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Servitization: A Deep Dive in the Healthcare Sector

Servitization in Healthcare: Exploring Business Models, Challenges, and Drivers

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Abstract

This master thesis explores the transformation of businesses from product-oriented to service-centric business models, known as "servitization". Through a combination of secondary and primary research, it identifies business models, drivers and challenges, focusing primarily on the medical technology and pharmaceutical industry within the healthcare sector, which is currently in the early stages of servitization. The results are then compared to the software and automotive industry to identify similarities such as revenue diversification or closer customer relationships. Furthermore, unique aspects impacting healthcare like heavy regulation or reimbursement challenges are outlined, affecting the future adoption of service business models.

Keywords

Servitization, strategy, commercial strategy, healthcare, MedTech, pharma, business model, Anything-as-a-service (XaaS), service providers, service offerings, servitization strategies

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1. Introduction

1.1 Motivation for the Topic & Research Question

A recent PwC survey of more than 4,000 CEOs from various industries found that more than 40% of the participants believe that their organization cannot be economically viable a decade from now if they continue with their current strategies (PwC 2023, 3). This highlights a need for disruption, causing many companies to seek new revenue-generating methods. In a Forbes article, Michael Ouissi highlights that monetizing products throughout their entire service lifetime, instead of just selling them, presents significant benefits for companies. This shift from selling products towards selling services is known as "servitization" and can be seen in many industries. Especially in a world with progressively commoditized offerings, servitization offers an opportunity for differentiation. (Ouissi 2023)

"The future of MedTech lies not in transactions, but in building lasting relationships through servitization, where every product becomes a gateway to holistic healthcare solutions." (Cavin 2023) This quote from Ernest Cavin, a sales executive of Ziemer Ophthalmic, a Swiss-based MedTech company, highlights the shift that is currently happening in the healthcare sector from a transactional business model of selling products to selling services. Numerous healthcare companies are now piloting service business models, making this sector a compelling opportunity to analyze servitization beyond the theoretical concepts.

This thesis named "Servitization: A Deep Dive in the Healthcare Sector", with the research question "What are business models, challenges, and drivers linked to servitization in general and in healthcare, and how can the findings be classified, compared to other industries?" aims to contribute to a deeper understanding on how servitization is re-shaping healthcare and its business models.

The motivation for exploring servitization within healthcare stems from the authors' unique combination of academic and practical experiences. With an internship at Siemens Advanta Consulting and particularly his involvement in the service workstream for a transformation project, Carlo Sinthern already had valuable exposure to the significance of servitization and its intricacies. Conversely, Niklas Staub has had practical experiences in the healthcare sector at Bayer and Merck, focusing on healthcare business models, particularly pay-per-use. The collective background provides valuable practical insights and connections to potential interview partners.

1.2 Overview of Existing Literature

The literature on the general topic of servitization is extensive, offering a comprehensive understanding of various aspects such as drivers, challenges, and trends. Existing findings in this domain tend to complement each other, providing a nuanced view of servitization. However, there is a notable divergence regarding the implications of servitization. While some studies emphasize the positive financial effects of embracing servitization strategies, others argue that there might be a negative financial impact in the short term or different effects depending on the industry cycle. This discrepancy in theoretical perspectives underscores the complexity of servitization and the need for a deeper exploration to reconcile these differing viewpoints.

The literature landscape regarding servitization in the specific healthcare context is comparatively limited. There is a predominant presence of consulting reports that often serve as promotional material for consultancy services, focusing on the general advantages of servitization and not the challenges companies face when transitioning to that business model. This highlights the need for further research to complement the spare theoretical findings with practical insights to enhance the depth and applicability of the results. Similarly, it can also be seen that industry-specific literature is limited regarding the automotive and software industries analyzed in Chapter 4.

1.3 Methodology

To answer the research question, servitization will be first examined in general. After defining servitization and service offerings, the concept of Anything-as-a-Service (XaaS) and its adoption will be explained. This is followed by an analysis of drivers, challenges and financial implications before trends and a future outlook of servitization will be outlined. After this general overview on servitization, a deep dive into the healthcare sector will be conducted to gain industry-specific insights on service business models piloted in healthcare, drivers and challenges. This is followed by a future outlook assessing future adoption of service business models in healthcare. The results from the healthcare sector are then compared to software vendors and the automotive industry to classify them. Therefore, the business models, drivers and challenges are compared to highlight similarities across the industries and identify unique aspects of the healthcare sector.

The methodology used for this thesis to generate holistic insights on servitization combines secondary research through literature review and primary research through interviews. The literature review was conducted to analyze and summarize existing research, reports, news articles and scientific papers. Therefore, similarities and areas of controversy could be identified and synthesized for a comprehensive review, structured thematically. To complement the results of the literature review with insights from practice, interviews were performed. There are three types of empirical research: descriptive, explorative and hypothesis-testing research (Berger-Grabner 2022, 120). Since industry-specific research on servitization, especially for healthcare, is scarce, the focus was on generating firsthand insights instead of confirming existing theories through a large number of interviews. Therefore, explorative research was chosen and eight semi-structured expert interviews were conducted with servitization experts and healthcare executives of globally leading pharmaceutical and MedTech companies. They were approached either through existing connections or via LinkedIn.

Group part

The general servitization Chapter 2 features insights from three selected experts. Two of them serve as consultants in companies that assist clients on their servitization journey. The third expert has hands-on experience from being involved in a servitization transformation project. Therefore, these experts bring practical perspectives that complement the theoretical insights obtained from the literature review. Nearly 20 healthcare executives from leading global companies have been approached to generate industry-specific insights on servitization in the healthcare sector. The focus was mainly on executives in strategy, market access or commercial roles, as these are closest to servitization activities. While most of the interviewees approached were interested in the research, only five individuals agreed to participate in the interview for Chapter 3 focusing on servitization in healthcare. The main reason for refusal was the limitation to disclose competitive information. An overview of the experts and their qualifications can be found in Appendix 1. The interviews have been conducted and recorded using Microsoft Teams and transcribed using software. Upon request of the interviewees, specific transcripts have been pseudo-anonymized and redacted for competitive reasons, ensuring that neither the company nor the name of the employee is disclosed. This also highlights the topic's relevance, as companies are piloting different servitization strategies they are not ready to disclose publicly yet. The redacted sections in the transcript are highlighted by square brackets, e.g. "[specific information]". The transcripts can be found in Appendixes 4-11 and will be referenced in the text with the line number.

The insights for the industry comparison in Chapter 4 have been generated via secondary research. The limited access to industry-specific literature highlights the importance of interviews to collect insights about the industries. While this is beyond the scope of this thesis, it would be interesting to perform interviews similar to those done in the healthcare sector with other industries.

2 A Holistic Examination of Servitization: From Drivers to Future Trends

This master thesis has been carried out as part of a combined academic work between Niklas Staub and Carlo Sinthern. The part of Carlo Sinthern, “A Holistic Examination of Servitization: From Drivers to Future Trends” is available separately.

3 Servitization in Healthcare: Exploring Business Models, Challenges, and Drivers

3.1 Introduction to the Healthcare Sector, MedTech and Pharma Industry

According to the Global Industry Classification Sector (GICS) (MSCI Inc and S&P Dow Jones Indices LLC 2023, 1), developed by S&P Global and MSCI, the healthcare sector can be broken down into several subsections. The first industry group "Healthcare Equipment and Services" focusses on providing healthcare services to patients and consists of medical technology (MedTech) companies that manufacture medical equipment (e.g. CT-Scanners, Bandages, Catheters, etc.), provide medical services (e.g. hospitals, doctor's offices, etc.) or engage in healthcare technology as well as research & development to improve current healthcare practices and procedures. The second group "Pharmaceuticals, Biotechnology & Life Science Tools and Services" includes companies that perform research & development and manufacture drugs derived either from living organisms (Biotechnology), on a chemical basis (Pharmaceuticals) or manufacture equipment or services for research, analysis or clinical testing. (CFI Education Inc. n.d.) This thesis will mainly focus on servitization in the MedTech industry, as this seems to be the most promising application of the new business models, and the pharmaceutical (pharma) industry, which is often related to MedTech, as numerous companies offer both product categories.

The MedTech Industry includes manufacturers of medical devices used for the prevention, diagnosis and treatment of diseases. The global industry market size in 2021 was around €550 billion with the strongest segments being in vitro diagnostics, cardiology, diagnostic imaging and orthopedics. (Stewart 2023) The leading companies of the industry based on revenue include Abbott, Medtronic Inc., Johnson & Johnson and Siemens Healthineers (Medical Product Outsourcing 2023).

The pharmaceutical industry encompasses companies that develop, produce and sell drugs used for different types of preventive measures, treatments and therapies for diseases. The industry has experienced continuous growth during the past years resulting in a global market size of roughly $1.5 trillion. It can be divided into prescription drugs (Rx-drugs) and non-prescription drugs. (Statista n.d.) Non-prescription drugs that are sold directly to the patient in a B2C model are out of scope for this thesis due to the lack of interviewees. The leading companies based on Rx revenue include Pfizer, AbbVie, Johnson & Johnson, Novartis and Merck & Co (Christel 2023, 17).

Both the pharma and MedTech industry are historically driven by transactional/product-centric business models of selling a piece of equipment to healthcare institutions while potentially offering additional product-centric services (Cavin 2023; Appendix 6, lines 18-41). Nevertheless, most companies are piloting service-centric business models for a variety of reasons, which will be described below. The research has shown that there are differences between MedTech and pharma in terms of the adoption of servitization and the nature of the respective business models.

Generally, the companies in both industries can be described as manufacturing companies. However, it is important to highlight that a clear distinction between manufacturing and software companies is not always possible anymore, as an increasing number of manufacturers are adding standalone digital products/software to their product portfolio. Examples include big companies like Bayer with their AI software for diagnostic imaging, Johnson & Johnson, Pfizer, Siemens Healthineers and more. (Bayer n.d.; Olesch 2021; Siemens Healthineers AG 2021)

3.2 Servitization in MedTech

3.2.1 Service Business Models in the MedTech Industry

Initially, MedTech operated within a purely transactional business model of selling products and services either through one-time purchases or deferred payments to their customers who are

hospitals and healthcare professionals (HCPs) like doctors or medical staff. (Cavin 2023) Currently, services provided by MedTech companies are usually sold as part of a new equipment sale, not standalone. An example of these product-centric service business models is equipment or preventive maintenance service. Most companies generate profit from the maintenance of their devices and not from the sale itself. Often, expensive equipment like CT scanners or MRI machines are sold at cost, with the profit coming solely from equipment service. Equipment service is often sold as a contract with a fixed duration, including preventive maintenance and an on-call service for equipment breakdowns. (see Appendix 5, lines 55-63; Appendix 6, lines 20-25; Appendix 8, lines 18-22, 29-30)

While product-centric business models are already established to a certain extent in MedTech, companies are also piloting services that can be classified as service-centric offerings, based on the classification highlighted in Chapter 2.1. MedTech and other healthcare companies are moving towards offering solutions instead of products, so-called solution selling. (Ehrhardt 2021; Bano et al. 2018, 3f) Deloitte describes solution selling as the initiative of creating holistic (care) platforms that assist providers and payers in delivering high-quality and cost-effective care. They define solutions as the combination of products (equipment, disposables, etc.), services (technical-, clinical-, consulting services, etc.) and flexible contracts (output-based contracts, risk-sharing models, etc.). (Bano et al. 2018, 3f) All companies interviewed have confirmed that they are piloting different service business models, these include XaaS models for devices and software, automated replenishment services and integrated health offerings, which will be described in this chapter. In an article from BCG focusing on growth opportunities of MedTech companies using services, they project standalone profit margins of MedTech services in the range of 35%-50% (Lavoie, Aggarwal and Sisko 2018). However, the interviews highlighted that most companies are

still in the pilot phase of those models and generate little to no revenue (see Appendix 7, lines 186-188; Appendix 6, lines 25-31).

One of the service-centric business models that companies are piloting are flexible XaaS models for medical devices, so-called DaaS models, often associated with risk-sharing between the customer and supplier. This model allows the customer to avoid the upfront capital investment for the device and pay on a subscription basis or per procedure ("pay-per-use"). That is especially attractive for expensive equipment such as CT scanners or robotics systems that are often seven-figure investments. Deferring the investment over individual payments can be attractive for customers since healthcare markets are under financial pressure. Therefore, these risk-sharing models can free up capital that would otherwise be tied to equipment. In addition to that, hospitals get access to the latest equipment. (Venkat 2016) Siemens Healthineers offers a DaaS model bundling the equipment, maintenance and additional services like consulting to optimize the customer's workflow into one service. They offer four different financing options, as described in their "Innovative solutions for healthcare financing" whitepaper. In the unitary payment model, the service is charged in a fixed payment over regular intervals, delinked from the usage of the equipment. The second option is a pay-per-use model, where the customer pays a given fee per use of the equipment, essentially sharing the operational risk between the customer and the equipment provider. With a subscription model, Siemens offers a hybrid of the above-mentioned options allowing for a fixed monthly payment up to a specific volume and additional usages through contractually agreed fees. The last option is a performance-sharing model tying the manufacturer's compensation to the performance of the equipment or service, often referred to as value-based contracts. (Siemens Healthcare GmbH 2019, 6f.; Cavlan et al. 2018) Other companies such as Medtronic, St Jude Medical and Johnson & Johnson are offering similar models with and without risk-sharing (Zhu et al. 2020, 8). These models are also piloted in the companies of interviewed

experts B, C, D and E, but are still exceptions rather than the rule. The usage- and performance-based models are enabled by usage data of the equipment and require IoT capabilities and electronic data exchange. Therefore, they are often linked to software and need the capability of sending (anonymized) usage data to the company to process it. (Learning Loop n.d.) Another model often linked to DaaS is an automated replenishment service, often referred to as vendor managed inventory. In this model, the MedTech company is responsible for managing the customer's stock (often only of a certain department, e.g. Medical Imaging). Like pay-per-use, this model requires electronic data exchange in order to assess stock levels and product usage to place respective orders of consumables. (Essex 2011; Appendix 8, lines 118-120) This model is especially attractive for smaller hospitals or private clinics that do not have a lot of administrative staff, as they can outsource these activities to the supplier (see Appendix 6, lines 82-91; Appendix 7, lines 72-77).

Many companies are also investing in digital platforms and applications. These can either be standalone products or applications to improve the hospital's workflow with existing products. An example is Calantic by Bayer, a cloud-hosted platform that delivers access to digital applications, including AI applications for medical imaging (Bayer 2022). Access to the platform is granted through a SaaS model with a subscription license agreement (Bayer 2023a). Expert D's company is also using a SaaS model to charge for its digital patient platform (see Appendix 7, lines 36-38).

Another service-centric business model that is shared by MedTech and pharma companies are integrated health offerings. In this model, companies fully equip new hospital departments or even run them under the brand of a (well-known) hospital chain. (see Appendix 8, lines 82-105; Appendix 5, lines 59-65, 74-83, 263-271) Examples of these include Medtronic Integrated Health Solutions which supports hospitals in either building or optimizing cath labs, equipping them with their products but also being the single point of contact for the hospitals of the other products supplied (Medtronic n.d.). With Enterprise Services Solutions, Siemens Healthineers is offering a

similar service, helping clinics to improve their workflows, reduce costs or improve the patient experience through consulting services (Siemens Medical Solutions USA, Inc. n.d.). They then charge for that service either by a fixed percentage of the department's revenues or via a pay-per-procedure model (see Appendix 5, lines 55-65).

3.2.2 Drivers of Servitization in the MedTech Industry

Throughout the interviews with different MedTech companies, it became evident that servitization is mainly driven by internal factors and therefore a push from the industry rather than being driven externally by customer demand or authorities (see Appendix 7, lines 68-74; Appendix 6, line 62). MedTech companies are trying to establish new profit pools through service business models, besides their traditional transactional business model. The profitability of MedTech companies on average is still far above those of other manufacturing industries, averaging at over 22% EBITDA-margin over the past 15 years compared to less than 10% of industrial and automotive manufacturers (Kaltenbach et al. 2022, 6). Nevertheless, MedTech is facing high price pressure in many markets, especially in Germany, impacting their profitability (see Appendix 7, lines 52-56). From a financial perspective, service business models are very attractive for MedTech companies. The experts are convinced, that service business models can be more profitable in the long term through synergies and cross-selling opportunities of other products. (see Appendix 7, lines 88-91; Appendix 8, lines 112-117) Besides a consistent revenue flow which allows for more accurate budgeting and forecasting, customer acquisition costs are another key driver of service business models. In a transactional business model, they are linked to one specific sale and companies need to reinvest in order to maintain the relationship before pursuing another sale, leading to escalating costs. In a service business model in which the company enters a long-term contract with a customer, the acquisition costs decrease progressively over time, as the relationship endures over

a longer period. (see Appendix 6, lines 53-58) Service business models allow MedTech companies to build stronger relationships with their customers, fostering a stronger exchange with more touchpoints (Hoesen et al. 2020, 4; Appendix 7, lines 94-95; Appendix 8, lines 179-180). Another advantage is that service business models can be associated with higher switching costs for the customers, therefore tying them to the offering and the company (Hoesen et al. 2020, 4; Appendix 7, lines 93-94). Several experts have highlighted the importance and value of data for the healthcare sector, to improve treatments and develop products and tailored offerings for the customer. However, customers are unwilling to share these voluntarily, which is why companies need to offer services in exchange for the data. (see Appendix 7, lines 59-67; Appendix 6, lines 232-235; Appendix 8, lines 183-188)

While servitization is mainly driven by the industry, there are certain external drivers contributing to the attractiveness of this business model for customers and payers. The world population aged 65 or above is projected to increase from 10% to 16% by 2050 (United Nations 2022, ii). The geriatric population in combination with decreasing hospital staff puts pressure on operational costs and resources of healthcare systems (Chen, Ding and Wang 2023, 1623; Appendix 8, lines 148-152; Appendix 5, lines 214-218). As a consequence, healthcare providers and payers are demanding more efficient treatments in order to decrease costs (Hoesen et al. 2020, 4). This fosters the willingness of the hospitals and healthcare providers to partner with the industry to improve workflows and add automation to the treatments or risk sharing, by avoiding high capital investments for expensive machinery through XaaS models (Appendix 8, lines 148-163). Additionally, XaaS models allow customers to test equipment or software without high capital investment (see Appendix 6, lines 63-67). While this is a clear advantage for the customer, this bears a risk for the manufacturer who is sharing the risk of the investment. A study from DLL and the Rotterdam University of Management also highlighted that XaaS models have a tax benefit for

the customer, as the equipment is not listed in the balance sheet but can be deducted as an operational expense (Hoesen et al. 2020, 5).

