transition of initially product-oriented companies to adjust their portfolio, and offer a combination of products and services to become service providers as well.[38] Vandermerwe and Rada (1988) substantially coined the term, indicating that "firms offer 'bundles' consisting of customer-focused combinations of goods, services, support, self-service, and knowledge".[39] Baines et al. (2009) built upon that and defined servitization as "the innovation of an organisations capabilities and processes to better create mutual value through a shift from selling product to selling PSS".[40] Figure 1 illustrates the transformation companies are undergoing as they move toward servitization and shift to services as a value driver.

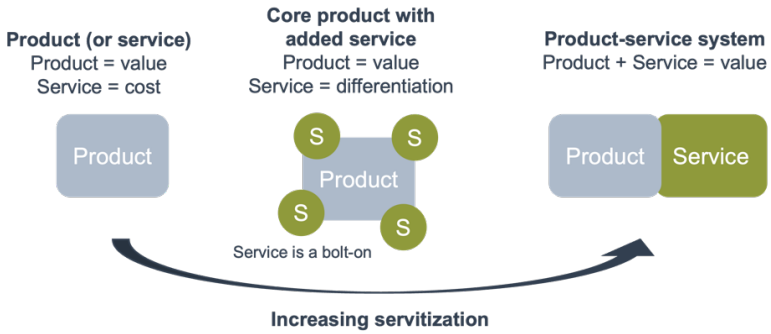

Figure 1: Product-Service System (PSS) Continuum Stages[41]

Kohtamäki et al. (2021) elaborate a definition from summarized terms used synonymously with servitization in scientific literature.

[34] Levitt 1972.
[35] Kohtamäki et al. 2021, p. 3.
[36] Baines et al. 2009, p. 555–556.
[37] Baines et al. 2009, p. 554; Cenamor; Sjödin; Parida 2017, p. 55; Coreynen; Matthyssens; Van Bockhaven 2017, p. 42; Duschek 2016, p. 26–27; Dressel; Pfeiffer 2011, p. 28; Lay 2014, p. 1–2; West; Gaiardelli; Saccani 2022, p. 4.
[38] Baines et al. 2009, p. 554; Coreynen; Matthyssens; Van Bockhaven 2017, p. 42; Lay 2014, p. 1–2; Osterrieder 2021, p. 7.
[39] Vandermerwe; Rada 1988, p. 316.
[40] Baines et al. 2009, p. 555.
[41] Own illustration based on West; Gaiardelli; Saccani 2022, p. 5.

> *At the core, servitization is about the transition from product to service logic, often involving a complex integration of product-service-software systems, where the ideal-typical form of service logic can be understood as a customer paying for the realized value in use.*[42]

Moreover, Vargo and Lusch (2007) invented the term service-dominant logic, S-D logic, in which they emphasize the importance of the services offered by companies. In doing so, they note that a turnaround is taking place and it is no longer about the pure product, but rather about the value that customers receive from services and the competence of the providers contained therein.[43] What all definitions have in common is that the traditional notion of stand-alone products is changing and moving towards value-added services. These services go beyond physical maintenance, repair and education to include sophisticated and customized options. Furthermore, manufacturers are increasingly becoming solution providers, offering a complete package of products and services to gain a competitive advantage.[44]

Among the reasons for this are the fact that customer requirements and the possibilities for exchanging information are evolving, and globalization is gaining significance, which is leading to a new competitive situation. Besides, there is a need for transformation due to saturated markets and increasing innovation activities in the product and service area.[45] Predominantly, the drivers of servitization are in the areas of finance, strategy, and marketing. Long-lived products, such as those in mechanical engineering, show revenue potential since services are to be performed continuously throughout the product's life. This ranges from maintenance to specific spare parts and repairs, and is closely associated with continuous operational readiness, reliability, and output. In general, services offer higher margins and, due to the necessary expertise, an obstacle to imitation by competitors. Another driver of this transformation process is customer demand, as they are keen to focus on their core business. They expect suppliers to provide services that are related to their performance, which is to be improved as a result. That enables the establishment and care of an intensive business relationship through enhanced offers.[46] Additionally, firms must evolve with the times and rely on emerging technologies to counteract declining profit margins in manufacturing.[47]

Vandermerwe and Rada (1988) already stated that customization of the services offered is anticipated, which is supported by the integration of technology and thus allows flexible solutions adapted to the customer's needs.[48] However, the rapid surge in complexity due to innovative tools results in an increased need for service provision.[49] There is a discernible shift from free standard services to complex solutions and value-generation that can provide an income stream apart from or including the manufactured asset.[50] In response to these drivers, a service-based business model can be derived in which the service is seen as the central

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[42] Kohtamäki et al. 2021, p. 3.
[43] Lusch; Vargo; O'Brien 2007, p. 9.
[44] Lerch; Gotsch 2015, p. 76.
[45] Kamal et al. 2020, p. 2.
[46] Baines et al. 2009, p. 556–557; Fließ; Lexutt 2016, p. 51–52; Oliva; Kallenberg 2003, p. 160; Osterrieder 2021, p. 8.
[47] Martín-Peña; Sánchez-López; Díaz-Garrido 2020, p. 565.
[48] Vandermerwe; Rada 1988, p. 318.
[49] Kleinaltenkamp; Jacob; Plötner 2015, p. 314.
[50] Hogreve 2013, p. 87; West; Gaiardelli; Saccani 2022, p. 4–6.

anchor point.[51] Servitization is therefore perceived as an innovation process that impacts the company's business model and in this context leads not only to enhanced performance and user satisfaction but also to market advantages.[52] Figure 2 depicts the transition from a pure industrial goods manufacturer to the most extreme form, a service-only business. In other words, from a transaction-based product to a service or even solution delivery. Particularly, the scope of services and the general strategic service orientation in the company become apparent.

Figure 2: Servitization Transformation Line[53]

Wellener et al. (2020) note that industrial manufacturers are currently mostly located where core products are sold with additional services. However, the trend is going in the right direction, because it is vital to develop according to the greatest benefit for the customer.[54] According to Bruhn and Hadwich (2016) along with Kohtamäki, Rabetino and Einola (2018), the terms "servitization", "service infusion", "service transition" or "service transformation" are used interchangeably in literature, which is applied in this thesis as well.[55] The opportunities presented by service innovations or servitization and their impact are explained in following chapters.

Product-Service Systems

Over time, numerous forms of servitization have evolved and are becoming increasingly important for industrial manufacturers as hybrid bundles, integrated solutions, and product-service systems that form combinations of products and services. More and more product-service systems (PSS) and, consequently, new business models have appeared on the market that attach promising relevance to the service offer.[56] These are customer value-enhancing bundles consisting of products and integrated services that result from the servitization development process.[57] Tukker (2004) is deeply involved in the subject matter and defines PSS as a combination of intangible services and tangible assets that can meet individual customer needs.[58] Considering the PSS continuum below, it is clear that the situation is ideally shifting

[51] Paluch 2017.
[52] Pistoni; Songini 2017, p. 9.
[53] Own illustration translated by the author based on Schuh; Gudergan; Thomassen; et al. 2016, p. 44 accroding to Hildenbrand 2006.
[54] Wellener et al. 2020.
[55] Bruhn; Hadwich 2016, p. 8; Kohtamäki; Rabetino; Einola 2018.
[56] Fließ; Lexutt 2016, p. 51; West; Gaiardelli; Saccani 2022, p. 4–6.
[57] Bakås et al. 2013, p. 337; Buschak; Lerch; Gotsch 2014, p. 98.
[58] Tukker 2004, p. 246.

from being purely a product manufacturer to pursuing the service logic, a more service-oriented business model, delivering value in use.[59] Baines et al. (2009) explain this as a progression from services perceived as an add-on to products to products perceived as an add-on to services. The focus here is on customer centricity to meet customer requirements, creating a solution rather than a purely physical product.[60] In his widely used model, Figure 3, Tukker (2004) depicts the archetypal forms of PSS and classifies them into the product, use, or result-oriented systems.[61]

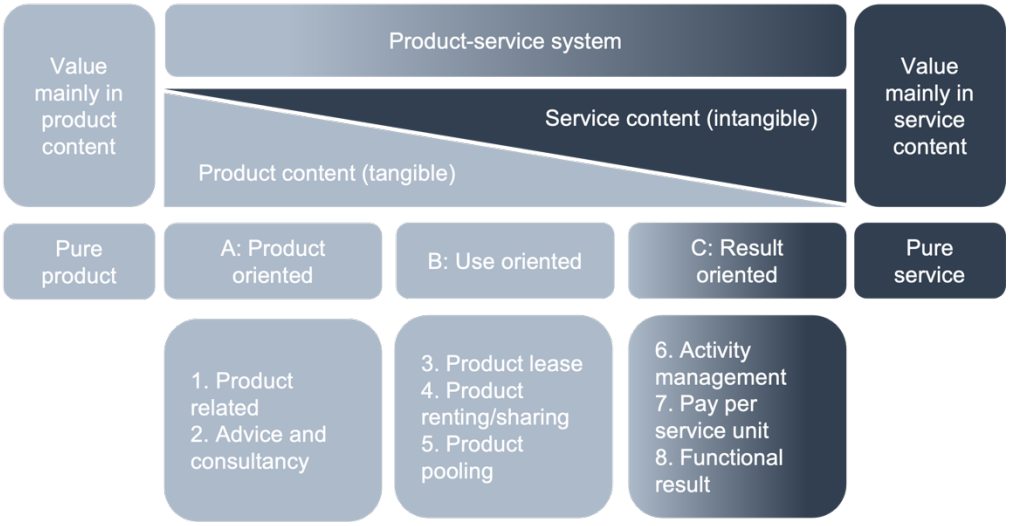

Figure 3: Product-Service Systems[62]

This phenomenon is frequently considered in the context of sustainability and thus the circular economy approach, which is supported by advanced technologies in the IoT sector. Paiola et al. (2021) discovered that digital services can impact the customer's sustainability regardless of the efficiency potential that they offer. A contribution is made by an enhanced and prolonged utilization of assets, i.e. an extension of the product life cycle, in the sense of intelligent solutions that detect and prevent potential damage at an early stage.[63] This is because resource-conserving business models that are revolutionary in terms of consumption and use are emerging, made possible by PSS.[64] In the long term, the pursuit of a PSS leads to business models that no longer focus on the mere sale of an asset itself combined with a standard service. Well-known here are outcome-based service offers, which state that at least part of the costs for the customer are based on guaranteed operational results. The trend is moving from ownership to service-oriented use that follows an operator model, where ownership rights and thus responsibility for functionality often lie with the original manufacturer.[65] However, this service-oriented approach does not have to be deployed exclusively on its own but can coexist with the product-oriented sales tactic, so that service bundles can be conveyed.[66] Such operator models entail considerable risks, as they create a mutual dependency and transfer the

[59] Kohtamäki et al. 2021, p. 13; Tukker 2004, p. 248.
[60] Baines et al. 2009, p. 557.
[61] Tukker 2004, p. 248.
[62] Own illustration based on Tukker 2004, p. 248.
[63] Paiola et al. 2021, p. 513–514.
[64] Kjaer et al. 2019, p. 23.
[65] Adrodegari et al. 2015, p. 245, 249; Korkeamäki; Kohtamäki; Parida 2021, p. 93.
[66] Kohtamäki et al. 2021, p. 13.

risk of the customer's success to the manufacturer. The more intensively the services are integrated into the offer, the higher the risk for the provider.[67] West, Gaiardelli and Saccani (2022) note that many existent business models in this area still focus on the sale of products and the provision of services alongside their use. Others combine both and offer usage-based PSS that do not sell a product but focus on marketing the service as a total solution.[68] For instance, a mechanical engineering company provides services tailored to the machines it sells, ensuring a long service life and reliable maintenance. This is valued by customers, as the machine is up and always running and is serviced or upgraded in accordance with a schedule. As a result, a certain dependency is created, which integrates the product with the service, trying to get the best possible deal from the offer.[69] Exemplary companies in this context are Caterpillar, which offers construction machinery as a PSS, and Hilti with its power tools. It is therefore obvious that different forms of product and service bundles can be offered.[70]

Value Creation

As Drucker pointed out in 1986, the value a customer perceives is not the product, but the benefit they obtain from purchasing the product or service.[71] In this respect, AS is crucial to fulfill this desire and create a close customer relationship. Value creation through services differs above all from value delivered by products, whereby the customer is to be seen as a collaborator and is therefore included in the service design and execution process.[72] Hence, the trend towards servitization gives companies the edge in effective value creation for themselves as well as for their customers by adding services. It is no longer the product or service alone that is decisive, but the value-in-use, the value that the customer derives from using the resources offered.[73] First and foremost, the aim is to generate profits, reduce costs, keep the equipment up and running, and ensure general safety during operation.[74] In their study, Gustafsson et al. (2012) emphasize the need for constant interaction between customers and suppliers to understand their experiences and continuously create value with new ideas.[75]

Developments are primarily based on the needs of the customer and therefore demonstrate a clear benefit orientation for the individual situation.[76] To narrow down value creation somewhat, Grönroos and Voima (2013) emphasize the main characteristic, which is that "value creation entails a process that increases the customer's well-being, such that the user becomes better off in some respect".[77] From this perspective, creating shared value implies that the involved parties integrate, share, exchange, and combine their resources to leverage common competencies.[78] Deploying digital technologies enable manufacturers to improve

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[67] Schuh; Gudergan; Grefrath 2016, p. 88–89.
[68] West; Gaiardelli; Saccani 2022, p. 6–7.
[69] Leimeister 2020, p. 130.
[70] West; Gaiardelli; Saccani 2022, p. 4.
[71] Drucker 1986, p. 47.
[72] Lusch; Vargo; O'Brien 2007, p. 7; Pistoni; Songini 2017, p. 9; Reckenfelderbäumer; Busse 2006, p. 145; Vargo; Wieland; Akaka 2015, p. 64.
[73] Gorldt et al. 2017, p. 369; Grönroos; Voima 2013, p. 135; Robra-Bissantz 2018, p. 263.
[74] Momeni; Martinsuo 2018, p. 794.
[75] Gustafsson; Kristensson; Witell 2012, p. 321.
[76] Weiber; Mohr 2020, p. 1099.
[77] Grönroos; Voima 2013, p. 134.
[78] Grönroos; Voima 2013, p. 135; Randhawa; Scerri 2015, p. 28.

customers' value creation processes by integrating them.[79] In this respect, the impact of digitalization has severe consequences for the value proposition to the customer and changes the way companies create and capture it as the nature of services diverges.[80] Coreynen, Matthyssens and Van Bockhaven (2017) created a pictorial construct that contrasts the value proposition and the focus area of whether the customer's process or the product is being supported by the specific service, illustrated in Figure 4.[81]

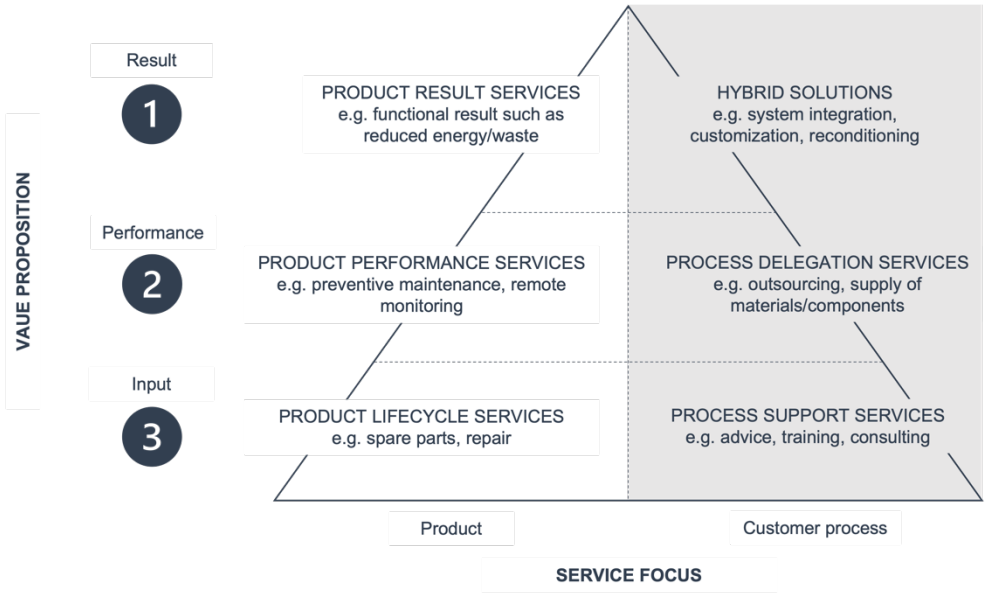

Figure 4: Servitization Pyramid[82]

The displayed value propositions are consistent with Baines and Lightfoot's (2014) statements about the degree of manufacturer involvement and post-purchase activity adoption. According to the authors, services can be classified into three categories depending on their value proposition, namely base, intermediate, and advanced services. Base services are provided separately to the product, such as spare parts. Intermediate services pursue the goal of maintaining the functionality and performance of the product that can be done, among other possibilities, through preventive maintenance. Advanced services are associated with the product-service systems outlined above and focus on the customer's desired outcome, which is obtained by offering a complete solution instead of the physical product alone.[83] These are services that complement the original product by offering availability or performance contracts.[84] In fact, servitization can be understood as the increasing shift to providing advanced services in conjunction with their products.[85]

A well-known example of advanced service and PSS is provided by Rolls Royce, which sells aviation engines as part of its power-by-the-hour business model, thus selling the service by the hour in use rather than the engine itself. In this way, they have succeeded in creating

[79] Ciasullo et al. 2021, p. 143.
[80] Iansiti; Lakhani 2014.
[81] Coreynen; Matthyssens; Van Bockhaven 2017, p. 43.
[82] Own illustration based on Coreynen; Matthyssens; Van Bockhaven 2017, p. 43.
[83] Baines; Lightfoot 2014, p. 4–5.
[84] Baines; Lightfoot 2014, p. 3; Oliva; Kallenberg 2003, p. 171.
[85] Baines et al. 2020, p. 2, 5.

added value for the customer by supplying a complete integrated solution instead of the spare parts previously offered alongside the engines. As a result, the customer must no longer be concerned with the functionality of the product itself, but instead takes advantage of its use as a service. This results in significant value-in-use for the customer, as advanced data analytics enable maintenance to be performed proactively, prolonging service life.[86] Step by step, the manufacturing company delves deeper into the customer's value chain, which means that potentials are approached by implementing comprehensive solutions.[87] An increasing number of manufacturers recognize the prospective in offering services, yet it is often left unexploited. In this regard, in their research, Klein, Biehl and Friedli (2018) found that value is often miscommunicated due to the basic attitude of the product-related company.[88]

Customer Integration and Co-Creation

Customers are increasingly establishing themselves as an integral part of service innovations and are actively contributing to their development. As mentioned above, this is aimed at a decisive impact on the customer's business processes.[89] Nowadays, services are supposed to offer added value to the customer and enable companies to generate relevance and revenue as a result. The focus here is on customer benefit, which often emerges through the integration of the customer into the development and execution of the service.[90] Moreover, it permits manufacturers to maintain their position at the cutting edge of the technological progress and gain an advantage over their competitors.[91]

Vargo and Lusch (2008), in their S-D logic, note that in this context there is a shift from perceiving the customer as a co-producer to a co-creator of value. This signifies an intensification of cooperation between suppliers, customers, and possibly other actors in the ecosystem to support the introduction of new products or services.[92] According to Grönroos and Gummerus (2014), value creation can therefore be understood as the joint activity of different stakeholders, such as the provider and the customer, who create value for the customer through the use of services, whereby the provider can support and influence the customer's value creation through co-creation.[93] Value is created through direct engagement in which both parties are actively involved, transforming interaction "from transaction-based to relationship-based collaboration".[94] It is argued that customers create value for their purposes, and the provider serves merely to deliver resources facilitating their value-creating process.[95] In summary, the value that a supplier brings to the customer is no longer purely product-related but is based on a variety of relationships between both parties that enable beneficial use. This highlights the importance of collaboration, as the customer imparts competencies, capabilities, and expertise as well.[96] Tronvoll et al. (2020) primarily address the enabling effect of digitization here,

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[86] Smith 2013, p. 1001.
[87] Pistoni; Songini 2017, p. 9.
[88] Klein; Biehl; Friedli 2018, p. 846–847, 853.
[89] Gorldt et al. 2017, p. 369–370.
[90] Kohtamäki et al. 2021, p. 11; Reckenfelderbäumer; Busse 2006, p. 146; Sjödin et al. 2020, p. 479.
[91] Lindh; Nordman 2018, p. 110.
[92] Vargo; Lusch 2008, p. 2.
[93] Grönroos; Gummerus 2014, p. 210.
[94] Sjödin et al. 2020, p. 480.
[95] Siltaloppi; Nenonen 2013, p. 157.
[96] Momeni; Martinsuo 2018, p. 792.

which provides the means to create suitable value propositions from a broad spectrum of customer data and to promote co-creation initiatives.[97] Gustafsson et al. (2012) found in their study on co-creation that intensive communication is particularly effective in getting to know customers better and understanding their situation to enable value creation. Therefore, they should be considered as essential partners in the development process.[98]

Especially in servitization, the customer is the central point of reference for further developments, which makes continuous two-way communication and integration essential. This can be attributed, on the one hand, to the fact that the move is to services for customer processes, and, on the other hand, to a change in the relationship between supplier and customer, from a purely transactional approach toward a relationship focus.[99] This is accompanied by adjustments to the value proposition towards PSS, a change in approach to revenue generation and partnerships while providing solutions to customers' challenges.[100] It is argued that long-lasting business relationships promote the economic success of a supplier through repeat purchases. Services enable an emotional connection between the two sides that is to be maintained.[101] Interactive value creation takes place in which the provider is integrated into the customer's usage process and thus contributes to value creation on the customer side and vice versa. This customer interaction is closely linked to the service offer, as they are part of the service creation process. New technologies and digital communication are widespread in this area and are used, for example, in self-service solutions.[102]

2.1.3 Digital Service Innovation

This segment discusses how digitization and servitization interact and builds on the previous remarks. Current research, drawing on servitization, reveals a strong emphasis on the inclusion of the digital aspect.[103] The drivers are mainly globalization and demographic change, increasing automation and self-service offers together with the Internet, which enables novel business models.[104] In addition, digital services are an important factor for internationalization, as they allow advanced services to be offered to globally located customers that can be controlled and monitored remotely.[105]

Opazo-Basáez, Vendrell-Herrero and Bustinza (2021) discovered in their research that manufacturers achieve the greatest profit by leveraging technological advancement through a combination of process, product, and digital service innovation.[106] Consequently, digital service innovation has emerged and represents an important aspect in the servitization shift of product-oriented companies, involving novel services based on digital technology.[107] Thereby,

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[97] Tronvoll et al. 2020, p. 299.
[98] Gustafsson; Kristensson; Witell 2012, p. 321–322.
[99] Baines et al. 2009, p. 556; Oliva; Kallenberg 2003, p. 161; Sjödin et al. 2020, p. 478.
[100] Paiola et al. 2021, p. 508.
[101] Schawalder; Lenz; Röllin 2013, p. 15–16; Scheutzow 2017, p. 33–34.
[102] Weiber; Ferreira 2015, p. 37–39.
[103] Klein; Biehl; Friedli 2018, p. 846; Tronvoll et al. 2020, p. 294.
[104] Link; Sigg 2011, p. 63.
[105] Kolagar et al. 2022, p. 146–147.
[106] Opazo-Basáez; Vendrell-Herrero; Bustinza 2022, p. 110.
[107] Klein; Biehl; Friedli 2018, p. 846; Opazo-Basáez; Vendrell-Herrero; Bustinza 2022, p. 98; Paschou et al. 2020, p. 3; Tronvoll et al. 2020, p. 294.

digital transformation, which is pushed in almost all production companies, implies that emerging opportunities such as connected products and corresponding services are capable of creating value through the use of data and innovative combinations, rather than solely putting a digital spin on what already exists.[108]

Changing customer behavior coupled with constantly accelerating developments in technology requires companies to continually innovate to deliver on customer expectations.[109] A generally applicable definition, such as it exists for product or process innovation, is not yet available, however, Opazo-Basáez, Vendrell-Herrero and Bustinza (2022) have developed an explanation of digital service innovations in the context of industrial manufacturing.

> *The introduction of a new service associated with existing products or new products of a company through the use of digital technologies. The service is built on digital elements that improve the operation of the product or facilitate access to data in real-time that allow improving the use of the product. Examples of these services include real-time tracking, machine health monitoring, consultancy-based data analytics.*[110]

Subsequently, digital service innovation is also referred to as digital servitization, which concerns the components of products and services combined with software.[111] Opazo-Basáez, Vendrell-Herrero and Bustinza (2022) refer to digital servitization as "the use of digital means to provide innovative, value-creating and revenue-generating opportunities to manufacturing firms in the service ecosystem".[112] This is echoed by Sjödin et al. (2020), who expand on the digital aspect as "the transformation in processes, capabilities, and offerings within industrial firms and their associate ecosystems to progressively create, deliver, and capture increased service value arising from a broad range of enabling digital technologies".[113]

The ability to innovate depends on digitalization, i.e. combining digital technologies to generate and capture value in novel forms, while digitization indicates the transition from analog to digital information.[114] Industry 4.0 is often referred to in this context, as developments in the field of digital services coincide with this maturity stage. Frank et al. (2019) refer to Industry 4.0 developments, as the concept of

> *a new industrial maturity stage of product firms, based on the connectivity provided by the industrial Internet of things, where the companies' products and process are interconnected and integrated to achieve higher value for both customers and the companies' internal processes.*[115]

Taking this further, Kohtamäki et al. (2019) refer to the factor of a smart solution, as "the transition toward smart product-service-software systems that enable value creation and capture through monitoring, control, optimization, and autonomous function".[116] Smartness here implies the capability to interact and cooperate in real-time, independently decide and navigate

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[108] Govindarajan; Immelt 2019, p. 26; West; Gaiardelli; Saccani 2022, p. 99–100.
[109] Helmer et al. 2021, p. 2797–2798; Sjödin et al. 2020, p. 478.
[110] Opazo-Basáez; Vendrell-Herrero; Bustinza 2022, p. 101.
[111] Kohtamäki et al. 2021, p. 2.
[112] Opazo-Basáez; Vendrell-Herrero; Bustinza 2022, p. 99.
[113] Sjödin et al. 2020, p. 478.
[114] Ciasullo et al. 2021, p. 143.
[115] Frank et al. 2019, p. 343.
[116] Kohtamäki et al. 2019, p. 390.

based on the information received.[117] All definitions focus on the factor of transforming business outputs into digital solutions rather than solely the physical product.