3.2.3 Challenges of Servitization in the MedTech Industry

Servitization in MedTech is facing a variety of challenges and limitations. A major challenge is that the existing healthcare reimbursement system favors transactional models over service business models. Healthcare reimbursement refers to the compensation a healthcare provider receives from the payer, typically the health insurance, for providing a medical service, like treatment or diagnosis (Definitive Healthcare LLC 2023). According to the interviewees, services or software are in most cases not reimbursed and therefore need to be funded by the customer, making it even harder to convince them of the value of the service (see Appendix 8, lines 191-196; Appendix 5, lines 88-96, 101-107). In addition to that, many service business models in MedTech involve risk sharing between the customer and the equipment provider, as described in earlier chapters. While this is an advantage for the customer, this is certainly a disadvantage for the provider who is taking a part of the risk (see Appendix 5, lines 80-83).

Another major challenge of servitization comes from a change in the skill set required to sell services. The sales team needs to adapt to a whole new way of interacting with the customer on these rather long-term relationships resulting from the service business models. Additionally, MedTech companies experience reluctance from the customer to pay for these services, as they are used to getting services included when buying a product. (see Appendix 7, lines 143-144) Sales teams have traditionally been driven medically/scientifically, however with the introduction of service business models, the skill set needs to change towards selling services and their economic implications for the customer (see Appendix 6, lines 263-267). Linked to the sales approach is the issue that huge portions of the revenue are generated via tenders. In a tender, suppliers can bid on

contracts to provide products or services to public institutions (Madden 2023). Expert C highlights that you are forced into the model specified by the tender, limiting the possibility of offering new exotic business models like XaaS (see Appendix 6, lines 300-319).

Another substantial challenge for servitization in MedTech is data management. Data is one of the key enablers of service business models in the MedTech industry, however, many traditional MedTech companies do not have experience in data management, -storage, -analytics or -security. However, these factors are relevant for service business models that are built on data, like pay-per-use, vendor-managed inventory, workflow optimization services and more. Hospitals require companies to prove that they are handling the (patient-)data in a compliant and secure way, for example through certifications. Hospitals often have unique IT security checklists before letting a third party like a MedTech service provider access their network and data. Answering these checklists demands substantial resources, consumes significant time and prolongs the implementation process of the service. (see Appendix 7, lines 91,174-176, 193-197; MedTech Executive, personal conversation with Niklas Staub, November 5, 2023) An additional obstacle is that hospitals do not run on unified hospital information systems (HIS), requiring different interfaces and IT requirements for each customer, complicating the scalability of service business models that require IT access (see Appendix 7, lines 174-175, 196-197).

While most interviewees are convinced that service business models allow for higher profit margins, it became evident that transitioning to these models involves a short-term margin reduction, as they are associated with huge investments in new processes and systems. Furthermore, new services often require free pilots that can be used as proof of concepts (see Appendix 7, lines 130-131) and more after-sales support (see Appendix 7, line 146). Justifying service business models with lower profitability towards MedTech management can be challenging (see Appendix 7, lines 88-91). Furthermore, convincing both customers and payers of the value

added by these service models remains a challenge. While products undergo rigorous testing and certifications through studies that can be presented to customers, this is not necessarily the case for software and/or services. Therefore, MedTech companies need to find ways to prove the value of their service to customers and payers. (see Appendix 4, lines 175-177, 185-189)

Another challenge is that the IT systems for ordering and billing of many MedTech companies are not ready for service business models. The ERP systems are often not designed for automatic rebilling of services or product packages. Instead, they are designed for handling individual transactions of single products. (see Appendix 6, lines 252-263; Appendix 5, lines 51-54; Appendix 8, lines 206-210; Bano et al. 2018, 09). In order to process the ordering, invoicing and billing of these business models, lots of manual labor from the finance and fulfillment teams is required as systems often do not support the ongoing transactions or are unable to talk to each other, limiting the scalability of these models (Vaidya n.d.). Therefore, companies need to invest in a second system to process ongoing transactions automatically, which is a huge financial burden. Since MedTech companies will not transition towards service business models completely and immediately, transactional and service business models will have to co-exist in the companies, requiring lots of manual labor or a huge investment into a new ERP system. (see Appendix 6, lines 252-263, Appendix 5, lines 51-54) For example, Bayer has recently invested in a new ERP system SAP 4/HANA that can handle the recurring revenue streams to avoid manual work (Sagar 2023).

3.3 Servitization in the Pharma Industry

3.3.1 Service Business Models in the Pharma Industry

Through desk research and the interviews conducted, it became prominent that Pharma companies are mostly focusing their servitization activities on product-oriented services, enhancing their current product offering through patient support programs (PSPs). PSPs are used to create services

around therapies to improve the outcome, strengthen the relationship with the Health Care Professionals (HCPs) and patients, while also driving differentiation from the competition. (Ford et al. 2020, 1; Appendix 5, line 98) These can include services like education about the disease, monitoring of the treatment to ensure adherence or financial support (SRx Health n.d.).

Pharma companies nowadays use data and the IoT to monitor adherence to medication, for example by sending data of injection devices directly to the HCP. One of the interviewed companies is developing platforms for HCPs to monitor this data. (see Appendix 4, lines 46-53, 234-237) In an article, Senra et al. emphasize the development of more intelligent treatment solutions using services as a great opportunity to ensure better treatment results, especially in terms of adherence (Senra, Figueiredo and Araujo 2016). This is also relevant for compliance reasons, as some treatments need to be monitored and protocolled to perform safety and quality control audits. For example, in medical imaging, where the timing of the contrast media injection is crucial for the patient's health and the outcome of the procedure, as Lauretti et al. concluded in a study from 2015. (cited in Applied Radiology 2015; Appendix 8, lines 124-125, 137-139) Both pharma companies and MedTech companies have started to offer software and platforms that can monitor and store this kind of information automatically. An example of this is Bayer's "Workflow Solutions //Insights" platform (Bayer 2023b).

In terms of financial support, companies are piloting result-based payment of drugs like Pfizer's "warranty program" for its cancer treatment Xalkori or its CIDP treatment PANZYGA. If the drug does not work as expected, patients are eligible for a partial refund. (Darwin Research Group Inc. 2021; Appendix 4, lines 143-160; Appendix 5, lines 103-104, 116-117) Other pharma companies like SANOFI have started to offer similar risk-sharing agreements. However, this model is still very novel to the industry and rather an exception than the rule (Mireku 2023). Pharma's result-

based payments are of similar nature as the risk-sharing agreements of MedTech, even though they are targeting the patient and/or the payer and not the healthcare institution.

3.3.2 Drivers of Servitization in the Pharma Industry

The drivers and advantages of service business models in pharma are limited compared to MedTech. In general, pharma companies offer additional services mainly to improve their treatments in order to justify a higher price of the drug, increase or secure market share or increase the profitability. Moreover, improving the quality of the treatment and the overall patient journey around it can increase the likelihood of HCPs prescribing the drug, which is essential for pharmaceutical companies to sell it. (see Appendix 4, lines 64-68; Appendix 5, lines 98-99) Just like the MedTech industry, pharma companies are trying to benefit from stronger relationships with their customers, building entry barriers to the competition and new sources of financial income (Ruizalba, Soares and Morales 2016, 98). The latter two aspects can be especially challenging in the pharmaceutical industry, as described in the following chapter.

3.3.3 Challenges of Servitization in the Pharma Industry

The pharmaceutical industry is facing the same challenges in terms of servitization as the MedTech industry, like the IT backend, which is not ready for service business models, the challenging reimbursement landscape, the need to prove the added value of services and the fact that transactional and service models will have to co-exist in the companies. However, establishing service business models in the pharma industry is even more challenging for several additional reasons. The regulation through laws and codes of conduct of pharmaceutical associations on sales is limiting the possibility of pharma companies influencing the prescription behavior of doctors. Therefore, it is tough for manufacturers to agree on long-term contracts like subscriptions or pay-per-use models for pharmaceuticals. Doctors need to remain flexible in the decision of which drug

they prescribe to treat a disease. (see Appendix 5, lines 40-43) Furthermore, in most global markets there are no direct transactions and the product flow and financial flow are separated. The payment process for drugs involves many parties such as the doctor that prescribes a drug, health insurance, wholesalers, etc. The manufacturer never gets paid by the hospital/doctor or the patient directly which means service contracts would need to be negotiated with more than one party. (see Appendix 5, lines 44-50; Appendix 6, lines 170-173) Another key challenge of servitization in the pharmaceutical industry is that developing drugs is a highly risky business that requires huge R&D spending of up to $1 billion. These huge investments are even more critical through the fact only roughly 12% of the products in development get approved by authorities like the FDA or EMA. (Austin and Hayford 2021, 2) These huge development costs need to be amortized by the products that make it to the market. Expert C highlights, that in a reasonably priced service business model they will struggle to be profitable. (see Appendix 6, lines 107-113) Another issue of the pricing of service business models in pharma is the volatility of drug prices. Through initiatives like international reference pricing in the EU, where 26 countries control national drug prices by using other countries' prices as a benchmark (Foxon 2021), it can be tough to agree on a long-term price of a drug in a subscription model (see Appendix 6, lines 140-147; Appendix 4, lines 315-323).

Experts A and B highlight that pharma's possibility of charging for PSPs is currently very limited. Additional services are rarely reimbursed and customers are unwilling to pay for something additional, as they expect the best treatment right away and not a two-class treatment. (see Appendix 4, lines 60-63; Appendix 5 lines 240-246)

3.4 Conclusion and Future Outlook

Servitization in the healthcare sector leads to a promising shift from a purely transactional business model towards a service-oriented approach, that is going to stay and continue changing the business

of MedTech and pharma companies. The interviewees have confirmed that they will continue their initiative around piloting these models. Nevertheless, servitization is facing huge barriers and challenges that will limit the viability of these models. Especially in the heavily regulated pharma industry, the possibilities of offering services that a customer can be charged for are very limited. While Expert A sees the potential of product-centric service business models like PSPs in the pharma industry as rather limited in the short term, he believes that service models that are unlinked from the drug itself could offer possibilities to generate revenue. This would include services like lifestyle/diet coaching or adherence support that could be offered separately from the drug to the patient or the payer (insurance). (see Appendix 4, lines 335-340)

In contrast to that, servitization in the MedTech industry seems much more promising. As medical devices that are used as equipment in healthcare institutions like hospitals are regulated to a lesser degree, companies are granted more flexibility in the ways they can sell their devices. Furthermore, the extended lifespan of devices as part of the hospital services offers higher potential for service contracts like an XaaS model, compared to a drug administered as a one-time treatment for the patient. Expert B and E highlight that the industry needs to change, as the time of high capital investments with huge operational and financial risks is not future-proof (see Appendix 5, lines 211-220; Appendix 8, lines 169-171). In 2020, Deloitte predicted that by 2025, MedTech companies will offer value-based contracts, that share the risk between manufacturer and customer (Taylor, Bhatti and Ferris 2020, 24). This trend can be confirmed through the interviews. The pharma industry is experiencing a similar trend, where risk-sharing agreements have been growing at an average annual growth rate of 24% (Watt 2023).

While there are differences between the two industries, it is important to mention that many companies operate in both, as they offer a range of pharmaceutical products and medical devices. Therefore, a clear distinction is not always possible. A study from EY is estimating that 12% of the

life science/healthcare sector is generating more than 60% of their revenue through as-a-service models and 43% between 21%-60% (Kanazawa, Englund and Bhuta 2022). This number needs to be reviewed carefully, as they do not disclose the interviewed companies and it is therefore difficult to classify whether it is primarily life science or healthcare companies driving this number. The interviews have shown that companies are generating little to no revenue with their pilots, even though they can be considered as leading players in the industry. Expert D highlights that service business models only account for a fraction of the sales at his company. (see Appendix 7, lines 186-188) Similar estimates can be made for the other companies interviewed. While the share is going to increase, it is tough to estimate the speed of adoption as this is dependent on various internal factors of the companies like management, strategic orientation, IT infrastructure, data management and many external variables like reimbursement and regulatory constraints.

The above-mentioned challenges suggest that transitioning to a service business model can be more challenging for large corporations with established products and processes than for young healthcare startups that design their products with a service approach in mind.

Generally, it can be concluded that servitization in the healthcare sector is in its early stages. Even though product-centric business models are somewhat established in MedTech, service-centric business models are mostly pilots and the possibility of pharma monetizing its current service offering is limited. Nevertheless, the interviewees are convinced that especially service-centric business models offer huge potential for the healthcare sector, even though a complete transition replacing transactional models seems unlikely.

4 Servitization in Other Industries – Classification of the Results

4.1 Servitization in Different Industries

In order to classify the insights of servitization in healthcare, the findings of Chapter 3 are compared to the servitization transformation in other industries, as the impact and prevalence of servitization exhibit notable variations across industries and products. (Li et al. 2022, 11; Appendix 9, 180-191; Langley 2022, 7)

Servitization is especially widespread within core SaaS sectors such as software vendors, platform providers and digital services, where a substantial proportion, notably 16% of companies, has completed a full transition to XaaS. This stands in sharp contrast to the 5% of companies observed in other industry segments. However, other industries such as industrial manufacturers, automotive or life sciences and health care are also forming a second wave that migrates to XaaS models. (Kanazawa, Englund and Bhuta 2022) Industrial manufacturers are already covered as objects of reflection in the second chapter and the healthcare sector is covered in the third chapter. That is why, in the following chapters, the business models, drivers and challenges of servitization in healthcare are classified into findings from the servitization transformation of software vendors and the automotive industry. While a trend towards digital as-a-service offerings within SaaS companies can be identified, the automotive industry is experiencing a shift from traditional product manufacturers to mobility service providers.

4.2 Service Business Models

As highlighted in Chapter 3, the healthcare sector is experiencing a shift from products to solutions, with various service options for different customers. Servitization in MedTech aims to create holistic (care) platforms that assist providers and payers in delivering high-quality and cost-effective care. Therefore, products and services can be combined and sold as part of a DaaS model.

With this model, customers benefit from increased flexibility and the avoidance of high upfront capital investment for the device. Instead, companies can charge their customers through various models like subscription, pay-per-use, result-based and more. Often linked to these models are vendor-managed inventory services, where MedTech companies take over the stock management of the customer. Another business model piloted is Integrated Health Offerings, in which companies use their expertise to equip new hospital departments (e.g. imaging department), optimize their workflow or even run them under the hospital brand. The business models mentioned above can be classified as service-centric offerings, based on the classification made in Chapter 2.1. However, MedTech has already implemented product-centric business models through equipment maintenance services, that represent a substantial part of their revenue.

Pharma focuses its servitization activities mainly on product-oriented services. PSPs offer additional services around the drugs to optimize the outcome of treatments and justify higher prices or overall differentiation from the competition. PSPs can include services centered around disease education, treatment monitoring to ensure adherence to the treatment or even financial support. With both pharma and MedTech companies adding software to their portfolios, SaaS is another business model being established in healthcare.

While there are a variety of service business models in healthcare, in the software industry, SaaS is the predominant service business model. SaaS is a service-centric offering where service providers deliver software-based services to clients through a centralized internet server. Concentrating software provision on a centralized server enables real-time interchanges and synchronous distribution, which saves time and money and alleviates scalability and compatibility issues. Prominent examples of SaaS include Microsoft Office 365, Google Apps, Dropbox and Amazon Web Services. (Vaudour and Heinze 2019, 31; Li and Kumar 2022, 2588) Especially the COVID-19 pandemic encouraged software companies to incorporate subscription services into

their core product lines to benefit from recurring revenues. Moreover, low-interest rates and abundant investor capital enabled many software companies to prioritize growth over immediate profitability. Between 2012 and 2018, subscription businesses saw exceptional growth of over 300%, outpacing S&P 500 companies by about fivefold. However, this growth ended with the "SaaS crash" in 2022, accompanied by a shift in investor sentiment from preferring "scalable" growth regardless of profitability to valuing "sustainable" growth based on enduring subscription model drivers. (Cespedes and van der Kooij 2023)

In the automotive industry, more and more companies are implementing the upcoming service-centric paradigm MaaS. MaaS integrates diverse mobility services such as ride-sharing, car-sharing, car subscription and micromobility into a centralized digital platform for seamless registration, planning, booking, e-ticketing and payment through a standard interface. (Karlsson et al. 2020, 284; Casady 2020, 1451; Bauer, Buss and Chacko 2020, 8) Achieving comparable levels of reliability, comfort and flexibility to private vehicles is essential for MaaS services to fulfil their goal of reducing private car traffic (Maas 2022, 22). Consequently, there is a shift from traditional product manufacturers to mobility service providers, leading to a change from discrete transactions to establishing more relational and collaborative agreements with customers. This also affects a shift from provider-led to user-led systems, which means that offerings are adjusted to the specific desires of individual users and value is also provided during the product's use phase. (Genzlinger, Zejnilovic and Bustinza 2020, 215; Mahut et al 2017, 2102; Enoch and Potter 2023, 31) Besides MaaS, the automotive industry is facing another disruption with the introduction of connected car services. Tesla is one of the pioneers in automotive industry, offering in-car subscriptions for Spotify, Google Maps, internet browsing and more. (Lambert 2019) The company has now even extended their subscription service beyond connectivity by launching an autonomous driving subscription for $199 per month. Morgan Stanley is projecting that the value of Tesla's recurring

software revenue could exceed its hardware business. (Lambert 2021) Other car manufacturers are following Tesla's approach in order to generate recurring revenue by offering IoT connectivity services. Nowadays, all large manufacturers offer these subscription services. (Rajamohan 2023) These newly introduced offerings can be seen as product-centric services, making the car to be sold more attractive to customers.

While the software industry mainly focuses on SaaS models, healthcare and the automotive industry offer both service- and product-centric service business models. As mentioned in Chapter 3, different healthcare companies are developing and piloting various service business models in close collaboration with their customers. Since healthcare is still in the early stages of servitization, a predominant service business model could be established in the future.

When comparing the adoption of service business models, as mentioned before, the software industry can be identified as the adoption leader. As visualized in Appendix 3, 23% of companies generate more than 60% of revenues through SaaS models and 65% between 21% to 60% of revenues. In healthcare, most companies are still piloting service business models, which is why the experts interviewed state that their companies are generating little to no revenue with service models. Currently, a complete replacement of transactional models through service business models seems unlikely. Nevertheless, EY estimates that 12% of the life science/healthcare sector generates more than 60% of their revenue through as-a-service models and 43% between 21%-60%. As mentioned in Chapter 3.4, these numbers need to be interpreted cautiously. Regarding the automotive industry, only 9% of automotive manufacturers generate more than 60% of revenues with as-a-service offerings, while 51% generate 21%-60%. (Kanazawa, Englund and Bhuta 2022) This means that many automotive manufacturers adopted MaaS, but the product business will remain significant as vehicles are essential for offering mobility services. Offline retail provided by dealerships also remains relevant due to the high demand for product information, as customers

often prefer a hands-on experience before making a purchase decision. However, manufacturers need to apply new technologies and emphasize customer satisfaction to enable innovative service offerings and retain a loyal customer base. (Genzlinger, Zejnilovic and Bustinza 2020, 224)

4.3 Drivers of Servitization

Comparing healthcare to other industries, similarities in specific drivers become apparent, yet healthcare has its unique drivers of servitization.

As outlined in Chapters 3.2.2 and 3.3.2, servitization in healthcare is driven by a mixture of internal and external factors. On the one hand, companies view service business models as an opportunity to create new revenue pools and increase profitability in the long term. For example, additional services can improve treatments and, therefore, justify a higher drug price, increase or secure market share or increase profitability. In addition, customer acquisition costs are decreased through long-term contracts established in service business models. Moreover, the prescription decision of HCPs needs to solely depend on the quality of the treatment and the overall patient journey, which can be improved through value-adding services, representing another driver. On the other hand, there are some external factors for servitization in healthcare. This includes factors such as demographic change and consequently rising healthcare costs as well as hospital staff shortages, putting pressure on operational costs and resources of healthcare systems. Consequently, automation and more efficient treatments are required. Moreover, XaaS models allow customers to test equipment or software without high capital investment.

Similarly, the shift towards MaaS in the automotive industry is also driven by overarching trends such as sustainability, digitalization and especially the trend of shared mobility, which are transforming transportation habits. With an expanding population engaging in daily activities such as commuting to work, attending school and pursuing leisure, the demand for urban and suburban

transportation is expected to escalate. This poses challenges, including growing emissions, increased noise, congestion and strained infrastructures. MaaS emerges as a potential solution, as it addresses issues like underutilization and expense of personal vehicle ownership and offers more flexibility and cost savings. The in Chapter 4.2 mentioned mobility services were enabled by technologies such as GPS, smartphones and big data and analytics which among others, enable more eco-friendliness and the anticipation of customer needs and traffic jams. (Karlsson et al. 2020, 284; Bauer, Buss and Chacko 2020, 8-16)

Across industries, one of the key drivers of servitization is customer centricity and the closer relationship achieved through these new business models. Capturing value through closer relationships has already been highlighted as one of the key drivers of servitization in Chapter 2.3. This also applies to the healthcare sector, which uses service contracts for cross-selling opportunities, tying the customer to their offering through increased switching costs while benefiting from decreasing customer acquisition costs over time. Furthermore, pharma companies are trying to benefit from stronger relationships with their customers, building entry barriers to the competition and new sources of financial income. Customer centricity as a driver is also shown by the example of the gaming industry, which ties the player to the game for a more extended period of several months or years through a subscription model. This ultimately increases the revenue generated per customer compared to the transactional model. (Vaudour and Heinze 2019, 32) An increase in customer engagement and the possibility of reaching new customer groups can also be seen in the automotive industry. MaaS, as mentioned in Chapter 4.2, gives users access to cars through subscription or car-sharing options, engaging the customer throughout the use phase. Moreover, the automotive industry is implementing connected car services into its portfolio. Studies have shown that connected car services can be a differentiator and positively impact customers' purchasing decisions (Teknowlogy Group and NTT DATA 2020, 7; Bertoncello et al.

2021). Additionally, subscription services for features become more financially accessible, as in the case of a complete purchase at the dealership, the initial investment can be overwhelming (S&P Global Mobility 2023).

Furthermore, servitization across industries is heavily driven by technology, primarily through IoT, cloud services and user data access. Software vendors are continuously transitioning their software from on-premise solutions to the cloud, which enables the use of SaaS models. (Classen 2019, 61) The automotive industry uses data analytics to optimize its offerings and meet customer habits (Bauer, Buss and Chacko 2020, 8f.). Furthermore, data generated via connected car services can be monetized by the manufacturer, selling it to third parties such as insurances or advertising agencies (Bertoncello et al. 2021). Also, in the case of MedTech, IoT is a key enabler of service business models like pay-per-use or value-based agreements.

4.4 Challenges of Servitization

Similar to drivers, there are some common but also unique challenges across industries. As digitalization is a common driver of servitization, its increasing relevance leads to the common challenge of data security and privacy. Especially in healthcare this is very important, as companies need to prove that they are handling patient data in a compliant and secure way. Also in the automotive industry, a lack of confidence in data privacy and cyber security remains a major obstacle for customers to subscribe to connected car services (Teknowlogy Group and NTT DATA 2020, 9). However, companies across all industries need to ensure that personal and financial data of clients is stored in compliance with data protection regulation. This can be more challenging for manufacturers who only in recent years have started to adopt data analysis into their processes and portfolio and now need to invest in updated processes and knowledge, new IT systems for secure storage and staff training. (Humayun et al. 2022, 1; Maas 2022, 22)

An additional common challenge, also mentioned by companies in the EY survey, is the skill set required for selling services. The sales team needs to adapt to an entirely different approach to interacting with customers, especially in the context of rather long-term relationships which result from service business models. For instance, to generate recurring revenue, SaaS models need to include customer success teams, which are responsible for early customer identification, tracking product impact and recurring customer interaction. (Cespedes and van der Kooij 2023) Customers need to be convinced of service business models and their value. The key to reaching a broader customer base lies in the individualization of offerings, leading to tailored packages. Moreover, the availability of on-demand services and addressing willingness-to-pay considerations are vital for realizing service model benefits. (Maas 2022, 22)

Another challenge that affects all three industries is the transfer of the risk of ownership from the customer to the service provider (Langley 2022, 7). While healthcare is experiencing risk sharing between the customer and the MedTech equipment manufacturers, in the automotive industry, the risk of ownership fully transfers from the customer to the service provider via the utilization of MaaS. Within the software industry, service providers need to build the infrastructure, develop the software and host the service. To prevent unnecessary costs, it is crucial to identify the right customers early on. (Cespedes and van der Kooij 2023)

Moreover, as examined in Chapters 2.4 and 3.2.2, transitioning to a service business model often involves a short-term margin reduction. This applies particularly to the largest firms, while smaller servitized firms often generate higher net profits than companies that do not offer services. (Neely 2008, 114) In healthcare, moving from a transactional to a service business model can pose more significant hurdles for established large corporations with set procedures and products. Servitization can be easier for healthcare startups that design their products and processes with a service-centric mindset. In contrast to these findings, in the automotive industry, traditional car

manufacturers can use their resources and capabilities to successfully enter the new market of mobility services and react to emerging trends such as the rise of electric mobility. (Genzlinger, Zejnilovic and Bustinza 2020, 224)

Similar to the healthcare sector, the automotive industry is facing regulatory challenges as there is legislation about transport, innovation and public administration (Karlsson et al. 2020, 283). However, policymaking is also not exclusive to the national level, initiatives and policies can also originate at a regional or local level (Karlsson et al. 2020, 292). That is why, the development and implementation of viable MaaS offerings necessitates multi-level collaboration between transport practitioners and policymakers (Maas 2022, 22; Enoch and Potter 2023, 38). In contrast to healthcare, most of the challenges in the automotive industry center around private actors (Karlsson et al. 2020, 283). The potential user group of MaaS are primarily young, progressive and well-educated individuals. Based on this user group, the adoption of MaaS depends on solving challenges such as low technology adoption, car ownership needs, low willingness to pay and a preference for traditional public transport (Maas 2022, 22; Alonso-Gonzáleza, 2020, 396). This is why, analogical to healthcare, due to its complex landscape and the aforementioned challenges, there are uncertainties regarding the adoption of MaaS and its widespread application remains a challenge. Henceforth, it has not yet attained a major presence. (Enoch and Potter 2023, 31f., 38) This is also the case for the adoption of connected car services that experience low willingness from customers to pay for additional services, similar to PSPs in healthcare (Teknowlogy Group and NTT DATA 2020, 9).

Besides these common challenges, healthcare is facing unique challenges that have already been highlighted in Chapter 3, such as the challenging reimbursement landscape, tenders, regulatory limitations, complicated payment processes and huge R&D investments.

4.5 Conclusion

The comparison highlights the diverse landscape of servitization across industries. While the software industry is dominated by the service-centric SaaS model, the upcoming MaaS model and the offering of additional subscription services are rapidly transforming the automotive industry. In contrast to that, healthcare is still in the early stage of exploring service business models.

Healthcare faces industry-specific challenges such as heavy regulation and the lack of reimbursement for services. However, it becomes clear that some overarching challenges and drivers are transforming business models across industries. Therefore, companies in the healthcare sector can get valuable guidance from best practices in other industries to navigate through complexities and overcome challenges such as the automation of ordering and billing processes, data security and privacy. Furthermore, healthcare could adopt a collaborative partnership approach with payers and policymakers to drive servitization, as seen in the automotive industry.

5 Limitations and Further Research Opportunities

There are four main limitations encountered throughout the research process of this master thesis. While these limitations were somehow necessary to shape the thesis' scope and level of depth, they provide potential areas for further investigation.

The first limitation is based on the interviews in the healthcare sector. Due to limited availability, the research focused on interviewees employed in large MedTech and pharma companies, excluding startups and smaller corporations. This selection criterion might limit the generalizability of the findings. Moreover, even though nearly 20 healthcare executives have been approached via various channels such as LinkedIn, email or the author's network, only five experts agreed to participate on the condition that the interviews would be anonymized. The main reason for declining the interview request was the unwillingness of companies to disclose information on their

servitization strategies, primarily for competitive reasons. This highlights the relevance and sensitivity of the topic. The second limitation is the exclusive focus on MedTech and pharma companies within the broad healthcare sector. While these are essential industries, they only represent certain areas of the sector. As a consequence, conclusions drawn from these two industries may not uniformly apply to the entire sector. The third limitation is related to the high-level approach chosen for the industry comparison in Chapter 4. While taking a deep dive with expert interviews in servitization in the healthcare sector, a similar depth of exploration for the other industries was not possible. The industry comparison with software vendors and the automotive industry is based solely on secondary research. The fourth limitation is the qualitative nature of our findings regarding servitization in healthcare, with financial implications left largely unexplored. The inherent uncertainty among companies regarding the financial outcomes of servitization pilots restricts the availability of concrete financial data. In addition to that, even though complemented through literature review, these qualitative findings through interviews always bear the risk of subconscious bias from the interviewees (Alshenqeeti 2014, 43).

However, these limitations pave the way for future research endeavors. For example, it would be insightful to analyze the servitization transformation of a specific company and conduct interviews with different functions affected by servitization in that company. By doing this, specific challenges for the three servitization barriers, introduced in Chapter 2.5, could be identified and servitization strategies for specific products outlined. Moreover, complementing the secondary research for Chapter 4 with interviews involving software vendors and automotive manufacturers, to achieve a comparable deep dive just like with healthcare, would be interesting. Furthermore, quantitative research on the financial implications of servitization in healthcare would be valuable.

Despite these limitations, the master thesis offers valuable qualitative insights into servitization in general, in healthcare and a brief overview of similarities and differences to servitization in other industries, creating a foundation for future research in this dynamic field.

6 Conclusion

This thesis, aimed at answering the following research question: “What are business models, challenges and drivers linked to servitization in general and in healthcare and how can the findings be classified, compared to other industries?” Therefore, a mixture of secondary research and primary research in form of expert interviews was conducted to generate valuable insights into the evolving landscape of servitization in general and in the healthcare sector. These findings were then classified by comparing them to the servitization transformation within the software and automotive industry.

Servitization can be described as the shift from a product to a service portfolio, ultimately leading to the service-centric XaaS model. From a company perspective, the monetization of services enables a new, more stable revenue stream which is why servitization is adopted by more and more companies. While most studies conclude that servitization increases revenues, others highlight that there is a short-term decline in profitability because of initially lower revenues and organizational investments. This phenomenon is also present in the healthcare sector, as the interviews have shown.

Service business models can be classified into product-oriented services and service-centric offerings. Healthcare and the automotive industry are offering both service business models, while the software industry is dominated by the service-centric SaaS model. Healthcare is still in the early stage of servitization, piloting a variety of service models. These include DaaS models allowing customers to avoid high upfront investments and pay in a subscription or pay-per-use model,

vendor managed inventory services, integrated health offerings, patient support programs, but also SaaS. Meanwhile, the automotive industry is transformed by the upcoming MaaS model and the offering of additional services such as connected car services. While healthcare and automotive companies are still struggling with the implementation of service business models due to existing complexities and uncertainties, the software industry can be identified as adoption leader.

Some overarching challenges and drivers are transforming business models across industries. In general, the most significant drivers are generating an additional and more predictable revenue stream, creating a closer customer relationship, differentiation to competition, increase of efficiency, enabling innovativeness and more openness of employees and managers towards service business models. These drivers can also be found in the examined industries.

To achieve successful servitization, certain challenges need to be overcome. These challenges range from knowledge or experience to develop service offerings, to monetization of services, data security or the sentiment of the organizational culture towards servitization. The challenges can be overcome by a variety of tools, including collaborative partnerships, monitoring costs, implementation of modern technologies and a highly committed management. In the industry analysis, it was found that especially data security and privacy is a challenge that is common across industries. In healthcare, this has an especially high relevance as it is processing patient data. Furthermore, companies need to adapt their skill set to sell services, for example by establishing customer success teams or offering tailored service packages. Moreover, companies are challenged by the transfer of risk of ownership from customers to the service provider. However, there are also healthcare-specific challenges such as the challenging reimbursement landscape limiting the monetization of services, regulatory limitations, complicated payment processes and the need to invest in new IT systems to automate ordering and billing of service models. When a company is not able to solve these challenges, servitization fails. This goes along with unprofitability of the

service business and low value creation to the customer, for example, when the service offering lacks customer-centricity.

Going forward, the most important trend for servitization will be digital transformation and the increasing generation of data. Data is obtained by a variety of tools and enables the tailoring of service solutions to the customer. Moreover, data can be monetized and allows dynamic and value-based pricing.

To conclude, servitization in healthcare is a long-lasting process with complex challenges. While the potential of service business models in the pharma industry is limited, service-centric business models seem promising in the MedTech industry. However, they are unlikely to completely replace the transactional business model. Managers need to monitor external and internal challenges, set up tailored servitization strategies and leverage valuable insights from cross-industry best practices to navigate the challenging healthcare landscape effectively.

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8 Appendix

Appendix 1: Expert Interview Overview

Pseudonym or Name*	Appendix	Interview Focus	Years in Industry	Current Job Title	Job Description & Background	Interviewer	Date of Interview
Expert A	4	Servitization in Healthcare	15+	Director Global Market Access & Pricing	Responsible for a set of pharmaceutical products at a multinational healthcare company. The expert has a PhD in cancer biology and consulting experience.	Niklas Staub	October 10, 2023
Expert B	5	Servitization in Healthcare	15+	Vice President and Global Head New Product Planning, Portfolio Expansion and Strategic Partnerships*	Responsible for the development of new drugs, (digital) services and devices to complement the current offering beyond the traditional drug sales model. The expert has a diverse background in pharmaceuticals, diagnostics and MedTech.	Niklas Staub	October 11, 2023
Expert C	6	Servitization in Healthcare	10+	Head of Innovation	Responsible for internal and external innovation in terms of driving innovation, new product concepts, new service concepts, new business processes and internal efficiency improvements in a multinational pharmaceutical company offering both pharmaceutical products and medical devices. The expert has a background in engineering, followed by several years of commercial experience and	Niklas Staub	October 30, 2023

					R&D experience in the pharmaceutical and MedTech industry.		
Expert D	7	Servitization in Healthcare	5+	Director Market Access & Health Economics*	Piloting innovative digital business models and solutions for a leading multinational MedTech provider. Focus on delivering solutions instead of products. The expert has a background in health economics and consulting.	Niklas Staub	October 19, 2023
Expert E	8	Servitization in Healthcare	5+	Global Market Access Manager	The expert is an experienced healthcare technology professional with professional and academic knowledge of healthcare delivery solutions at a multinational pharmaceutical and medical device company. Furthermore, the expert has several years of experience as a key account manager in MedTech.	Niklas Staub	October 18, 2023
Expert F	9	Holistic Examination of Servitization	4+	Strategy Consultant	The expert is a consultant who advised a electricity storage provider on the reorganization of their service business.	Carlo Sinthern	October 25, 2023
Volkmar Mohs	10	Holistic Examination of Servitization	20+	Product Manager and Solution Designer at CHG-MERIDIAN Group	The expert worked for more than 20 years in the field of utilization concepts, with a focus on IT, industry and healthcare. Moreover, he has also been increasingly involved in taking over service level agreements for customers.	Carlo Sinthern	October 17, 2023

Manuel Rüsing	11	Holistic Examination of Servitization	2+	Founder and managing director at Synctive GmbH	The expert founded a German start-up which is dedicated to support mechanical engineering companies in their servitization transformation. They built a platform that enables mechanical engineering companies to offer digital after-sales services, including new digital business models.	Carlo Sinthern	November 17, 2023

*= If an interviewee asked for anonymization, their name will be replaced by a pseudonym.