In addition, new service options, platform solutions and smart products, but also the development of new, more resilient business models can be mentioned as exemplary outputs. Manufacturers are therefore keen to introduce technologies in this area.[118] Moreover, the digitization of services in manufacturing opens up a potential that was previously unavailable. Among these is the enhancement of the value of tangible assets, process and operational efficiency based on connectivity, as well as the proficiency to base decisions on well-founded information.[119] Digital servitization is supported by IoT, which creates network-like architectures by intelligently linking assets that communicate sensor, operational, and location data in real-time. Cloud platforms, Big Data, and data analytics can be used to extract information and thus develop and establish technology-driven service innovations.[120] Moreover, they pose the need to establish novel capabilities in digital services, allowing servitization and PSS to flourish.[121] Further, robotics, additive manufacturing, simulation, cloud computing, AI, AR, and VR are all significant with respect to technological progress.[122] Fundamentally, a connection is seen between the service and the information movement, which is placed in direct context. In the transition to becoming a service provider, the available technology is applied for more efficient service delivery.[123]

Service innovations may be influenced by digital technology in two ways. First, they have a direct impact on easing the innovation process itself; second, they lead to innovative, novel outcomes in products or services where digital technology is vital.[124] Furthermore, they promote interaction along the supply chain and enable greater stakeholder integration. This, in turn, empowers companies to pursue customized value propositions focused on digital-based services and connections.[125] Consequently, a certain level of expertise is required that individual companies do not yet have, necessitating partnerships or sourcing specific capabilities from the manufacturer's ecosystem.[126] In general, those digital technologies are acknowledged to improve service quality, noticeably reduce costs, and provide the opportunity to offer at low prices to capitalize on complementary and substitution economies.[127] However, challenges arise as industry boundaries can become blurred and processes and the attitude toward customer relationships as well as the company's market position change.[128]

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[117] Weking et al. 2020, p. 2.
[118] Emmrich et al. 2015, p. 25; Kohtamäki et al. 2019, p. 380; Kowalkowski; Sörhammar; Tronvoll 2021, p. 28.
[119] Paschou et al. 2020, p. 1.
[120] Naik et al. 2020, p. 233; Paiola; Gebauer 2020, p. 245–246; Sjödin et al. 2020, p. 478.
[121] Paiola et al. 2021, p. 508; Paiola; Gebauer 2020, p. 245–246.
[122] Blichfeldt; Faullant 2021, p. 3; Kohtamäki et al. 2019, p. 390.
[123] Paschou et al. 2020, p. 5.
[124] Abrell et al. 2016, p. 325.
[125] Opazo-Basáez; Vendrell-Herrero; Bustinza 2022, p. 100,112.
[126] Tronvoll et al. 2020, p. 302.
[127] Cenamor; Sjödin; Parida 2017, p. 55–56.
[128] Kowalkowski et al. 2022, p. 1258.

2.1.4 Digital Service Innovation Processes

Digital service innovation has recently become very prevalent in service innovation research as outlined above. Nevertheless, the available studies currently lack the development of a sophisticated digital service innovation process for product-oriented manufacturers that intend to drive the incorporation of digital services into their day-to-day operations. Although awareness of services has been around for several decades, manufacturers still approach product development processes that are not inherently suited to services.[129] Especially regarding services that require the core competencies from the provider, it is reasonable to provide these in-house and not to outsource them, for which suitable innovation processes are necessary to accelerate the speed of development.[130] In general, innovation processes can be defined as "the exploration and exploitation of opportunities for new or improved products, processes or services, based either on an advance in technical practice ("know-how"), or a change in market demand, or a combination of the two. Innovation is therefore essentially a matching process".[131]

The results can be categorized into either incremental or radical innovations, depending on the degree of innovativeness and novelty in an applied context. Incremental service innovations arise when slight adjustments are applied to an established service, while radical innovations tend to relate to creating new value propositions and thus substantially new attributes. Johansson, Raddats and Witell (2019) point out that this classification and attribution of innovation characteristics is incumbent on the respective manufacturer.[132] Moreover, it is claimed that the trigger for digital service innovation is a technology push, i.e., the establishment of an advanced technology that identifies the idea for a service. However, when developing services, it is not only the technological push that is significant but also the market pull that should be integrated to strengthen customer orientation and create mutual added value.[133] Subsequently, manufacturers are able to directly influence customer satisfaction and service experience.[134]

Innovation Processes

Remarkably, service innovation processes differ from product innovation processes. The speed of digital innovation is faster than that of physical products and is deeply aligned with customer value. Additionally, interaction and feedback between customer and provider is of greater importance. This applies if products are not developed specifically for a particular customer.[135] In the case of digital services, however, attention must be paid to the capabilities of both software and service. This is related to the feasibility of the planned digital solutions.[136] Alam and Perry (2002) found in their research that companies proactively seek input from their

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[129] Biemans; Griffin 2018, p. 113; Bullinger; Fähnrich; Meiren 2003, p. 282; Helmer et al. 2021, p. 2798; Kindström; Kowalkowski 2014, p. 97; Friedli; Osterrieder; Tienken 2021, p. 22.
[130] Gotsch et al. 2018, p. 375.
[131] Pavitt 2006, p. 88.
[132] Johansson; Raddats; Witell 2019, p. 329.
[133] Geum; Jeon; Lee 2016, p. 532; Riedl; Leimeister; Krcmar 2009, p. 5; Schweiger 2011, p. 14.
[134] Mehta; Balakumar 2021, p. 1.
[135] Kindström; Kowalkowski 2009, p. 157; Friedli; Osterrieder; Tienken 2021, p. 22–23.
[136] Bullinger; van Husen 2006, p. 29.

customers to increase the speed of new service development and idea generation.[137] Designing new services requires adapted innovation processes, considering the involvement of various stakeholders, which are strongly geared towards customer benefits and needs and thus meet market requirements. Joint development has a positive impact on acceptance, especially for product-related services and customer processes.[138] Process models within service development are generally oriented towards a structured path with a customer-centric approach focused on competitive advantage.[139] They provide the framework and required activities for service development in process steps by specifying space and structure for the appropriate application of tools and methods in the individual phases.[140]

Fundamentally, a wide variety of approaches exist as to how a process model is structured. Regarding the basic architecture, a distinction can be made between linear, iterative, prototypical, and agile models. All these describe a top-down approach, which means that development takes place from idea to market launch.[141] When comparing the different types, it is evident that linear and iterative models only deal with the rapid dynamics of the markets and thus accelerated life cycles to a limited extent.[142] The remedy here is agility, which enables rapid and flexible action and therefore responds to market requirements, as intermediate results are analyzed repeatedly, and the definitive solution is thus constantly optimized.[143] In this context, Sjödin et al. (2020) emphasize the significance of an agile version of a process model for digital service innovation that enables co-creation and consequently focuses on flexibility and enabling innovativeness.[144] Through continuous improvement, companies can ensure high service quality and adapt to changing customer needs.[145] The following illustration, Figure 5, gives an overview of the different approaches and iteration phases of the above-mentioned types of process models.

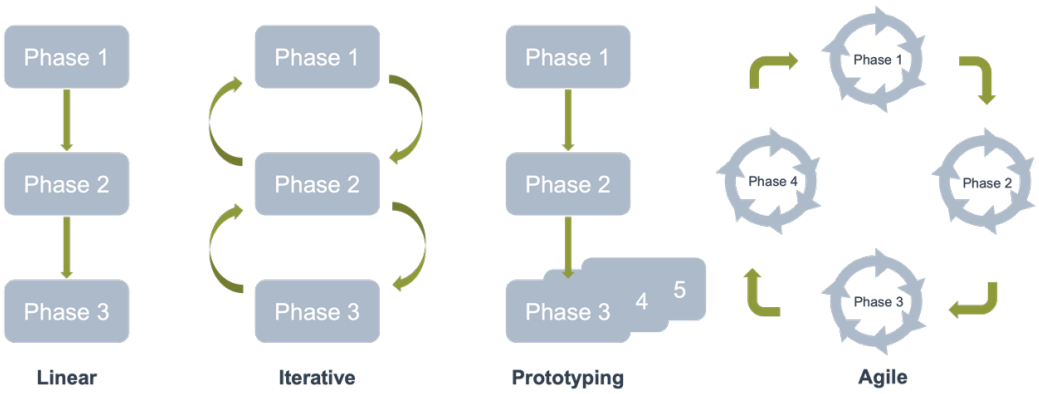

Figure 5: Different Process Models[146]

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[137] Alam; Perry 2002, p. 523.
[138] Fließ; Lexutt 2016, p. 59.
[139] Reckenfelderbäumer; Busse 2006, p. 146–147; Schuh; Gudergan; Senderek; et al. 2016, p. 169–171.
[140] Leimeister 2020, p. 91.
[141] Leimeister 2020, p. 91, 97.
[142] Leimeister 2020, p. 91, 97; Randhawa; Scerri 2015, p. 41.
[143] Leimeister 2020, p. 97; Teece; Peteraf; Leih 2016, p. 17.
[144] Sjödin et al. 2020, p. 480.
[145] Link; Sigg 2011, p. 62.
[146] Own illustration translated by the author based on Leimeister 2020, p. 91.

Overall, iterative, agile, and prototyping models are suitable, in principle, for complex service developments, as rounds of improvements are initiated at an early stage. This means that errors are identified rapidly and customers are involved more intensively. Despite these advantages, simple phase models are widely adopted in practice, as not every service innovation requires agile or prototype-oriented processes. Fundamentally, service innovation is largely based on experimentation and is perceived more as a growth process.[147]

Linear and Iterative Innovation Processes

The literature on service innovation shows that the underlying development processes exhibit a high degree of similarity, undergoing evolution from product to service focus. Phase models, such as those of Booz, Allen and Hamilton in 1982, long centered on product development[148], or Scheuing and Johnson, who started to focus on intangible services in 1989, already integrating external stakeholders[149], emerged. Specific constraints, as highlighted by the dynamics of the customer-provider relationship, were addressed with subsequent procedural models. These are based on parts of the above approaches, with Alam and Perry (2002) emphasizing a comprehensive list of ten steps within a linear service innovation process. Essentially, this involves strategic planning, idea generation, idea screening, business analysis, forming a cross-functional team, service design and process system design, personnel training, service testing and pilot run, test marketing and commercialization.[150]

However, a recognizable scheme is emerging on which numerous concepts surrounding innovation processes are based. This is primarily related to the successive phases, which are supplemented or adapted by individual aspects in the respective model, for instance, with iteration cycles. In principle, these phase models start with the generation of an idea, which is analyzed in the next step. If the evaluation is positive, this is followed by the conception phase, in which overall and individual specifications are modeled and created. This leads to the preparation phase, where resources are deployed, and the service idea is developed. The next step is the test phase, where the extent to which the service offer meets the market requirements during piloting is evaluated. Finally, the service is launched on the market. A summary is shown in Figure 6.[151]

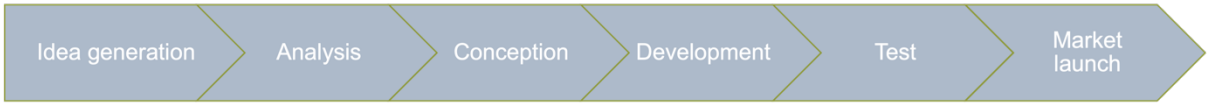

Figure 6: Generic Steps of Service Innovation Processes[152]

[147] Leimeister 2020, p. 99.
[148] Nasir; Rahim; Hamzah 2016, p. 813.
[149] Scheuing; Johnson 1989.
[150] Alam; Perry 2002, p. 523.
[151] Alam; Perry 2002, p. 523; Bullinger; Schreiner 2006, p. 73; Bullinger; van Husen 2006, p. 26; Bullinger; Fähnrich; Meiren 2003, p. 281; Cooper 2008, p. 223; Haller 2015, p. 91; Häikiö; Koivumäki 2016, p. 108; Kieninger; Meiren; Münster 2011, p. 94; Kleinaltenkamp; Saab 2021, p. 87; Leimeister 2020, p. 104; Scheuing; Johnson 1989.
[152] Own illustration based on Alam; Perry 2002, p. 523; Bullinger; Schreiner 2006, p. 73; Bullinger; van Husen 2006, p. 26; Bullinger; Fähnrich; Meiren 2003, p. 281; Cooper 2008, p. 223; Haller 2015, p. 91;

Over time, customer involvement, more agile methods, and, above all, the integration of iteration phases have appeared as important core aspects of innovation processes. Iterative aspects are therefore particularly valued in the innovation of digital services in the analysis and test phase. Nevertheless, the frame of reference and the rough processes from idea generation to launch are highly similar to previous approaches. Research even argues that flexibility leading to a more circular process design is necessary since processes are not closed but provide room for new services to emerge or continuous adjustment to market demand.[153] Recent studies have demonstrated that the number of stages becomes denser over time, as process steps are combined to accelerate development speed. This can be seen in the NSD process, which is considered below. In addition, Melton and Hartline (2015) found in their study that customers should be involved in the ideation, conceptualization, and testing of prototypes during NSD.[154] Since each company has different requirements and thus demands specific aspects of an innovation process[155], the two most frequently mentioned and widely accepted agile methods are described. For this reason, entirely linear process models are considered as a basis and support for understanding, but due to the lack of essential characteristics for the development of digital service innovations, they are not examined in greater detail for the further course of the research.

New Service Development Process Cycle

Building on the idea of a more continuous circular perspective, Johnson et al. (2000) illustrate the importance of iterative and interactive measures with their developed NSD Process Cycle. The model proposes four distinct phases, namely design, analysis, development, and finally the launch of the resulting service innovation, which are steps frequently mentioned in NSD. Moreover, it includes the facilitators of service innovation directly, that are placed in the center as teams, tools, and organizational context.[156] Ideas for new services thus do not solely originate from the provider sphere but can equally be inspired by the business environment and prevailing trends, which provide the input for the design phase.[157] It is argued that process design is significantly iterative, allowing feedback loops to revise decisions and phases. To build the model, design and analysis were among the planning phases, looking primarily at internal resources and decisions such as feasibility. The other two, development and full launch phases, represent the execution stages. Here, service design, cross-functional development, and facilitator integration must be considered. Johnson et al. (2000) state that at least a well-designed execution phase must take place, although the formal planning side can be superseded by ad hoc creativity that allows for improvisation.[158]

Various enablers are active throughout the process. Central to the process is invariably the service product, which, according to the authors, consists of the technology, the people

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Häikiö; Koivumäki 2016, p. 108; Kieninger; Meiren; Münster 2011, p. 94; Leimeister 2020, p. 104; Scheuing; Johnson 1989.
[153] Riedl; Leimeister; Krcmar 2009, p. 7.
[154] Melton; Hartline 2015, p. 120.
[155] Link 2014, p. 70.
[156] Johnson et al. 2000, p. 18; Melton; Hartline 2010, p. 412; Riedl; Leimeister; Krcmar 2009, p. 5; Stevens; Dimitriadis 2005, p. 177–178.
[157] Leimeister 2020, p. 95.
[158] Johnson et al. 2000, p. 18–19.

involved, and the system.[159] Edvardsson et al. (2013) found in their research on NSD, that "going beyond internally integrated development teams is necessary by integrating customers and other external actors knowledge and skills"[160], which has already been highlighted by Vargo and Lusch (2008).[161] Melton and Hartline (2010) examined the stages where customer input is beneficial and supports the sale of derived services, focusing specifically on improving marketability through inclusion in the design and development stages.[162] In doing so, it is important "to communicate with customers to understand their needs, as well as the context and other resources they use in meeting those needs".[163] A systematic approach to the innovation process increases the likelihood that the result will be accepted and introduced successfully to the market.[164] Figure 7 illustrates the steps taken to develop the new service and what activities they include.

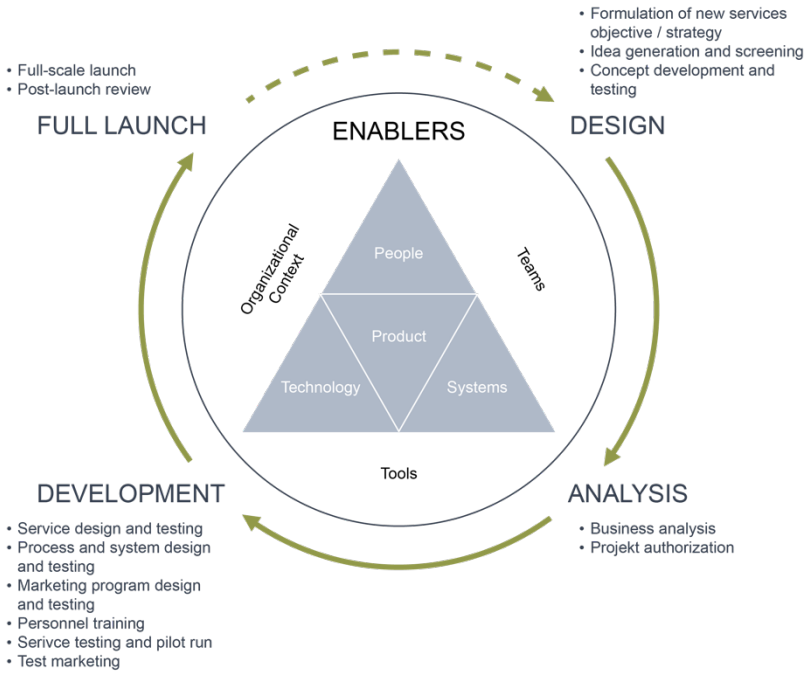

Figure 7: New Service Development (NSD) Cycle Process[165]

The model allows the development of radical service innovations which, after the launch phase, slide again into incremental innovation rounds. They thus form the basic framework, which is equipped with adaptations and other improvements. Accelerating the pace through a high degree of iteration and stakeholder engagement, even in the early stages, helps service development identify conceptual flaws or hurdles early. Since stakeholders are constantly involved in the process, they can be quickly eliminated, and their demands considered.[166]

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[159] Leimeister 2020, p. 96.
[160] Edvardsson et al. 2013.
[161] Vargo; Lusch 2008, p. 2.
[162] Melton; Hartline 2010, p. 420.
[163] Melton; Hartline 2015, p. 113.
[164] Edvardsson et al. 2013; Roth 2015, p. 129.
[165] Own illustration based on Johnson et al. 2000, p. 18.
[166] Johnson et al. 2000, p. 19.

Stage-Gate Process

In the years following the development of the first approach in the 1980s, adjustments were made to the process and its purpose to counteract the prevailing trend toward iterative and open activities. Criticism was directed primarily against the linear and highly structured process approach, which allowed for few adjustments as reactions to market changes and little experimentation.[167] The Stage-Gate process according to Cooper is relevant, as he recognized early on that after each activity process phase, gates are passed, and the progress is reviewed accordingly. Moreover, it is one of the most widely adopted processes in the industry. It usually starts with the perception of a predefined outcome.[168] After each of these gates, a decision is made about the potential of the idea and thus its further pursuit. The focus is on the speed of development, which is strongly product-related and not specifically reflected in services. Like the NSD process described above, the Stage-Gate process follows iterative loops and post-launch improvement but is still focusing on a linear manner. In this regard, Cooper (2008) states that several companies are adapting the process to incorporate open innovation or other approaches to enhance flexibility. Figure 8 shows the flow of the Stage-Gate process.[169]

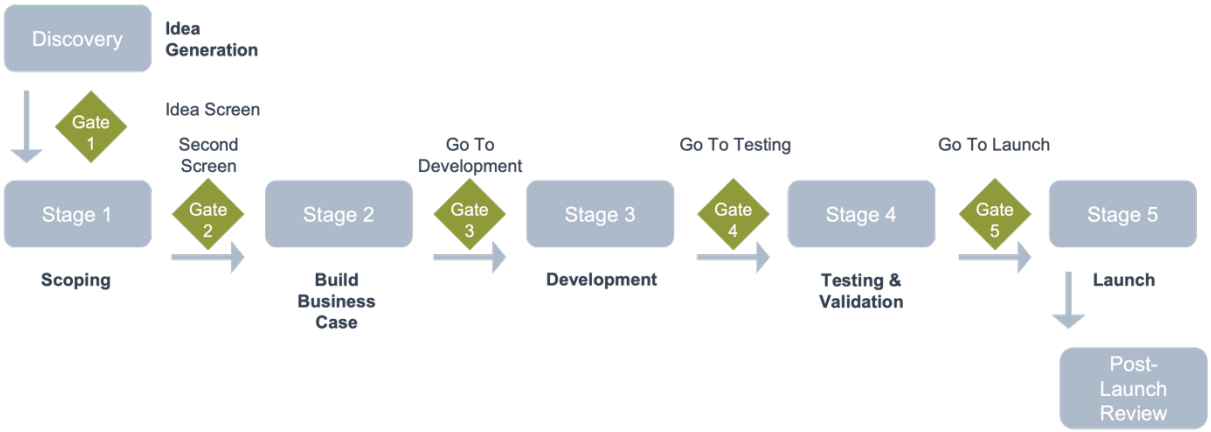

Figure 8: Stage-Gate Process[170]

This sequential model includes prototype-oriented methods and is mainly used in product development. However, it is also partially approached in the service sector, especially in product-oriented companies, since no specific processes for services are established there.[171] Counteracting criticism, Cooper and Sommer (2016) developed the process even further and provide insights into an agile Stage-Gate hybrid model. They argue that this model offers efficiency gains, increased flexibility about changes in customer requirements, and proactive integration of customer voices. In addition to the process sequence, agile methods are adapted and applied. Especially in the early stages of the process, agile methods are a source of

[167] Cooper 2014, p. 20; Sjödin et al. 2020, p. 480.
[168] Cooper 2008, p. 214–216, 231; Link 2014, p. 70–72.
[169] Cooper 2008, p. 214–216, 231.
[170] Cooper 2008, p. 215; 2010, p. 2.
[171] Cooper 2008, p. 225, 231; Link 2014, p. 69; Link; Sigg 2011, p. 58; Tesch; Brillinger; Bilgeri 2017, p. 4.

security for further, potentially costly, developments.[172] Link (2014) likewise attributes added value to the use of agile methods.[173]

Agile Methods

Agile methods are increasingly used for generating service innovations due to their characteristics suitable for a dynamic environment, such as flexibility, interactivity, and iterative cycles. In principle, agility can bring efficiency and openness to innovation processes and allow early detection of misguided ideas by integrating customer perspectives and other stakeholders. This is mainly because customer requirements and perceptions, as well as environmental conditions in today's fast-changing world, must be considered in the development process and influence a significant part of the continuous improvement measures.[174] Agility signifies "the capacity of an organization to efficiently and effectively redeploy/redirect its resources to value-creating and value protecting (and capturing) higher-yield activities as internal and external circumstances warrant".[175] Several common project management methods can be used, each with a different purpose.[176] In this thesis, they are only presented as possible options to enrich innovation processes, which is why they are not explained in detail.

Chesbrough (2011), who was instrumental in coining the term **open innovation**, affirms that "openness generally refers to ways of sharing with others and inviting their participation".[177] Services, in particular, offer the space to focus on an open approach to innovation since both providers and customers often do not explicitly know what they want or need. As previously mentioned, the involvement and intensive integration of stakeholders is a crucial means of efficiently driving service innovation and eliminating potential errors from the process and adjusting as early as possible. By promoting an open approach to innovation, resources for developing ideas are not squandered, as they can be used either from outside the company to the inside or from inside the company to the outside.[178] Innovation processes like the Stage-Gate procedure can integrate an open attitude towards innovation methods to provide the necessary flexibility and access to systems. This enables increased value creation at every stage of the process.[179]

There are three common methods, procedural approaches such as **design thinking**, **lean startup**, **and scrum**, which can be used for various purposes, supporting customer-centricity. However, what can often be observed is that these approaches are adapted to the respective needs and that there is no strict adherence to them.[180] Scrum is one of the most widely used methods, especially in software development.[181] Particularly in the service domain, Link and Sigg (2011) identify great opportunities in the application of design thinking and the co-creation approach, both of which can be incorporated into the process.[182] Frequent iteration phases,

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[172] Cooper; Sommer 2016, p. 1.
[173] Link 2014, p. 87.
[174] Link 2014, p. 79–80; Wobser 2022, p. 10–12.
[175] Teece; Peteraf; Leih 2016, p. 16.
[176] Link 2014, p. 79–80; Wobser 2022, p. 10–12.
[177] Chesbrough 2011, p. 87–88.
[178] Chesbrough 2011, p. 88–89.
[179] Cooper 2008, p. 231.
[180] Blank 2013; Wobser 2022, p. 10–11, 100.
[181] Link 2014, p. 76; Wobser 2022, p. 95.
[182] Link; Sigg 2011, p. 59.

which enable rapid progress in service development and thus the development of initial prototypes for testing by potential or actual future users, provide valuable input that has an accelerating effect on the innovation process.[183] Creative approaches take place primarily in the early stages, especially in ideation and design, to address market ambiguities and to test technologies along with requirements gathering to provide clarity in complex environments.[184] Lean Startup focuses on the establishment of an MVP, a Minimum Viable Product, which enables findings of the readiness to buy. Subsequently, iteration loops are performed via a build-measure-learn cycle until the appropriate product-market fit is achieved.[185] Referring to the study by Tronvoll et al. (2020), they emphasize that agile methods are crucial in digital servitization, as fundamentally different competencies are required, and multidisciplinary teams should therefore be formed.[186]

Even though these innovation processes and agile methods are generally suitable for service innovations, several researchers note that, especially for industrial companies that have previously focused on product innovations, digital service innovation processes also have a structural impact on other business areas. There is not yet a specific and market-oriented process design for innovations in the context of digital servitization. For this reason, it is necessary to establish an adapted approach for the development of such innovations to enable industrial B2B manufacturers to use efficient methods and thus promote the leap to service delivery while enhancing competitive advantages.[187]

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[183] Bauer et al. 2019, p. 109.
[184] Link 2014, p. 72.
[185] Blank 2013; Camuffo et al. 2020, p. 566.
[186] Tronvoll et al. 2020, p. 302.
[187] Baines; Lightfoot 2014, p. 22; Gebauer et al. 2008, p. 392; Osterrieder 2021, p. 11; Troilo; De Luca; Guenzi 2017.

2.2 Industrial After-Sales

Service provision, as described in the previous chapters, is becoming increasingly fundamental and holds enormous potential for the future. Especially regarding servitization and the associated requirement to ensure that a reliable product is always available to avoid downtime scenarios, AS and thus maintenance and repair are attributed essential value. The following section deals with the implications and opportunities of digitization in the after-sales area in the context of digital services.