**= Job title simplified for anonymization purposes.

Appendix 3: Companies Deriving Revenue from As-a-Service Models across Different Industries

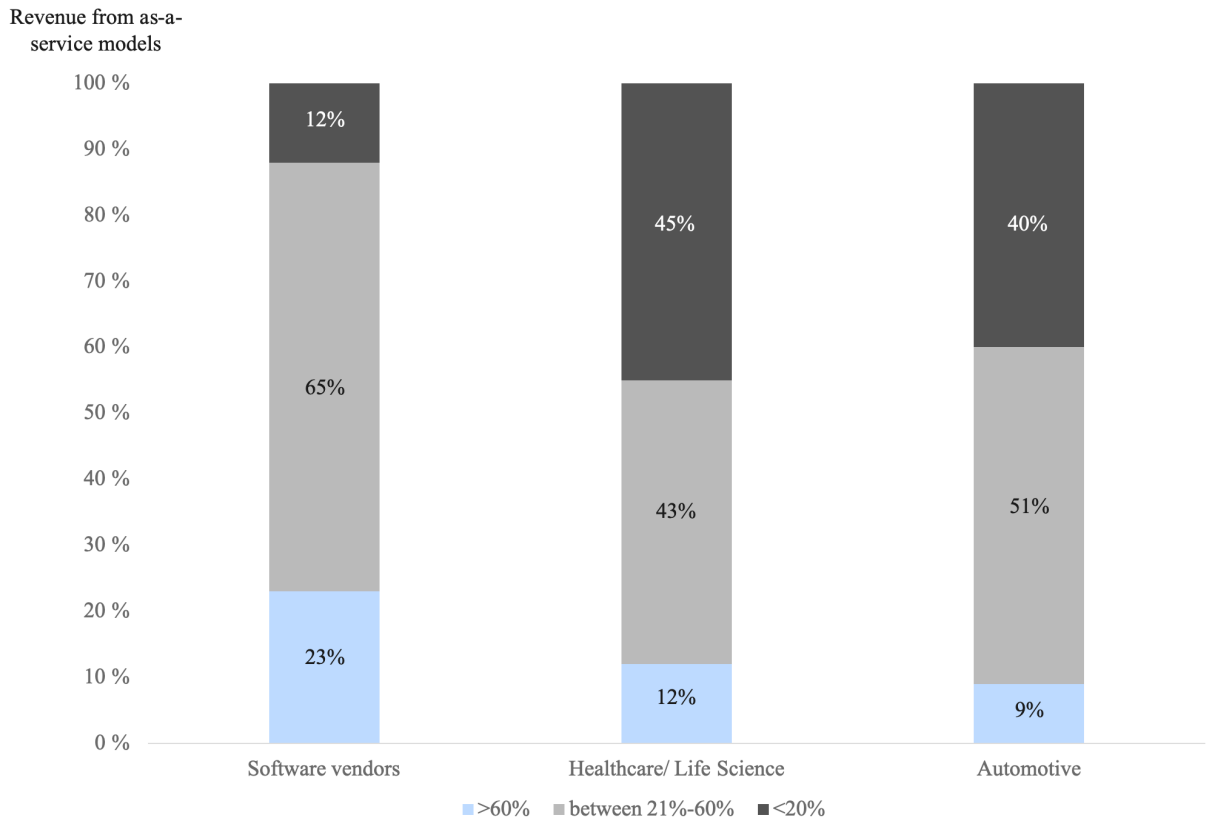

Figure 2: Comparison of the revenue generated from as-a-service models of companies across different industries (based on Kanazawa, Englund and Bhuta 2022)

Appendix 4: Interview Transcript – Expert A (October 10, 2023)

Niklas Staub: All right. Let me quickly guide you through the topics of the interview, and then we also start with a brief introduction from yourself, obviously, what your role is, what your role within [company name] is. And then also what I want to look is whether there are any service business models within [company name] or within the healthcare sector which you are familiar with? What are drivers of servitization in healthcare? What are the advantages and disadvantages of that Anything-as-a-Service business model for the company and maybe also for the consumer? And then also what could be some success factors, challenges, and limitations of servitization within the healthcare industry? And then going into a trends and future outlook maybe to assess that. I'm going to stop sharing now and then it's just a conversation between you and me.

Expert A: I can start with a little bit of an introduction, I think you did before. Thank you for coming back to me. My name is [specific detail]. I'm a director in the Global Market Access and Pricing team here at [company name] based in [specific detail]. I am responsible for a set of cardiovascular and endocrinology products in our portfolio for basically all major markets for the last four years already. Before, I was part of the inhouse consulting team within the company, which was basically cross-sector support, cross-life sciences, and in healthcare. And then my background, I'm a scientist, I have a PhD in cancer biology, and via consulting, I'm now responsible for basically pricing and access topics within the global team.

Niklas Staub: Very impressive, thank you. And just to be sure, in the oncology and the cardiovascular team, you only have pharmaceuticals, right? You don't have any medical devices in [company name].

Expert A: I'm glad you asked because this fits quite nicely to the topic. Basically, as a company, yes, we're a pharmaceutical company, but you will see that basically, and we will dive to that more and more, that basically when you look into pharmaceuticals, it's a quite old-fashioned business.

You will know that better than myself that we are often 10 years behind the general trend of the pharmaceutical industry. Where we see basically servitization and you will dive into that, even with my branches in supporting devices and apps basically as an adjacent factor, basically helping the patient with their medication. So we are per se, we don't have any business model in the company where we are basically providing only medical devices, but we have a couple of examples where we're basically supporting the patient with devices.

Niklas Staub: Okay, very interesting. Thanks. I think that's the perfect jump over to the next question. Do you have some examples of servitization at [company name]?

Expert A: I think really the best example that we are most advanced is in the endocrinology field. I'm basically responsible for a product called [product name], which is a growth hormone for patients. For pediatric patients, actually, children that have some deficiency in their growth hormone secretion naturally and have basically growth impairment. Standard of care is daily injections with [specific detail] to replace the endogenous growth hormone. And for those patients, it's really, really hard to make sure that they are adhering to the medication because often the treatment starts very early, like four or five years old. You have caretakers or often the parents that actually need to think of everyday injections, you see a quite direct impact on their growth curve if they don't adhere to their treatment every single day. So basically it's really important that we and the doctor actually get a good understanding that the patients are adherent and that in case they see any difficulties with the growth pattern, this is not due to the treatment itself and response to treatment itself, but really coming back to adherence. There is an injection device that we are actually market leader with, which is a digital automated injection device, which in the newest generation is all the time connected with a SIM card included.

Basically, this is part of the package, and every injection will be back basically transferred to a cloud service where all the settings, all the individual data points, time points, and everything will

be transferred and the doctor can actually real time go to that platform and can see how often did they inject, how much they inject, were there any technical difficulties? And every time basically the patient is visiting the doctor, they can revisit the data, look at the standard growth-curve, look at how the child is doing and basically trying to check whether there are any treatment continuity issues that may contribute to the pattern. This is actually, I think, quite a role model example how in pharma business we are using basically devices that can help the patient and the medication.

Niklas Staub: Is this something which is then rented out to the patient or how is that reimbursed in the end also by the insurances?

Expert A: This is basically part of the entire package. So then there's prescription with [product name]. In most markets, they get a device called the device called [product name], as the injection device with the needles over their patient support program. So there's training to that, there's basically guidance on how to use it, and they have a certain shelf, like a time of usage every three or four years, basically if you need a new device, they also get the new device. So basically it's part of the overall treatment. It's not extra cost, it's just basically part of [product name]. And that's often basically how these things work in pharma. Let's say, in case a device or an app is only working with a certain medication, it's very hard to get a business model in place that you charge for that. From the regulatory framework, often it also doesn't make sense because basically why do you do this? You do this to basically differentiate your product. In this context, there are multiple products which are seen as very similar. And with that device and the ecosystem, the digital health ecosystem that we're providing, we are basically separating ourselves from the competition to show that we're having added value services to the patient.

Similarly, for example, in the cardiovascular field, we are developing apps to support the patients. Apps that are only working also with our medication. There is basically just a certain code on the package of the treatment. Patients can actually download that app that is linked to their treatment

and they get information like educational elements. They get a tracker on their adherence tracking that they manually can put in if they took their tablets. They get some reminders and supporting the patient in their treatment journey. This is usually in that environment we are developing bits and pieces to actually differentiate our products, which are basically in a competitive environment where basically products are seen as quite similar.

Niklas Staub: Yeah, okay. So it's really about differentiating and not really about changing the business model itself, because then I also think the way you get the money will stay the same. It's not like you're changing to an regular payment.

Expert A: Exactly. When you go to diabetes sales, for example, it's quite similar, right? You have the package that basically is often related to a certain drug. So to separate basically the drug business from the medical device business, it's under the medical device regulations and needs some openness of the system, and then you're losing that differentiation now. You cannot do both. You cannot differentiate the product and still create a separate business model where you rely on a commercial business of the device as well. You usually have to strategically choose the one or the other.

Niklas Staub: Okay, but I think that's already a really good example of how to build a service around or to broaden that service around one single product. Is there anything else which comes to your mind that [company name] is doing?

Expert A: I think this topic is taking off slowly. We are working on some clinical trial setup where basically you look into [specific information] and some digitalization of that, but this is not really going back to service models, more on basically incorporating technology into the drug development, I think it's probably a bit different. I wouldn't know any other development right now in this direction. One thing when you think of a service system, we often think of devices and apps, for example, and we can talk about their reimbursement in a minute, but often, for example, in a

diabetes environment, it's not only devices that play a role, but you can avoid certain treatment if you are working, for example, on a lifestyle change. And there are some programs, some pilots that we had in the market that are basically together with an early low dose treatment, we were basically recommending programs where basically patients got educated on proper diet, on certain level of adequate sports for them. So I think these are elements that probably also fall in the category of services that you are basically bundling your treatment in a way that you try to keep the patient as long as possible on these early stages of a disease by offering basically service beyond.

Niklas Staub: Yeah. Maybe just towards that example, is that something which would then be charged towards the patient or is that something that is then reimbursed by insurance or how does that work?

Expert A: Yeah, and that's a very tricky one. Even as a company, this is a challenge for us and it's often complicated due to legislation and regulations in the different markets. You can imagine that something that works in Vietnam probably doesn't work in Germany or in Hong Kong or China. That's something when you come back to your challenges, you will see that basically medical device regulations vary and also this service bundling approaches vary also often due to compliance reasons.

The pharma business is a highly regulated business in all markets. And if you're adding this service aspects in areas which are less regulated and grey zones, you're coming into this of interfaces where you are struggling to understand like it's just still part of your medical offer or is this something different? And often you try to separate this to a certain degree referring to it, but basically third parties are part of the one aspect of the service and you're part of the other part of the service and you're linking it to the level that basically it's compliant from the doctor's perspective as well. In the end you're giving recommendations to the doctor to a certain degree, but in the end from a

medical perspective, and you create certain infrastructure that the doctors may choose to prescribe and support to the patient.

And if you're going back to the reimbursement, something like that varies also from market to market. You have markets where there's a general low level of reimbursement, and actually when you go to added services, it is rarely covered, and often this is like a private service that the patients would need to cover themselves. You have some other markets that probably are evolving to a certain degree that both, let's say, patient support as well as added services may slowly make it into individual formularies, but this is also a long way to go to make this like a standard routine.

Niklas Staub: Yeah, okay. No, but it's good insights. Thank you very much for that. Maybe going towards the next question, what do you think are primary drivers for healthcare companies to start looking at moving from the product-centric business model to service business models?

Expert A: I think in general, pharma is trying to catch up with general trends and explore what is doable and what's not doable in the overall much more difficult regulated framework that we're in. And of course, when you're thinking of a chronic disease, it may make sense to a certain degree of patients that you treat overall disease and basically have a model that basically makes it easier for the patient. And all this service model that you were to do provided, it goes back to ease for the patient and for the wellbeing. So basically having that ambition towards that I understand and I think this is there also for us, when you think of the complexity of healthcare, of different products, often with many intermediates, including the doctors, the pharmacies, the wholesalers, and the business that is not directly to the end customer makes it very hard to establish such model. It could happen that in early stage you probably are supposed to give a certain product and another stage a different one, and how to handle that across all these different stakeholders, across different price points, for example, and creating basically a single figure of a model for that is very, very challenging and to be the frank I don't see that happening in the next 10 years in pharma.

Where we see some development is in the direction of the outcome based treatment in a way of like you charge only if it really works or if it's patient's to see a certain benefit to it, be it adherence, be it any easily measurable outcomes. And the first companies now started even overcoming these payment topics, because in the end again, what you're paying in the pharmacy is something many markets but the health system is covering, especially for more expensive treatments. And if you think of an oncology treatment, this can easily cost a six-digit figure over a year, right? And basically you're rarely as a private person covering that yourself. It's either your private insurance via your company or your national coverage or some other health coverage that basically takes a big chunk of that. And this makes it sometimes really difficult to basically allocate how do you create infrastructure for measuring the impact of the treatment and also then taking the consequence of reimbursing the patient in case it's not working. I think it was Roche or Pfizer that was one product that I created really a website where patients can actually ask for their money back if the treatment didn't work on them. This is something I recommend to do a quick check on that. This is the first example that basically patients can go to a website, fill a form, probably add some medical data and say, It didn't work for me. I paid much money for it. Please give it back. And that's a big challenge for them. Again, considering the whole value chain of pharma, they found a way to overcome it, I think it's an American example, which is probably very different to other systems, but it was the first example in the right direction. Again, the challenges go back to difficulties in the different markets, to different regulations and all the aspects of that in the majority of markets the doctor should have the freedom and autonomy to basically prescribe and choose the medication for the patient what they believe is the most adequate. And of course, they have guidelines, of course, they have certain restrictions, they have quotas in different markets, which basically affects the treatment decision. But any service model may basically be difficult to basically align the doctor's ownership of prescription and treatment.

Niklas Staub: Who would you actually consider being the customer in the sense of pharmaceutical products? Because thinking about diagnostic imaging, for example, and you're the manufacturer of a CT scanner, then obviously your customer is the doctor that is using that scanner. But it might differ a bit if you have medication for a patient, and then as you said, there's a lot of people involved, the doctor, the insurances, and stuff. So who would you actually consider being the customer in that sense?

Expert A: From my perspective, all that we do is with the patient. It's about patient access, patients getting the best treatment possible. And to do so, you have stakeholders on the way that you need to convince that whatever you're offering is a good offer and the best offer in this case. And there you, of course, have in most markets doctors on the one-hand side where our medical teams are closely in contact to show the medical value of our solutions. And from our perspective, let's say, market access pricing, the payers play a very important role and probably are my customers, if you say so, because they are a major barrier on the way that patients can get the solution that we feel they should be able to get. And then especially in a specialty market, you can imagine that very few patients can afford their medication themselves. So the payers are the ones that decide whether something is worth reimbursing or not. And we're now slowly only getting there that anything beyond the medication is considered. If you look into our, let's say, dossier that we're submitting, it's all about comparative data based to the standard of care on clinical medical data.

Having added services in there plays a really minor role. It's a nice to have, it's a soft factor, especially if you can prove quality of life benefits, but then you also have to build those solutions in a way that you have say, head to head data in a controlled study environment that you have the service in a group and you have another group that you don't have to service that you can actually claim that the benefit that the patient's experience is really due to that service. And that's the tricky part. It's very scientifically driven and it's very methodological. Basically you have to show both

to regulatory bodies but also to the payers that whatever you're offering on top is really making a difference to the patient.

Niklas Staub: Okay. So that also means that added services, which you have is more to obviously give a better outcome towards the patient in the end. But also this is more relevant for the doctors to actually decide to prescribe because that service will give a benefit. And probably, if I understood it correctly now, it's not the payer that cares too much about it right now.

Expert A: Convincing the payer right now on that is a little more tricky. We are not, as an industry, built yet in a way that we are incorporating services into our trials. There the whole drug development process is quite old school and still focusing on what's the value of the drug itself. We don't have controlled groups of services. If we would have, then all the bodies would probably be more eager and open to that. Without that data, it's quite hard. And then it often goes back to marketing with the doctor, where basically we're showing beyond the medical aspects, what else may these solutions offer to the patient. And it's more on the doctor's side to give them the option to do more for the patient. We start to have, especially we're thinking of risks of the applications and disconnected applications, I think, business models based on healthcare applications. We start seeing that all are being covered more and more. You being from Germany know probably about the DIGA (digital health applications), the digital application in Germany, I think for the last two years, Germany has been quite a first country, like a pioneer in allowing the doctor to prescribe applications as a service for the patients.

But also there the rule is for the first year you can price it the way you feel it's appropriate, and after the launch then you have to show head-to-head trial data. You have to create groups of patients within the board and show that it doesn't really make a difference and then you can keep charging what you ask for. It's really going back to comparative data and relevant endpoints to patients that are standardized to a certain degree to really show the difference.

Niklas Staub: Okay, well, maybe coming back to the example you gave earlier about the growth hormone and the doctor being able to look into the data that is being sent out by the injecting tool, is this something where you also consider the doctor giving him the best possible way of looking at the data and managing all of his patients in the end? Or are you more focusing on the patient itself rather than the doctor being the customer in that way?

Expert A: Yeah, we actually try both to a certain degree because if you want to get the most out of that, you need basically more information, some information that are not automated, right? And patients and the caretakers can add additional information in there, for example, of mood, of activities, of even self-measurement over time. And of course, if you get that rich data and you can correlate certain aspects, it's helping both the patient and the doctor. We want to motivate and we have playful apps as well in that environment that it's not only a single-sided doctor sees what's happening, but also the patient can see his own data or in this case, the parents, and get motivated by basically seeing how their child is actually growing and how this is aligning nicely with basically good coverage of adherence and bringing basically the whole, let's say, interaction between doctor, caretaker, and patient closer together. It's basically a tool to foster that conversation, to have a better relationship, not being afraid, not shying away from these conversations, but being on an high level and helping each other to get the best for the patient.

Niklas Staub: Yeah, but I assume that applications and software which you are having is only for the [company name] products, right? You don't open that to other companies, for example?

Expert A: Exactly. This is again tailored to all our services, both from, let's say, adjusted to the label of the drug, but also the overall branding and exchange of information and data security aspects. So it's all really related to that ecosystem. I would assume that especially in pharma, that is probably more common. So to my understanding, you will not find too many companies that are

big in pharma and try to create a lot of services aside business that are disattached from their products, they often go together.

Niklas Staub: What would you consider being certain advantages and disadvantages of the service business model for [company name] and for its customers? Are there any? Because usually it would be something like reoccurring revenues for [company name], but that's not the case here. Is there any specific advantage which you can think of?

Expert A: I mean, advantage for the company? I think size and ecosystem is a very good example that you have added benefits to differentiation from products that are seen otherwise as quite similar. So this is both in front of the doctor as well as from the patient. You can basically engage with the patient. You can engage with the caretakers in a way that basically you create a pull from the patient in a way of wanting your product instead of the others. That's certainly a benefit for the company. From the patient perspective, through use of complexity, of course, imagine if you would start, let's try to separate the business. You have a device business, you make it optional to get a nice device. You could get also another device that has less features. It creates a lot of complexity and uncertainty to the patient because patients usually don't, are not the ones informed, doctors are the ones deciding it to a certain degree for them. And if you would add a certain, let's say, also complexity of costs in there, we're talking about chronic diseases, you would make patients life very, very hard. And you would probably, also from the doctor's side, also not be well accepted, because what you want is you want to reduce the burden, reduce the complexity to the patient, make them focus most on getting better and not on what elements you choose from a certain treatment.

So I think really simplicity and level of care, of course, and it's important to the patient here and of course for the company it creates the disadvantage of additional costs, of course. But the differentiation is usually helping to let's say cover for that and it creates a lot of logistical issues.

In the end, we are a pharma company, we are not a medical device company. We need to work with experts together both when it comes to, let's say, the medical device side, but also to the legal, compliance, data protection side. So all of that creates additional complexity for our business, also like resupplying the devices. For example, the medication, you get a prescription, you get it in your pharmacy, that's done. And if you need a new, like for initiation or continuation you need a new device or you need new needles or you need any equipment that is a complexity that you have to build your supply chain accordingly, that you understand per market, which again may differ what is the right place where you can basically transport those to the patient and also make sure that they know how to use it.

Niklas Staub: I think that's exactly what you're saying is one of the big disadvantages or problems within that field of servitization is that companies that have previously not been very digital or engaged with data privacy or with devices, as you're saying right now, they need to learn all of that and that's obviously complexity, involves a lot of cost. Maybe one of the big challenges in that field as well and disadvantages.

Expert A: Absolutely. We have a similar, again, now launching an app in the [specific detail] field. I also got the feedback of it would be helpful in those markets to differentiate. Sometimes the feedback is like we had very high challenges, big challenges in those markets with data protection, and sometimes these things decide on where you can go in the market and where you cannot go in the market.

Niklas Staub: Yeah. Absolutely. When trying to integrate such a service business model, are there any critical success factors from the company side which you think are important?

Expert A: As you rightly heard right now, I'm coming from the market access function. I mentioned to you the commercial functions, I mentioned supply, medical, the doctors play an important role. It is super cross-functional. And in these big companies, you can imagine there are many people

involved and I think you need to find and build the right structures end-to-end to really think it through. What does it really mean to have those? What limitations might come up? Which stakeholders externally may come back and ask questions for that? Are we prepared to answer them in the right and faster fashion. But the coordination internally, doing the right functions, planning this from beginning to the end, I think it's a big challenge.

Niklas Staub: Okay, thank you very much. Then we've also briefly touched on the challenges of that business model already. So being very different regulations over the different countries or in the different markets. Anything else which comes to your mind, challenges and also limitations, maybe I think they go hand in hand.

Expert A: You said before, I think it's a bit of going back to the old notes that in pharma it's a quite typical/traditional business model, and I see that only slowly evolving. People think of basically finding a drug target, having the pre-clinic testing this through, at some point this goes to first human testing, then you have your classical phase one, phase two, phase three development. By now we're luckily thinking earlier on about the payer and the role of the payer to be prepared for that. But in the help of the people and the education of the people and the experience of the people, this doesn't play that big role yet. And if you're not getting there and if also let's say there is not a big push towards that. And I still don't necessarily see that from doctors or patient side. We have bits and pieces where you can differentiate with these models. But primarily doctors and patients are interested in the best medication in a drug that basically prolongs their lives, improves their lives, creates life in the fertility space. So these are the hard endpoints that most people are interested in. Yes, we see quality of life evolving. We want to improve care, but these ones are in many markets still a cherry on top, not like the primary thing to look at. And as long as this is the case, I think it's really hard to justify big investments and developments in that field.

Niklas Staub: Yeah, makes absolutely sense. And in terms of limitations, is that something which from a regulatory perspective would even be possible to implement these service business models or to go to an extend where you say, we would start charging monthly for an application thinking of something like a diabetes drug, which you need to take for a very long time, starting to have that as a monthly subscription. Would that even be possible? Not really if it makes sense, but whether it would be possible from a regulatory side, for example, in Germany?

Expert A: It's probably very difficult. Also from the concept of a globalized business where basically drug prices are also interconnected. I don't know how much you know about that. There is something called international reference pricing. Basically every pack of products has a list price that is publicly available. Markets between each other would basically refer to that and say, like well, the price in Slovakia is lower than in Russia. The Russian authorities want the same price as in Slovakia. Basically, this is very deep in the thinking about global network of pricing and regulation that even if you would find a pilot market a bit more isolated from that, a smaller market, you may go for that. It's probably challenging to implement that in a global scale due to this traditional concept.

Niklas Staub: Thank you very much. Really a lot of insights, really good insights. My last question would actually be about the future outlook, but I think we've already touched upon that already a bit. You've mentioned that this is probably at least in the short term, not really a model that will have a lot of future in the healthcare industry, especially maybe... Because that's what would be interesting, I think, about the thesis, because I'm also trying to talk with some companies that are more towards offering medical technology for hospitals. There it might be a bit different if you don't have it for the patient, but thinking, for example, of CT scanners and how hospitals and doctors can use that. I think that could be a bit different there.

Expert A: Absolutely. I think here at the pharmaceutical field where we are again have the end patient, we have to authorize, we have a lot of regulations around that and a bit more classical focus on, again, these hard endpoints. Personally, again, I can only assume my personal experience and personal point of view, I see this as an on-top offering often linked to our products. I see options for let's say service models which are absolutely unlinked, like delinked from the product. Then of course, you have programs like lifestyle coaching. We have programs like diet support, whatever. They are also medically relevant. And if you think of the Weight Watches programs or whatever, it's very similar. You have service models that are helping your health in some way, but really in this chronic disease setup, in a regulated treatment setup, it's probably more challenging.

Niklas Staub: Okay. Yeah, thanks a lot. It was really helpful. It will help me a lot, I think, with my thesis and good insights. I'm just going to stop the recording right now.

Appendix 5: Interview Transcript – Expert B (October 11, 2023)

Niklas Staub: Okay, perfect I started the recording. So maybe just to briefly summarize Servitization that we are talking about the same thing. So as I said, Servitization is the shift from that product centric to that service-centric business model and closely related to the concept of Anything-as-a-Service (XaaS). I'm not sure whether you've heard of that business model.

Expert B: Yep, I did.

Niklas Staub: Okay, so then I don't need to jump into all of those details right here. What I would like to cover with you is six topics of the interview. So first of all, some personal introduction from your side and as well confirmation of the expertise. So just briefly explain your role and how it's linked to business models. And then looking at maybe some examples of service business model models in healthcare or more specifically at [company name] that you have encountered. Then also what are drivers of Servitization in healthcare, then looking at advantages and disadvantages, both for customers but also for [company name], obviously, and then trying to identify some success factors, challenges and limitations of that business model before then going into a future outlook.

Niklas Staub: All right then would you be able to provide an overview of your role and your expertise within the industry and those business models?

Expert B: Sure. I'm currently the Vice President and Global head for new product planning, Portfolio expansion and global strategic partnership management in the [specific detail] of [company name]. In that role, me and my teams are responsible to develop new products and services so that can be either therapeutics, so the traditional drugs, business devices for drugs or standalone devices, including digital options, as well as service offering with value add to complement our offering beyond the traditional drug sales model.

Niklas Staub: Thank you very much. Do you have some examples of service at work or more specifically? Is that shift towards or is servitization happening in your therapeutic area as well?

Expert B: There are discussions about it. However, it's not a Servitization in the context of Software-as-a-Service (SaaS), for example. What's happening not in healthcare, but in the pharma industry. I think we have to differentiate. If you talk healthcare, which is really broad, right? You have medical devices, you have pharma sector and we have the services sectors of clinics, etc. Servitization is present to different levels. In the pharmaceutical industry it's actually the least present. And also in the pharma industry it's the most challenging, in my opinion and experience, to develop servitization models. But, Pharma is aware that they need to move beyond the traditional, R&D-based business model: Identifying unmet need, looking for a drug, developing the drug, selling the drug at highest prices while it's under (patent) protection. However, servitization how it's used today is mostly used, like providing services around the drug to make the drug more attractive. So it's not really like SaaS, where you get the product for free and you pay on a monthly basis. That's not so present.

So what pharma industry is doing is checking what other services they can offer. Patient support programs are a traditional one, etc. However, these are usually provided for free, they're not expensed. The service element to differentiate the offering is provided for free and priced into the drug, and the drug is then still paid in the traditional way. The reason for those limitations are twofold. Firstly, compliance and the fact that you're not allowed to influence prescribing behaviors. Decision of the physician needs to be solely made on the purpose of finding the best drug. It could be perceived that if I offer other things around it, that you divert from the risk-benefit assessment, which should be the key driver of the prescribing behavior. The other reason is that in most healthcare markets globally, there is no direct transaction. So product flow and financial flows in pharmaceutical are separated. The physician prescribes the drug. You go with the prescription to a pharmacy, you collect your drug, you might pay the pharmacy or you get it and your health insurance pays for it. But then in the end, the pharma industry is paid for having provided that drug

to a wholesaler. So there are not there's no direct selling to a pharmacy or to a clinic, which makes it also more complicated because then also the end customer (the patient) is not directly served by the pharma industry, and these two factors make it more difficult for pharma.

And also pharma processes are not set up in a way to to cater for this service models. And and also here, when we try to establish it, we have the experience that it's very difficult to maintain two different business models to different underlying process landscapes, ERP systems, at the same time and that all limits servitization in the pharma industry.

If you look into medical devices, it's different. If you look into Siemens for example or if you look into Medtronic, whether they provide large machines or consumables, catheters, etc., which are used in the context or even the diagnostic industry there, it's much, much more pronounced. So in their case the product is simply a vehicle to place services at the customer and later on make the majority of earnings with that service. This can be a technical service for the product, in the example of Siemens providing X-ray machines or CT machines, a service in providing actually the whole workflow, for example Medtronic heart catheter Labs, etc. or diagnostics services where by now it's actually a most widely used business model is not pay per test or pay per machine, it's actually pay-per-procedure. So you actually provide all the services and depending on the outcome, you get cross-charged a part of the reimbursement fee that goes to the to the clinic. So these are much more pronounced there.

Niklas Staub: And that's very interesting because, before I was starting my Masters, I was working for [specific detail], exactly on [specific detail] for their devices. And this is also what triggered sort of my idea of looking more into it. And I feel like, as you say, the pharmaceutical industry has a lot of limitations in that in that field. While the medical device industry, on the other hand, has a lot of potential, however, and maybe you are able to rate my thoughts here: I feel like this obviously only works for capital equipment which is then used in the hospital. So medical devices like

implants for patients, pacemakers or stuff like that they obviously don't have the potential for those service business models or what do you think?

Expert B: No, I wouldn't fully agree. I agree it's easier with like equipment. But for example, the example of Medtronic who provided heart catheter labs to clinics, they equipped the heart catheter lab, they trained the staff, they provided all the consumables they sold, and they basically were paid per heart catheter exam. So they wrapped everything together and go even that far that they are actually running or operating the heart catheter lab. So they even at least they looked into even having the staff there. And you simply then got a share of what the hospital gets from, the health insurance for doing such an examination. And then the benefit of the clinic is that, okay, there's no risk upfront investment, etc. The benefit for Medtronic was the idea that they can run this more efficient and therefore make more money. And its possible to lock in the clinic on using our equipment only.

Niklas Staub: Okay. Yeah, very interesting concept. Thanks for the insights. So coming back to your examples these service add-ons that you provide for your products in your therapeutic area. Um there's no way for you to charge for them, right?

Expert B: No there is. So I think again that's a bit a uniqueness of [our therapeutic area]. So it always depends on the market environment where you operate. If the market or the treatment area you operate in is reimbursed, then it's very tricky because then you have really limited options. If it's a private or out of pocket market, it's more easy or it's feasible in general, let's say put it that way. But then it depends again, you have different options. Do you follow B2B concept: Selling a service to a clinic, who then sells us to the patient vs. do I sell in B2C setup where I would sell directly to the patients. The latter is even more complex and difficult. The one where I provide services, products, devices to a hospital or any entity that's providing a healthcare service. That can

be feasible. Then the question is if it the service is linked to a product or if is it just an additional offering I provide, which is easier. If its linked to the drug its more tricky again.

Niklas Staub: And these service add-ons. What are main reasons for you to decide to offer those?

Expert B: Differentiate our offering, justify a higher price, provide value add that convinces the clinic to use our product. So yeah, it's either a better price, higher market share or more profitable offering.

I also have some hypothetical thoughts: If the reimbursement landscape would change. Because also today it's purely transactional, right? A drug is prescribed, is used, and you get paid for providing the drug. If it would move into outcome-based reimbursement models, so you are only paid partially or fully if the drug you provided was successful, I think the concept of servitization or offering additional services changes completely. Because then you can say it addresses a compliance dilemma because you don't influence the behavior, you can say, I only get money if you're successful.

However, if you look into health care offerings, you cannot look at the drug in isolation, right? It depends on the right diagnosis. If the drug was correctly applied, if there was no accompanying surgery, etc. So you need to look at it more holistically and there then offer opportunities to then provide offers depending on the disease and the treatment options that would ensure that you document the treatment properly, that you can later also judge if the outcome has improved, has changed and therefore was successful when you get partially or fully paid for that. However, there are very, very few examples of that so far. Because it's complex, it's difficult for every player. So for the health insurers, for the healthcare plans as well as pharma industry, that's really not kicking off yet. When you see outcome models today, it is more like a risk sharing model where you actually get a deferred payment for using the drug and not the full drug up front.

Another example where servitization becomes interesting is when you think about gene therapies and cellular therapies, because they're you don't provide a single product anymore like that. In a cell therapy, you actually sell a process. You usually take out the immune cells of the patient. You train them, you purify them, you inject them back. So you provide equipment, staff, etc., that does that. And not an ampule with cells to inject. So. That's definitely something that will only work in a servitization set up context. But also there. You see the struggles, if you see that Novartis actually moved out being leading in cell therapies and dropped most of it. So the question in that area is actually who will be the future provider of these? This is a pharma industry or the hospital, is it the life science industry? A question that still remains to be solved. Similar for gene therapy where you would have like you need to personalize this. You would whatever gene you would like to replace or add back, you need to personalize that. So it's also a specific element. So this you still could argue well works via via product transfer, but it's also integration.

Niklas Staub: Yeah, okay. But that's very interesting. And who would you actually consider as your main customer in thinking about your therapeutic area now? Is it the customer? Is it the clinic or the doctor?

Expert B: No it's clinic. It's a doctor that provides the treatment. We we looked at this very carefully and in theory it could be the patient. But as it is an out-of-pocket treatment in most of the market. So there's a business transaction between patient to clinic, if you would go directly to patients would be perceived as competing with our customers, which are the clinics. And from interviews, we know that patients prefer to have the trustworthy or trustful relationship with the doctor. So we would interfere with that. We clearly said, no, it's B2B and the clinic provides the service to the patient.

However, in our therapeutic area you see that it starts to change a bit and specifically around the topic of consumer health, women’s health, lifestyle coaching. All these variables, the ovulation

tracking apps, all these things, which is much more direct to consumer, fitness, well-being set up starts to reach out or spread into [our therapeutic area]. So we're currently asking ourselves how will it change the model? What do we do going forward? Yeah. But if you would like to provide direct to patient models, you would actually need to own clinics. You cannot do it as the pharma industry. You would need to own clinics who provide it and then you would again need to find setups which sufficiently separate the one part from the other that they can, you know, considered being in a role to influence prescribing behavior. I think the most advanced example there in Germany would be the Fresenius group who looks into all these different elements, but also there they have dedicated divisions to provide each separately, so they are to some extent independent.

Niklas Staub: Yeah, okay. But then I also feel like one of the biggest limitations, as you've been saying right now, is really that you cannot influence the prescription. And in the end, what you need to do is then to have those service add ons to offer the best product and ideally the best outcome. Or in the eyes of the doctor, the best outcome for the patient.

Expert B: Yeah, exactly. And another challenge is it's very difficult to get IP for services. So. You're in a big risk that someone could just go forward and copy that. And as today, still like the bread and butter business is defining a new drug and maximizing the profit of the drug while it's under patent protection. It will be very difficult to transfer that onto services. They come much more into play in the context of lifecycle management. Later stages of the lifecycle of a product to maintain benefit rather than at the beginning. And if you look at [company name] for example, like companion diagnostics or monitoring devices etc. But these are not servitizations, these are services offered to address risks of the drug to make sure it's correct to use. But when the value stream is linked to the drug again.

Niklas Staub: Yeah. Did you ever consider optimizing the workflow of the doctors or helping them to optimize their workflow in clinics?

Expert B: Yes. And we actually offered for a while training on that and consulting services, but again at arm's length principle. So we develop concepts, tools to do that. But we didn't provide it ourselves. We licensed an independent company who provided those in the clinics. And again, um, whenever we do that, preferable the clinic pays for that. Then it's clean. If the clinic doesn't want to pay for that, but you as a company want to support that, then you need to check what are legal and compliant ways to do that. Not just that you don't influence prescribing behavior, because you also provide a value to the customer and based on fair market competition law, you have to provide those as fair market value. You cannot give something away for free because it was raised a suspicion that you might bribe the customer for future transactions. Which is of course not the intent. So all the services always underlie quite some scrutiny from a legal compliance framework to find the right way to do that.

Niklas Staub: And because you were mentioning earlier the outcome-based reimbursement which would allow servitization for example, is this something which is discussed, for example in a German market?

Expert B: It pops up now and there and people are looking into it, but really nobody is driving it. And we tried to do it at [company name]. Again, it's now medical device industry, not pharma industry. And then we also negotiated with health insurances in Germany. And then the problem is also how they work. So a health insurance, has an annual budget and is eager to maintain the inner budget, they're not incentivized to save money carried over next year. What they have in a year, they have in a year. And that's it. If you look into outcome-based models, you frequently look into year spending or several year processes where you need to track something. And that is not reflected on how health insurances at least in Germany manages their Profit and Loss (P&L). So we couldn't get together to find a way that works from either side. So it was very difficult to proceed.

Niklas Staub: And who do you think is the biggest player either limiting or having an influence on how servitization could work in the industry? Is it in the end, the health insurance that says, yes or no?

Expert B: I think there's not one big player. It's a complexity of healthcare such and how the players interact. For example, in Germany I think that the "Ärztliche Selbstverwaltung" (Medical self-administration) is a major hurdle as well as how our health insurances operate. For the U.S. it's a bit different with the patient benefit managers and more, these integrated employer run health care plans, it's a bit different. They for some elements do more Servitization there. But again it's limited. I think the, the biggest hurdle is, is the independence of the clinic or the doctor and taking the best treatment decision. Which is also very important. You don't want your health to be dependent on monetary decisions you want that the doctor takes a objective decision on the best treatment option for you. And that ultimately decides what is done when, how, with the patient. But on the other hand, if you want to provide the services, you need to tap into these pools so that independence provides this significant flexibility or limitations when it comes to offering servitization.

Niklas Staub: One thing I would like to find out is whether the healthcare industry needs to change at all or if the current model is fine and future-proof.

Expert B: Well, that's a very personal view. Yeah, I think it has to change and I think it will change. However, there are significant forces that push back across the whole line from patients who are very careful. You're way less willing to try something that impacts your health compared to trying a new car.

Niklas Staub: Yeah.

Expert B: So, but also for pharma industry, where you have very long upfront investment periods and a model that's based on high risk, high reward to change that. So and I think the healthcare industry overall has not found the right intermediate steps to move towards changing their business

model. But on the other hand, if you consider all the demographic development side, we become an older society, there are no treatment options coming, disease costs per person are increasing in U.S., health care spend per capita has outgrown GDP growth for several years. This is not sustainable, because at one point we spend all our money on health and well-being. So therefore ultimately it has to change. But nobody is eager to be the first to do it. So I think unless governments change the legal framework or look into how this healthcare system is set up, the driving force will not come from the industry, in my opinion.