2.2.1 Industrial B2B After-Sales Services

After-sales takes place after the purchase has been completed and broadly designates the customer service alongside the product offering that serves to differentiate the company from its competitors.[188] Saccani et al. (2007) agree and define them as "the set of activities taking place after the purchase of the product, devoted to supporting customers in the usage and disposal of goods".[189] Offered services frequently play a decisive role in a customer's decision to favor a supplier due to the fact that the pure end-product increasingly finds interchangeable counterparts available on the market. For this reason, more and more services are being offered, such as user training, installation and assembly, support, maintenance, warranty and parts service. These are applied in the integration as well as utilization phase of the product.[190] Figure 9 illustrates the situational aspect of AS and gives an overview of the functional areas.

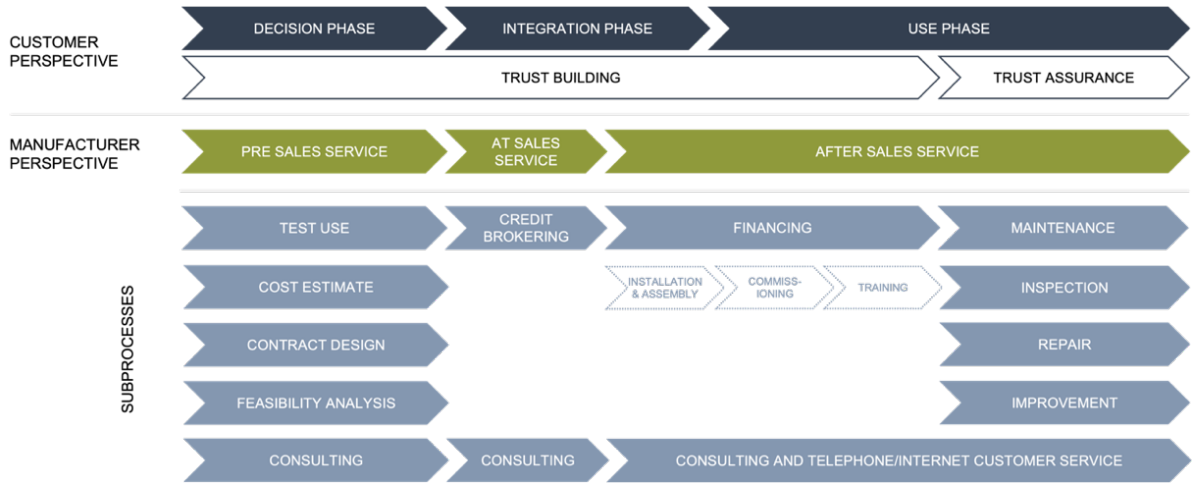

Figure 9: Sales Process Steps - Customer and Manufacturer Perspective[191]

Environmental factors such as the COVID-19 pandemic are having a substantial impact, as revenue is often no longer generated by product sales alone, due to market disruption. Maintenance and life extension have become the focus, and value-added digital services on a remote

[188] Tavakoli et al. 2016, p. 123, 126.
[189] Saccani; Johansson; Perona 2007, p. 54.
[190] Baader; Montanus; Sfat 2006, p. 3–4; Dombrowski; Fochler; Malorny; et al. 2020, p. 1–3; Kenning; Markgraf 2018; Prandini et al. 2018, p. 7; Rebelo et al. 2021, p. 463; Tavakoli et al. 2016, p. 123.
[191] Own illustration translated by the author based on Dombrowski; Fochler; Malorny; et al. 2020, p. 128.

basis have been rapidly introduced to sustain revenue. In this context, it is mentioned that certain manufacturers already earn 40-50% of their profits through services.[192]

Moreover, the increasingly global and homogeneous range of goods on the market makes it difficult for companies to stand out based on quality or price. For this reason, services are progressively being introduced that are oriented toward the customer and thus extend product life cycles. In the context of this thesis, reference is made to product-related AS and new business opportunities, meaning that digital services are offered in addition to or in support of the physical product. It is emphasized that companies have recognized the strategic potential that lies in offering spare parts and maintenance services as a source of revenue.[193]

Customer Potential

Kleinaltenkamp, Plötner and Zedler (2004) stress that services in the post-purchase phase are intended to result in a lasting business relationship by gaining the customer's trust.[194] It is therefore reasonable to interact in a value adding manner during the time of use to guarantee customer procurement. As this phase is of utmost importance for the customer, providers must act here to consolidate future potential and intensify customer loyalty.[195] Other goals are to establish new customer segments, improve image, positively impact profits, and promote differentiation potential. Considering the offer from the customer's point of view, satisfactory AS has a significant impact on the willingness to repurchase. Consequently, the after-sales phase enables a new pre-sales phase to be initiated.[196] The enormous revenue potential, with profitability often exceeding that of physical products, is also reflected in the effects of cross-selling, additional purchases, and resales through up-selling, which generate further income after implementation.[197] Assuming the customer is satisfied with the provider's service package, the sale of further products and services is conceivable and offers opportunities within the long-term customer relationship. Accordingly, AS can increase customer satisfaction and strengthen customer loyalty.[198]

After-Sales Service Opportunities

Beyond this, the realization of AS carries an informational value, as feedback on current products and services is provided on an ongoing basis. This, in turn, gives well-founded approaches to improving the existing or developing new offerings.[199] By linking capital goods, it is easier to track how they are used by customers. If the manufacturer identifies positive and negative aspects of usage, it is possible to target services or further sales and thus exploit the potential in the after-sales area.[200] Figure 10 shows the great opportunities offered through

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[192] Wellener et al. 2020.
[193] Cohen; Agrawal; Agrawal 2006.
[194] Kleinaltenkamp; Plötner; Zedier 2004, p. 632.
[195] Baumbach 2004, p. 14; Schuh; Gudergan; Thomassen; et al. 2016, p. 34.
[196] Court et al. 2009; Dombrowski; Malorny; et al. 2020, p. 8; Prandini et al. 2018, p. 8; Schawalder; Lenz; Röllin 2013, p. 8, 34; Schuh; Gudergan; Thomassen; et al. 2016, p. 34; Schuh; Georgi 2008, p. 63.
[197] Felker 2008, p. 31; Schawalder; Lenz; Röllin 2013, p. 9; Schuh; Gudergan; Thomassen; et al. 2016, p. 34.
[198] Homburg 2020, p. 1032.
[199] Mehta; Balakumar 2021, p. 2; Voeth; Zimmermann 2020, p. 378.
[200] Deloitte 2020, p. 15.

enhancing after-sales service. By offering value-added services, the provider can be closer to the customer, generate incremental revenue through contractual service agreements, and decrease downtime for the user. At the same time, the customer relationship is strengthened through ongoing interaction during the product lifecycle. Upgrades and value-preserving methods create customer benefits, including digital services that enable predictive maintenance and digital updates. This enables the supplier to meet the customer as a solution provider who delivers services around the product and, based on the information gained, improves tangible and intangible offerings.[201]

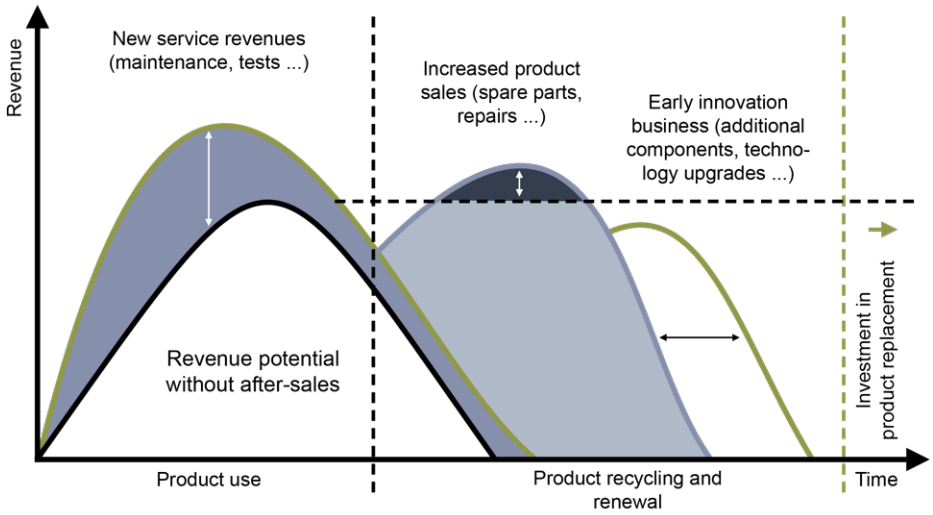

Figure 10: Main Approaches to Increasing Yields in the Product Lifecycle[202]

As elaborated in chapter 2.1.2, servitization plays a crucial role in today's fast-changing economy, and there is no way around it, especially for industrial manufacturers, if they strive to maintain their relevance in the market. AS is subject to a positive and increasing forecast, whereby companies need to maintain and improve serviceability. A starting point for the development of manufacturers into service providers is the offering of services close to the primary product, such as spare parts, repair, and maintenance. However, it is also observed that more advanced services are provided, which are mostly technology-based, such as sensor-enabled services.[203] The following chapter delves into the technical issue and identifies certain digital opportunities in the after-sales area.

2.2.2 Digitalization in Industrial B2B After-Sales

"Leading manufacturing firms are gaining on servitization transformation by increasingly exploiting new digital technologies."[204] Digital transformation's strong impact on all areas of the company also entails changes in AS. Today, almost every industry is forced to deliver its services digitally, to use digital technology as such or as an extension of the existing service

[201] Helbling Management Consulting GmbH 2008.
[202] Own illustration translated by the author based on Helbling Management Consulting GmbH 2008.
[203] Link; Sigg 2011, p. 55; Vaittinen; Martinsuo; Ortt 2018, p. 54–55.
[204] Cenamor; Sjödin; Parida 2018.

offer.[205] The cyclical nature of the procurement process, especially for capital goods, is supported by services that contribute to a steady flow of revenue.[206] Whereas in the past it was just about satisfying customers, the focus today is on integrating them and creating flexible interconnected structures. Regarding the digital design of services in particular, the literature shows strong links to sub-areas of after-sales that are undergoing a digital transformation. In mechanical engineering especially, digitalization is taking place in a wide variety of ways, with the overriding goal of avoiding downtime and making improvements remotely. Thus, the product should always be available to the customer in its entirety and capacities fully exploitable. Completely new perspectives become possible, involving growth and innovation as well as adaptation to customer requirements.[207]

Advantages

A major advantage of digitization is that services can be provided directly and remotely, regardless of time and place. This approach supports internationalization through simplified availability of multiple languages and thereby lowers barriers to entering foreign markets.[208] Manufacturing companies, especially in the industrial sector, appreciate advantages in dealing with ICT, Information and Communication Technology. It is a source of digital information exchange and increases efficiency in terms of time, resources, processes, and costs compared to previous methods, which invariably demanded direct personal interaction.[209] Intelligent assistants, e.g. chatbots, are increasingly being integrated for communicating with customers.[210] The overarching purpose of using these technologies is to analyze the data obtained and thereby increase productivity. In the context of disruptive innovations such as the IoT, Internet of Things, the aim is to use new developments like sensors that are capable of transporting and collecting information that is invisible to human perception. The prerequisite for this is that customers embrace and demand the technology.[211] This leads to a “lock-in” effect, as customers can only use the products properly in the long term if they purchase further services from the provider. As a result, the customer potential is significantly increased as there are certain dependencies in the system.[212]

Challenges

A challenge in this case is the perceived risk and thus the acceptance of customers regarding the introduction of digital service innovations.[213] Still, providers are not leveraging the benefits as much as they could because the necessary infrastructure must be in place for effective data processing and the general integration of digital services. Tracking is of little use unless it is properly analyzed, and the information gained from it is converted into added value. In general, the services mentioned are not entirely new innovations, but rather extensions and enrichments fostered by the advancement of technological capabilities. In this respect,

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[205] Moker; Brosi; Welpe 2020, p. 1146.
[206] Deloitte 2020, p. 10.
[207] Dombrowski; Malorny; et al. 2020, p. 6.
[208] Appelfeller; Feldmann 2018, p. 100; Bruhn 2020, p. 152; Momeni; Martinsuo 2018, p. 794.
[209] Momeni; Martinsuo 2018, p. 792–793.
[210] Weiber; Mohr 2020, p. 1099.
[211] Momeni; Martinsuo 2018, p. 792–793.
[212] Cohen; Agrawal; Agrawal 2006.
[213] Hood; Brady 2016; Wünderlich; Wangenheim; Bitner 2013, p. 4.

specifically product-oriented companies are hardly able to recognize the value behind the development of services and thus realize the potential in terms of revenue streams over the entire life cycle based on higher margins as well as repurchases.[214] These services rely heavily on data generation and customers' willingness to share. Tronvoll et al. (2020) noted in their studies that "issues related to the data generation, collection, utilization, and ownership may create new tensions between firms", suggesting that data could be used to promote competitive advantages over customer rivals.[215]

Global challenges arise primarily from the different technological standards, whether due to country-specific conditions or the inclusion of differently advanced products. Moreover, there may not exist a seamless transition from smart communication along the value chain. One of the main problems is that data is generated but not evaluated in a targeted way, resulting in missed opportunities for new developments.[216] The following section presents the perspectives for digitization in the after-sales area concerning maintenance and repair as well as product monitoring through IoT platforms.

Maintenance, Repair and Platform Solutions

> *Smart, connected products offer exponentially expanding opportunities for new functionality, far greater reliability, much higher product utilization, and capabilities that cut across and transcend traditional product boundaries.*[217]

In principle, the basic activities in the maintenance and repair area include servicing to extend the product life cycle, inspection including screening of the condition of the product, repairs including reconstruction and enhancements of the product.[218] Since not every spare part can be stocked for every product sold, yet the demand for continuous functionality is prevalent, data-based and network-enabled services such as predictive maintenance are becoming increasingly important for both the customer and the supplier.[219] Due to technological advances, there has been a shift from periodic servicing and incident repair alone, to **predictive and proactive maintenance** to ensure trouble-free availability of the physical product over its time in use. This is done by examining the condition of the tangible asset through digital connections.[220] Furthermore, a trend toward **remote monitoring** systems in efficient and fast service delivery, which is demonstrated by remote repair, diagnosis, or maintenance based on connectivity, is evident. These intelligent services support the product by reducing downtime risks through early monitoring and remote notification of unusual events.[221] This is strongly linked to the analysis of the product as well as usage data.[222] In addition, **updates** can be performed more easily through digital connections to keep the product up to date with the latest technology and improve operations.[223] Overall, the digitization of service delivery increases the

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[214] Deloitte 2020, p. 7,10; Klein; Biehl; Friedli 2018, p. 850.
[215] Tronvoll et al. 2020, p. 302.
[216] Klein; Biehl; Friedli 2018, p. 850; Wellener et al. 2020.
[217] Porter; Heppelmann 2014.
[218] Dombrowski; Fochler; Sendler; et al. 2020, p. 140; Wellener et al. 2020.
[219] Rolstadaas; Hvolby; Falster 2008, p. 385.
[220] Appelfeller; Feldmann 2018, p. 177; Deloitte 2020, p. 19; Silvestri et al. 2020, p. 1.
[221] Klein; Biehl; Friedli 2018, p. 846; Westergren 2011, p. 224.
[222] Tronvoll et al. 2020, p. 294.
[223] Appelfeller; Feldmann 2018, p. 47; Wellener et al. 2020.

company's operational flexibility and reliability. At the same time, it extends capacity limits, allowing the manufacturing company to run more efficiently and faster.[224]

Supported by IoT, physical assets are interconnected and able to transmit data through the application of electronics, sensors, software, or RFID tags. By equipping goods with smart technologies, a degree of **connectivity** can be achieved that communicates information to a central location, allowing conclusions to be drawn about performance and critical changes to be detected through data analytics. This is made possible by tracking and documenting real-time machine data to achieve efficiencies through analysis. More specifically, predictive analytics algorithms are used to provide customers with a dynamically administered predictive maintenance service based on historical and real-time data.[225] AI and machine learning can therefore be leveraged to create predictive capabilities and transparently visualize products remotely through automated analytics.[226] Especially for manufacturing equipment, the generated data volumes and evaluations are crucial for sustained uninterrupted uptime.[227] Through the long-term monitoring and evaluation of user data, new service or product developments can be initiated in a targeted manner, enabling customers to specify and improve their processes. This pushes co-creation, generates value for both sides of the business relationship, and allows customized services.[228]

Another maintenance option simplified by digitization is the use of **digital twins**, i.e., digital replicas of physical assets or processes that show specific complications on machines, for instance. They greatly contribute to facilitating problem identification, maintenance and enable remote actions, as detailed information about the product's malfunction is given and easily accessible. In this way, it provides insight into the operations and allows simulations for the customer. Large amounts of data are transferred and processed by analysis tools that support the prevention options mentioned above. In addition, such records enable products to be adjusted according to the evaluations and optimized in the next step.[229]

With innovation through digitalization, industrial **IoT platforms** continue to evolve. Based on the development of digital technologies, notably IoT, manufacturers often adopt an advanced service approach as part of digital servitization, such as providing an industrial platform that aims to increase efficiency and add value to operations. On these IoT platforms, the interactions between industrial assets, services, and other digital elements can be presented in a customer-specific interface and module composition in real-time, e.g. dashboards for data visualization supported by AI. In doing so, physical products must be equipped with smart technology that enables a connection between different inputs and thus creates value.[230]

Visualization is provided that gives the customer insight into functionality based on implemented sensors and data analysis combined with experience-based benchmarks. Among other things, these insights allow markets to be segmented based on their usage data and

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[224] Hogreve et al. 2016, p. 264.
[225] March; Scudder 2019, p. 327–328, 336; Presser et al. 2019, p. 35–36.
[226] Wellener et al. 2020.
[227] Presser et al. 2019, p. 39.
[228] Westergren 2011, p. 227.
[229] Rojek; Mikołajewski; Dostatni 2021, p. 1–2.
[230] Appelfeller; Feldmann 2018, p. 186; Cenamor; Sjödin; Parida 2018; Jovanovic; Sjödin; Parida 2021, p. 1; Neuhüttler; Woyke; Ganz 2018, p. 105; Nie; Kosaka 2016, p. 270.

enable manufacturers to leverage emerging business potential and introduce AS. It is possible to show the customer in a comprehensible way how costs and benefits develop during use and thus determine the consumption of the value of industrial goods.[231] Collected data is aggregated and made available to facilitate work on service solutions offered by the manufacturer. Different stakeholders can benefit from universal access via cloud applications in the ecosystem.[232] Ecosystems are mainly defined as joint activities of manufacturers, customers, and partners.[233]

Cloud-based solutions are increasingly being integrated that are capable of gathering, storing, organizing, and analyzing data.[234] This, in turn, leads to valuable and useful insights that can be exploited proactively to drive innovative services and preventively detect maintenance needs or optimization potential, allowing for the generation of knowledge. To achieve substantial value creation in the manufacturing industry, either an increase in productivity in the customer's operations and processes must be realized, or the development of a new business model and thus revenue potential is required.[235] Deploying these IoT-based solutions facilitates customer integration and enables the co-creation of value for both parties.[236] In addition, these platforms can function as self-service, enabling customers to utilize smart services in their environment and get an overview of the maintenance operations and efficiency of the product. Moreover, they can offer the possibility of digital ordering processes.[237] In this case, **spare parts** and services are ordered through the Internet, which has become an increasingly important and cost-effective channel for B2B purchasing processes. This makes it easier for customers to gain insight into the availability, delivery times, and tracking, but also facilitates competitors' entry into the spare parts market, as the high level of transparency enables direct price comparisons.[238] Whether self-services can be offered depends on the complexity and ambiguity of the task, which may require human interaction. However, when information is made available through digital portals, it is used because of the ease and flexibility of access.[239]

2.2.3 Emerging Business Models

The ongoing trend of servitization, as described in chapter 2.1.2, is moving in the direction of changing the current product-centric business model to a service-based operator model.[240] Successful business models today depend on the extent to which they allow value creation on both sides. However, the actual implementation of these types of business models and processes in industrial manufacturing is still in its early stages.[241] In this context, it is precisely the transformation from linear value chains to dynamic value networks that represents a

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[231] Porter; Heppelmann 2014.
[232] Presser et al. 2019, p. 34–35.
[233] Jovanovic; Sjödin; Parida 2021, p. 2.
[234] Barbieri et al. 2021, p. 96.
[235] Barbieri et al. 2021, p. 96; Jovanovic; Sjödin; Parida 2021, p. 2.
[236] Coreynen et al. 2020, p. 267.
[237] Hood; Brady 2016; Wünderlich; Wangenheim; Bitner 2013, p. 4.
[238] Dombrowski; Schulze; Engel 2011, p. 368.
[239] Scherer; Wünderlich; Wangenheim 2015, p. 184.
[240] Langley 2022, p. 2–3.
[241] Emmrich et al. 2015, p. 5.

transformation of Industry 4.0.[242] Combining digitization and servitization enables the development of new digital business models based on technology push.[243] As they are expected to grow in importance, their complexity makes it necessary to recognize the significance of introducing digital services at an early stage.[244] For this reason, insights are provided, as further development of IoT-supported services such as predictive maintenance, remote monitoring systems or flexible payment options arise.

New sources of revenue can be generated by manufacturers through the networking of the real and virtual world. Business models are increasingly data and service-driven, directly related to and based on AS. This has implications for both the customer and the provider itself, as the integration of sophisticated technology and changes to the business model require internal and external adjustments.[245] Value is added in the use phase with innovative pricing systems, like subscription fees or based on actual output or usage, and a focus on product performance.[246] A high level of service integration is particularly evident in performance-based or service-related compensation, where product ownership remains with the manufacturer. Here, the customer merely pays for a specific service, or rents equipment for a certain period for the agreed upon performance.[247] These are usually based on the provision of a product or service that aims to meet customer requirements and delivers added value. In the context of IoT, service offerings are being adapted and business models are becoming complex problem-solving pathways that focus on user experience.[248]

As mentioned earlier, PSS aim to improve services and enable these types of value-based, customer-centric business models, merely based on data-driven performance-dependent payment models.[249] They can be optimized in a future-oriented and value-creating way to foster long-term relationships through customer-focused offerings, resulting in a significant degree of competitiveness.[250] Consequently, the shift from a product-centric to a value and benefit-centric approach is changing the way companies do business and manage their product portfolio.[251]

Table 1 illustrates several business model opportunities that are suitable for a variety of industries and are already anchored in some to foster growth potential. Breitfuß et al. (2017) divide business model patterns into evolutionary, which are enhancements to existing options, and revolutionary, which are more disruptive. In their research, there was a clear trend of implementation and awareness in evolutionary options, especially smart automation, and digital add-on services visible.[252]

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[242] Breitfuß et al. 2017, p. 5.
[243] Martín-Peña; Sánchez-López; Díaz-Garrido 2020, p. 566.
[244] Emmrich et al. 2015, p. 5.
[245] Deloitte 2020, p. 16.
[246] Roth; Stoppel 2014, p. 195.
[247] Appelfeller; Feldmann 2018, p. 178; Emmrich et al. 2015, p. 25.
[248] Weking et al. 2020, p. 4, 8; Wobser 2022, p. 134–135.
[249] West; Gaiardelli; Saccani 2022, p. 4–6.
[250] Tukker 2004, p. 247.
[251] West; Gaiardelli; Saccani 2022, p. 6–7.
[252] Breitfuß et al. 2017, p. 16.

EVOLUTIONARY	**Smart Automation**	Products, systems, and materials communicate with each other and, through the interlinking of components, enable automated intelligent processes that independently carry out optimizations and thus allow customer-specific offers to be created in an economically attractive manner.
	Digital Add-on	Physical products are specifically enhanced with additional digital services. Digital products with additional modules are also possible.
	Connected Products & Data-driven Services	Data acquisition through integrated sensor technology and connectivity of usage, location, and environment. Service optimization and development of new services in the after-sales area by deriving efficiency-enhancing measures and maintenance processes.
	Self-Service	IoT supports automated reordering of products or spare parts as well as specific product configurators.
REVOLUTIONARY	**Everything as a Service (XaaS)**	Consistent service orientation with value proposition (Value as a Service) and provision of software (Software as a Service) and/or hardware for visualization on platforms (Platform as a Service). In addition, there is also provision of infrastructure (Infrastructure as a Service). Product as a Service charges a fee for use and returns the product at the end of the subscription period.
	Pay per X	Value-based business models, focusing on demand-dependent use, which can be based on availability, productivity, or functionality. Examples include pay per hour, per piece, per use or per feature. This is supported by digital components for connectivity and recording of operating time or output.
	Digital Lock-In	Customer loyalty through complementary products created by technical features or dependencies of products or services. Smart products support this, as services are usually required for proper functioning.

Table 1: Business Model Patterns[253]

In addition, other researchers state that the business models resulting from servitization can be subdivided into product-oriented, use-oriented, or result-oriented types. The first option focuses on transferring ownership of the physical product to the customer, and services are provided in the form of AS. Usage-based approaches state that the customer pays an amount for the provision of the product and thus for its use. The main advantage is that ownership remains with the manufacturer and the product can be used by different customers, always being maintained by the supplier. The last one is primarily about the result, on which the costs incurred are based.[254] How these fit into the servitization approach is illustrated by Tukker's (2004) model in chapter 2.1.2, associated with PSS.

2.2.4 B2B Customer Perspective

As outlined in the previous chapters, interaction with the customer through digital services is gaining great significance. Generally, there is little research available on customer perceptions of digital AS. The following segment deals with customer integration and their expectations of digital AS, as these form an essential part of the further empirical investigation.

Sjödin et al. (2020) emphasize that digital service development is all about the interplay between supplier and customer, as co-creation can drive innovation and create value. This is where numerous B2B companies find themselves in trouble because although they launch

[253] Own illustration based on Appelfeller; Feldmann 2018, p. 170, 178; Breitfuß et al. 2017, p. 10–12; Emmrich et al. 2015, p. 35, 47.
[254] Bressanelli et al. 2018, p. 4–5; Vogel-Heuser; Lindemann; Reinhart 2014, p. 4–6.

new services on the market, they do not generate the desired and requested customer value.[255] Here, it is important to consider the so-called service paradox, namely the high level of investment by providers in expanding the range of services, but the absence of a corresponding increase in returns.[256] The communication between supplier and customer is changing due to the emergence of new technologies and the phenomenon of digitalization, proceeding through virtual exchanges.[257] Particularly in the area of AS, not only interaction but also active integration is crucial.[258] It is therefore vital to maintain well-functioning inter-company cooperation to ensure that services can be adapted to customer needs and create sustainable value.[259] As stated in chapter 2.2.2, the trend is toward remote diagnosis and maintenance, which requires the personal presence of service employees only to a limited extent.[260] This is where connectivity between partners in the ecosystem has become particularly relevant and automatically leads to a certain level of permanent connection. As a result, it is possible for providers to monitor interconnected products to identify needs and thus support satisfaction.[261]

However, every interaction the manufacturer has with the customer contributes to the customer's contentment. Depending on the quality of these touchpoints, the customer is more likely to be satisfied or dissatisfied with the company's service and reflects this in future business relationships and repurchases.[262] Essentially, this is related to the customer's expectations of a certain level of performance and support from the provider, which, among other factors, are based upon experience. If this expected target state is exceeded, it contributes significantly to satisfaction.[263] Previous research has found that there is a high correlation between satisfaction and customer service, which in turn has a direct impact on customer loyalty.[264] Additional value propositions such as spare parts service or maintenance positively impact the customer relationship, as they not only contribute to improving the market position but also offer benefits for the customer.[265]

Customer Expectations of Digital After-Sales Services

In general, customers are placing increasingly high expectations on the AS for industrial goods. Customers expect a physical product that is readily available and perfectly functional in the long term, with AS representing an essential factor. This is accompanied by a certain urgency, as high costs and other far-reaching implications arise in the event of a failure of the corresponding product. Therefore, they expect the provider to act immediately and offer some level of convenience.[266] In addition, they demand greater integration, individualization, personalization, and mobility as part of the service innovation. Especially in comparison to other industries, expectations are transferred and anticipated to be offered by all. Getting their

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[255] Sjödin et al. 2020, p. 478–479.
[256] Gebauer; Fleisch; Friedli 2005, p. 14.
[257] Lindh; Nordman 2018, p. 108; Witell et al. 2020, p. 420.
[258] Appelfeller; Feldmann 2018, p. 36; Fließ; Lexutt 2016, p. 59.
[259] Lindh; Nordman 2018, p. 108; Witell et al. 2020, p. 420.
[260] Klein; Biehl; Friedli 2018, p. 846.
[261] Porter; Heppelmann 2014.
[262] Aichner; Gruber 2017, p. 131.
[263] Kleinaltenkamp; Saab 2021, p. 215–216.
[264] Shokouhyar; Shokoohyar; Safari 2020, p. 1–2.
[265] Kleinaltenkamp; Saab 2021, p. 219.
[266] Dombrowski; Malorny; et al. 2020, p. 6.

opinion and assessing their expectations for the development of digital services is a critical success factor in achieving the aim of creating tailored offers.[267] This is because services should be fundamentally oriented toward the customers to ensure their loyalty and thus retention.[268]

Among the reasons for developing a range of digital services is also the explicit demand from customers to enhance their efficiencies, particularly in mechanical and system engineering.[269] However, what customers perceive as a benefit resides in their subjective perception of value, which is associated with their expectation of service delivery. In addition, the fulfillment of their business objectives is paramount.[270] Wünderlich and Wangenheim (2015) found in their study that customers value the option of self-service, which the customer can perform himself, but also reinforce the importance of human-supported information. Exploiting both methods facilitates the generation and preservation of customer retention and thus increases loyalty to the provider. Digital self-service, digital human interaction, and face-to-face communication can therefore be offered throughout the relationship with the customer. Nevertheless, especially when providing self-service, they must be developed according to customer expectations. If they do not comply, they can potentially hinder customer satisfaction.[271] This includes supplier transparency, as customers demand insight into product information.[272] Moreover, the speed of interactions is critical[273], and smart solutions equipped with intelligent technology are capable of mitigating this issue by allowing remote repair.[274] Customers are increasingly demanding interconnectivity and thus compatibility in the sense of the smooth connection of different products and services on one platform.[275] Dangelmaier et al. (2004) state that those expectations are mainly based on an impeccable use of the product, for instance, production equipment, to avoid failures.[276]

In the global context, customer requirements are reflected above all in the uniformity of the provider. If service is provided at a certain speed in one country, it is expected to be delivered at the same in another. Similarly, this applies to spare parts, price agreements, quotations, and service cycles. This poses challenges for providers that make it even more important to consider the global context when developing services.[277] The extent to which customers are served and invested in, depends largely on their future sales potential, their current value, and the desire to retain them over the long term. By segmenting customers, since not all can be promoted equally, measures may be derived, and an appropriate customer experience created.[278]

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[267] D'Emidio; Dorton; Duncan 2015.
[268] Link; Sigg 2011, p. 53.
[269] Kieninger; Meiren; Münster 2011, p. 92.
[270] Schuh; Georgi 2008, p. 68.
[271] Scherer; Wünderlich; Wangenheim 2015, p. 178–179, 195.
[272] Wellener et al. 2020.
[273] Halb; Seebacher 2021, p. 336.
[274] Klein; Biehl; Friedli 2018, p. 846.
[275] Ritter; Pedersen 2020, p. 185.
[276] Dangelmaier et al. 2004, p. 103.
[277] Martens 2011, p. 166–167.
[278] Müller; Brandl; Passarge 2008, p. 295–296.

2.3 Research Focus

This section provides an overview of the existing theoretical foundation and thus forms the basis for the investigation guided by the previously elaborated research questions. The trend towards servitization is increasingly being taken up by industrial B2B manufacturers and integrated into their processes or supplemented by the creation of additional services. However, the extent of this transition is often limited to the provision of after-sales services and therefore rarely leads to truly disruptive business model innovations that focus exclusively on the provision of services. In addition, the literature confirms the emerging role of customer integration, which should take place early in the development process to incorporate their opinions and thus influence both time to market and avoidance of failure.[279]

Precisely because digitization and hence, digital transformation show great potential in the service sector and consequently in customer loyalty concerning follow-up purchases, an examination of these possibilities is vital and ubiquitous today.[280] As part of this process, considerable emphasis is placed on collaboration and cooperation between various stakeholders, especially providers and customers.[281] These are involved in the development process as well as in the provision of the service. For many suppliers, the current technological age simplifies the efficient integration of digital services in the after-sales area.[282] This primarily involves efficiency-enhancing measures, most of which are data-based, in the context of creating value. These include predictive maintenance, visualization on platforms, digital interfaces, and processes facilitated by IoT.[283] To be able to establish such services, innovation processes must be applied that allow market-compliant solutions with customer integration and agile methods.[284]

Research shows that technology is an important enabler for advanced AS, which then offers the possibility of enforcing digital business models that allow customer-oriented pricing options, such as billing based on actual usage.[285] This holds future potential because, on the one hand, goods associated with high investments are more easily accessible to the customer. On the other hand, the manufacturer always provides an intact product, which in turn has a positive impact on customer loyalty and thus satisfaction. The extent to which such approaches appeal to industrial manufacturers and customers will be clarified in the following investigation.[286] Consequently, both sides have expectations that demand individual and efficient AS that meet customer needs. To be able to develop digital AS in line with the expectations and trends, a suitable innovation process for digital service innovations in the after-sales area of industrial B2B manufacturers must be established and represent a central research focus.[287]

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[279] Kieninger; Meiren; Münster 2011, p. 100.
[280] Felker 2008, p. 31; Schawalder; Lenz; Röllin 2013, p. 9; Schuh; Gudergan; Thomassen; et al. 2016, p. 34.
[281] Gorldt et al. 2017, p. 369–370; Pistoni; Songini 2017, p. 9; Randhawa; Scerri 2015, p. 30; Reckenfelderbäumer; Busse 2006, p. 145.
[282] Weiber; Ferreira 2015, p. 37–39.
[283] Paiola; Gebauer 2020, p. 245–246; Paschou et al. 2020, p. 1; Sjödin et al. 2020, p. 478.
[284] Link 2014, p. 79–80; Wobser 2022, p. 10–12.
[285] Langley 2022, p. 2–3.
[286] Deloitte 2020, p. 16.
[287] Baines; Lightfoot 2014, p. 22; Gebauer et al. 2008, p. 392; Osterrieder 2021, p. 11; Troilo; De Luca; Guenzi 2017.

Current research and literature show a mostly one-sided view due to the strong focus on the pure supplier perspective, which indicates that the investigation of both sides, customer and supplier, is a research gap regarding digital AS. As mentioned at the beginning of the thesis, the customer perspective is usually not considered enough by suppliers, which reinforces the need for research involving input from both sides, since the interaction between the two parties is often crucial for service development to convey actual customer value.

3 Empirical Research

After an overview of the current state of research on service transformation and thus digital after-sales service innovation is given, the exploratory qualitative research approach is outlined in the context of the thesis. The following provides insights into various aspects of the research subject, such as the chosen methodology, the research setting, as well as data collection and analysis.

3.1 Research Design

In the succeeding section, a detailed overview of the chosen research methodology is given, including background information, guidelines, and sampling criteria. Furthermore, the quality requirements for qualitative studies are outlined, and based on this, the choice of the guided interview approach is described. Figure 11 provides an overview of the steps taken to address the topic and thus the elaborated research questions. Subsequently, the selection of the design and the collection as well as the processing of the data will be given to allow for adequate analysis and presentation of the results.

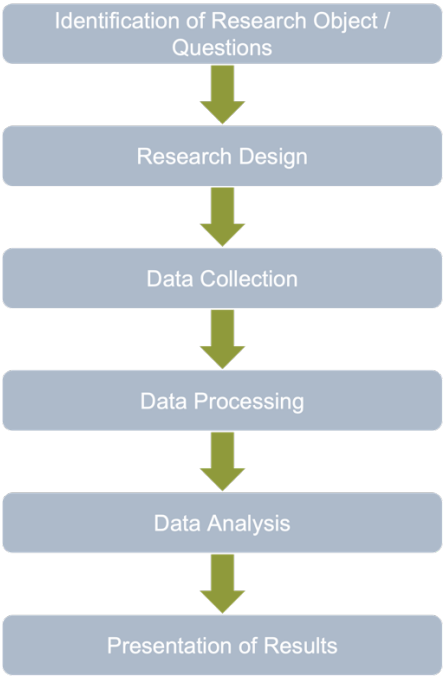

Figure 11: Research Design[288]

[288] Own illustration

3.1.1 Methodological Approach

The study aims to examine the provider and customer perspectives on the digitalization of AS and the resulting opportunities, together with a consideration of the associated innovation process required to enable successful development. Under the umbrella of the widely discussed topic of servitization, the current framework conditions and future potentials that an early rethinking of the production and provision of industrial goods entails are investigated. The overriding goal of the empirical study is to answer the derived research questions, as mentioned in chapter 1.2. Due to the demand for the generation of primary knowledge about a concrete topic, the guideline-based interview method is applied.[289]

In this context, and since the available scientific literature studied does not contain explicit guidelines for digital service innovation processes and in-depth information on the research purpose, the study is designed on an exploratory principle. The aim is to guide the conversation while generating data through open-ended questions to enable the discovery and exploration of new information. Moreover, the study is partly descriptive, as current situations and actual executions of the digital services and their development steps are to be depicted, leading to a combined approach. For this purpose, an open interview style is suitable to generate deep information, as in semi-structured settings.[290]

Furthermore, quality criteria are considered to exclude any associated issues. These primarily concern the preparation and carrying out of the interviews to ensure that the data is collected and analyzed appropriately. Accordingly, the research process should be coherent and transparent in such a way that it is comprehensible to others that the collection of data and evaluation of said data were carried out to the best of knowledge and beliefs.[291] Derived from quantitative approaches, objectivity, validity, and reliability are also considered relevant in the context of qualitative research.[292]

Dependability in qualitative research is the equivalent of reliability in quantitative research and states that confidence in the study being conducted is captured by recording and making all steps that are taken accessible. This is done to provide a comprehensible view of the emerging research focus.[293]

Credibility is consistent with internal validity, which emphasizes that the accurate representation of participants' reality must match the reality depicted in the research findings. These results are then confirmed by the link to actual reality.[294]

Transferability, which is associated with external validity and generalizability, means that by disclosing the approach and results, the possibility of transfer to other areas is enabled.[295]

Confirmability states that objectivity implies that the author's subjective influence must be excluded when evaluating the data. The subjective opinion and values of the researcher are

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[289] Kuß; Wildner; Kreis 2014, p. 40; Mayer 2013, p. 37.
[290] Saunders; Lewis; Thornhill 2016, p. 174–175, 394.
[291] Berger-Grabner 2016, p. 129; Mayer 2013, p. 55–56; Saunders; Lewis; Thornhill 2016, p. 396.
[292] Bryman; Bell 2007, p. 410–411.
[293] Bryman; Bell 2007, p. 414; Mayer 2013, p. 56; Saunders; Lewis; Thornhill 2016, p. 206.
[294] Bryman; Bell 2007, p. 411; Saunders; Lewis; Thornhill 2016, p. 206.
[295] Bryman; Bell 2007, p. 413; Saunders; Lewis; Thornhill 2016, p. 206.

therefore, in principle, not allowed to avoid the influence of one's perspective. However, according to the authors, a completely objective approach is almost impossible in a business context.[296]

3.1.2 Guided Interviews

In the case of interviews, a basic distinction is made according to the number of individuals interviewed simultaneously and the chosen structure and thus openness.[297] Guided interviews essentially have the characteristic that a guideline serves as the basis for the interview, but does not prescribe answers to the interviewees, who are free to express their opinions. The purpose is therefore to provide a certain degree of comparability and structure. This is vital in order to avoid omitting any important aspects when answering the research question, although the order of the questions does not have to be strictly adhered to and intermediate questions are allowed.[298] Semi-structured guides for the customer and supplier perspective were designed based on the above-mentioned theoretical background. These are not completely standardized and allow for a reaction to the respondent's attitude towards the question.[299] One form of guided interviewing is the expert interview, which is of great importance for this thesis since the functionality and expertise of the interviewee are key factors in deriving substantial information.[300]

The choice of partly structured interviews seemed appropriate for the aim of the research, as current information and future assessments were sought directly and questions could be asked flexibly in the event of ambiguities, or if there was a need for more detailed statements. Especially regarding individual approaches to the development of digital AS and the relationship with the customer as well as the offer itself, this agility is helpful to react specifically to the responses. Furthermore, the degree of development of digital services in the companies targeted was not previously discernible. In the first step, questions were collected based on the literature and research purpose, which were then sorted and structured according to superordinate topics.[301] In the process, the content guidelines for the providers were defined, and based on this, the questions for the customers were created in a similar structure. This resulted in the following blocks of topics, illustrated in Figure 12.

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[296] Bryman; Bell 2007, p. 414.
[297] Cooper; Schindler 2011, p. 168.
[298] Mayer 2013, p. 37; Saunders; Lewis; Thornhill 2016, p. 391.
[299] Saunders; Lewis; Thornhill 2016, p. 391.
[300] Mayer 2013, p. 38.
[301] Mayer 2013, p. 43–44.

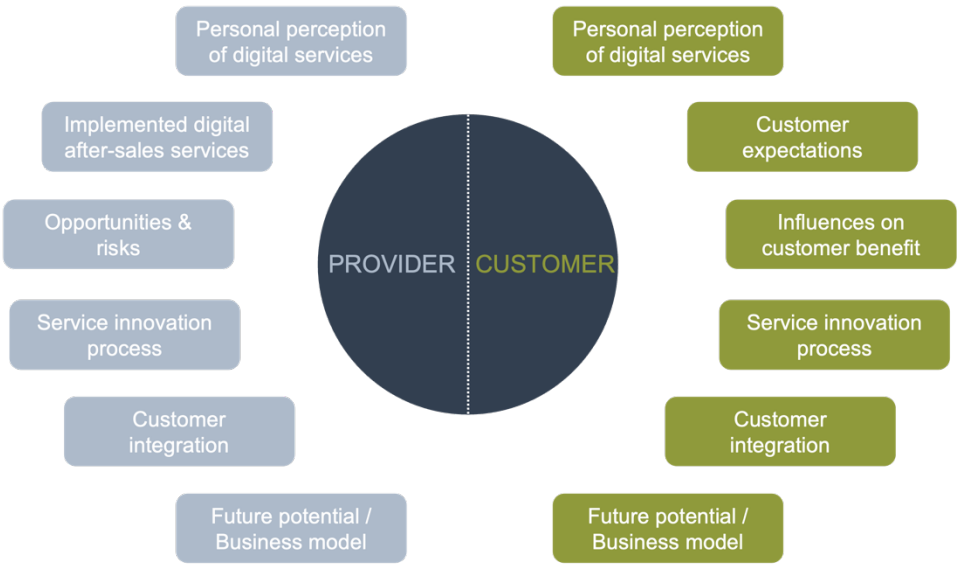

Figure 12: Topics of Interview Guidelines[302]

Care was taken to ensure that the questions asked did not restrict the interviewees' opinions and thus constituted an open guide, while closed questions were to be avoided. Apart from this, they were formulated thoughtfully to ensure quick comprehension.[303] The interviews started with some introductory questions and a general assessment of the subject area by the interviewee. To guarantee the flow of conversation and spontaneous responses, the interviews were conducted in the native language of the respective respondent, in this case, German. Both interview guides were pre-tested and are attached in the appendix.

3.1.3 Sampling Criteria

In contrast to quantitative research approaches, where the selection of the sample claims to be statistically representative, in many qualitative projects it is not possible to interview all elements of a population. Nevertheless, generalization is also insisted on here, depending on the research purpose, which must be argued why there is generalizability in individual cases.[304] Qualitative research approaches typically involve a smaller number of participants who are purposively selected, meaning that respondents are chosen directly by the researcher. The reason for this is to gain insights into detailed current knowledge, different perceptions, and future intentions as well as two different perspectives on the topic.[305] In this case, the specific interviewees are selected "arbitrarily for their unique characteristics or their experiences, attitudes, or perceptions".[306] Accordingly, their relevance to the subject under investigation is pivotal.[307]

Some basic selection criteria were applied that the respondents had to fulfill to ensure the relevance of the statements in answering the research questions. Firstly, working in an

[302] Own illustration
[303] Bryman; Bell 2007, p. 483.
[304] Mayer 2013, p. 38–39.
[305] Berger-Grabner 2016, p. 128; Cooper; Schindler 2011, p. 163; Saunders; Lewis; Thornhill 2016, p. 174.
[306] Cooper; Schindler 2011, p. 167.
[307] Mayer 2013, p. 39.

internationally active industrial manufacturing company in the B2B sector was crucial, and secondly, the respondent's area of responsibility should be close to the development of the digital AS to gain practical insights at a high professional level. Among the customers, the focus was on the actual demand for digital customer services from an international supplier of the physical products and proximity to the application of the services in the company. Both parties were expected to have the potential for further progress and innovation in the development.

The international context was created by the diversity of the companies surveyed as well as by the research topic itself, which is emerging due to facilitated global business opportunities and therefore growing competition. The focus was on international customer-supplier relationships because the advantages of digital services lie precisely in their location independence. Still, it is to be considered limited, as originally customers stationed abroad were intended to be surveyed. However, this was not feasible due to the dependence on the companies involved in the research, hence potential or even actual customers in Austria were interviewed.

3.2 Data Collection

Further details on how the required primary data was collected and processed are specified in the following chapter. Insights into supplier and customer-specific information in the interviews are presented and the general conditions fundamental to the transcript are outlined.

Conducted Interviews

The chosen methodology is grounded on a series of one-on-one interviews with respondents professionally engaged in industrial B2B manufacturing companies. Here, the selection was made because of a substantiated personal recommendation within the context of the above-mentioned selection criteria. Accordingly, a letter was sent by e-mail, primarily to providers with a request to contact one of their customers. Where this was not possible, general customers of such services were subsequently contacted. Participating experts were informed that the interview is recorded for transcription purposes and anonymized to avoid inferences about the company to ensure open responses to the questions.[308] This was consolidated by signing a consent form. A total of ten interviews were conducted between March 21st, 2022, and April 21st, 2022, based on the above two coordinated separate interview guides.

Generally, the situation around COVID-19 made in-person access difficult and necessitated switching to online interviews for the full number of appointments. The interviews lasted, on average, 52 minutes – well within the original estimate of 45 to 60 minutes. The following table provides an overview of the background information on the interviews conducted, such as the acronym for anonymization and simultaneous identification in the further course of the work, as well as the position of the interview partner in the company. In addition, details on the interview process, such as medium, date, and duration, are provided. Suppliers are marked in blue (SUP-1 to SUP-6) and customers in green (CUS-1 to CUS-4).

[308] Mayer 2013, p. 46–47.

Interview #	Position	Medium	Date	Duration
SUP-1	Vice President Corporate Development	MS Teams	21.03.2022	44:40
SUP-2	Product Marketing Manager	MS Teams	24.03.2022	01:01:40
SUP-3	Head of Product Management Digital Solutions and Consulting	MS Teams	31.03.2022	53:57
SUP-4	Vice President Business Development	MS Teams	05.04.2022	01:07:56
SUP-5	Head of Business Units	MS Teams	06.04.2022	34:31
SUP-6	Head of Development	MS Teams	20.04.2022	01:00:50
CUS-1	Head of Development and Innovation	MS Teams	14.04.2022	01:03:17
CUS-2	Head of Production Planning and Industrialization	MS Teams	14.04.2022	50:34
CUS-3	Head of Production Engineering	MS Teams	20.04.2022	49:06
CUS-4	Corporate Maintenance Manager	MS Teams	21.04.2022	41:57

Table 2: Overview of the Study Participants and Interviews[309]

Transcription Process and Rules

An audio recording of the interview was made after obtaining a signed consent form. After the interview the recording was transcribed to follow a transparent procedure. In general, transcriptions follow certain rules that determine the level of detail and provide the framework for software-assisted or manual capturing.[310] For standardization, the approach according to Kuckartz (2018) is focused on which transcription rules are specified for a computer-assisted evaluation. The following rules imply the application of Kuckartz's concept to this thesis.[311]

- The approach of literal transcription is followed, meaning that dialect expressions are transcribed into High German. In this case, what is said is taken literally and not summarized. Only repeated words have been smoothed out.
- Likewise, spoilers or gap fillers (e.g. um) are omitted, since the main emphasis is on the information transferred and details provided. Similarly, affirmative or negative sounds (e.g. mhm) are not transcribed unless they have further meaning.
- Significantly longer pauses are marked with (...).
- Slight smoothing of language and punctuation is set according to the meaning.
- Details that allow conclusions to be drawn about the respondent or the company are anonymized as agreed. Significantly, identifying filler words such as "name", "company" or "product" are written instead of the name, company wording, or product description.
- Incomprehensible parts are marked with (inc.).

In this case, MAXQDA 2022 is used as a tool for transcription, which facilitates the exact positioning of time markers and assignment of respondents. Furthermore, the interviewer was

[309] Own illustration
[310] Fuß; Karbach 2019, p. 13–17; Kuckartz 2018, p. 166.
[311] Fuß; Karbach 2019, p. 42; Kuckartz 2018, p. 167; Mayer 2013, p. 47.

indicated with “I” and the respondents with the above-stated abbreviation. Additionally, based on the information collected, a qualitative content analysis was conducted using the same software, which is discussed further in the following chapter. The advantage is the automatic documentation of the performed analysis, which allows increased transparency in the procedure.[312]

3.3 Data Analysis and Interpretation

The following section of the master thesis deals with the procedure of data analysis based on the transcripts of the qualitative interviews conducted. This is done on the principle of Mayring’s qualitative content analysis, which is why the coding system is presented in greater detail. Justification for the choice of this method lies primarily in the fact that conclusions are drawn from actual company examples and personal impressions are attributable to generally derivable categories. Primarily, these categories serve to structure the data collected, but also to present the results in subsequent main chapters.

Qualitative Content Analysis According to Mayring

Strict adherence to the systematics of qualitative content analysis enables a step-by-step reduction of the generated information. In this process, the entire content is divided into smaller units, which pass through this process of steps and are addressed one after the other. The focus of this procedure lies in the formation of categories, which are derived and structured in this process and thus result in a category system. This serves as the basis for further filtering and processing of the material.[313] It is emphasized that content analysis varies depending on the subject and material and should be modified to suit the specific case.[314]

In general, according to Mayring (2015), three different interpretive approaches are distinguished in content analysis, which is divided into summarization, explication, and structuring. Since the aim is to filter out the essential content of the qualitative research, a summarization is focused in the context of this master thesis. This means that an overview of the main aspects can be gained through a certain level of abstraction that is always oriented towards the basic material.[315] The applied process model is outlined step by step in Figure 13.

[312] Flick 2019, p. 483.
[313] Mayring 2016, p. 114.
[314] Mayring 2015, p. 51.
[315] Mayring 2015, p. 67.

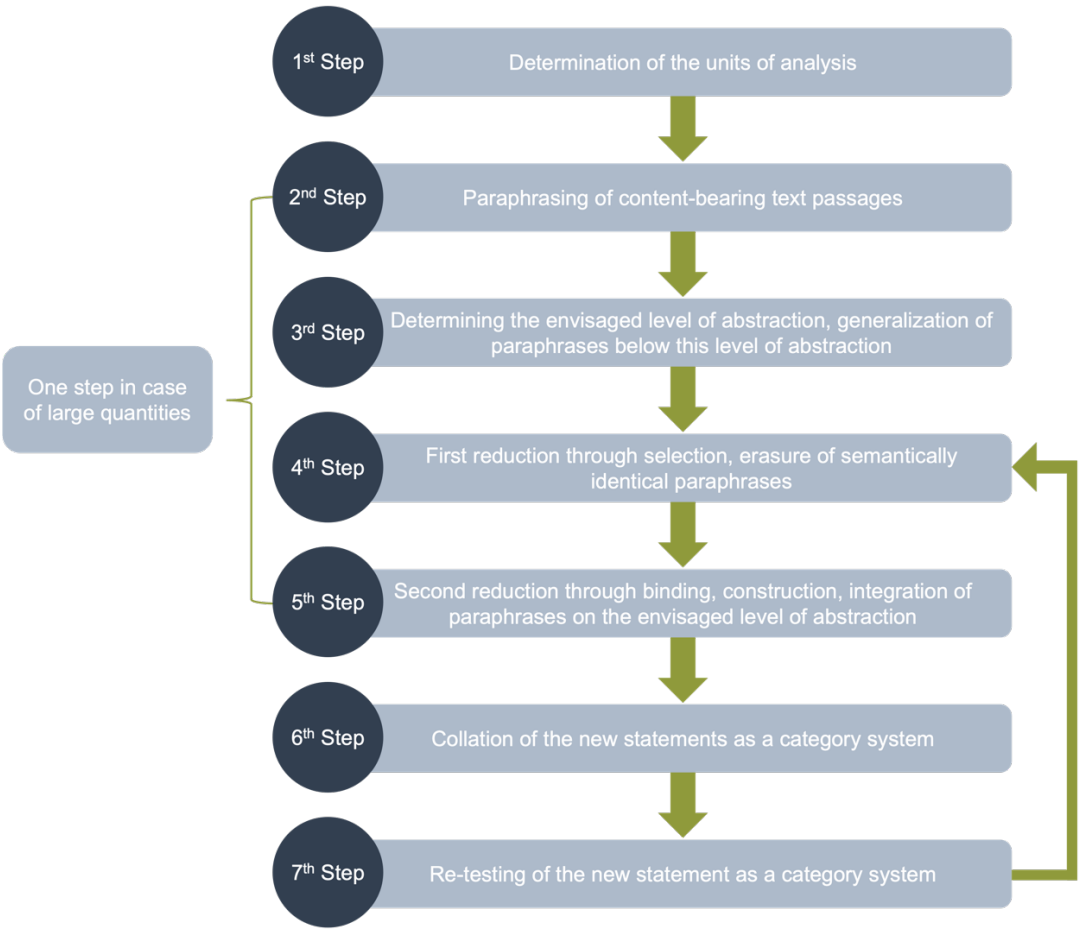

Figure 13: Process Model of Summarizing Content Analysis[316]

The following segment briefly outlines the steps to understanding. However, for large data sets, steps two through five are combined and integrated into one step at the level of targeted abstraction. This results in a total of four phases, which are followed in this analysis.[317]

1st Step: Determining the units of analysis, including what should be summarized based on the research question.