Niklas Staub: Yeah. That's a very interesting, thought and good insight. Obviously, then in the end, one of the biggest limitations is the market your operating in and how their healthcare system is set up.

Expert B: Yeah, so I think if you take a tax paid system like the UK, it most likely would be easier to look into servitization as they also have a body that looks into services, interventions and devices to do a health technology assessment to see if they're actually beneficial. I think that that's also a requirement you would need to to have. If you want to move to servitization, you would need to prove that your service is beneficial. Like today you have clinical trials. You show that your drug works. You would need to prove that your service works to then get the service paid. And it's already complex to prove the benefit and big investment for a drug. So now think about you have a drug and you want to translate the drug into a service model. You need to not only prove that the drug works, you also need to prove that the services work in providing the drug or whatever. Tricky, not easy. And this is these are just the thing that that keep it back. If you're looking to market which is self-paid, where it's also not mandatory to take a treatment like [specific detail]. That's a personal decision to go to a doctor, to go to an [specific detail] center and ask for the treatment. There are more options. So then it's more down to the classical questions: How do I change my business model? Can I offer two business models next to each other and the legal compliance issues? That's

why for us [our therapeutic area] is an interesting field to explore and test ideas. Potentially they might be relevant in oncology, neurology or other disease areas at a later stage.

Niklas Staub: But it would probably never be a model like: you have your treatment and now we as [company name] offer you additional services like we have apps to help you monitor the optimal timing of when to take it or do you take it and stuff like that. And you can pay for that as the patient.

Expert B: Well providing these services yes, but having the patient pay for it? Most likely not So either you say, it's optional and the patient can pay for it if he/she wants it. That's not really resonating well with patients. They're like: "What? But I take your drug already now I need to pay for something else? No!" So that's off the table.

If it's mandatory to use it, then we say, well then I pay just for one thing. And again, they're like mixed models. E.g.: I offer a drug for chronic treatment. Patient has to take it every day and offer solutions that monitor the adherence of the patient. So, that is something that could be sold. It could be sold to the health insurance because the health insurers will be able to monitor the consumption and say: "Dear patient you have not taken your drug, therefore your disease is progressing. Therefore, we only pay 50% of the drug. We pay 100% of the drug if we really take it as prescribed." Or you say, it's treatment via drug usage and you only pay me for the drug actually used not to for the full package, which is not really servitization, it's just more changing the payment scheme. But it's not servitization in the classical context. And these are more likely the things that pop up or are emerging already in, in healthcare. Okay

Niklas Staub: Yeah. Thank you very much. Really good insights helped me a lot and also backed me in my feeling that servitization itself will most likely be more relevant in the MedTech industry or also for the equipment for hospitals.

Expert B: (confirming nodding)

Niklas Staub: But yeah, thanks a lot. Really helped very much. Any, last things that came up to your mind which you would like to mention?

Expert B: Yeah. Another thing where it could change if you would get let's call like integrated healthcare companies. So maybe the company operating an oncology clinic. Running developing their own treatment options for that oncology treatment clinic. And you go there consciously knowing you are treated there with their own products. Um, but again, that would mean that you really focus it on, on those areas. But it would be very difficult for them to provide their products outside of their own clinics. So it's it's again a different sort. And then it becomes challenging because reach and market presence is a key success factor for offering medication. The more markets to launch in, the higher your return is. If you would limit that to only markets where you have your own channel. It again comes with complexity.

Another interesting thing in the nearer future is AI based drug development. These technologies really allow to significantly accelerate drug development and reduce drug development costs. Then I think, that changes also the picture, because if you don't talk about refinancing a multi-billion development, right, you also have much more flexibility. Currently the ticket price of developing new drugs and therefore the return you're trying to generate also limiting options a lot.

Niklas Staub: Ah, okay. That's very interesting. But from a regulatory standpoint, would it be possible to operate your own integrated health clinic, for example? So, if [company name] would do its own clinics, but only used its own products because you were mentioning that freedom of prescription.

Expert B: Yeah, so it would be possible. Within in a class. So from a drug treatment you have different molecule classes. And then you can say we follow that protocol and this protocol and we only use that molecule. That's already happening today. Hospitals are doing that right. They don't want to offer ten different treatments. They select one and they negotiate one contract with

companies. They make changes from time to time. But to say, okay, they're comparable and we just pick one to reduce complexity. This you could do. What you couldn't do is like, okay, here you get only treated with this treatment option. And not the other one. That again would be unethical. But if you say no within this bucket there are five products. One is ours and they're comparable. And therefore we just use ours. It's still complicated though. How to do with this, but that would be feasible.

Niklas Staub: Okay.

Expert B: The question is like always ethical question. Right. Do I risk patient health because of limiting options there. And that's not allowed in any country.

Niklas Staub: Very interesting. Thanks a lot. So maybe. So again, thank you very much for your time and for the insights. It was nice to talk to you.

Appendix 6: Interview Transcript – Expert C (October 30, 2023)

Niklas Staub: First of all, maybe you can start with a personal introduction of yourself and just your role a bit.

Expert C: The title is I am the Head of Innovation for Business Unit [specific information] within our Pharma division. Part of that, I am responsible for internal and external innovation in an open innovation model. That means basically responsible for all of the early ideas in driving innovation, new product concepts, new service concepts, new business process, and efficiency improvements internally. And that includes a process for gathering ideas, setting innovation strategy. Then my responsibilities are for our discovery pipeline, which is everything from the concept of an idea up until you start formal research and decide to invest. And then I'm responsible also for external innovation. So obviously not every idea comes from inside. So we work with a lot of partners in the startup community, also in academia and institutions, and then also medium to large size multinational corporations and co-developments, co-commercialization agreements, licensing, these types of things. And obviously we have everything in between there. So that's my responsibility areas.

Niklas Staub: Yeah, cool. All right, then looking into the service model in healthcare or the business model in healthcare in general, do you have some examples of [company name]? What you are doing?

Expert C: Yeah, I think if we look at our business, and obviously we are nicely unique, but if you think about it from a historical perspective, we were traditionally an equipment service provider. When you provide equipment in a healthcare setup, the most traditional and longest standing model for servitization would be physical equipment service, managed equipment services. That is basically enter into a contract, that contract has a duration, and you're paying on some invoice cycle for an on-call service, so yearly preventative maintenance is, but also if there are emergency

breakdowns, that somebody is on standby waiting to come fix your device. I think that's been the very longest standing service-based business model that we have in our therapeutic area. In addition to that, obviously, we started with things like Pay-Per-Procesude/Pay-Per-Use. We had vendor managed inventory as well. But what we're talking about and these examples outside of just equipment service are all basically conceptual. With early pilots and things like that, none of these are scaled yet business models. If I think about what we're trying to do with our AI platform and this we've started, we have, I think, a handful of customers at this point and already have started to see a little bit of revenue flowing in, is a platform and then platform offering type of approach. You basically create a marketplace where you can deliver and sell services. That would be software-based, enterprise software applications, things even running on devices. You pay to install the platform or you pay for access to the platform if it's cloud-based, and then you are charging on a fee for use or a fee for duration of availability approach for the different applications and products that sit inside that platform. Those are the ones that we have. Again, the longest standing and actually really works is the equipment service and then the software platform approach and the different business models are very, very conceptual.

Niklas Staub: Maybe just to sum it up, you still have that product-centric view of selling the product itself, and then you have these additional services, maintenance, and then obviously the other conceptual services apart from digital solutions and that.

Expert C: Yeah. We'll get into, I think, in the upcoming sections about why that is and also some of the challenges that you face specifically in the healthcare industry about why it is so hard to move to XaaS in healthcare. Yeah.

Niklas Staub: We can actually jump over to that one. What are primary drivers in your view, of moving towards those service-centric business models?

Expert C: It's the classical mindset shift from a financial perspective of transaction-based to relationship-based. When you're transaction-based, you're extracting value from a customer one time, and there's a customer acquisition cost that's associated with that. Then you extract that value and then it's done. Then at that point now you put in efforts to be able to keep the relationship warm if you want to again engage in another one-time transaction, and that is very peaks and troughs with not a consistent flow of revenue over time, which makes it difficult from financial forecasting perspectives. Also, the customer acquisition cost over time is much higher than if you entered into this sustaining revenue-based approach, which is what you have in a servitization type of model where somebody is paying for you in chunks over time in a maintained, stable relationship. Everybody knows what they have to pay over time. Everybody knows what they're getting in over time. The overall customer acquisition cost to bring that revenue in over time is essentially amortized to nothing. From a financial perspective, every company in the world would ideally like to move towards that model. You see in almost every industry them doing just that.

Niklas Staub: Is there also some drivers from the customer side? Maybe thinking about your AI platform, what are drivers from the customer side to ask for those models?

Expert C: I think, to be honest, it's much more of a push from industry than a pull from the market about this in healthcare. But if you were to highlight a couple of values for the customer, I think it is mostly valuable when you are uncertain about the return on the asset that you want to purchase. In this particular case, if you're talking about our AI platform, you have the ability to dip your toe in the water of AI tools without saying that you're going to spend 6-12 million on a brand new IT system that has everything there for you. I think it lets people trial things out a little bit more. That would probably be the number one driver, which is also in the flip side, makes it challenging when you consider doing something like this for devices. If you were to enter into a leasing model or something like this, it's a little bit more challenging for industry, still nice for a customer because

you get to test out the product, taste it before you buy it or try on the shoes before you pay for it. That's a nice approach. The other thing would be also financially would be for forecasting and planning and budgeting purposes. We'll get into, again, the challenges associated with that when it comes to capital expenses versus operational expenses and how those are treated differently in a financial environment tends to be on the negative side for something like an XaaS model. But in general, I would say the try it before you buy it type of quasi approach, and then the stability in forecasting, financials, and budgeting would be two drivers. Yeah.

Niklas Staub: And stuff like, for example, thinking of these pay-per-use and managed inventory models, are customers saying: “Okay, I have resource restraints, especially with administrative costs, which is why I would like to outsource everything in terms of ordering and invoicing and stuff like that” or is that not too much of a driver?

Expert C: It depends on the customer segment that you're looking at. If you talk about small scale, even if you think in healthcare, you're talking about private institutions, these type of private, small franchise based companies, obviously this is a cost that they don't want to eat because it's not like they're sitting inside of a bigger network. So in a bigger hospital, you have admin staff everywhere. That's just something that you have as an available resource. So outsourcing these things from an admin perspective is always nice, but it's not something that's going to be like, thank God, this is such a great thing. I need this. But if you look at private entities within the healthcare industry, that is, I think, where you can get a lot of value because that's something that is an overhead cost for them. If they can outsource this as part of a deal where they're already getting services or goods from a manufacturer, that's just a bonus.

Niklas Staub: That's a good point. Do you see a difference between the pharmaceutical product and the devices in your portfolio in terms of the potential for servitization?

Expert C: Yeah. The regulation is significant around the pharmaceuticals. I guess it depends on how you think about servitization, to be honest. Because we do enter into essentially a... I mean, if you really zoom in, we are charging a price per milliliter and customers use milliliters, and we then just provide them recurring product supply over time. We tend to do this in a contractually agreed upon framework. For the next three years, this would be your price of this [product] per milliliter, and then you just order constantly when you need it. Yeah, it's hard. It's like, how would you XaaS your consumables unless you did it inside of just a bundled offering of we give you three or four different consumables. So to that point, I don't see any real difference between pharmaceutical products and medical devices when you look at things that are consumed and when you look at trying to create an XaaS model out of this somehow. When you talk about these products just in general, the time to market, the cost and complexity, the probability of technical and regulatory success (PTRS) for these products throughout development to bring to the market are drastically different.

Expert C: Your PTRS, for [our products], which granted is exponentially better than a normal standard pharmaceutical product, the therapeutic of a drug, is still going to be somewhere early on less than 10 %, 11 %. For devices, it's always going to be 70 %, 80, 90 %. Okay. And then over time, so basically, when you enter into a model, mixing your [pharmaceutical product] and your devices together in a bundled offering is not so easy because how pharma companies work, we invest a lot with high risk, and you need to amortize the failures of your products in the profit of the ones that do make it to the market. And so your margins are different. How you want to extract value out of a product in the market through the pricing is different between devices and pharmaceuticals. But for us in [our therapeutic area], it's a bit simpler because [pharmaceutical product] isn't so extreme as you would get for a therapeutic. But in general, I would say the need to extract maximum margin from the pharmaceuticals is not nearly as high as it is for devices. And

that creates a bit more of a challenge, because if you think about it in an Anything-as-a-Service model, it can't be something that really damages the wallet or the pocket of a customer. You're not going to pay 200 euro per month for Netflix, even if they took their current offering and made it 15 times larger. So it's got to be something within the realm of reason that makes creating Anything-as-a-Service model for a pharma product a bit more challenging.

Niklas Staub: These points are very interesting because this is also what I've heard from the other or learned from the other interview is that really for pharma, it's a bit tougher to implement these models simply because also you can't influence the prescription behavior of the doctor.

Expert C: Reimbursement, et cetera. Yeah, exactly. Yeah, you're exactly right. I think that is what I'm bringing in relative to the pricing is you're also tied to what that drug can get reimbursed for in the market. Then also, over time, the fluctuation, this is actually probably one of the more important pieces, the regulations on pharmaceutical products relative to reimbursement and pricing is much more volatile than you have for a device. Baking in a fixed price for a device, isn’t tough. I have the cost of goods, probably you can assume a yearly increase in cost of goods relative to inflation and the overall prices of the components. But when you talk about a pharmaceutical product, depending on where you are in the world, there are regular reviews of pricing. Think about what's happening with VBP in China is just crushing the prices of drugs. You also have drugs here in Europe where... I forget the exact name for it. I need to look this up. But there will be several countries where you take the average price of this drug or this class of drugs across several countries, and that will be the updated new price that you get as reimbursement for your product in a specific country.

Niklas Staub: Is that reference pricing?

Expert C: Yeah, I think it's reference pricing. Yeah, exactly. Depending on the timelines of how often there is a revisit of the pricing, you could be stuck into a multi-year contract that is in

Anything-as-a-service model to deliver that product at this cost over time. And then all of a sudden, the risk there on you that something changes from a healthcare reimbursement landscape, it's too high. Imagine you're sitting there and all of a sudden Germany just says, I mean, you look at what we have on the therapeutic side, but they say all of a sudden, look, you don't get the "Zusatznutzung" and all of a sudden your price is significantly lower than you expected. A generic is entering the market, driving prices down. I think it's too volatile for a pharma product. Yeah.

Niklas Staub: And then also I feel like you have the problem of it's not necessarily a monetary value which you can give to the customer. I think a service model will most likely always be more expensive than simply buying a product or what do.

Expert C: You mean over time? Yeah!

Niklas Staub: It's tough to give this argument towards the customer and say: “Hey, but we will have a better service involved and this will improve your workflow and stuff like that”, but in the end, it's coming down to the money.

Expert C: It always does. That's where you need to win on one of two fronts, which is you need to provide... First of all, you need to find a customer where somehow the way that they do their business, they don't have a lot of upfront capital, it's much better. They're happy as a clam. Like you and I, if we go buy a house, no way are we going to be able to shell out 800 thousand for a house, even though we know we're getting absolutely railroaded by the interest we have to pay over time, but we do it because that's just the only way otherwise I wouldn't be able to have a house. You have to find those customers, which unfortunately in a healthcare landscape is not very common. You either have to find those unique ones that can't afford the upfront capital for what you are trying to do or you have to provide so much value in a way where they just have to have it. In the same model that you don't offer it in any other way. The Mercedes always comes with the leather seats and a navigation. You don't get to take it out. If you want this and you want the value

that this offers and that value has to be high enough, then you have to live with the fact that you can only enter into in this engagement model. Yeah. Although if you're trying to sell optional stuff in an Anything-as-a-Service model, it is really, really difficult to do.

Niklas Staub: So baseline needs to be quite high.

Expert C: Yeah. That's really unique to healthcare because in healthcare, we're essentially selling to middlemen. You're not selling to an end customer. You're selling to somebody who needs to pay for those things to deliver a service to someone else to get money back to be able to continue operating their own business. If I'm selling Netflix, I'm selling to an end user, which means that you can sit there and say, Well, it's $16.99 a month, but I really like Netflix. Therefore, I'll have three, four less coffees per month. That's your own choice about how you're paying one to one. You don't have to then say, I am now a bar that is trying to pay to stream games, and then I need to make that money back from somebody else doing something. And that's where it's really B2B in healthcare versus B2C, which is a little bit easier for Anything-as-a-Service.

Niklas Staub: Yeah, fair point. Maybe coming back to the advantages and disadvantages of those models for [company name] in that case, apart from the customer retention maybe, and the you have a better relationship, and the financial aspect, of course, what are some other advantages or maybe even disadvantages of those services which you can think of?

Expert C: I mean, to the first point that you made, can you really argue that the relationship and the service is better? Because if you think about our business, right now, we sell on an ongoing basis. So as my key account managers or sales reps, they still need to keep the relationship warm to be able to prevent competition from coming in and cutting off that ongoing consumables revenue stream for me. It's not in an XaaS, but I have to constantly be there making sure that my customer is happy, solving problems that they have. I don't see that changing from a relationship, really like a you to me type of thing. In in Anything-as-a-Service model in our specific business approach.

The only thing that you're adding on top, which is a disadvantage, is now I need to take that time every invoice or billing cycle to be able to make sure that I'm back on top of you that you are going to make the next recurring payment. I have to resell the product to you every 12 months or whatever your billing cycle would be. Unless you entered into a mode where this is just an automatic, like an auto pay type of situation, then that would be much better. But the problem is in the healthcare industry, that is almost impossible to do. You constantly need quotes, purchase orders, invoice, and then you bill, where you can't flip the toggle switch for a turn on auto pay. That is the thing that makes the XaaS model so profitable is just like credit card companies. Credit card companies would not be able to be in business if they didn't have a reasonable enough proportion of people who only make the minimum payment and are living paycheck to paycheck because they're paying so much interest. It's the same thing for Anything-as-a-Service. You will just have people who don't use it, don't need it, but yet they're just too lazy or don't remember or have forgotten that they're paying this every month. And that's how you start to rack up even 10%, 15%, 20% of your customer base is just a passive not even using the product. That doesn't work in healthcare because you're physically using it. You're paying for what you use unless it's software. And even then with software, yeah, maybe you're not using these AI apps, but there's no way that you have a toggle switch somewhere that you're automatically getting billed for something and you're going to look at this and not question, Is this really worth it? When that whole industry is nothing but downward pricing pressure and economic pressure to do more with less cost.

Niklas Staub: Yeah, that's a really good point, actually.