2nd Step: Paraphrasing, which means rewriting text passages that are limited to topics relevant to the content, in a short consistent writing style. This is specifically relevant, as companies were surveyed for their use cases, whereby examples can be generalized, and anonymity preserved.

3rd Step: Establishing the level of abstraction, with a generalization of the paraphrased material. Passages that are identical in content at this point can be deleted and irrelevant material omitted.

4th Step: First level of selective reduction, where passages that are identical in content at this point can be deleted and irrelevant material omitted.

[316] Own illustration translated by the author based on Mayring 2015, p. 70.
[317] Mayring 2015, p. 71.

5th Step: Second level of reduction. Paraphrases are bundled, often scattered throughout the material, to be expressed in a new statement. For each new generalization, attention is paid as to whether it already appears in the material and can be integrated. In case of uncertainty, theoretical assumptions may be considered.

6th Step: Creating the category system based on new statements.

7th Step: Re-testing of the established category system. Care must be taken to present the most important content in an abbreviated and generalized format and in a somewhat abstract manner.[318]

Category Scheme

Based on an intensive review of the literature, the research questions, and the objective of the study, it was possible to determine the key points of the categories in advance, i.e. deductively. Likewise, an inductive categorization was chosen for this research purpose, as a purely deductive approach would be too limited and would lack the exploratory aspect of the research design. In this process, categories are systematically derived from the material obtained. Mayring (2015; 2016) recommends reviewing the categories after ten to 50% of the analysis, which was done to maintain the focus of the work.[319] Throughout the analysis, the categories were constantly reviewed and, if necessary, supplemented, adjusted, or revised.[320] The final category system can be found in the appendix.

[318] Mayring 2015, p. 70–72, 85.
[319] Mayring 2015, p. 85; 2016, p. 115–116.
[320] Kuckartz 2018, p. 95–96; Mayring 2014, p. 104.

4 Presentation of Results

Building on the previously described process of data collection and analysis, the following section presents the derived research results. This is based on the category system formed and conveys the core statements of the interviewees. The assessments of the providers and the perspective of the customers are considered and compared or treated in a complementary manner.

4.1 Drivers of Digitization of After-Sales Services

The tried-and-true "sell and forget" approach no longer works because suppliers are expected to do more than just physically deliver products, such as building long-term relationships.[321] Due to the increasing integration of digital elements in products such as smart sensors, specifically product-related digital AS are gaining in importance.[322] This category deals with the drivers behind the establishment of digital services within industrial B2B manufacturing companies to discuss the triggers of the transformation processes. Those are services in the digital sphere, which are expected to generate benefits for both customers and suppliers.

Generation Change

A generational shift is taking place, and the demographics are altering in terms of age structure. Digitization is becoming more present, both in business and private contexts, and takes up a significant part of today's customer-supplier interaction, such as conducting virtual conversations. This will replace highly personal relationship-based selling, which is becoming increasingly digital and likely to transform the customer relationship. The main reason for this is the new generation's affinity for digital services.[323] Along with this generational change comes a shortage of skilled workers, which makes it impossible for companies to consistently provide AS at the customer's site, where digitization, as well as the development of a service network, offer support. For this reason, providers are expanding their service offers to hand over certain tasks to the customer or perform them remotely through digital means.[324]

Competitive Position

Digital AS is described as a must to stand out from the competition in the industrial sector through a differentiated service offer. This is vital to note, as many industries are facing enormous competitive pressure, especially as products are frequently replicable and innovation cycles are accelerating. Competitors are entering these markets with a potential for cost leadership that is not enforceable within European standards and therefore differentiation dominates here. Consequently, forward integration, i.e. servitization, is critical and is seen as an essential part of the company's strategic direction and key success factor.[325]

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[321] SUP-2 2022, pos. 5.
[322] SUP-4 2022, pos. 6; SUP-6 2022, pos. 64.
[323] SUP-1 2022, pos. 8, 12; SUP-3 2022, pos. 8.
[324] SUP-3 2022, pos. 6; SUP-5 2022, pos. 8.
[325] SUP-2 2022, pos. 60, 106; SUP-3 2022, pos. 18; SUP-4 2022, pos. 58; SUP-5 2022, pos. 102.

Customer Relationship and Requirements

As a result of the increased use of digital services, it is desirable and necessary from the customer's point of view to offer services that enable products to be controlled and monitored remotely.[326] Companies' offers are experiencing a turnaround, focusing on an ongoing relationship with customers through evolving services such as, for example, smartphones and app stores. In the B2B sector, these are maintenance contracts, leasing offers, or even cloud solutions that create a recurring business.[327] As a result, the supplier is very close to its customers' business processes and thus influences value creation. This applies to the delivery of the overall package of hardware, software, and services.[328]

Technology Development

Digitization is being driven forward everywhere, and predictive maintenance is a term that frequently crops up in the process, involving the evaluation of data generated by digital tools.[329] In the course of digitization, a shift from reactive to predictive service is observable, and potential is identified in new business models. The progressive development of technology is opening new opportunities.[330] Subsequently, as SUP-2 confirms, the ever-increasing complexity, interconnectedness and dynamism of products consequently require adequate service and support.[331]

4.2 Perspectives on Digital After-Sales Services

A general evaluation of the perceived sentiment and opinions around digital AS is given. The importance of such digital services for both sides, the perceptions regarding the extent of services, and the advantages and disadvantages are described. Another essential feature of digital services is the generation and use of data as well as offering complete solutions with hybrid sales options. In the past, these services were offered as a means to a sale, but this has shifted to a defined product that is marketed and offered with an increased focus on the service component.[332]

Digital After-Sales Services

Customers are an integral part of business processes as they experience support and value in the form of services and make repeat purchases to build long-term relationships. This allows providers to create a base noise in revenue and not be solely dependent on new sales. It is crucial to identify their current needs and meet them in the after-sales area.[333] However, if this is satisfactory for the customers, they can be bound to the product and establish intensive cooperation. Moreover, the feedback that flows directly from the customer to the company is

[326] SUP-3 2022, pos. 8.
[327] SUP-2 2022, pos. 6.
[328] SUP-3 2022, pos. 18; SUP-4 2022, pos. 86.
[329] SUP-6 2022, pos. 20.
[330] SUP-3 2022, pos. 28; SUP-5 2022, pos. 8.
[331] SUP-2 2022, pos. 8; SUP-4 2022, pos. 58.
[332] SUP-4 2022, pos. 26.
[333] SUP-1 2022, pos. 4; SUP-2 2022, pos. 4; SUP-5 2022, pos. 68.

important for the further development of products and services.[334] Another major factor cited by both suppliers and customers is the avoidance of downtime, especially in terms of customer efficiency, and the correct use of products.[335] AS is particularly necessary for customized products, as these are usually not standardized and unexpected errors are therefore more likely to occur.[336] As far as the obstacles or challenges in the introduction of digital services are concerned, the positive aspects are increasingly being perceived. The challenges are primarily related to data generation and information gathering. Furthermore, it is emphasized that the framework conditions in the companies must be adapted accordingly to implement relevant results. Advantages lie primarily in the speed, transparency, and information gained based on evaluated data. Table 3 gives an overview of the advantages and challenges perceived by providers as well as customers regarding digital AS.

Advantages	Challenges
• Supports customer loyalty • Integration in customer process • Employer attractiveness • Internationalization through remote services • Irreplaceable as solution provider • Equipment/Product control and monitoring • Product data analysis with digital tools • Accelerated response time • Quick availability of information • Identification of customer needs through data • High operational reliability • Openness to cloud-based services increases • Individualization and customization • Transparency • Productivity growth • Acceleration of processes (e.g. repurchasing)	• Uncertainty in data sharing • Revenue losses due to transparency • Incorrect data analysis • Increasing complexity due to connectivity • Establishing appropriate internal processes (e.g. billing) • Internal and external change management • Readiness of the customer's organization to use digital services • Economic profitability • Delivering actual value to customers • Constant accessibility and increase in workload due to flexibility

Table 3: Advantages and Challenges of Digital Services[337]

[334] SUP-3 2022, pos. 4.
[335] SUP-2 2022, pos. 9; SUP-3 2022, pos. 25; SUP-5 2022, pos. 84; SUP-6 2022, pos. 6; CUS-1 2022, pos. 13; CUS-3 2022, pos. 4, 6; CUS-4 2022, pos. 62.
[336] CUS-3 2022, pos. 6.
[337] Own illustration based on SUP-1 2022, pos. 32, 34, 36, 44; SUP-2 2022, pos. 30, 34, 36, 56, 58, 70, 72, 90; SUP-3 2022, pos. 20, 36, 62, 90, 116; SUP-4 2022, pos. 16, 30, 42; SUP-5 2022, pos. 20, 24; SUP-6 2022, pos. 22, 58, 132; CUS-1 2022, pos. 21, 27; CUS-2 2022, pos. 14, 16, 42; CUS-3 2022, pos. 20, 22, 68; CUS-4 2022, pos. 16, 18.

Servitization

According to suppliers, the customer primarily wants to take care of his core business, his own unique competence, and have a reliably functioning plant. This is confirmed since customers prefer a holistic solution to a specific problem, not simply a particular product, and intend to outsource this competence.[338] Precisely because building up the necessary know-how at the customer level is expensive in relation to the benefits, and they themselves are unable to keep pace with technological progress. This in turn enables long-term customer loyalty at the point of sale and a degree of integration into customer processes.[339] Beyond that, the responsibility increasingly lies with the manufacturers, who must ensure that the systems work.[340] Currently, products that are essential for ongoing operations are maintained internally or in cooperation with suppliers, thus using bundled know-how to avoid downtime.[341]

Complete packages of hardware and software in combination with digital services are available. However, this way of thinking must be taken up again by companies so that a complete solution is marketed instead of a purely physical product. With this approach, it is possible to maintain the competitive edge, as these bundles are more resistant to reproduction.[342] Customers associate these all-round, worry-free options above all with constant availability and fast response times.[343] Suppliers are taking advantage of this trend to tap into growth potential, according to SUP-1. The key factor for companies is whether their business area is designed to operate meaningfully as a systems provider.[344]

Data Sharing and Use

Data generation and usage is a key matter in digital services and is closely related to the following chapters. Collecting, sharing, and using data is a critical issue, as customers are especially wary of process and operational data sharing.[345] From the perspective of SUP-1, the main concern is that it is unclear what happens to the data, who owns it and where it is located. This must be precisely regulated contractually to avoid discrepancies. However, this is a delicate matter, as digital services such as remote monitoring are taken with caution because of the constant access.[346] Customers often do not want data to be constantly transferred via an interface, but rather to be transmitted in a targeted and selective manner.[347]

Basically, the first step is to level the circumstances and goals of data measurements so that suitable observations can be made.[348] Data enables manufacturers, provided they have a corresponding data pool and access to real user data, to derive customer needs and thus develop

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[338] SUP-2 2022, pos. 10, 100; SUP-3 2022, pos. 18, 20, 112; SUP-4 2022, pos. 26, 42, 58; SUP-5 2022, pos. 6, 98, 100; CUS-1 2022, pos. 29, 89; CUS-4 2022, pos. 108.
[339] SUP-2 2022, pos. 10, 100; SUP-3 2022, pos. 18, 20, 112.
[340] CUS-4 2022, pos. 6.
[341] CUS-3 2022, pos. 82.
[342] SUP-2 2022, pos. 18, 60, 80.
[343] SUP-6 2022, pos. 22.
[344] SUP-1 2022, pos. 10, 12.
[345] SUP-1 2022, pos. 34, 42; SUP-4 2022, pos. 16; SUP-5 2022, pos. 60; CUS-1 2022, pos. 21, 23, 59; CUS-3 2022, pos. 12.
[346] SUP-1 2022, pos. 34, 42.
[347] CUS-2 2022, pos. 22; CUS-3 2022, pos. 12, 26.
[348] SUP-4 2022, pos. 20.

an adapted product portfolio for the respective market.[349] This also supports further product developments and advanced services such as predictive maintenance as well as optimizations and efficiency improvements.[350]

When it comes to data storage, there has been a shift in thinking among customers, who are increasingly open to data collection in the cloud rather than preferring their own local server.[351] SUP-2 believes that this is mainly due to the availability and reliability of the Internet. Many services, such as maintenance or product settings, are provided via cloud solutions that are constantly being adapted, expanded, and improved to leverage open potential.[352]

4.3 Deployed Digital After-Sales Services

The purpose of this category is to describe the digital services currently adopted in industrial B2B manufacturing companies. This is particularly relevant for answering the research questions to map the status of the companies and demonstrate their potential.

Digital Media

In some sectors, the prevailing trend toward smart products that communicate with each other and that are displayed with data has not yet become the norm. It all depends on the product and the after-sales capabilities as well as the customers' willingness to pay. Digitization takes place primarily in the context of digital media, with QR or barcodes being attached to products. When scanned, they provide a range of digital information, such as the ability to track, access relevant product data like operating instructions or blueprints, webinars, and order spare parts and services via platforms with web stores. Traceability enables quality promises, as digital documentation is available throughout the product's lifecycle. It is all about flexibility, simplification, and speed. Indeed, it can be considered semi-online, as products are not intelligently connected themselves.[353] Customers perceive the advantages in user-friendliness and faster search functions in digital documents for solving specific problems. However, there is still a lot of open potential to foster digitization.[354]

Interconnected Systems

There are interconnected systems that are products equipped with intelligent sensor technology and thus lay the foundation for advanced digital AS.[355] An overview of consumption, fault detection, or analysis of customer-specific usage can be displayed.[356] All stakeholders in the ecosystem benefit from this, as certain efficiency improvements and optimizations can be made, e.g. with regard to timely delivery. However, this is only possible if a data-driven

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[349] SUP-1 2022, pos. 34; SUP-3 2022, pos. 84, 94.
[350] SUP-4 2022, pos. 18; CUS-4 2022, pos. 8.
[351] SUP-2 2022, pos. 12, 64, 70; CUS-4 2022, pos. 20.
[352] SUP-2 2022, pos. 12, 64, 70; SUP-4 2022, pos. 46; SUP-6 2022, pos. 18, 26; CUS-1 2022, pos. 107.
[353] SUP-1 2022, pos. 6, 14; SUP-5 2022, pos. 10, 14, 16.
[354] CUS-2 2022, pos. 96.
[355] SUP-1 2022, pos. 24.
[356] SUP-1 2022, pos. 24; SUP-4 2022, pos. 12, 28; SUP-6 2022, pos. 50; CUS-1 2022, pos. 15; CUS-2 2022, pos. 8.

analysis is carried out properly.[357] A higher safety factor achieved through digital services is highlighted, as connectivity enables more precise control and rapid detection of problems. Automated processes then directly trigger security measures.[358] Others see a great benefit for themselves, even a convenience, as the data is quickly available, and troubleshooting has become easy due to the detailed records and monitoring of the product.[359]

The ability to always be available to the customer via remote access provides a strong bond between customer and supplier when a connection is made.[360] Customers demand and even expect digital representation based on general technological progress.[361] Here, interfaces can be created directly to the customer's system to input the data. However, the provider wants to define which data is passed on to the customer, as this is related to his own expertise.[362] Other systems enable efficient management using smart products with built-in sensors that measure various values and can be visualized and controlled via an app. This enables traceability through data collection.[363] IoT and digital services not only offer cost savings, but also added value for users in this regard. In fact, the trend is moving in this direction, though still in its early stages.[364] This is confirmed by CUS-2, as organizations are often not yet prepared to exploit the real potential of digital information.[365]

In the after-sales area of industrial B2B manufacturers today, there are a multitude of digital services that are somehow connected or require digital tools. These mainly include five service categories, which are illustrated in Figure 14.

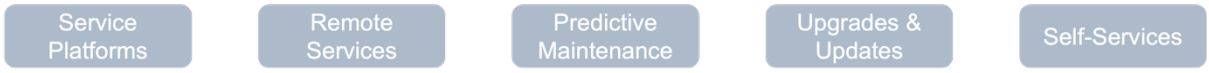

Figure 14: Deployed Services[366]

Service Platforms

Platforms can serve a variety of functions. One of these is the monitoring of products connected to it. The IoT data obtained can be displayed on a dashboard that provides the customer with a clear overview in real-time and direct options for action if required. Deterioration or potential problems can be identified early.[367] Transparency is created through the detailed recording of data on usage behavior. The actual operation and performance of the product, e.g. a machine, is visually represented by selected key figures and automatically generated reports about the condition may be obtained. This data not only benefits the customer, but also the manufacturer, as product issues and user behavior become digitally visible.

[357] SUP-1 2022, pos. 24; SUP-4 2022, pos. 12, 28.
[358] SUP-2 2022, pos. 32.
[359] CUS-1 2022, pos. 15; CUS-2 2022, pos. 8; CUS-3 2022, pos. 6, 58.
[360] SUP-2 2022, pos. 82.
[361] SUP-2 2022, pos. 96; CUS-2 2022, pos. 8.
[362] SUP-3 2022, pos. 10, 82.
[363] SUP-4 2022, pos. 10, 12.
[364] SUP-4 2022, pos. 10, 12; CUS-4 2022, pos. 20.
[365] CUS-2 2022, pos. 10.
[366] Own illustration
[367] SUP-2 2022, pos. 20, 24; SUP-3 2022, pos. 14; SUP-6 2022, pos. 8, 16.

Advantages lie in the simple comparability of the behavior of several products.[368] According to CUS-1, the advantage is that the error message can be displayed in detail to the service technician using filters to obtain the appropriate service efficiently. Nevertheless, they are often complicated and not thoroughly user-friendly.[369]

SUP-5 explains that by entering the product's serial number on the platform, one can view relevant product data such as an overview of spare parts, operating instructions or being able to order services directly.[370] Industrial B2B manufacturers can use the option of online sales for spare parts, services, or products, for example. While personal recommendations are still relevant, such platforms should support future sales intensively. Buying by way of self-service via online platforms helps providers to standardize and optimize processes.[371]

However, although they are still used, the large number of different platforms where customers must deal with several suppliers is seen as problematic.[372] CUS-3 reinforces this by making the supplier's response to customer requests regarding individualization a critical factor for purchasing decisions. Furthermore, internal uniform platforms would be more interesting to reduce dependency.[373]

Remote Services

Remote servicing is widely spread and means that services are not provided directly on site at the customer's premises, but that digital, networked capabilities are used to view products from the outside and identify faults. Especially during the COVID-19 pandemic, the ability to monitor machines remotely and determine their status was vital.[374] This is done, among other ways, via video calls in which service technicians support recommissioning. If necessary, other experts can be called in. Data analysis via digital connections makes it easy to identify and rectify errors. In a further step, business models result from this, which are offered, for example, as a subscription model over a certain period.[375] Here, a change from stand-alone solutions to a holistic system across several products is discernible.[376] Key added value is the speed of assistance, as travel time is eliminated.[377]

Predictive Maintenance

For unconnected products, predictive maintenance can be performed by connecting a module that is able to read product data. However, if the products are connected, this can be automated, provided the customer allows data access. These data-driven services can thus be controlled, and information derived remotely. It is important that predictive maintenance is based on a larger data set to see the big picture. Early detection of potential failures can

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[368] SUP-2 2022, pos. 20, 24; SUP-3 2022, pos. 10, 14; SUP-6 2022, pos. 8, 12, 16, 20, 22, 52; CUS-1 2022, pos. 67; CUS-4 2022, pos. 38.
[369] CUS-1 2022, pos. 113, 115.
[370] SUP-5 2022, pos. 78.
[371] SUP-3 2022, pos. 64, 66, 68.
[372] SUP-1 2022, pos. 42; SUP-3 2022, pos. 68; SUP-5 2022, pos. 80; CUS-2 2022, pos. 66; CUS-4 2022, pos. 40.
[373] CUS-3 2022, pos. 70, 94.
[374] SUP-1 2022, pos. 92; SUP-2 2022, pos. 72; SUP-6 2022. pos. 12.
[375] SUP-3 2022, pos. 10, 26; CUS-4 2022, pos. 44.
[376] SUP-4 2022, pos. 32.
[377] SUP-1 2022, pos. 92; SUP-6 2022, pos. 60.

ensure operational reliability.[378] For example, SUP-3 provides information for exchange recommendations upon request, as this is not yet automated, but certain patterns indicating useful predictive maintenance in data collection are apparent.[379] Based on historical comparative data, suppliers can provide maintenance recommendations in advance after a certain runtime. However, unplanned maintenance still occurs, which could be avoided by proactively evaluating the data.[380]

Such services are of great importance if downtime is to be avoided, as this is associated with high costs.[381] Although predictive maintenance is generally viewed in a very positive light, SUP-6 has not yet seen any major savings among users in this field. Consequently, the question arises as to the actual benefit.[382] In contrast, customers perceive high value when downtime is reduced, as service calls and commissioning requires more time than preventive or predictive maintenance actions. If this is the case and the production capacity cannot be used properly, it is useless for the customer. Therefore, it is sensible to invest in advance.[383] Customers are often open to this data collection and advocate starting it early to better determine preventative measures and minimize unplanned outages.[384]

Updates and Upgrades

Due to the heavy use of software-based services, updates are required over the course of use to evolve performance. However, it is not only the software itself that advances. SUP-2 points out that the technology of the product progresses and the services surrounding it need to be adapted accordingly to enable modernization and impeccable use; namely upgrades.[385] Some customers prefer provisions in products that can be equipped and upgraded with intelligence in the future.[386] Others appreciate that constant optimizations are carried out through updates resulting in better output and reduced disruptions. It supports the customer to always have a state-of-the-art product that can be updated remotely in faster cycles due to digitization.[387] Customers mention that some of this work is done in-house as skills are available.[388] The equipment itself is being upgraded to extend its life along with new services. It can be observed that, particularly in the case of high-priced capital goods, demand for modernization or replacement depends on the economic situation. If this is worse, upgrades are preferred to keep the capital in the company.[389] This includes digital add-ons such as assistance systems or automation that are subsequently added. Furthermore, AS embraces general equipment retrofits for digital services and has become a business model.[390]

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[378] SUP-1 2022, pos. 30, 38, 94; SUP-2 2022, pos. 24, 72; CUS-4 2022, pos. 28.
[379] SUP-3 2022, pos. 94.
[380] CUS-4 2022, pos. 26, 28.
[381] SUP-5 2022, pos. 10, 28.
[382] SUP-6 2022, pos. 20.
[383] CUS-1 2022, pos. 99, 101, 103; CUS-4 2022, pos. 26, 58.
[384] CUS-4 2022, pos. 8.
[385] SUP-2 2022, pos. 12.
[386] SUP-4 2022, pos. 40.
[387] CUS-1 2022, pos. 35, 37, 41.
[388] CUS-2 2022, pos. 34.
[389] SUP-3 2022, pos. 6, 70, 76.
[390] SUP-6 2022, pos. 82.

Self-Services

In principle, services that customers perform themselves on the products in their company are perceived as positive. However, the loss of revenue from the important procurement of spare parts could have a negative impact if the supplier releases parts data transparently, which is to be counteracted by personal recommendations. Digital tools help the customer to make diagnoses and, if necessary, to call in an expert on-demand. Today, however, personal direct support from the supplier is still the priority.[391] Customers consider self-services to be particularly useful for time-critical processes, although a certain amount of internal expertise is required.[392] Moreover, self-services within customer portals, in which records of purchased products and services, as well as other relevant information, are displayed, are of value.[393]

4.4 Impact of Digital After-Sales Services on Innovation Processes

Innovation processes are crucial for the development of digital services, as they usually aim to provide added value to the customer. Therefore, processes must be adapted to ensure that customers are satisfied with the result, and as mentioned earlier, can be connected to their systems, since the level of digitization varies. In addition, digital solutions increasingly require improvement loops and a certain accelerated speed to keep the technology up to date. This part is intended to demonstrate how innovation processes for digital services should be designed to meet customer expectations, leverage services, and thereby secure customer potential.

First, it should be noted that no specific processes have yet been established for digital AS and that these are strongly oriented to the company's usual product innovation process or are developed on an ad hoc basis. However, as the relevance decisively increases, some providers intend to develop service innovation processes.[394] There is a movement toward open innovation and the Lean Startup approach, which SUP-4 says relies heavily on the Stage-Gate process of small steps and reviews of results.[395] Specific agile methods are not yet used in the service area, as the focus is currently still heavily on physical products.[396] Suppliers are sometimes even dependent on customers' willingness to participate since they do not have any real testing facilities themselves.[397] Based on the statements of the suppliers, the innovation processes are comprised of relatively similar components. The most important aspects mentioned in connection with the development of digital services are summarized in Figure 15.

[391] SUP-3 2022, pos. 8, 6, 52, 90.
[392] SUP-3 2022, pos. 52; CUS-1 2022, pos. 45, 83; CUS-2 2022, pos. 12.
[393] CUS-3 2022, pos. 112.
[394] SUP-2 2022, pos. 50; SUP-3 2022, pos. 30; SUP-4 2022, pos. 54, 26; SUP-6 2022, pos. 92.
[395] SUP-1 2022, pos. 50; SUP-4 2022, p. 54.
[396] SUP-1 2022, pos. 54; SUP-2 2022, pos. 62; SUP-3 2022, pos. 44.
[397] SUP-6 2022, pos. 94.

1. Ideation

Idea generation from the customer or supplier side or collectively through various forms of interaction. At some suppliers, ideas flow together and are collectively selected by a committee. Others focus on engaging stakeholders early on to get them on board with the idea.

2. Scoping

Market research or analysis is used to determine whether there is a market that validates the idea. Such research can be done through ethnographic interviews, surveys, expert opinions, and use cases. This is necessary because incorrect assumptions about market demand are often made in the field of innovation. Expectations are set and evaluated to verify assumptions. Initial technical functions are also considered here together with stakeholders.

3. Prototyping

After the idea has been assessed as positive by the market, the creation of the first prototypes begins. Digital products must also be able to be presented physically so that customers understand the purpose. This can be explained to the customer through sketches, initial minimum viable products, mock-ups, or other simulated options. It is important that the added value, the customer benefit, is transported.

4. Testing

Prototypes, the first MVPs, are handed over to pilot customers for testing and an intensive exchange takes place. One company surveyed uses a guideline of five to ten testers in order to be able to create an offer that is in line with the market and to promote sales potential.

5. Service Sharpening

Customer feedback is incorporated into the further development of the service, and desired functions and other feedback are integrated or adapted if the provider deems them useful. There are also make-or-buy decisions to be made about parts of the service, such as sensors or cloud systems.

6. Market Launch

Finally, the service is ready to be implemented at the customer's site. If the solution was previously developed with a specific customer, approaches to standardization can now take place and be scaled.

Figure 15: Steps of Digital Service Innovation Processes[398]

As soon as the digital AS is in practical use and the customer can get a real picture of the benefits and added value of the solution, but also of the general handling and range of functions, feedback discussions are fruitful. Improvement loops are essential, especially for digital services, because software is alive and constantly evolving. This exchange may result in the potential for new services.[399] For example, features are added, processes adapted, customer benefits pushed, and additional modules created.[400] Figure 16 provides an overview of the most important aspects of digital service development revealed by the investigation.

[398] SUP-1 2022, pos. 46, 48, 54, 56, 58, 62; SUP-2 2022, pos. 46, 48, 50, 52, 78; SUP-3 2022, pos. 30, 32, 38, 46; SUP-4 2022, pos. 22, 24, 26, 52; SUP-5 2022, pos. 42, 44; SUP-6 2022, pos. 104, 106.
[399] SUP-2 2022, pos 78; CUS-1 2022, pos. 145.
[400] SUP-2 2022, pos. 64.

Customer Integration	Agility and flexibility of service development require early integration of stakeholders, as they offer a different level of knowledge. The open innovation approach enables early discussions about the value, feasibility, and broad scope of ideas. For this, the customer must be open to share data and experiences and recognize the added value in the collaboration, especially the generation of information according to the customer's needs. Often, developments take place with a few customers, which are then tested and standardized for the broad market. Mentioned approaches are innovation events, workshops, brainstorming, app-based options, unconventional exchange and feedback collection.
Speed of Development	In the innovation process itself, small steps should be taken quickly, as in the Stage-Gate model or in the Lean Startup approach with clear gates where the results are checked. Development aspects that are not of value are to be eliminated at an early stage, e.g., because they cannot be solved, there is no need for them, or the timing is wrong. The later mistakes are made, the more expensive it becomes. Customers play an elementary role in minimizing the potential for errors. Therefore, failures should be mitigated by pilot customers, co-creation, and customer proximity. In addition, speed is also important for market position, since market leaders must remain innovative.
Iteration Loops	Error detection and changes of direction are possible more frequently with services than with physical products. The idea of the final digital service is unclear at the beginning of the process. It is therefore important to conduct iteration loops with different stakeholders. Revisions and further developments are particularly necessary for digital services.
Outsourcing	The fast-moving area of digital services is associated with high costs and investments for in-house development, which is why sourcing for components such as software, e.g., a cloud solution, sensor technology, and network solutions is attractive. Agility increases through cooperation.

Figure 16: Key Factors of Digital Service Innovation[401]

Customers are interested in digital solutions as they themselves are pushing digitization. That is why the earliest possible contact, starting with idea generation for new digital AS, is important. Customers act as development partners and provide practical suggestions. The supplier gains insights into market needs and, conversely, customers receive solutions that create added value. Moreover, customers expect transparency and improvement measures in response to feedback.[402] From a business perspective, it is more attractive for customers to develop and support solutions with suppliers than to invest in their own developments. The supplier can in turn use these for other customers.[403] Therefore, many stakeholders are integrated, both internally and externally. These include, among other things, customers, development partners, software development, customer service, product management, sales, support, marketing, finance, and legal department.[404]

[401] Own illustration based on SUP-1 2022, pos. 50, 54, 62, 66; SUP-2 2022, pos. 54, 76, 64, 90; SUP-3 2022, pos. 36; SUP-4 2022, pos. 26, 54, 56; SUP-6 2022, pos. 96, 100, 104, 108, 118.
[402] CUS-1 2022, pos. 73, 75, 79, 129, 131, 135, 147, 153; CUS-4 2022, pos. 76, 86.
[403] CUS-4 2022, pos. 32, 74, 82.
[404] SUP-3 2022, pos. 34; SUP-5 2022, pos. 50.

4.5 Customer in Digital After-Sales Services

This chapter examines the extent to which digital interaction can and should be leveraged. First and foremost, from the provider's point of view, the findings consider how the added value of the services can be maintained for the customer despite digital interaction. In addition, the sales potential in the after-sales phase is examined. This is relevant for investigating the extent to which digitization of repeat purchases and services is possible.

Digital Interaction and Customer Relationship

According to the providers, digital interaction can only replace face-to-face contact to a limited extent. Currently, digitalization cannot cover everything. This could be the case in the distant future, but not in the foreseeable future. However, not all customers receive the same level of service, and the degree to which personal service is possible depends on internal capabilities and the availability of resources. The current adoption of digitalization is further exacerbated by the circumstances of COVID-19, from which virtual calls are used for conversations and unnecessary in-person meetings are avoided.[405] If the supplier is on-site, the customer still receives intensive personal support.[406] Personal contact is still important, especially for niche products. However, SUP-3 states that customers who contact them directly are referred to the ordering platform to facilitate and unify processes.[407]

Suppliers identify a shift, as information is often already available digitally and face-to-face meetings are increasingly used to maintain and build networks, pushing the customer relationship. Digitization facilitates addressing customers individually and more frequently, positively influencing the customer relationship in the long term. It is emphasized that intensive interaction is crucial for recommendations, and thus further sales potential.[408] Moreover, the type of communication depends on the topic of the interaction, as creative and critical issues are to be discussed in person, everything else is more efficient from a distance.[409] The customer relationship is correspondingly influenced by the complexity of products that leads to outsourcing to the manufacturer. In this context, customer service acts as a strong link to loyalty, as long-term cooperation is established, and suppliers have more insights.[410]

Co-Creation and Customer Value

Emphasis is always placed on added value for the customer, which is to be achieved through a differentiated offering by means of digital services.[411] Therefore, customer benefits include high transparency and product improvement, as well as time savings, safety, and cost reduction due to decreased downtime. In addition, the targeted control of downtime with services such as predictive maintenance is possible and the production schedule can be adjusted

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[405] SUP-1 2022, pos. 80, 84, 116.
[406] SUP-3 2022, pos. 64.
[407] SUP-3 2022, pos. 68, 80.
[408] SUP-2 2022, pos. 4, 40, 42; SUP-3 2022, pos. 90; SUP-6 2022, pos. 110, 114; CUS-4 2022 pos. 38, 40.
[409] SUP-4 2022, pos. 66, 72, 76, 78; CUS-1 2022, pos. 109, 111; CUS-4 2022, pos. 14, 36.
[410] SUP-2 2022, pos. 40; SUP-4 2022, pos. 42; SUP-5 2022, pos. 62; CUS-1 2022, pos. 13, 121; CUS-2 2022, pos. 30; CUS-3 2022, pos. 64, 66, 70.
[411] SUP-2 2022, pos. 48, 70, 80, 96; SUP-3 2022, pos. 24.

accordingly. Thus, optimization prediction creates value-in-use.[412] SUP-4 adds that more effective and efficient operations through new business models, such as performance-based contracting, add value to customer processes, including tracking based on IoT data enabled by digital services or facilitated repurchasing.[413] Even if problems occur with the product, detailed statements can be made through automated fault diagnosis. Digitization facilitates the monitoring of product performance, which is what the customer is concerned with, while transparency is also provided across multiple products.[414] However, CUS-2 mentions that this is only possible to the full extent if the company's own organizational form is aligned accordingly and derives added value from the data. In addition, they take a critical view of the way information is handled, as it is often not used in a targeted manner and the benefits are diminished as a result.[415]

Co-creation supports value generation. As stakeholders have access to various necessary networks to gather insights and access to expertise, suppliers recognize that increasingly more customers are advocating for an open development approach as the benefits are mutual.[416] SUP-2 sees co-creation in the individualization and customization of services, which are optimized together allowing failures to be avoided through customer proximity.[417] However, customers are positively disposed towards co-creation because they consider the bundling of know-how on both sides to be meaningful and fruitful.[418]

Customer and Sales Potential

By analyzing user data, manufacturers identify customers' near-term needs, but also whether capacity could be expanded by selling upgrades or recommendations for additional products or services. This allows the customer to be developed and the revenue potential, including recurring revenue through digital AS, to be realized.[419] Services may be purchased at any time.[420] SUP-1 attaches great importance to KPIs such as Net Promoter Score, especially in cross-selling, provided that they are regularly considered with specific measures selected for the particular business and appropriate action is taken in a timely manner.[421] This can also be observed remotely via IoT platforms. Cross-selling takes place when additional products are introduced via after-sales interaction and up-selling in the form of repeat purchases, upgrades, and updates.[422]

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[412] SUP-1 2022, pos. 41; SUP-2 2022, pos. 46; SUP-3 2022, pos. 24; SUP-6 2022, pos. 70, 86, 132.
[413] SUP-4 2022, pos. 10, 12, 50.
[414] SUP-5 2022, pos. 52; SUP-6 2022, pos. 86; CUS-3 2022, pos. 72.
[415] CUS-2 2022, pos. 46, 48.
[416] SUP-1 2022, pos. 74, 76; SUP-6 2022, pos. 108.
[417] SUP-2 2022, pos. 80, 90.
[418] SUP-1 2022, pos. 74; CUS-1 2022, pos. 151; CUS-3 2022, pos. 82.
[419] SUP-1 2022, pos. 4, 96; SUP-2 2022, pos. 4, 84; SUP-3 2022, pos. 96.
[420] SUP-4 2022, pos. 102.
[421] SUP-1 2022, pos. 78.
[422] SUP-5 2022, pos. 66, 68; SUP-6 2022, pos. 20, 84.

4.6 Customer Requirements and Expectations of Digital Services

This section describes how providers perceive the requirements of their customers as well as what expectations users have of digital AS. It is particularly relevant for answering the research question concerning customer perspective, and their expectations of digital services.

Suppliers perceive that customers are somewhat overwhelmed by the increasing variety of digital services since they basically do not have any major intrinsic demands. They primarily expect their needs to be met by a solution and certain tasks to be taken over by the provider. Moreover, they anticipate speed and accessibility when they claim service. They require preventive maintenance and servicing enabled by digitization so that downtimes are minimized, although price acceptance is still low in some segments. But a general interconnection of the products and digital visualization is desired.[423] There is still an attitude that services must be free, therefore, awareness of monetary customer benefits needs to be created.[424] Furthermore, the factor of market conditions and standards needs to be considered because technological prerequisites for digital services are not yet in place everywhere.[425] In the international field, there are different requirements more in the sense of company or application specifics, than in the sense of regional patterns.[426]

Rather than focusing on the adoption of a particular technology, the emphasis is on customer benefits that provide safety and convenience.[427] In doing so, the provider should solve the customer's problems, evolve, and set up services that add value and are compatible with the customer's infrastructure.[428] Customers want to increase their own value through digital means and gradually replace manual processes. At best, this is achieved through a sensible combination of functions, less effort, flexible after-sales packages with self-determined data collection through customization to the individual customer's benefit. This results partly from the importance of data security and confidentiality. Operational safety and reliability of the supplier are essential for their own business.[429] Digitization can provide support with remote diagnostics that enable location-independent troubleshooting and thus fast action. This is of value to the customer, as internal capacities are scarce and long waiting times cause great harm.[430] In this context, the topic of predictive maintenance, which is intended to counteract downtimes, is also mentioned to create value.[431]

For customers, the added value lies primarily in the acquisition of information to improve and standardize their own production and to make planning and operating hours more efficient. On the supplier side, the fast response time is particularly relevant, as information is mapped via networks and enables performance monitoring. Solutions can be generated, and root cause analysis can be facilitated.[432] Basically, in addition to maintenance and software

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[423] SUP-2 2022, pos. 96; SUP-3 2022, pos. 22; SUP-5 2022, pos. 26, 98, 100; SUP-6 2022, pos. 22.
[424] SUP-6 2022, pos. 58.
[425] SUP-3 2022, pos. 48.
[426] SUP-4 2022, pos. 34.
[427] CUS-1 2022, pos. 157.
[428] CUS-4 2022, pos. 30.
[429] CUS-1 2022, pos. 43, 51, 69.
[430] CUS-1 2022, pos. 15, 25, 31, 77; CUS-2 2022, pos. 6, 8, 26.
[431] CUS-3 2022, pos. 32.
[432] CUS-2 2022, pos. 24, 46; CUS-3 2022, pos. 56, 72, 74; CUS-4 2022, pos. 34, 70.

updates, suppliers are also asked to communicate when spare parts become unavailable or to schedule a retrofit to maintain the current status.[433] When support, responsiveness, solution finding, and therefore customer needs are met, repeat purchases are considered.[434] In terms of internal specifications, the provider is expected to align services such as platforms, accordingly.[435] Figure 17 provides an aggregated overview of the expectations derived from respondents concerning digital AS.

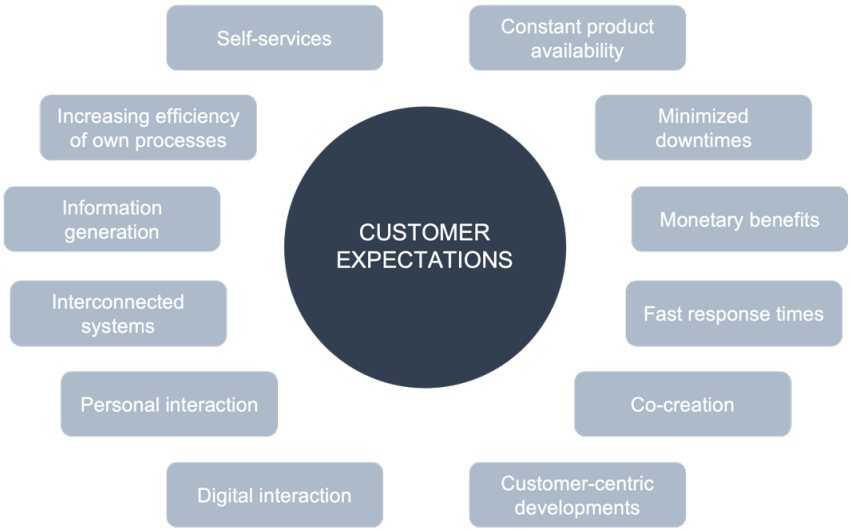

Figure 17: Customer Expectations of Digital AS[436]

4.7 Business Model Opportunities

Digital services offer enormous potential in the direction of new business models, some of which have already been introduced in certain industries. In others, their use is still limited, or the first basic principles have been set. This section provides an overview of the approaches currently implemented or in use and the respondents' assessments.

Generally, it can be argued that business models that are either **usage-based or output-based** can only be implemented meaningfully if this presupposes a later reuse or different use of the product.[437] SUP-4 shows that this also matters in terms of circular economy processes with the fact that today's product flows back into tomorrow's product.[438] SUP-2 believes that digital services are necessary for such approaches to maintain cost efficiency. It also gives the customer the opportunity to be more financially flexible, as no high investment costs burden the budget.[439]

In the case of machines, for example, billing by execution would work in principle.[440] Especially for software, billing models such as licensing are commonplace, but physical products incur

[433] CUS-3 2022, pos. 52.
[434] CUS-2 2022, pos. 50; CUS-3 2022, pos. 98.
[435] CUS-2 2022, pos. 70; CUS-3 2022, pos. 88.
[436] Own illustration
[437] SUP-1 2022, pos. 100, 110, 112.
[438] SUP-4 2022, pos. 88.
[439] SUP-2 2022, pos. 100, 104.
[440] SUP-1 2022, pos. 106.

manufacturing costs that still make the business models financially unattractive.[441] **Subscription** models, especially for services such as remote options, software and cloud use, or data analytics, as well as licensing models have become established. **Pay per use** with billing via operating costs is offered in isolated cases, and leasing or rental models are made possible for specific assets. However, customers are still reluctant to make ongoing payments, as they generally prefer to pay once.[442] Moreover, **Product as a Service**, which offers constant availability and functionality, and the provider of an all-round carefree package, is offered as a contracting model and is enjoying a positive trend.[443]

Customers claim that offers such as pay per use are an economic decision that does not yet pay off. However, it is recognizable that it is not suitable for every business purpose, as uncontrolled data storage and automatic upgrades are not ideal due to confidentiality. The advantage results from the actuality of the product, maximum downtimes, and low investments in case of limited investment power or if the full production capacity is not utilized.[444] It is also emphasized that these models are more interesting for standard business or products that seemingly need to be replaced more quickly due to development.[445] In the software area, the advantage of outsourcing security, storage, computing power, updates, and maintenance is seen as valuable, whereupon higher costs are accepted and charged via a subscription fee. Consequently, there are **Software as a Service** options, which enable data analysis and compensate for the information.[446]

There is a clear trend towards output-based models such as pay per use, as the emphasis is increasingly on benefits for the customer, both in the private and corporate context. However, it appears that the market is not yet ready for such models. Suppliers believe that such models will take time to develop, but that they have great potential in the context of IoT services, cloud deployment, and subscription services.[447]

4.8 Future Potential of After-Sales Services

Digitization will become more user-friendly and straightforward in the future.[448] This section addresses the visionary potential of digital customer services, which are set to become increasingly important in the industrial B2B market from the perspective of customers and suppliers. This is especially useful as there are intentions for services that desperately need to be implemented in a timely manner.

Data Generation and Usage

In terms of future potential, the sample tends to emphasize the need for improvement in dealing with the currently available data sources and their sensible collection and efficient use.

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[441] SUP-3 2022, pos. 114.
[442] SUP-3 2022, pos. 23, 58, 110; SUP-4 2022, pos. 42, 44; SUP-5 2022, pos. 92; SUP-6 2022, pos. 126.
[443] SUP-4 2022, pos. 10.
[444] CUS-1 2022, pos. 55, 57, 159; CUS-3 2022, pos. 138, 140.
[445] CUS-2 2022, pos. 82, 84; CUS-3 2022, pos. 128.
[446] CUS-4 2022, pos. 94, 102.
[447] SUP-2 2022, pos. 98; SUP-3 2022, pos. 60, 110, 114; SUP-4 2022, pos. 46.
[448] CUS-1 2022, pos. 65.

The prerequisite for this is that the devices are connected to each other and transmit information to receive any faults or other issues in real time. The challenges for the next three to four years will be to establish widespread connectivity and draw the appropriate conclusions based on intelligent data.[449] SUP-1 mentions the benefit of a CRM system that maps product tracking based on networked systems with self-learning functions and individual part tracking to draw conclusions for sales and customers, such as inventory levels or delivery capability.[450] Connections to ERP systems are important as well, to trigger automated orders, among other things.[451] Providers perceive this as an opportunity for new business models.[452] Moreover, technologies such as facial recognition, the application of QR codes and smartphone access are gaining relevance and will be integrated into product use. These provide insight into spare parts or commissioning, for instance.[453]

Predictive Maintenance and Platforms

Based on the data collected, further services such as predictive maintenance and chatbots can be set up that use AI to provide automated recommendations for action. The customer can actively ask questions through self-services and is directly informed digitally. Services that automatically derive information on the condition of the product will gain in importance in the future.[454] A platform that is not fully integrated is also conceivable here. It would allow for detailed and digitally available plant documentation to be retrieved as a maintenance system. Maintenance and servicing, in particular, use data and recognizable patterns to determine conditions and trigger certain activities.[455]

Extended Reality

Although customers and providers are repeatedly confronted with technologies within extended reality such as AR or VR, they still must be established, tested in practice, and made more suitable for use. The market is not yet ready for this, as it is currently more important to expand connections.[456] SUP-2 adds that this only makes sense for physical products and CUS-3 if the distance between customer and supplier is correspondingly large.[457] To narrow this down further, SUP-6 states that it is reasonable for standard products, as the effort for individual solutions is extremely high. Digital twins are mainly used for in-house tests that can run software as simulators.[458] CUS-1 considers the idea of the use of augmented reality and digital twins useful if they work reliably. These virtual systems are used to anticipate what happens to the product and to react accordingly. Potentially, physical services are no longer needed at all since the status can be detected on the twin.[459]

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[449] SUP-1 2022, pos. 88, 90; SUP-4 2022, pos. 30, 80; CUS-1 2022, pos. 105, 107, 155; CUS-2 2022, pos. 60; CUS-4 2022, pos. 52, 100.
[450] SUP-1 2022, pos. 24.
[451] SUP-6 2022, pos. 116.
[452] SUP-1 2022, pos. 24.
[453] SUP-2 2022, pos. 86; SUP-5 2022, pos. 76.
[454] SUP-3 2022, pos. 88; SUP-4 2022, pos. 80; SUP-5 2022, pos. 88.
[455] CUS-3 2022, pos. 112, 114, 146.
[456] SUP-1 2022, pos. 88; SUP-5 2022, pos. 90; CUS-1 2022, pos. 47; CUS-2 2022, pos. 76.
[457] SUP-2 2022, pos. 88; CUS-3 2022, pos. 120.
[458] SUP-6 2022, pos. 124; CUS-3 2022, pos. 118.
[459] CUS-1 2022, pos. 17, 165.

5 Discussion

This section evaluates and discusses the results of the qualitative content analysis presented in the previous chapter. Interpretations and links to scientific literature are made and implications are pointed out. Thereby, the main and sub-research questions stated in chapter 1.2 are answered, hence the outline is based on them. Sub-questions serve to elicit the status quo in industrial B2B manufacturing companies, as well as the requirements and demands of the customers. The overall research goal is to explore how after-sales services and repurchasing options are qualified for digitization and what role personal interaction still plays in fostering customer potential. For this purpose, providers and customers of digital after-sales services were surveyed utilizing qualitative interviews.

Industrial B2B manufacturers are increasingly confronted with growing competition, requiring them to add digital AS to their product portfolio to gain a competitive edge. Based on the research findings, it can be determined in advance that different manifestations of digital service offers focus primarily on the factors of product features, the intensity of use, as well as company resources that are correspondingly more or less prominent. Most of the companies surveyed are still in the early stages of the transition to advanced service providers. Although, awareness of the importance of digital service integration is high, and it will become increasingly established in the future. Digitization creates new opportunities in terms of services and business models that enable greater speed, flexibility, and time savings – factors that customers expect to be delivered. This is necessary to generate attractivity because customers often still maintain their own equipment to reduce downtime and dependence on suppliers.

It is noticeable that, depending on the existent physical product, services do not yet occupy a primary position, but are regarded as an add-on to the physical product. Scientific literature and research identify the customer as the most valuable source of information when developing digital AS. Precisely because it is often unclear at the beginning in which direction development will proceed, the constant exchange and alignment of the service with the needs and requirements of the customers are crucial. Therefore, companies need a certain level of digital readiness to take advantage of digital AS. In addition, customers and suppliers positively recognize the digital transformation in interaction. Still, it is not yet entirely possible to replace personal with digital interaction, as customers value in-person exchange, especially for critical issues or establishing trust. The results largely confirm the findings of previous investigations.

5.1 Customer Expectations of Digital Tools

The research revealed that customer expectations lie primarily in the **proper and efficient use of the products** with **minimized and planned downtime** in the company's production process, i.e. customer benefit and value-in-use are placed before the physical product or the technology adopted. Therefore, the **reliability** of the digital tools is considered a prerequisite to optimizing one's own processes. Dombrowski, Malorny et al. (2020), as well as the

interviewees, reason that failure has far-reaching consequences such as high costs and supply shortages.[460]

These results further support the idea of the theoretical insights on servitization, which envisages the delivery of a **complete solution** with physical products increasingly relegated to the background, leading to PSS. Kohtamäki et al. (2021) describe this as the overriding importance of the utility of the competencies offered by the provider rather than the purely tangible product.[461] This goes along with the trend of **transferring responsibility** to the manufacturer.[462] In this sense, the findings demonstrate that **interconnection** is anticipated to be appropriate to the customer systems and their degree of digitization in the company. This means that individual circumstances and prerequisites must be considered, and solutions tailored. Care must be taken when generating data as customers do not want to blindly transmit usage-based data to providers. Moreover, through the sensible use of intelligent systems, customer processes can be approximated, and **issues identified** at an early stage. This reflects research by Klein, Biehl and Friedli (2018) as well as Ritter and Pedersen (2020), who found that both **remote service speed and compatibility** are anticipated.[463] Concerning the range of services, a flexible option for customized compilation of service packages is valued as well, and fast response times are required.

A trend toward **digital interaction** is visible, with consultations and coordination being conducted virtually and products increasingly monitored remotely to increase flexibility and pace. However, digitization is not yet able to achieve complete substitutability, as personal contact is preferred situationally, especially for building trust or feedback rounds. This is confirmed by Halb and Seebacher (2021) and a study by Scherer, Wünderlich and Wangenheim (2015).[464]

Still, expectations vary in the international context specifically regarding company perceptions and capabilities as well as technological standards. Therefore, close collaboration is already desired in the development of digital services, as these need to match the capabilities and needs of customers to exploit potential and create value. In this way, the most common cause of unsuccessful digital AS, namely the lack of application benefits and consideration of customer expectations, can be circumvented. This presents the supplier with the task of designing solutions to identified customer pain points. Overall, customers anticipate efficient and improved processes, the right balance between personal and digital interaction, and integration in the development. They expect speed, flexibility, and adaptability from digital AS. These expectations relate primarily to the company's value creation and not to specific technologies per se, which means that a meaningful purpose for digital AS is paramount. Digitization should be applied to enhance processes and generate innovations that are individualized to the customer's benefit.