Expert C: The one thing I would add in addition to that is to project this out in the future, which is too often we, as human beings, we take how we see the world right now and we copy paste the world 15, 20 years from now and we just think of technology being different. But really one of the main problems that we will face in the next 10-40 years is the demographics issues that we have

globally. If you look at Europe, you look at places like Japan, Germany is one of the worst that there is. You have these upside-down triangles of demographics where you'll have many, many more people that are entering the retirement age, entering the age of chronic disease, entering sickness, and you'll have much less people that are entering the workforce to be able to pay the premiums to support those people. So if you project that forward, the healthcare systems will have nothing in the future but walls closing in more and more on costs. And when you do that, that's where you really start to be fiscally responsible of where every single penny and cent goes.

Expert C: And that will make the Anything-as-a-Service approach even more challenging, because in general, that model is more expensive over time. So I think that's one thing that will have to watch out for is, Yeah, it's nice. The business model sounds nice, but is that really something that the healthcare industry is going to be able to support in the future?

Niklas Staub: Yeah, this is actually a really good point, I think, going forward, looking at the future. Thinking of data, all of these models are based on data, usually like we did with the pay-per-use model. Is this something or is this reasonable for [company name] in that regard, thinking of the data and saying, Okay, maybe we will also have a little less profitability with that model. But the data is quite valuable for us? Is this something which you are considering?

Expert C: Yeah, for sure. That's obviously one of the things. And again, you talk about value. Sometimes as companies, we focus first on our own, the value we get out of something, and then customers don't see the value of doing something just so we get the data from it. But in general, the data is obviously very important for us, especially as a large company that has a significant footprint, because it can help us design better products. It can help us personalize the offerings that we have to individual customers. In general, the boundary of that, though, is on ownership of the data and ability to commercialize the data afterwards. If you don't own the data, which even if you can have access to it and use it for things like R&D or personalized services, if you can't sell that

data onwards to other people, that data is really not as valuable as you think. It is a halo effect, a bonus, a nice to have. I can improve my products a little bit. Does it generate incremental revenue? Maybe a little bit. But where companies make money off of data is by commercializing the data. In a healthcare landscape, it is very difficult to regain ownership over data that is coming from a healthcare institution. And in general, the regulatory hurdles, as well as the ingrained mindset about data from a place where health things are done, regardless of whether or not it has people's personally identifying information or health information in it, is a huge mindset barrier there. Coupled that with the fact that regulators are becoming much, much, much more strict on cyber security. This is something that is making it really, really difficult even just to have access to data. But I think the big hurdle for us in healthcare will be, can you really commercialize that data afterwards? If you can't, it's really just a nice to have.

Niklas Staub: Yeah, thanks. Maybe going over to what's the next question? What challenges can you think of when trying to implement a service business model? It goes hand in hand with the limitations of those models.

Expert C: Yeah, I think this challenge will be not unique in general, but unique to companies that are trying to transition and pivot from a traditional transaction-based model into an Anything-as-a-Service model, is that our IT systems for ordering and billing are just not set up for handling those types of large, autonomous, ongoing transactions. And if you think about SAP, having to transition your business from traditional to XaaS is a massive investment. Most companies that want to go from traditional to Anything-as-a-Service, they're not going to transition their whole business overnight, which means they're going to start small with small areas of the portfolio, probably just software in small segments, targeted markets. But then now you have two worlds supported by only one IT system, which means that mostly everything is going to be manual, ad-hoc, one-off or a second IT system just for that until you can scale. It creates a massive amount of complexity and

sharing within your organization from an IT backbone perspective. That is, for sure, challenge number one. In healthcare, you also have the field force. The capability of being able to sell a one-time thing, to be able to sell just smoke and air of a promise of an ongoing thing is something that can be very challenging, especially when you think about pharmaceutical sales reps. These are classically more scientifically driven people. Higher education, especially in Germany, if you think about it, that can be a pretty big challenge mindset-wise for your field force.

Niklas Staub: Does it help you that you have the service sales reps? Maintenance services, I mean?

Expert C: Yeah, no, we don't, at least not in most places. You may have a sales manager that can help with key accounts. But in general, when you purchase the device, this is something that you're negotiating the duration of the warranty, the inclusion of the service contract, and these types of things at that single point of sale. They're used to that. But in a lot of cases, these are things that are just standard offering. You get a three-year service contract, one-year warranty included, and there's almost nothing else. In general, the customer's willingness to accept that is so much higher. You buy a device, you need a warranty. If I buy a new Apple iPhone, there's a 75 % chance that I'm getting Apple Care+. It's like, do I need it? I hope not. But you just know that's something that you do, and you don't even think about that as Anything-as-a-Service. Even though I'm paying 9.99 per month to have a warranty on it. But in general, yeah, I think that mindset piece is really challenging, not just on the field force side, but also the customer side. I mean, we've been selling our products for 100 years, devices for more than 50 years. You also have customers that you've had long relationships with, and then all of a sudden, you're from one day to the next trying to sell them in a different way, the same thing. It can be a little bit challenging unless you can really identify the value for them in entering into this business model. And if you can't do that to enough of a way that makes them want to change what they've always done, they're not going to be open and receptive to it.

Niklas Staub: But are these customers actually the ones who are trying to target with those models or is it more like the younger people that are maybe also used to paying Netflix and they're just more comfortable with those service models?

Expert C: Again, this is a challenge where it's not B2C, it's B2B. In B2B, you are not talking classically to the young people that are more hip and interested in this. You're talking to a head of department, you're talking to a head of a procurement business that's probably in their mid to late 50s, maybe their 60s. You're just talking to a different demographic of people. Yes, eventually, in 10-15 years, the people that are our generation will be in those high-level management positions making purchasing decisions. But right now, the people we talk to, the younger ones, they're only there to provide input on usability and desirability of the product. They're not there at the table when now we start to sharpen our pencils and talk about negotiating into a deal. That is, to me, a bit of a barrier.

Niklas Staub: Okay, good point. Other limitations which you can think of, maybe also from a regulatory perspective or reimbursement perspective?

Expert C: Yeah, this is the one I wanted to bring up before, which is this is a unique piece, but to me, tenders are a big hurdle. That is a huge portion of our business. When you consider public funding for healthcare institutions, again, you're putting yourself in a class or category that is very challenging because now the source of funding for your customers is government or the large central government-backed or government-controlled, government-funded institutions. Inside of that, the tender process is a nightmare because that's basically you don't have the freedom to sell a customer on a product. The customer says: “Here's this giant document. You need to check all of these boxes and your offering needs to fit exactly in this structure that I have told you.” That essentially eliminates or takes away your ability to deliver any exotic new business model. You're forced into the model that is specified in the tender. And that's something that we found in our

business has been a huge challenge. Obviously, we wanted to launch Anything-as-a-Service for [product name] in Region EMEA. And instantly, what comes back from that is, Yeah, but in Italy, I have a giant tender that I'm not allowed to sell via this service. Basically, if I say it's Anything-as-a-Service, it's not included in the price of the offering upfront one-time payment. And then I look like it's an optional thing or that I don't have it, and then I lose out on the tender to other companies. I think that's a huge barrier. It takes away almost all your flexibility when you're delivering into a tender market. And this brings me back to, well, not everywhere you're selling is into tender. But now half my business is traditional, half isn't, and now my IT system in the background is a mess because now I can't be 100 % of one or 100 % of the other. That is a major barrier. Yeah.

Niklas Staub: Then obviously this is also different for every market, I guess, also the way you are limited in terms of maybe in Europe it's quite similar, I'm not sure. But I assume that every country will have different regulations and different flexibility for those models.

Expert C: Yeah, exactly. You have different regulations for sure. The reimbursement systems are different. The tenders are all different. There are hundreds of different varieties of tenders we have to fill out depending on the market. The durations are different. Also there are preferred or even specified billing periods that may be different. This all creates a massive increase in the amount of complexity. Whereas if you think of Netflix, they have a different price in Europe than they have in the US, but it's still roughly the same. Every customer pays the same thing. It's simple, it's straightforward. We are two, three orders of magnitude higher complexity than that.

Niklas Staub: Okay, there. Maybe trying to look at the future outlook because hearing all of this, it sounds to me like there's not a high demand also from the business perspective to invest a lot in those service business models because you simply can't really project how they will be viable in the future. What is your thought? What do you think about that?

Expert C: I think that we will force it in the software space. I think going forward, almost all software will be done as a service-based model. I think that organizations will continue to try to move in that direction for most of their business. But I see this just being two orbiting black holes of really two different business models trying to co-exist within one organization for quite some time. There would have to be major, major seismic changes in the way that healthcare industries or healthcare institutions and systems worldwide are structured and done from pricing and reimbursement to make it attractive for organizations to move into that fully. I would hope that where the innovation comes that enables this is in the backend IT infrastructure that these large companies or even maybe you have disruptors in that space that creates backend IT for ordering, billing, and customer relationship management that is flexible to dance between both. If you had that, a lot of your problems can go away. You still obviously have the value drivers and these types of things, field force mentality, etc. But if you have an easy, quick, simple system in the background that also automates messages that get sent to customers, handles all of these quoting and billing processes quite easily, and is relatively low investment versus going to SAP and wanting a custom module, that is something that I could see having a very positive effect on people feeling more comfortable to move into that. Then it can be a snowball effect of critical mass of now people are just used to the fact that maybe 20%, 30% of the things that they purchase as a healthcare institution from industry is done in this type of model. Then over time, it may just become part of everyday life.

Niklas Staub: Yeah, but it will not replace the other model in any short or long term. I mean, it's always tough to project, but right now, it doesn't look like it will.

Expert C: It's very, very unlikely that it would be 100% replacement. Yeah.

Niklas Staub: Oh, very interesting. I think because we see so many industries moving into that model and then there are just some industries which are not going to move in that direction or not as likely to move in that direction.

Expert C: I mean, it's like a good proxy for this, is you tell me when the airline industry moves into Anything-as-a-Service model, and then I'll tell you that maybe the healthcare industry is able to do the same, but you have too much complexity and too many variables, including variable cost of jet fuel and things like this that no one's going to offer you like they actually did one time, I think, one airline back 30 years ago did pay a fee and you can use it as much as you want. They had this one-time thing. But that's why you're also transactional based there. There are just some industries where the world around you just does not let you do it. Even though financially, if you could get there, that would be awesome. It'd be perfect as a business. It's just the hurdles are too high.

Niklas Staub: Ok, perfect. Thank you so much for your insights!

Appendix 7: Interview Transcript – Expert D (October 19, 2023)

Niklas Staub: I would just ask you to maybe give a short introduction to yourself and your role and how you might have had touchpoints with the topic.

Expert D: I am head of market access and health economics for the DACH region at [company name]. [company name] is a large portfolio MedTech provider with [specific information] billion in sales and activities across a broad spectrum: orthopedics, surgery, ambulance equipment and so on. I myself am also piloting innovative digital business models or solutions in my area. And with the approach: how can we offer not just a product, but a solution that is more than just the individual product. It's also about the digital patient journey, where the implant or the surgery is one thing and then offering more around it in order to achieve more standardization for the use of our product technologies the other, but then of course also to generate more data. This also aims to achieve greater differentiation from the competition and generate more sales. I am also piloting this because I hope to obtain data with which I can show that our solutions have added value compared to the current supply model or competitor products. The market access approach, so to speak.

Niklas Staub: Yes, super exciting. Cool. And do you already have some models at [company name]? Well, you mentioned that you're piloting a bit. In which direction is servitization going for you? How would you define that for you?

Expert D: Let me give you an example. We have a robotic assistance system in arthroplasty, the leading system. It's a bit comparable to Davinci, the system from Intuitive Surgical. And there is the implant and there is a robotic system. Then there's analytics, which helps the hospital to improve the operation, perhaps to benchmark itself. There is also the digital patient solution, which helps to standardize data for analytics, but also processes. And servitization is mainly in these last three. In robotics, there is a product specialist, i.e. a clinical expert who accompanies the operations. This is a service provided by [company name], which also costs money. An employee must be present at

every surgery to operate and support the system. And the other two things are ultimately also service models that are to be increasingly monetized.

Niklas Staub: Yes, okay. Are you also going in the pay-per-use direction, for example? If you look at the payment for the products, how does that work?

Expert D: Yes, we try it out every now and then. Not a big deal yet, I would say. But it is of course a possibility. That always depends very much on how the procedure is reimbursed for the hospitals. In Germany, for example, the financing for capital goods, i.e. investment goods in hospitals, and for operating costs is very separate. And so there are more and more models where you somehow bundle this or, so to speak, finance the capital goods via the procedures. That's difficult in Germany because it's so separate.

Niklas Staub: And the areas that you've now addressed, with the model that you have, how is that then charged to the customer? Is it always a one-time purchase of this service?

Expert D: We have the digital patient platform, which costs X euros per patient. But then there are also models where you pay a certain amount for all patients per year. I don't think it's yet clear which is the best model.

Niklas Staub: Yes, okay. Yes, but it's definitely very exciting. I've already spoken to some pharmaceutical companies and it has become clear that servitization really has very little potential and is more focused on the MedTech sector, especially with regard to equipment for hospitals. As I understand it, you are focusing more on products that are suitable for hospitals, such as this robot, and less on implants, right?

Expert D: Yes, you can also use the robot system in ambulant settings, so that's also going more and more into the ambulant setting, if that's your question.

Niklas Staub: No, I mean more in the direction of the patient, for example. So who the customer is in that case. Is the customer then the hospital or the patient?

Expert D: The customer is the hospital first and foremost. Yes.

Niklas Staub: And if you look at this shift now, away from the product-centric business model to this service business model. Where did that come from? Why do you think the industry is now looking at this?

Expert D: Yes, so it's mainly profitability. So the price pressure on the product price is enormous and people are trying to establish other revenue pools. Because the price pressure on the product is so enormous, you have less room to offer things for free. Especially in Germany. In France, most implants are twice as expensive as in Germany, and in the UK too. And that's why you actually have to charge extra for everything in Germany. The market is more or less moving in that direction. For example, clinical support for operations, etc. You can also increase customer loyalty with service packages. Data is also becoming increasingly important. Here you always have to consider data protection and the customer needs an incentive to provide you with the data. There must also be added value. This is usually possible with a service like this.

Niklas Staub: Yes, absolutely. That's a very interesting topic, because that's exactly what I did in my role at my former employer. And there I worked on a pay-per-use model and the data that could be analyzed was more of an advantage for the company and the pay-per-use model was not so attractive for the company, to be honest, because it is of course associated with high costs and more effort. But the data was so valuable that it was delivered as a kind of goodie for the customer in order to get access to the data.

Expert D: Yes, exactly.

Niklas Staub: Do you also feel this push from the customer side, i.e. that customers are also saying we want more services? Or is this more something that is only related to the reasons you have already mentioned?

Expert D: It's hard to say. Customers want that a little, but the average customer is still a further away. Of course, many customers already have the problem that they have a shortage of resources, that they themselves are somehow thinking about how they can expand their value pools. And that's why they are interested in partnerships. There are also models, e.g. Medtronic, that set up entire cathlabs for hospitals and then equip them with their products. And then, of course, there is the motivation for the hospital that they don't have the capital to do it themselves and don't have the people or the time.

Niklas Staub: What's it like in the MedTech industry in general? What I've learned in pharma is that the problem with these service models is often that you shouldn't influence the doctor in deciding which medication to prescribe. This also limits these service models, for example, because you can't restrict the customer or the doctor to one medication. Is this different in the MedTech industry or is this restriction at least officially in place?

Expert D: Yes, you have to be careful. It is contractually very difficult in Germany to set up these concepts. Yes, there is a certain kind of restriction.

Niklas Staub: All right. And in your opinion, what are the advantages or disadvantages of these service business models for your company, for example? You've already mentioned the revenue pools, for example, which can be expanded.

Expert D: Exactly. I think in the short term, things like this often fail because the profiling is lower at the beginning than in the product business. And if you then have a product division, you say yes, why should I invest there now? In the long term, that usually turns around or at least that's the expectation. That was a disadvantage. Another disadvantage is that they are usually somehow more complex and more difficult to set up legally, in terms of data protection, etc. The advantages are the data that often comes with it, which can be analyzed. But also higher customer loyalty due to higher switching costs. You are also likely to be closer to the customer and have a better customer

relationship. One disadvantage is that sales staff often first have to learn how to sell these services. Because you need different skills and experience than in the normal product business.

Niklas Staub: Okay, very good.

Expert D: Yes, exactly.

Niklas Staub: And we don't have to go through that in such detail now, but can you think of a few advantages or disadvantages for the customer, for example? Just off the top of my head.

Expert D: Yes, the customer can outsource a few things to us that they don't have the capacity for themselves. Or there are some customers, for example, who want us to provide nursing staff in the operating theatre who specialize in orthopedic operations, so to speak, because they simply can't get nursing care themselves and perhaps can't pay them well enough. Customers think that we have more flexibility here. Financing options, i.e. that you have other financing options within larger service models that perhaps give the customer more flexibility. For example, we also offer a service that allows customers to switch to our products. The advantage of this for the customer is that they can operate again more quickly. So service and process optimization. Plus this analytics program that I mentioned, which of course also helps the customer to improve. That the surgeries become faster, better, fewer errors, costs and time savings.

Niklas Staub: Are you already building platforms that allow customers to view the data, so to speak? And perhaps following on from that question, are these platforms that you are only building for your products? Or are they platforms that can also work across companies, for example with other products or interact with other devices?

Expert D: Well, we have this platform, most of it is still, let's say, exclusive to ours. Of course, we are also thinking about making it a bit more open, but it's still more of a closed system, so to speak.

Niklas Staub: Yes, because I find the topic very exciting, as it is clear that many companies are now starting to create digital products with these digital solutions. And if you compare this with

consumer products as we know them, such as the App Store or iTunes, at some point one of these products may become established, so that not every hospital has a different system. That's why I think it's a very exciting area.

Expert D: Yes, exactly.

Niklas Staub: Okay. In your opinion, what are the critical success factors for such a service business model? What has to happen for it to work? What I've already heard, for example, is the Internet of Things in general, the connectivity of the products, because these services often work on data. Are there any other things you can think of?

Expert D: Connectivity in any case. I need experts for this area, both for sales and for setting it up for customers. I probably need to do this in a separate unit so that it is separate from the legacy business, so that it is simply a different way of thinking. You need a different mindset to some extent. You need to have a strong proof of concept if you want to sell it. So you probably need to invest at the beginning, do two or three free projects with well-known customers. You have to continuously improve, so you have to work in a very agile way. At the same time, of course, you have to somehow take into account the regulatory restrictions in the healthcare market, which are significantly higher than in all other industries. You have to take them into account, but at the same time not let them hold you back too much. You have to be as data-based as possible. The added value for the customer must be clearly recognizable and easy to explain. This is not always the case. And ideally, it must also be scalable. In other words, the more data, the more value, so that there are network effects, so to speak.