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[460] Dombrowski; Malorny; et al. 2020, p. 6.
[461] Kohtamäki et al. 2021, p. 3.
[462] Schuh; Gudergan; Grefrath 2016, p. 88–89.
[463] Klein; Biehl; Friedli 2018, p. 846; Ritter; Pedersen 2020, p. 185.
[464] Halb; Seebacher 2021, p. 332; Scherer; Wünderlich; Wangenheim 2015, p. 42.

5.2 Influences on Customer Expectations

Customer expectations are significantly influenced by their daily operations. These include factors related to their own operational reliability, and thus costly downtime, which should be minimized through intelligent systems and digital services such as remote monitoring or predictive maintenance. This intention results from the fact that unplanned downtimes massively restrict the customer's **delivery capability** or **production planning**. Dangelmaier et al. (2004) as well as Dombrowski, Malorny et al. (2020) confirm this influence on expectations, adding that customers seek greater **convenience** in product usage through services.[465] Customers are equally keen to keep high-priced industrial equipment in the company for longer and not replace them prematurely because the generation has become obsolete. Therefore, updates and upgrades are an aid to keep products up to date. This intent is consistent with prior research that services are designed to **extend the operating life of products**.[466]

Those influences on customer expectations originate primarily from the need to **support and simplify internal processes** and the company's own business to eliminate complications through greater automation. Westergren (2011) states that customer processes are supported by deriving information from monitoring user data and thus developing the service accordingly.[467] Customers are eager to **outsource responsibility** and **leverage supplier expertise** when know-how is not available internally.[468] Furthermore, **internal rules and regulations** can serve as an influence on expectations, as services need to be established according to set standards. Another major factor is the **type of product** purchased, as services are required particularly for complex custom designs, as these are not routinely manufactured, and unexpected issues may arise.

However, knowledge of the background of the influences can be interpreted as an opportunity to sensitize customers to their concerns and thus win them over for holistic offerings and comprehensive PSS solutions. The digital AS should facilitate the expectations placed on it and eliminate all sources of dissatisfaction. Above all, the aim is to ensure that reliable systems minimize the effort required by the customer and that the competencies of suppliers are used to exert a positive influence on customer processes.

5.3 Best-Suited After-Sales Processes for Digitization

Research shows that **product-related services**, which facilitate and enhance the function of the product, are currently the most suitable digital AS. This is primarily because there is still open potential and customers are eager to use products in the long term while increasing their efficiency. Bakås et al. (2013), as well as Buschak, Lerch and Gotsch (2014) and Tukker (2004) point out that these bundles of tangible products and intangible services result from the

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[465] Dangelmaier et al. 2004, p. 103; Dombrowski; Malorny; et al. 2020, p. 6.
[466] Appelfeller; Feldmann 2018, p. 47; Dombrowski; Fochler; Sendler; et al. 2020, p. 140; Wellener et al. 2020.
[467] Westergren 2011, p. 227.
[468] Adrodegari et al. 2015, p. 245, 249; Korkeamäki; Kohtamäki; Parida 2021, p. 93.

servitization transition of the companies and allow customization.[469] The focus is on services that represent added value for the customer.

The greatest potential lies in the monitoring and maintenance of the physical asset through the exploitation of IoT and connectivity. These include, above all, **remote monitoring and control**, which allows suppliers insights into usage, location, and product issues without being directly on site. Here, **dashboards** specified for customer requirements are commonly used if customers have permitted data transmission. By investigating the information, suppliers get insights and can, for example, approach the customer with recommendations for maintenance, spare parts, or additional products and services. The customer further gains visualized insight into the efficiency of the operations and any malfunctions or automated warnings about potential failures. Especially in times when traveling is difficult and takes up too much time, location-independent digital interactions directly through the product are valuable. Additionally, great importance is attached to **predictive maintenance**, allowing for the minimizing of downtime for unplanned maintenance tasks. This constant connection leads to an intensified bond between supplier and customer. Following the model of Coreynen, Matthyssens and Van Bockhaven (2017) and the approaches of Baines and Lightfoot (2014), these services reflect the value proposition in terms of product performance and pursue the goal of a product that always functions.[470] To enhance performance, **digital add-ons** are being developed and **updates** installed that are well suited for the service area. The theory indicates that these are easy to install through digital connections and they support product features.[471]

Moreover, **digital platforms** that function as customer portals and web stores are particularly suitable for the digital transition. They are able to offer insights into product history as well as further information, and automated ordering options, e.g. for spare parts, services, or repeat purchases, and are considered to be reasonably implementable through digitization. These can be made accessible, for example, via a QR code on the product. The theory shows that it is a cost-effective and transparent method, as stock levels or delivery times can be integrated as well as tracked.[472]

Concerning new **business models** based on digital services, few respondents mention solutions in the direction of subscription models, pay per use options, or Performance as a Service, which are slowly establishing themselves and gaining market acceptance. Specifically pay per use is becoming interesting for standard products. Nevertheless, it is not yet accepted and supported in all industries. Therefore, it is highly product-dependent.

Industrial B2B manufacturers have the potential to leverage the full spectrum of digital services, as products such as machines can integrate an enormous number of services through connectivity to increase efficiency and provide benefits to the supplier such as facilitated problem identification and resolution through location-independent access, as well as the development of new services and products. It was found that suppliers are already aware of digitization in after-sales, but mostly no specific attention has been paid to the development of services and it is therefore perceived more as a secondary aspect of the physical product. Increasingly,

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[469] Bakås et al. 2013, p. 337; Buschak; Lerch; Gotsch 2014, p. 98; Tukker 2004, p. 246.
[470] Baines; Lightfoot 2014, p. 4–5; Coreynen; Matthyssens; Van Bockhaven 2017, p. 43.
[471] Appelfeller; Feldmann 2018, p. 47; Wellener et al. 2020.
[472] Dombrowski; Schulze; Engel 2011, p. 368.

however, the monetary aspect and opportunities are being recognized, but the market does not yet seem ready to apply disruptive business models to industrial services, which means acquiring products accordingly on a utility basis. In addition, the choice and application of digital AS are decided on a case-by-case basis as to which digital services represent value for the individual company.

5.4 Implementation of Digital After-Sales Services

In practice, there are several approaches to digitalization in after-sales. Some providers are more advanced, others do not yet see the need for heavy use of digitalization, or the products are not designed to be linked with intelligence. However, research shows that industrial B2B manufacturers are generally still in the early stages and full integration is rare. Yet, they are keen to realize the possibilities and potentials noted in prior studies and to establish them on an ongoing basis, since customers, especially in conservative industries with low momentum, must first be introduced to the advantages of digital AS and their openness to new business models must be increased. However, the shift to **outcome or usage-based models** will take time and require a mindset shift across entire industries. This result is consistent with the findings of Breitfuß et al. (2017), who even then noted a trend toward evolutionary models rather than truly disruptive ones.[473] The research reveals that this is still the case, and those disruptive business models are adopted only for certain products, such as software subscriptions or performance contracts. Considering the PSS continuum according to Tukker (2004), it is evident that the current state is strongly focused on the physical product.[474] Although product orientation remains paramount, suppliers identify great potential for further progress toward usage orientation, provided there is appropriate demand and economic viability.

Generally, the service offer and post-purchase customer interaction are considered to be of high importance for the promotion of customer potential and are thus regarded as a central component of corporate strategies and objectives. Along with this, there is an impactful generational change, globalization, as well as technological progress, and increasing complexity, which are driving the integration of digital AS. The following list provides an overview of the digital AS that have already been implemented or are planned.

- **Digital platforms**: customer portals with product information, plans and web shop for spare parts, services and products, blueprints, documents, self-service options
- **Connectivity**: overall connectivity to derive conclusions for business activities e.g. sales potential, trends, customer needs, installation of updates, new service and product ideas, failure detection
- **Maintenance**: automated predictive maintenance, remote maintenance
- **Remote services**: condition monitoring and remote control
- **Digital interaction**: virtual communication tools, customer-supplier interfaces

[473] Breitfuß et al. 2017, p. 10–12, 16.
[474] Tukker 2004, p. 248.

- **Updates**: remote installation and control

In principle, much can already be supported by digitization, but not everything. Today, advice and recommendations are given through personal interaction, but **chatbots** are also being considered or **IoT platforms** developed to suggest solutions and recommended actions with the help of AI. This is expected to facilitate spare parts purchases and repurchases, but also to support root cause identification and problem-solving through automation and connectivity. In addition, digital exchange via **virtual conversation** is already having a positive impact. Through more precise predictability, products can be used more efficiently, planning security increases and thus generate value. This means that capacities can be visualized through the analysis and interpretation of data, and actions executed accordingly.

In any case, the range of digital services in the industrial B2B sector is expandable. Although there are approaches across the board, they are not consistently pursued or completed, primarily around connectivity and consequently predictive maintenance, and thus usage-based data analysis. The previous academic literature, in particular, claims that more advanced services have already been implemented, which is not steadily the case in the sample studied, thus showing potential for further expansion of digital AS, which is explained in more detail in the following chapter.

5.5 Digital Services to be Introduced in the Future

There is a strong overlap in the perspectives of providers and customers, especially regarding **data analytics**. The focus is on enabling **connectivity**, which provides insights and data analytics remotely to make products and processes more efficient and to develop new opportunities, such as automated notifications and the use of predictive maintenance through self-learning systems. Encouraging this is important to avoid data misuse and continuously derive trends and feedback. There is a positive correlation between digital AS and customer-supplier relationships, which is why the integration and improvement of these services must be pushed. Consideration must be given to whether customers want a direct connection to the supplier or whether they prefer other forms of data transfer or even analysis within their company. Appropriate security measures and benefits for the customer must exist to be permitted to use data themselves as a supplier.

For the short term, the focus will still be on the establishment of **productivity-enhancing services**. Although countless technologies and processes make it possible to pursue service-based business models, the efficient handling of data and the general integration of connectivity are to be followed as the next step. Currently, data is generated, but the meaningful derivation of knowledge, which is to be supported by automation and AI, is still open in many companies. Customers, as well as suppliers, are urging to drive this issue so that data creates value for both sides, to harness efficiencies and synergies. Prior research points out the importance of generating data that is invisible to human perception and achieving productivity gains from the information obtained.[475] Based on meaningful data analysis, the integration of predictive maintenance and thus scheduled downtime is expected.

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[475] Momeni; Martinsuo 2018, p. 792–793.

Moreover, **self-service** should be offered so that the customer can react quickly, flexibly and receive insights digitally. The focus needs to be on the customer's existing capabilities to exploit the full potential. The findings of Scherer, Wünderlich, and Wangenheim (2015) encourage the advocacy of self-services, but also the expectation of personal support.[476] Another finding is the future increase in **virtual communication**. In this way, a regular digital face-to-face exchange can take place. Momeni and Martinsuo (2018) identify major advantages as efficiency is increased in terms of time, resources, processes, and costs.[477] Intelligent technologies based on AI will be deployed here, such as intelligent assistants and chatbots that provide automated support to customers.[478]

In principle, most after-sales services can be digitized or are even more valuable when they are implemented in that form. Communication between customer and supplier is feasible through virtual platforms and is considered an efficient method in terms of cost, time, and flexibility. Product-related services create enormous added value for both sides in intelligent systems, when considering customer expectations. The path leads to more usage-oriented models and eventually to outcome orientation, but this is still a long way off because first the devices, data usage and the attitude towards digital AS must be adapted. This entails numerous advantages, but also difficulties, as the data is usually reluctant to be made available to the supplier permanently, which requires a mutually suitable arrangement.

5.6 Qualification of After-Sales Services for Digitization

Based on the research and scientific literature, it is evident that the trend toward digital AS is becoming firmly established. The sub-questions have provided an overview of the opportunities and the requirements of the customers, while the main research question addresses the issue of how the AS qualifies for digitization. Digitization is a key factor in many after-sales processes and is of great importance, as efficiencies are perceived from different perspectives, making AS highly qualified. For the implementation of technology-supported services to be accepted and communicated in a way that adds value, a corresponding innovation process with a strong orientation toward customers and, above all, users is essential. Especially since development will increase in the future and so far, no processes with these characteristics are anchored.

Personal to Digital Interaction

After-sales services and repeat purchases show great potential in terms of suitability for digitization. The main triggers here are the general use of digital means in everyday life, a shortage of skilled workers, approaches to internationalization, but also developments in technology. It is evident that a shift is taking place, and openness to new possibilities such as cloud services is increasing. The study shows that digitization is not yet fully capable of replacing personal interaction. A direct contact person in the company is still desired, on-site service technicians when needed, and certain trust-building, critical or creative topics cannot ideally be dealt with virtually. In addition, providers indicate that the way services are delivered is based on the

[476] Scherer; Wünderlich; Wangenheim 2015, p. 178–179, 195.
[477] Momeni; Martinsuo 2018, p. 792–793.
[478] Weiber; Mohr 2020, p. 1099.

customer's revenue potential. Digital interaction does not lead to a deterioration of the customer-supplier relationship, but rather the opposite, as touchpoints are far more frequent and additional value is conveyed. These touchpoints should be personalized and customized to the individual customer, supported by technology. Maechler et al. (2017) confirm this with the necessary right mix of digital and face-to-face interaction[479], while Rodríguez et al. (2020) highlight precisely the importance of personal interaction in the context of increasing complexity.[480] However, as the study revealed, these services can be offered digitally, provided the interlocutors have a certain understanding of the subject.

Customer Potential

Digitization of AS is found to have an impact on customer potential, as needs can be identified in a significantly more targeted manner based on substantiated customer and product data. Additional sales potential can be addressed through cross-selling and upselling. Moreover, customer satisfaction is influenced by the service itself and strengthened by higher and personalized digital and face-to-face interaction and established measures to improve customer processes. Customer orientation serves as the basis for value creation in AS, as the focus is on benefits for the customer, which creates a lock-in effect. As described in section 2.2.1, AS offer enormous potential for recurring turnover throughout the product life cycle, by further sales and long-term customer relationships.[481] This is confirmed and desired by industrial B2B manufacturers. If digital AS are developed in a customer-oriented manner with an appropriate innovation process, the customer potential can be increased, as they go hand in hand with their demands and benefits.

Digital After-Sales Innovation Process

The development of digital services is faster and requires greater involvement of customers and other stakeholders in general since the output is usually not precisely definable at the beginning. Therefore, the initial situation is much less clear than with products since functions and, above all, value creation must first be identified and tested. In addition, small steps are emphasized for services, which makes the NSD cycle over four rough phases and unclear iteration loops not entirely suitable. The interviewees increasingly advocate the steps of a manageable process, like the Stage-Gate process with feedback and iteration loops, which integrates improvement possibilities after the launch, since it is often a software that evolves and must be constantly developed. In addition, flexibility, openness in the sense of open innovation, as well as co-creation and agile approaches for faster error detection, are considered important in the process, which is highly iterative and customer-centric. This is to avoid neglecting the customer perspective in the development of the digital AS, which, according to Maechler et al. (2017), is the main concern and the most common source of failure.[482] The following cornerstones of successful digital AS development were identified.

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[479] Maechler et al. 2017.
[480] Rodríguez; Svensson; Mehl 2020, p. 10.
[481] Cohen; Agrawal; Agrawal 2006; Deloitte 2020, p. 15; Helbling Management Consulting GmbH 2008; Prandini et al. 2018, p. 8; Schawalder; Lenz; Röllin 2013, p. 8, 34; Schuh; Gudergan; Thomassen; et al. 2016, p. 34; Schuh; Georgi 2008, p. 63.
[482] Maechler et al. 2017.

Customer Integration

Early involvement of customers is crucial to rule out misdirection and non-value-added developments at an early stage. This is confirmed and supported by both suppliers and customers. It also aligns with the findings of Melton and Hartline (2015), emphasizing customer involvement during ideation, concept, and prototype testing.[483] Strong cooperation and collaboration are particularly important in digitization. Through co-creation and an open innovation approach, customers' ideas or requests can be incorporated into the ideation process. In addition, prototypes, MVPs, are tested together with the customers and adapted via iteration loops. Ongoing intensive customer integration can ensure added value and customer focus and thereby increase market acceptance, especially for digital solutions. This is important because some customer groups are not aware of the digital possibilities, while others are highly interested and can provide important input.[484] The willingness of customers to become involved in the innovation process is high and is seen as an advantage, as the technology can be tested and reviewed at an early stage. Moreover, knowledge from practitioners is brought into the company to which there is otherwise no access.

Capability Analysis

Several interviewees pointed out that, especially given the acceleration of processes and innovation cycles, not everything has to be developed by the provider, but that the use of partners' competencies is crucial. Therefore, capabilities should be explored, and suitable partners acquired. This can be, for example, the integration of an already established and approved sensor technology, software systems such as cloud, or other platform solutions. Consequently, a make-or-buy decision is crucial. However, care must be taken to ensure that the know-how is in place for the long term, especially for software that continues to evolve. This was also considered by Tronvoll et al. (2020) to be purposeful if competencies from the respective ecosystem are harnessed.[485]

Service Tangibility

Customers require a physical prototype or other options to explore the features and utility of the digital AS. These can be models, initial software modules or simulations that illustrate with real data. As a result, it is possible to better determine and clarify the benefits and make statements about the willingness to buy, rather than from pure imagination.

Speed of Development

By using agile methods that focus on speed and error detection, development processes are accelerated with the involvement of the various stakeholders. This is important in order not to miss out on opportunities in the fast-moving market.[486]

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[483] Melton; Hartline 2015, p. 120.
[484] Alam; Perry 2002, p. 523; Kohtamäki et al. 2021, p. 11.
[485] Tronvoll et al. 2020, p. 302.
[486] Link 2014, p. 79–80; Wobser 2022, p. 10–12.

Corporate Alignment

What was emphatically mentioned by providers is the willingness of the entire company to act as a service provider and to adapt processes and structures such as recurring billing or data analytics, and rely on the combination of the PSS. In addition, the customer infrastructure must be considered so that they can take value-added actions with the derived results of the digital AS and corresponding data evaluations. A shift in thinking is required to pursue the servitization strategy.

Process Design

Research shows that the focus is increasingly on speed, flexibility, agility, openness, cross-functional teams, early detection of undesirable developments as well as active stakeholder integration throughout the process. Some of these characterizing features have been identified by previous research and are substantiated with strong practical relevance for industrial B2B manufacturers by the present research. Therefore, the initial circularity of the NSD cycle process is adjusted and further developed with important parts of the Stage-Gate process as well as practice-relevant approaches from the theory of agile methods and qualitative research. Emphasis is placed on the specific aspects of digital AS development. Internal coordination or involvement such as marketing plans or sales strategies are not considered here. It is purely about the process and the necessary interaction with customers in the development of digital services.

The main steps are expanded to six distinct phases as they are considered most important in the study. The preceding small steps with cross-checks are highlighted. Primary emphasis is on customer centricity, whether through active integration or intentional value creation. The individual customer integration points are flexible, e.g. customers can enter the process in the second or fourth phase if ideas were generated by the supplier, to ensure that value is actually perceived. The derived process, outlined in Figure 18, enables fast and agile progress while maintaining close customer interaction. It is designed as a flexible circular construct that involves repeated iterations and intermediate goals that must be passed through, actively integrate customers, and test prototypes quickly to finally introduce a marketable digital AS with a high probability of acceptance to the market. In addition, the integrated gates ensure that progress is constantly monitored, and value is added to the customer. If it is determined that the developed service does not meet the goals set for the phase, iteration loops can be used to eliminate them and focus the service to meet market needs. Depending on the situation, a step is taken back, or the next phase is initiated. Iterations are mainly based on customer feedback or market research. For example, after the prototype is evaluated by the customer, either a new attempt at the prototype is started or it is discarded, leading to new ideation, or it is approved. The last major iteration loop after the launch either refers to small changes as updates that trigger another development phase or to a completely new version that starts again at ideation. It is a flexible approach that does not constrain creativity with rigid structures and serves as a governing aid, as a certain structure adapted to the respective situation is advantageous. The explanations under the sequential model for each phase represent the specifications that research indicates are appropriate for developing digital AS. A more detailed explanation can be found in the appendix.

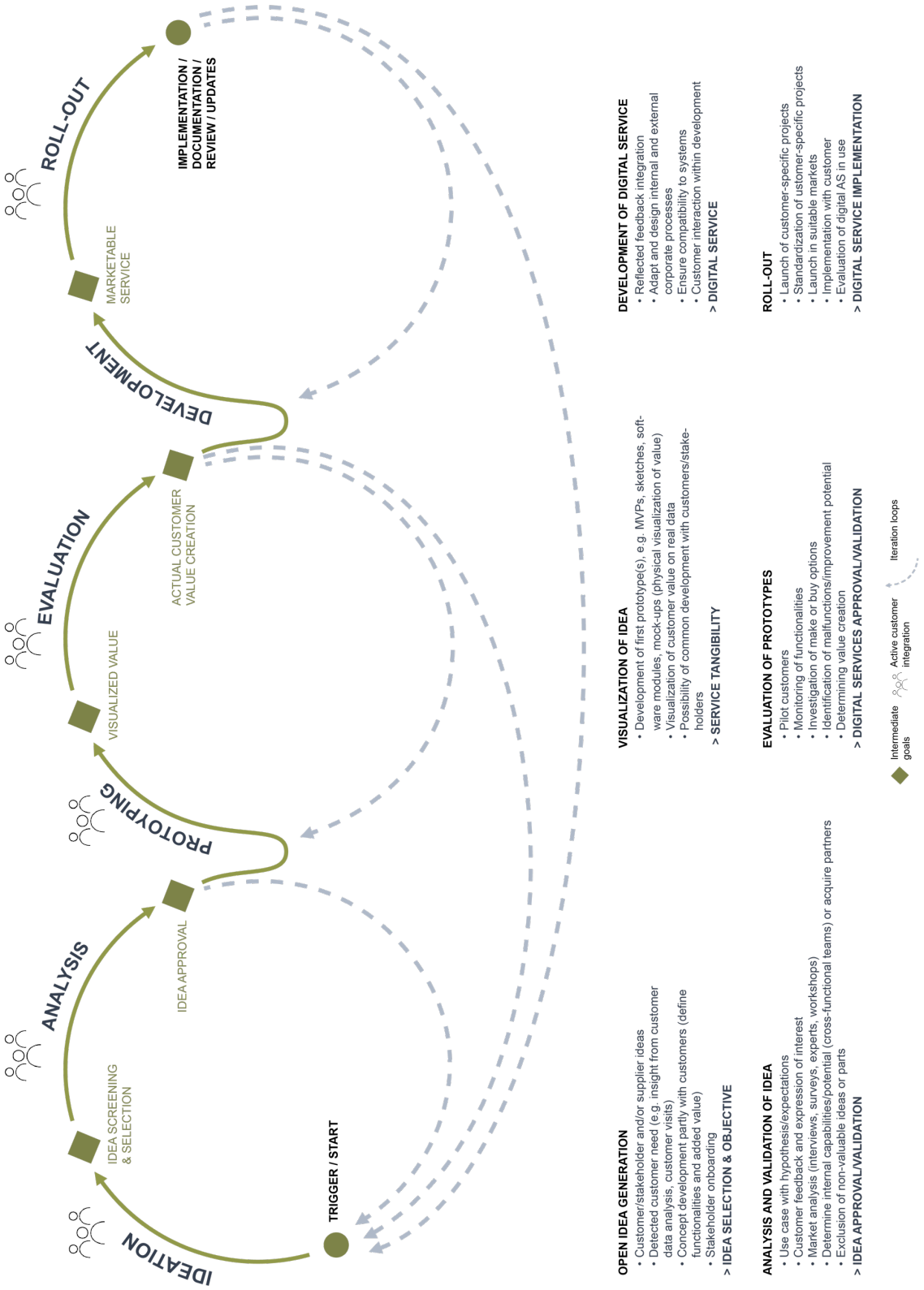

Figure 18: Digital Service Innovation Process[487]

[487] Own illustration

5.7 Practical Implications

Industrial B2B manufacturers have recognized the great potential and necessity of providing digital AS to strengthen customer loyalty and increase appeal. Still, there are two-way learning processes along the servitization transformation path that require increasing interaction between suppliers and customers to meet both expectations. In any case, actions and further developments in the digital after-sales area are essential and in demand to create and capture value and increase efficiency. To pave the way for the introduction of usage-based, output-based, or other novel business models, it is reasonable to take the next steps towards digital AS early on to stay relevant and not miss any market opportunities.

In the coming years, the digitalization of after-sales services in industrial B2B manufacturing will focus on connectivity and significant data collection for automated analysis, as well as remote control, monitoring, and the updating of products. This particularly supports serving the global market by eliminating the need for an on-site presence to service and maintain physical products after the sale. In addition, documents and product data as well as spare parts or repurchases, i.e. self-services, can be made available to customers digitally via platforms, which, observed in use cases, is already well-received. For this purpose, appropriate analyses must be defined to generate corresponding data. It is therefore important to always consider the establishment of technology-enabled digital business models in the long term, as customers generally appreciate comprehensive overall solutions.

Since no specific digital service innovation processes have been established to date, the developed version of the master's thesis serves as a reference point for industrial B2B manufacturers. To successfully anchor the service offer with the customer, approaches for an innovation process were outlined that are based on existing scientific concepts as well as on new findings. It is advisable to examine the customer's overall situation to address specific, identifiable challenges that enable value creation through digitization. Here, the inclusion of the customer's perspective is crucial and thus individualization and personalization are necessary since the solution must ultimately meet their requirements and create value for their processes. Customer integration and co-creation with different stakeholders are to be focused on during the innovation process to identify misdirection at an early stage and adapt through iteration phases. In this way, diverse competencies can be bundled and used to accelerate the process. This is sensible, as different technological development levels and existing customer systems must be considered. By doing so, it is possible to achieve strong market acceptance and generate continuous improvements through close customer ties, fostering customer potential.

Whether completely independent in-house development is worthwhile depends on the available capacities, but it is advisable to acquire certain parts of services from partners with appropriate know-how and integrate them to support development speed. Therefore, cross-functional teams are to be formed for further development that is in intensive exchange with customers. Another critical factor is the tangibility of the service, which should be presented in the form of a prototype that visualizes the value created and the functionalities of the service to illustrate its purpose and benefits directly to the customer. The proposed process approach covers the aspects that are specifically important for the development of digital AS.

The extent to which personal interaction is necessary depends primarily on the topic and the target group, but digitization generally has a positive influence on the customer-supplier relationship. Research has shown that the younger generation is open and experienced in dealing with digital solutions and can therefore be addressed digitally on a broad level. However, it is noted that critical, trust-building and creative issues should be approached in person. A shift towards increased digital communication and the use of digital AS is discernible and should be taken up by providers to introduce increasingly relevant business models and advanced services in the future.

Considering the customer and their processes allows industrial B2B manufacturers to further immerse themselves in the servitization issue. This allows for new value-added, efficiency-enhanced and more flexible offers supported by a variety of resources with an open approach to digital service innovation.

5.8 Limitations and Outlook

This master thesis, like most research projects, contains limitations that can be addressed through further explorations. Consequently, the first limitation is the restriction of the sample, since there was no direct business relationship between the provider and the customer. Indeed, the importance, as well as the sophistication and scope of the services offered, vary from provider to provider due to the different business orientations. For further research, comparisons with widely similar companies, be it size or product types, would be interesting. The original intention was to survey providers' direct customers about their services, but unfortunately, this was not possible due to a lack of willingness as well as privacy policies. Nevertheless, the study showed that there are no major differences in perspectives and opinions on the subject, stated by the suppliers and that sooner or later it will be applied everywhere. In general, the author believes that it is reasonable to obtain both perspectives on this issue.

In addition, more suppliers than customers were ultimately interviewed, which results in a strong focus on the supplier perspective. Generally, the sample size must be viewed critically for a representative study. The international context is likewise only established by the internationalized and globally active companies investigated and the opportunities for internationalization provided by the core topic. Here, actual international consideration would have been interesting and approaches for further research as to whether significant differences in demands exist on an international level. Limitations also arise from looking at industrial B2B companies, as their specific, inherently technical product focus may not be generalizable to other industries, which limits the conclusions that can be drawn about their service landscape.

The fact that there is still no official definition of service innovation and no widely used innovation processes for digital service innovation, as there are for products and processes, shows that the topic needs to be researched further and guidelines for companies need to be drawn up. Moreover, the study revealed that there is still a considerable need to consolidate digital AS in practice. Further research approaches arise in the following directions:

- Investigation of international discrepancies, due to different technical standards and levels of development, in the acceptance of digital AS.
- Comparison of the current status quo after a specified time to assess progress and identify significant reasons for potential failure or success.
- Comparison of B2C and B2B approaches or different industries regarding service innovations and potential synergies, including a discussion of industry-dependent influencing factors for the acceptance of digital services.
- Investigation of the influence of company size on openness and the pursuit of a joint development between providers and customers.
- Conducting an in-depth industry analysis including supplier and direct customers on the future potential of digital AS.
- Separation of perspectives to conduct more targeted research, e.g., going deeper into the real-world development and testing of a service innovation process or accompanying the integration of digital services at the customer's site with an assessment of what conditions need to prevail for efficient use (e.g. change management, digital transformation, infrastructure).
- Profitability of the introduction and promotion of digital services and corresponding business models.
- Evaluating the impact of constant digital interconnectedness on the customer-supplier relationship.

6 Conclusion

Finally, the master's thesis concludes with a presentation of the main findings from the previous academic scholars and the underlying empirical investigation. The aim was to examine how digital exchange can be used instead of personal interaction in the after-sales phase and how the development can be designed based on an adapted innovation process for digital AS.

In recent years, the topic of servitization has attracted increasing attention and will continue to be a component of scientific research on the one hand and corporate practice on the other. The general relevance of digital AS in the industrial B2B sector should not be underestimated and the leap into the market not be missed. There is great potential and increasing importance to be observed with the development of advanced technologies and the necessary active integration of digital and location-independent opportunities in the market. This requires companies to act quickly to achieve a certain level of differentiation and attractiveness, especially given the increasing competition and the complexity of physical products. In this respect, the digital AS approach facilitates internationalization and thus the expansion of the operating environment through remote capabilities and predictable maintenance. High-efficiency gains, fewer downtimes and fast responses are key reasons and at the same time customer requirements for why AS and repurchase processes are ideally suited for digitization. Industrial B2B manufacturers are still at the beginning of their servitization transformation, since first PSS, usage-based business models, and performance-based contracts are offered only occasionally.

Both customers and suppliers are in favor of using digital tools to enhance the efficiency of processes and are well aware of digital opportunities. Fulfilling the expectations of customers and the plans of suppliers requires further development steps. First and foremost, this is the value-added use of data that accumulates at the customer end and can be transmitted by digital connections. Targeted analyses can be used to offer services such as predictive maintenance or self-services. In addition, new service and product ideas may be identified more easily through digitization. The needs derived from the analysis can, in turn, be translated into cross-selling and up-selling, thus consolidating customer potential. For this, benefits and data security must be provided and communicated accordingly. This is made possible through close collaboration as early as the development phase. These again form the basis for disruptive business models with supplier ownership, for example, pay per use, which enables targeted billing through close technological connection.

It is therefore vital to investigate customer expectations and include them extensively in digital service development. The study contributes to the development of a digital service innovation process, as there is no anchored innovation process for digital services and development is mostly based on product innovation processes or ad hoc. However, there are crucial differences, especially in the areas of strong customer integration, speed, and uncertainty of the output. Furthermore, short steps and agile and flexible approaches are important to identify and exclude undesirable developments at an early stage. Ultimately, digital after-sales services are primarily about adding value for the customer and changing the value proposition to one of greater integration into customer processes. Digitalization is enabling the transformation on the path of servitization to a PSS in which services shift to the center of attention and products take on the role of add-ons. Industrial B2B manufacturers see this

change if it has not already been initiated for individual products, moving further into the future, which is a consequence of their previous focus on physical products or customer readiness.

Overall, there is an increasing openness to digital interaction and the implementation of digital AS, which is associated with great mutual benefits. Digitization is not yet in a position to completely replace personal interaction, but the technological possibilities are being driven forward and the role of face-to-face interaction is shifting increasingly toward relationship building and networking. A customer-oriented and value-centric development process serves as a prerequisite for creating real added value for customers and for obtaining attractive offers that are in line with market requirements. Based on the results, the trend and importance of taking rapid steps in the direction of digital AS is confirmed by both customers and suppliers.

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Appendix

Appendix 1: Digital Service Innovation Process

Appendix 2: Category System

Appendix 3: Semi-Structured Interview Guideline – Customer

Appendix 4: Semi-Structured Interview Guideline – Service Provider

Appendix 1: Digital Service Innovation Process (Figure 18)

Since a detailed explanation would exceed the scope of the main part of the thesis, the steps considered for a digital service innovation process are explained in the following section. Based on the findings of the study, it is vital to implement a customer-centric innovation process so that suppliers, industrial B2B manufacturers, can exploit the future potential of digital AS. This customer involvement is particularly important because digital AS focuses on adding value with intangible services, and so a mutual understanding and positive appreciation of the added value is crucial to success. Close cooperation is particularly important in an international context in order to recognize the different needs and circumstances for the implementation of digital AS, as various interviewees emphasized. Ultimately, successful implementation is primarily a matter of the benefits in the respective customer company. This is supported by a data-driven analysis that identifies certain patterns in the use of physical products and thus allows the service offer to be established for certain assets, markets or individual companies.

Manufacturers that used to be purely product-centric are confronted with the challenge of creating value for the customer through services, which is not primarily related to the technological competence of the product and requires a different, value-based approach to development. This approach allows greater acceptance of digital AS, as customers can experience the usefulness of the services at an early stage and make their internal demands for improvement known.

The process builds on the circularity of the NSD Process Cycle and is supplemented by intermediate goals according to the idea of the Stage-Gate model to establish predefined triggers for revision. Especially in the case of digital AS, it is unclear in advance what the result will be and what features it will contain, requiring adjustments. Here the customer perspective is crucial since they are ultimately the final users in active operation. Especially in the case of different technological standards of globally situated customers, the usability and implementability should be tested directly with real customers. In doing so, the process is designed to be flexible to respond to changing market dynamics. The outcome is intended to become clearer step by step and meet market requirements. Development takes place in close collaboration with customers, partners, and internal company employees in cross-functional teams. Digital exchange is also possible here. As in other process models, it is not necessary to follow the phases in a straight line; they represent reference points but can be used flexibly and in an agile manner. However, it is important to consider customer focus and the value creation and capture throughout. It is about keeping risk of failure low by constantly reviewing the development of set objectives.

Here, too, some enablers ensure rapid process progress and a digital AS adapted to customer needs through the interaction of internal and external competencies. Specifically, these include cross-functional teams (internal + external), pilot customers, technology, tools, physical products, systems, and partners (development partners, specific competencies, module integration). Iteration phases are indicated by the blue arrows (page 75). These arrows are not exclusively bound to these steps, which is why they are dashed. All phases can be iterated internally if required.

1st Phase: Ideation

The first critical phase, idea generation, is initiated by a trigger. This can originate from stakeholders, customers, customer visits, within the company (e.g. innovation events, meetings, employee ideas), or other external sources such as the business environment or previous developments. This is done according to the principles of open innovation. It is important to involve the customer at this point, or at the latest in the next stage to eliminate non-value-creating ideas from the process early on and to detect new market needs and potential. Frequently, this is achieved through a brief exchange with existing customers. The aim is an open collection of ideas, whereupon certain proposals are selected and further developed by a committee or other decision-making body. Digital AS is often distributed in combination with new business models such as subscription, XaaS, or even operator models, which must be tested for acceptance in the next phase. Ideas that are considered to have potential are to be evaluated by means of customer testimonials and their market relevance for subsequent sales is discussed.

GOAL: Idea screening and selection

2nd Phase: Analysis

To ensure that the idea (digital service and corresponding business model) meets the practical requirements of the customer, it must be tested for market relevance and customer benefit in the next step. This can be done through various forms of market research, in the case of specific customer developments with the individual customer, but a loose exchange with potential pilot customers is conceivable with digital AS to generate quick insight into the acceptance level. In addition, if the idea is not fundamentally based on a partner collaboration, initial considerations are made here about working together with external areas of expertise. The focus here is on which parts can be outsourced and what is needed for in-house development and whether these competencies are available. What is important is a clear expression of the benefits that the customer will derive from using this service. Internal clarifications regarding feasibility are necessary here. Through interaction with the stakeholders, the idea is either validated for further pursuit and goes directly into the prototype phase, or it is classified as not valuable or there is a lack of actual interest. Ideation is initiated again and the idea is adapted accordingly, or the project is aborted.

GOAL: Idea approval

3rd Phase: Prototyping

In this phase, after a positive idea selection, one or more prototypes are created and then tested directly with the customer for usability and value creation. The aim here is the rapid creation of an executable prototype so that, as previously mentioned, the development speed can progress quickly in line with customer requirements. Through visualization, a physical communication of the value of the solution is possible. Customers do not need a finished solution; the visualized idea and the conceived purpose is sufficient. At best, this value creation can be done with real data in order to illustrate the actual benefit. Prototypes may be developed in collaboration with or without the customer, based on previous analysis and own perception.

GOAL: Prototype with visualized value

4th Phase: Evaluation

Depending on the project, longer pilot phases and iteration loops may be run within this step. This involves intensive interaction and exchange with customers, often special pilot customers or project-related implementations with individual customers, to determine the digital service according to the greatest possible benefit together with the customer. Industrial B2B manufacturers thereby have the opportunity through co-creation to discover direct problems, suggestions, and additional useful features. This results in a usability proof and discussion of concerns and requests that can be considered and integrated in the next step.

Here, possibilities such as sketches, software modules, and mock-ups are used to create the first MVPs and to gain customer impressions. This is based on the lean startup method and involves learning from feedback rounds and pre-established expectations through hypothesis testing. If the tested prototype does not receive a positive response or is not perceived as valuable or useful by the customer, iteration loops are possible, resulting in either a new idea or a revision of the prototyping before the service development results in a market-ready development.

GOAL: Validation and approval of actual value creation for the customer

5th Phase: Development

After the prototype has been evaluated, the final digital service is designed in this step based on initial developments and feedback rounds. This is done either entirely in-house or with selected partners who, for example, provide a certain cloud solution or sensor technology that is required for the digital AS. In the digital domain, it makes sense to leverage the expertise of others, since the characteristic fast-moving nature of digital innovations means that laborious and costly in-house development is of limited benefit. Beyond that, industrial B2B producers can rely on solutions that are well-known on the market and accepted in the industry.

Not only the service itself, but also billing modalities, business models and responsibilities, which are designed to be provider-specific, must be considered if they are not already defined from the outset. Internal and external processes must be ready to use other forms of billing, such as pay per use. If there are questions for the customer, they can be included in the phase that will deal with customer-specific developments. However, development is fundamentally the responsibility of the provider and does not envisage complete customer integration.

GOAL: Digital service ready for market

6th Phase: Roll-Out

Once the digital AS has been finally developed, it is rolled out in selected markets or to specific customers, and the implementation process is monitored in collaboration with the customer. Here, processes are monitored and, if necessary, adjustments are made, which can be supported by digitization as well as remote access to control the implementation. The business relationship is further supported by updates, enhancements, and data exchange as well as collection.

GOAL: Implementation, documentation of functioning, evaluation of necessary updates

AFTER ROLL-OUT

After the roll-out, it is important to constantly monitor the further development of digital services and to observe whether improvements or potentials for extensions or changes by means of updates arise from the real user data. Documentation, implementation support, feedback and suggestions from actual users with real processes are important. Through ongoing interaction, customer satisfaction can be increased, concerns can be responded to quickly, and output such as data can be used for internal company purposes such as product and service development or improvement. It can result in a new ideation or development phase, depending on the extent to which existing services are adapted or new ideas pass through the process neutrally and are tested for feasibility, market acceptance and value transfer.

Appendix 2: Category System

The following is a description of the findings regarding use cases in the manufacturing B2B industry. In determining the category system, a total of eight main categories were identified, each of which was subdivided into further subcategories to allow for better allocation and clarity.

Main Categories	# of Subcategories
Drivers of Digital Services	• Generation Change • Shortage of Skilled Workers • Competitive Position • Technology Development • Customer Relationships and Requirements
Digital After-Sales Services	• Importance of After-Sales Services • Challenges of Digital After-Sales Services • Advantages of Digital After-Sales Services • Data Sharing and Use • Solution Provider
Implemented After-Sales Services	• Digital Media • Interconnected Systems • Service Platforms • Remote Services • Predictive Maintenance • Updates and Upgrades • Self-Services
Innovation Process	• Innovation Process Steps • Customer Integration • Agile Methods • Improvement Loops
Customer in Digital Services	• Digital Interaction • Customer-Supplier Relationship • Co-Creation • Customer Value • Customer and Sales Potential
Customer Requirements / Expectations	• Influences on Customer Expectations • Rapid Action Capability / Preventive Actions • Customer Process Benefits • Customized Services • Perceived Customer Expectations by Supplier
Business Model Opportunities	• Subscription Model • Pay per X • X as a Service
After-Sales Service Future Potential	• Data Generation and Analysis • Connectivity • Extended Reality • Preventive / Predictive Maintenance

Table 4: Category System[488]

[488] Own illustration

Appendix 3: Semi-Structured Interview Guideline – Customer

Introduction of the interviewer, background and goal of the research/interview, point out the recording of the interview, explain the anonymization of the interview and clarify open questions.

Einstiegsfragen

1. Stellen Sie bitte sich und Ihren Verantwortungsbereich kurz vor und wie lange Sie schon in diesem Bereich tätig sind.
2. Welche Bedeutung bzw. welchen Stellenwert schreiben Sie dem Kundenservice bzw. After-Sales Service als Kunde in der B2B Industrie zu?
3. Wie hat sich das Serviceangebot von Lieferanten aus Ihrer Sichtweise in den letzten Jahren, gerade auch im Hinblick auf die Technologieentwicklung, gewandelt?
    a. Welche Trends sind hier erkennbar?
    b. Wie zeigt sich der Einfluss der Digitalisierung in After-Sales Services?

Erwartungen

4. Was sind Ihrer Meinung nach die Vorteile von digitalen After-Sales Services?
5. Was sind die Nachteile digitaler After-Sales Services? Welche Challenges oder Hürden können diese mit sich bringen?
    a. Services basieren oft auf der Auswertung von Daten generiert durch das physische Produkt. Wie ist hier die Offenheit für Schnittstellen zum Lieferanten?
    b. Werden Dashboards oder Plattformen, um das Produkt zu beobachten und gegebenenfalls Daten und Auswertungen für Services zu erhalten, genutzt?
6. Welche Erwartungen bzw. Ansprüche haben Sie an den Einsatz von digitalen After-Sales Services?
    a. Welche digitalen Services von Lieferanten werden im Unternehmen beansprucht? Sind hier vernetzte Produkte, die Daten generieren im Einsatz? Wofür werden diese Daten genutzt?
    b. Welche Ziele verfolgen Sie mit der Beanspruchung dieser Dienstleistungen? Wie können Anbieter damit Wert für euch als Nutzer schaffen?
    c. Welche After-Sales Aktivitäten eignen sich Ihrer Meinung nach besonders gut für die Digitalisierung und wo ist der persönliche Kontakt vor allem wichtig?
7. Was erwarten Sie sich von Lieferanten, wenn sie die Wartung und Instandhaltung Ihrer Maschinen übernehmen?
8. Wie sehen Sie das Thema Self-Services? Sprich, dass Kunden ohne direkten Kontakt mit einem Mitarbeiter oder einer Mitarbeiterin beispielsweise über eine Kundenplattform Ersatzteile bestellen, Informationen abrufen oder eine Selbstdiagnose machen können?
9. Welche digitalen After-Sales Services sehen Sie in naher Zukunft als sinnvoll zu implementieren?
    a. Was sind die Treiber hinter diesen?

Einflüsse

10. Welche Bedeutung haben solche digitalen Services, wie beispielsweise vorausschauende Wartung, remote Monitoring oder Kundenplattformen, für Ihr eigenes Geschäft und die eigenen Prozesse?
    a. Welchen Mehrwert bringen Services, wenn diese remote und digital stattfinden können?
    b. Wie verbessern digitale Services die Nutzung des physischen Produkts bei Ihnen im Unternehmen?
11. Wie beeinflussen digitale Services die Kunden-Lieferanten-Beziehung?

a. Welche positiven, aber auch negativen Aspekte sehen Sie in der vermehrten Nutzung von digitalen Mitteln anstatt persönlicher Interaktion zwischen Lieferanten und Kunde?
b. Wie beeinflusst das Angebot an Services parallel zum physischen Produkt die langfristige Geschäftsbeziehung?
c. Welchen Einfluss hat die After-Sales Phase, um auch erneut bei dem Lieferanten Wiederkäufe zu tätigen?

Kundenintegration

12. Wie intensiv sollte die Zusammenarbeit bezüglich der Entwicklung von Dienstleistungen zwischen Lieferanten und Kunden sein? Welche Erwartungen haben Sie an diese?
    a. Wie erfolgt die kundenspezifische Anpassung von Services?
    b. Die Literatur besagt, dass gerade für die Serviceentwicklung Kundenintegration bedeutend ist, vor allem die starke Integration in den Innovationsprozess. Wie sehen Sie diese Aussage?
13. Wie sollte Ihrer Meinung nach ein Lieferant vorgehen, um den Kundennutzen schon im Entwicklungsprozess zu sichern?
    a. Wie sollen Kunden in den Innovationsprozess von Dienstleistungen miteinbezogen werden?
    b. Zu welchem Zeitpunkt im Innovationsprozess macht für Sie Kundenfeedback zu neuen Entwicklungen Sinn?
14. Wie wichtig ist für Sie die persönliche Interaktion mit dem Lieferanten? Welche Möglichkeiten sprechen Sie hier der Digitalisierung zu?

Zukunftspotenzial

15. Welche After-Sales Services haben Ihrer Ansicht nach Zukunftspotenzial für die Digitalisierung bzw. welche können durch die Digitalisierung etabliert werden?
    a. Welche Technologien sind hier spannend?
    b. Wie würde Sie das unterstützen?
16. Wie siehst du den Umschwung in Richtung neue Geschäftsmodelle, bei denen das Produkt im Besitz des Herstellers bleibt und nach Output oder Nutzung abgerechnet wird? Dadurch wäre dann der Hersteller verantwortlich für die einwandfreie Nutzung.
    a. Was macht Lösungsanbieter interessant?
    b. Wie sähe hier die ideale Konstellation für Sie aus?
    c. Was spricht für solche Geschäftsmodelle? Welche Vorteile, welchen Wert erkennen Sie darin?
    d. Was spricht gegen solche Geschäftsmodelle?

Abschluss

17. Was wünschen Sie sich zukünftig von Ihren Lieferanten, den Anbietern von Services?
18. Gibt es noch etwas, das Sie abschließend ergänzen möchten?

Appendix 4: Semi-Structured Interview Guideline – Service Provider

Introduction of the interviewer, background and goal of the research/interview, point out the recording of the interview, explain the anonymization of the interview and clarify open questions.

Einstiegsfragen

1. Stellen Sie bitte sich und Ihren Verantwortungsbereich kurz vor und wie lange Sie schon in diesem Bereich tätig sind.
2. Welche Bedeutung schreiben Sie dem Kundenservice bzw. After-Sales Service in der B2B Industrie zu?
3. Wie hat sich das Serviceangebot aus Ihrer Sichtweise in den letzten Jahren, gerade im Hinblick auf die Technologieentwicklung gewandelt? Ist hier ein Trend zur Servicierung und dem Einsatz digitaler Services erkennbar?
    a. Was sind Ihrer Ansicht nach die Treiber?
    b. Würden Sie diesen Wandel als Trend vom reinen Produzenten in Richtung Systemanbieter oder gar Betreiber bezeichnen?

Ist-Situation

4. Welche digitalen Services im After-Sales Bereich bieten Sie an?
    a. In welcher Konstellation zum Produkt werden diese angeboten?
    b. Welche After-Sales Aktivitäten eignen sich Ihrer Ansicht nach besonders gut für die Digitalisierung?
5. Welche Technologien werden hier verwendet?
    a. Diese mit Technologie bestückten Produkte generieren Daten. Dienen diese als Grundlage für weitere Entwicklungen im Unternehmen?
6. Welche Risiken oder Nachteile bringt die Digitalisierung im After-Sales Bereich mit sich?
7. Welche Potenziale und Chancen sehen Sie in der Etablierung von digitalen Services für den Kunden, als auch den Anbieter?
8. Welche Erwartungen seitens der Kunden an das digitale Serviceangebot begegnen Ihnen?
    a. Sie haben viele internationale Kunden. Sind hier unterschiedliche Erwartungen spürbar?
    b. Wie werden hier unterschiedliche Erwartungen im Hinblick auf deren Herkunft berücksichtigt?
9. Wie gestaltet sich der Kundenwert in diesen digitalen Möglichkeiten?
10. Wie wird Ihrer Meinung nach die Kundenbeziehung durch den Einsatz digitaler Mittel beeinflusst?

Serviceinnovationsprozess

11. Welche Auslöser gibt es für die Entwicklung von Serviceinnovationen?
    a. Würden Sie sagen, dass Services eher aufgrund von Kundennachfrage oder basierend auf Technologieentwicklung etabliert werden?
12. Wie gehen Sie im Unternehmen die Entwicklung digitaler Serviceinnovationsprojekte an?
    a. Welche Rahmenbedingungen und Akteure sind für die Entwicklung wichtig?
13. Wie würden Sie den Innovationsprozess dieser digitalen Services darstellen?
    a. Wie beeinflusst die Entwicklung von digitalen Services den Innovationsprozess? Wie unterscheidet sich dieser von anderen Innovationsprozessen im Unternehmen?

   b. Welche Faktoren sind bei der Entwicklung und auch Verbesserung von Serviceinnovationen wichtig?
   c. Die Literatur zeigt vermehrt iterative und zirkuläre Ansätze bzw. agile Methoden, die gerade für digitale Serviceinnovationen genutzt werden. Wie würden Sie Ihr Vorgehen hier einordnen?
14. Verwendet ihr agile Methoden, um neue Services zu entwickeln? Falls ja, welche und warum diese?
   a. Wann ist der Einsatz dieser empfehlenswert und in welcher Situation gibt es Schwierigkeiten?
   b. Was davon ist gerade im Kontext der Serviceentwicklung sinnvoll und anwendbar?

Kundenintegration

15. Wie sieht die Kundenintegration in der Serviceentwicklung aus?
   a. Welche Bedeutung haben Kundenfeedback im Entwicklungsprozess?
   b. Wo wird er einbezogen? Wie intensiv wird zusammengearbeitet?
   c. Wie wird dabei einen Mehrwert für beide Seiten generiert, Stichwort Co-Creation?
16. Wie wird das Kundenpotenzial durch den Kundenservice gefördert? Gerade im Blick auf langfristige Kundenbeziehungen sowie Cross- und Upselling-Potenziale?
17. Wie wichtig ist hier noch der persönliche Kontakt bei der Dienstleistungserbringung?
   a. Gibt es hier erkennbare Unterschiede, je nachdem woher die Kunden stammen?
   b. Wie intensiv würden Sie die Zusammenarbeit mit Kunden bei der Servicedurchführung beschreiben? Wird hier vieles Remote gemacht?
   c. Was sind die Vor- und Nachteile, gerade hinsichtlich der Kundeninteraktion und -bindung, wenn so vieles automatisiert und digital verläuft?

Zukunftspotenzial

18. Gibt es Technologien, die zukünftig noch weiter an Relevanz bei After-Sales Services gewinnen?
   a. Gibt es schon Projekte in Planung? Ansätze?
   b. Gab es schon Ideen, die nicht weiterverfolgt wurden?
19. Die Digitalisierung im After-Sales bringt viele Potenziale mit sich. Was wird Ihrer Meinung nach Zukunftspotenzial in der produzierenden B2B Industrie haben?
20. Es heißt, durch Services können neue Geschäftsmodelle entstehen. Welche Zukunftspotenziale sehen Sie in der Wertgenerierung durch digitale Services?
   a. Wie sehen Sie den Umschwung in Richtung Betreibermodelle, bei denen das Produkt im Besitz des Herstellers bleibt und nach Output oder Nutzung abgerechnet wird?
   b. Der Hersteller wäre dann auch verantwortlich für die einwandfreie Nutzung. Ist das interessant als Lieferant?

Abschluss

21. Gibt es noch etwas, das Sie abschließend ergänzen möchten?

Statement of Affirmation

I hereby declare that all parts of this thesis were exclusively prepared by me, without using resources other than those stated above. The thoughts taken directly or indirectly from external sources are appropriately annotated.

This thesis or parts of it were not previously submitted to any other academic institution and have not yet been published.

Dornbirn, July 3, 2022 Belinda Konzett, BA