Niklas Staub: Yes. Okay, yes exciting. And then maybe going further. You've already mentioned a few challenges. Can you think of a few examples that you experienced where you ran into problems when you tried to implement something like this or in the proof of concept phase, for example?

Expert D: Data protection, data protection, data protection. Data protection is always very, very difficult in Germany. Also the willingness to pay for it on the customer side, because sometimes they think: "I'll get this for free because I'm buying your product." The deal conversion cycles are longer than in normal business, but so are the implementation cycles. You need other people to sell and implement it. You also need more after-sales support in some cases. Then there's the lower margin at the beginning, which is always compared to the product business. Yes, those were the most important ones.

Niklas Staub: If you look at the customer's willingness to pay. Many products that we use on a day-to-day basis, such as Netflix, Spotify or online magazines, now have a subscription model. You now have to pay for everything. There is a paywall almost everywhere. Have your customers already gotten used to these paywalls and do they expect them in your sector? Or is it still difficult for you to implement something like this in hospitals?

Expert D: It is still difficult to implement something like this. Especially in healthcare because it is so regulated. I can think of another challenge. You also need know-how and capacity on the customer side to implement service models. These are often completely lacking. In addition, hospitals are often at the limit of their budgets and therefore also lag behind in terms of willingness to pay for services.

Niklas Staub: Yes, okay. And if we go into the hospital now, who is your customer for these service models? So who are the people you talk to? Both in the hospital and, if applicable, in terms of financing?

Expert D: You actually need the head physician, a clinical champion. You also need someone on the business side, preferably as high up as possible, i.e. C-suite. And ideally both, so that they can say: "Dear colleagues in the hospital, we have to do this now." And if you don't have that, then it becomes very difficult with the other departments. Because they're all overworked and then you

don't get any IT capacity. IT basically says: “Yes, we can do it, but not for another two years.” Data protection and the legal department cause problems because these are often new models.

Niklas Staub: Yes, okay. Yes, great, thank you very much! The next question is actually very similar and you've already touched on it. So what are the limitations of these service business models in the healthcare industry? You've already mentioned regulations, the highly regulated market in general. Are there any other things you can think of?

Expert D: The most important thing is that it's often not as well scalable across countries compared to the implant business. Because you can sell an implant in other countries if you have a license. With service business models, you often have to somehow find other contractual constructs and other data protection concepts. So scalability is a limitation. Know-how, capacities on the customer side and the willingness to pay are problems. Also how certain things are reimbursed in the healthcare sector, i.e. where customers get the money from, so to speak. That also limits whether they can do something like this or not or only in a complicated way.

Niklas Staub: So what's the status there in terms of reimbursement for these models? Is it something that is already being considered to some extent? Or are you still trying to implement it in the industry or in regulations that don't actually allow it officially yet?

Expert D: Yes, it is already permitted, but it is very complex. And because it is complex, it takes a long time.

Niklas Staub: All right. Okay, good. Let's look into the crystal ball. What do you think the future holds for these service models in the healthcare industry? And what is the current status for you? How much of your revenue do these service models account for? Or is it only a very small fraction at the moment and you are more likely to be piloting them?

Expert D: A fraction. And yes, it will become more. Simply because of revenue and profitability, it has to increase. But it's very difficult to know when and how.

Niklas Staub: Yes, as you say, different to each country and not scalable

Expert D: And the mindset is changing so slowly. These are basic requirements. Yes. Exactly. Difficult.

Niklas Staub: And it's probably extremely different for each customer even within a country, also in terms of implementing the IT stuff. Everyone has a different IT department, everyone has a different IT security checklist and so on.

Expert D: Everyone has a different HIS system, a different hospital information system where you have to integrate and yes, that's exactly why it's very complex.

Niklas Staub: Okay. Yes. Super. Yes, [Expert D], thank you very much in any case for your impressions. That helped me a lot and confirms my theory that this is a topic that is being looked at, at least in MedTech. But now, for example, if you compare the pharma side of the field, it's something that will somehow have little relevance in the future. But especially because I learned that you can hardly generate any revenue there. You seem to be able to do that now or at least in the long term at some point.

Expert D: That's the idea. Exactly.

Niklas Staub: Very interesting impressions in this respect. Thank you very much.

Expert D: Yes, it was my pleasure.

Appendix 8: Interview Transcript – Expert E (October 18, 2023)

Niklas Staub: Are you familiar with the term servitization or Anything-as-a-Service?

Expert E: I mean, basically shifting from a product to service-centric, right? Yeah.

Niklas Staub: Exactly.

Expert E: You've written that. My question was, there's a difference between service of a product and Software-as-a-Service. What are you looking for?

Niklas Staub: We're actually trying to evaluate everything. So when looking at Anything-as-a-Service, I think Software-as-a-Service is a subgroup of it. But then there's also Devices-as-a-Service, for example or services around the product. So what we're just trying to evaluate is really, in the healthcare industry, what models are you using? So one of the models could be a Software-as-a-Service, but then another one might be, for example, you have Pay-per-Use models or whatever. So it's basically both, which we are interested in.

Expert E: Yeah. So it's more about financial modeling of a purchase rather than post-sale maintenance service part of it?

Niklas Staub: Exactly, yeah. So service could be something which is included maybe. So, for example, you decide that you have a monthly fee or you have a Pay-per-Use model where the service could be included, that's then obviously also in scope, but it's rather about the business model of selling the product and not necessarily the maintenance of it.

Expert E: I don't know how much you want to include that, especially in healthcare industry, what happens is if the equipment has a very high capital investment, now this is coming to imaging equipment like MRI and PET scans and those things, because the capital investment is so high, the imaging companies actually don't make money from the sale, but they make money from service, which is maintenance.

Niklas Staub: Ah, okay.

Expert E: And the maintenance margins are so high because when, especially again, in the case of the healthcare industry because it's regulated and it's also so niche, you can buy the most expensive car and there will be a local dealer who can still take a look at it and they'll still be fine. Whereas let's say if it's a PET, CT or a high-end MRI from a particular company, as soon as somebody else touches it, it's gone. Your warranty is gone. All the parts are gone. The company will not even touch it. So when you buy such equipment, one of the really attractive business models is to sell at almost cost. They don't make money from the sale. It's what happens after the sale, which is the post sale.

Expert E: It could be maintenance of just the equipment. It could also be upgrades. It could be anything related to that equipment, and that's where most of the companies make money in diagnostic field at least.

Niklas Staub: Okay, yeah, that's good to know. I didn't know that actually, but very interesting then. But then obviously service is something which is really important as a business model then for the companies.

Expert E: Very because you can't really compete in a market with such tight competition, so many options available with high prices. So all of this matters in what type of market you're playing as well. And the next step to that is you can only go down on price so much, that's when you start coming up with financial models. That's when you start giving the customer options of, Okay, maybe don't even give me a capital investment. Rather, I will defer this by X, Y, Z means, so that it elevates pressure on you. But more than that, the industry is saying it elevates pressure on me as well, because there's only so much discount I can give you on my price. In the end, I can't go below cost. So there's that part of it, and that's what brings in the need to have financial models which are a bit more lucrative than one-time purchase.

Expert E: Which adds to the point of how both service maintenance can also be then part of this. And that's how you can tie these two points together too.

Niklas Staub: Yeah, that's very interesting, actually. And so how is the sale going, for example? I'm a bit familiar with how it's working at [company name] at the moment. But for example, for the bigger MRI machines or CT scans, is that then a one-time purchase or are they usually leased or are they giving for free and then you pay-per-use or how does that work?

Expert E: All of these options are something that can be looked at and are being looked at by pretty much every vendor in the market today. I think gone are those days. I remember even five, six years ago, the customer would themselves ask: "What are the ways that you can help me purchase this equipment where I don't have to make such a huge capital investment?" So if it's such a high risk on your budget, then can we do risk sharing? Companies like Siemens have their own financial wing. I think GE also has one, but they don't have it like what Siemens has something called Siemens Financial Services, which is basically an NBFC (non-banking financial company). They can help this. So when an equipment is too expensive and the customer doesn't really want to go to a bank to get a lease or a loan, the company can go to their financial wing and be like, can you have this on your books and we shate the risk.

Having said that, one thing that is really important to understand is as soon as you provide any type of deferment in payment, the overall cost of ownership is always going to go high. And if an equipment costs $100 for one time payment, then if it's being deffered into, let's say, five years at 60 installments monthly, then the price will definitely go up by 20 % or more, depending on how big the risk is. So the factor of deferment and the risk also comes in where you need to understand the customer's portfolio. What do I get, in terms of supplier, by having this equipment in this particular institution? Is it going to give me marketing advantage? If it's a huge hospital where I can say, Look, they have it. Because of that, you should have it too. Then for me, the risk appetite

is a bit more. I can take a bit more risk. Having said that, there's definitely going to be a price increase compared to one-time purchase. That's the whole ideology behind it.

Niklas Staub: Yeah. But this is now really focused on the payment of the product. So it's another financial model, instead of just buying a one-time purchase you have now, for example, a lease or you paid in installments.

Expert E: (confirming nodding)

Niklas Staub: But thinking of a service model, is this something which is also considered? So for example, we don't just offer the CT scan anymore, but we offer a whole lab, for example. We will equip your hospital with a whole lab with products from either only our company, but also maybe other companies. And then you will, for example, pay us X amount because we've offered you that service or consulting services included and stuff like that.

Expert E: Yeah, there are. There's a wing in Siemens, which used to be called enterprise Solutions back then. I don't know about other companies who've done that. There were a few pilots within [company name] that was being checked where, from my experience, at least in [previous company name], I have given offers to customers where, You can just give me a piece of land. We will build the hospital. We will equip the entire hospital. We will bring in the healthcare professionals, everything run the show. But you have the name. So if it's Berlin, take the best possible name that's there. And if I have another hospital on the other side of Berlin, which could be Charité 2.0, then people already know this brand, that Charité is good, then they will come for it. And if they're coming, depending on how much is my investment in terms of the vendor's investment, usually the revenue share here, it'll be a lot. This will not be called as a servitization because this is more a revenue share because the risk appetite is really high.

And this is where the negotiations happen about, okay, do you have your own health care professionals or am I providing that too? Are you going to build the hospital or am I going to do

that too? Are you going to give me a space? Are you going to give me one department? Usually, imaging department is given out to somebody else because of the, again, huge capital investment. There are models that way where one vendor can bring in different vendors together, because in the end, the customer gets one face and they would prefer that. Usually, this type of business is for those hospital chains. This would not be a small hospital because nobody would want to do that for them. So if you're an established brand already and you really don't want to invest on resources to bring in another one, but you would rather have that taken care by somebody else, but continue your brand, continue building your brand, this is the scenario where what you were talking about comes in, where a vendor takes over everything, depending on how much and what the customer wants. And then depending on the investment, you need to also recoup that investment, right? So if I've invested $100 in this, then within five years, I would like to get the $100 back and then from there also make money. So when do I want my break-even point? How soon can that be? These are the things that will then come into picture.

Niklas Staub: Okay. And if you try to think about service business models now, really, okay, think of an [product name] or whatever or building that into a service. Do you have some examples? Is [company name] trying to do that at the moment or are there initiatives?

Expert E: Without getting into specifics, I think what is not just, but the industry looking at right now is not one equipment. It need not be just an injector, because the offer needs to be a bit more holistic for you to go into business models or service models and things like that, where instead of saying buy this injector or buy this contrast media, if I say, have the injector, contrast media, some software that could help you better use the injector, some software that could help you understand the use of contrast media and the extent of use. Also allowing for cross-selling. Can the injector talk to the equipment, the imaging equipment? Because it's really important when it comes to contrast that it is given at the right time. So there has to be proper communication between ancillary

equipment and the main equipment, inventory management, dosage, blah, blah, blah, all of this. It's about what we are seeing right now in the industry. It's about combining a more holistic offer so that a hospital can be... They don't have to worry about when do I have to order more consumables? Or am I going to be out of my contrast media?

Or is there going to be an audit where somebody's going to ask me “Did you use too much dosage?“ All of these administrative tasks, along with the procurement and invoicing, do I have to keep on invoicing somebody at different vendors? All of that is a headache. So what the industry is looking for is to bring in automation in that. And also, that's the risk the industry can take, because it's their equipment and it's their offering, right? So they can have one invoice and be like, Okay, we are going to take care of all of this for you. You will have to pay me once a month with one invoice and you get all of this. Let us take care of it.

Having said that, again, people are not there to do charity, right? It's a business. So as soon as all of this comes, even though it might look lucrative, it comes with the cost. You will never be able to provide this type of service at the same price if you compare. Let's say for five years, you've compared this with one-time purchase, it'll never be the same price. It'll be higher. But the opportunity cost of this premium that you're paying, the way you need to look at it is, am I saving on my headache? Am I saving on my resources for invoicing? Am I saving on unwanted audits and legal issues? Am I saving on the actual contrast media? A lot of contrast media gets wasted if it's not given in the right way. So the benefits of that, which is called value communication, has to be done in a way where you don't compare price to price. It has to be what's the opportunity cost of this type of an investment where if you're deferring, the savings is done in a different way and not just multiply it by five times.

Niklas Staub: Okay, yeah, makes absolutely sense. And is there any trend in the industry that is pushing in that direction? Or where is the interest from customers coming from? So, for example,

thinking about pressures on just what you hear, for example, of the NHS in the UK, where they have a lot of pressures on the imaging departments, for example. Are those reasons why these models are interesting for customers or is it more coming from the industry side?

Expert E: You would have to divide the market. There's no one reason for it. You said NHS, their problem is there's more demand than they can suffice. So they will have to bring in more efficient ways to do this. That's why they're investing so much in AI and digitization and these things because number of radiologists are going down, number of sick people is going up. There is a discrepancy between this. Somewhere, we need to bring in automation. And especially when it's a trust and it's not about profit making, then there's a certain amount of fund available, and this fund is not going to keep going up. It'll remain the same. Having said that the number of patients keeps going up. So how can we efficiently manage this fund to cater to a demand which keeps going high? And add to the fact that expertise required is very expensive, and this is where the demand is being seeded about, okay, how are ways the industry can help elevate this pressure that we have as a healthcare-industry about, I may not have a neuro specialist in my hospital 24/7. So if there's a stroke patient that comes in the night and I don't have a specialist, neuro-radiologist or even neurosurgeon available, who is going to take a look at this patient?

And how can we best serve the need at least until someone is available? So this is where the lack of expertise available will have to be somehow funded through the different models and ways of digitization and financing and things like that from the industry.

Niklas Staub: Yeah, okay. That makes absolutely sense. And what do you think? Is this business model of servitization interesting for healthcare companies or is this more of a headache itself? Because a lot of investment needed also changing in the way you invoice, for example. How is that? Is that actually beneficial for the companies or do they just follow the trend and the need of the customer?

Expert E: Twofold. Again, it's almost inevitable, so you have to keep up with it. This is a trend where I told you, gone are those days where huge capital investment would be done and taken care of. It's almost prisoner's dilemma, right? There's somebody else who's going to do it if you don't do it. So I'm scared that if they do it, I'm going to lose out on my market, so I've got to do it too. You can't cuddle with all the players in the market and be like: "Hey, don't offer it". There's somebody who's definitely going to offer it. That seeds the requirement of the industry having to adapt to these changes. They have to. AI is here, digitalization is here. As soon as you bring in software, that means nobody wants to pay. How do you understand the value of software? There's no immediate benefit. It's going to be long term benefit. If it's going to be long term benefit, that means I need to defer. I need to offer SaaS services and things like that. It is something that they have to do. But the byproduct of doing that is you get relationship with the customer, which is long term.

If it's a one time sale, the salesperson comes in, sells something, goes to the next customer. That customer is no longer in the radar unless and until there's the service person going there for any requirement. So one other thing that's beneficial by having this is the long term relationship is data is money. You are getting data. When you invoice a customer for five years, you know that they are using so much and you can extrapolate that data. You can use that data for a million things today. So that's an advantage, which is a byproduct of having a more long term relationship and new business models because you get access to all this data, which you may not have before. Yeah.

Niklas Staub: And thinking of this business model, do you think there are some limitations with it? So, for example, regulatory limitations. Is it tough to implement it? Is it easy to implement it?

Expert E: The biggest hurdle is reimbursement. If what is reimbursed is one procedure. And that's how the equipment or the hospital would understand that an equipment is viable or not. If I buy this equipment, I can do so many procedures. This much is the amount that is reimbursed for this

procedure. Eventually, I'll make this much money. Then it makes sense that this is financially feasible and viable. There is no package or there's no AI that is reimbursed or there's no software that is reimbursed today. It's all procedure related reimbursements that are there. Lack of reimbursement is causing a big problem for understanding what's the value of this. How do you quantify the benefits of these things? That's a big drawback, both for the companies and also for the institutions. If a radiology department has to go and ask for their budget to their CEO, they need to show that benefit saying that I'm bringing in this benefit. How do you show that with something that's not tangible right away? To show long term benefits is difficult. So that's one thing. And for the industry itself, to train your salesperson to be like, you're not going to get incentivized by selling one big equipment now, but rather you'll have to bring in SaaS-related models and things like that, which the sales team, legacy sales people would not be able to do this. I have seen that everywhere. So how do you adapt your sales approach? Then internally, is my IT system ready? Is the SAP ready? The invoicing used to be equipment based. Now, if it has to be a package based, then the invoicing system internally needs to change. Is the company ready for such a big change? How much is it going to cost them? And especially in huge corporates, that means change of ways of work in ways that they never imagined. So can you bring about those change? So it's difficult, but it's inevitable and they will have to do it. So the drawback is if you don't do it, then you're lagging behind somebody else who's going to do it.

Niklas Staub: Very good insights. Thank you very much. I know we're already over time. I'm not sure whether you have a hard cut.

Expert E: Yeah, man, I have another call already. So unfortunately, I will have to drop off. But hopefully whatever I gave you was helpful enough.

Niklas Staub: Definitely. Because I was looking at pharmaceutical companies earlier and what I actually found out is that there's not a lot of potential, at least when it comes to just pharmaceutical products.

Expert E: You know why?

Niklas Staub: Yeah, mostly also because you have a label and stuff, so you cannot change it into a service. And you obviously also have a patient involved who's not paying for it.

Expert E: Yeah. And also their revenues and profit margins are high already. If you're protected by a patent as a pharma product, then they know that nobody else can offer the same product and come up with, Oh, you take this product in a lesser price, but it's not going to work that way because this is paid and protected. That can't happen in the other parts of the industry. So when you have a cash cow, when you have a chicken that's giving you golden eggs, you're not going to be like, Oh, I'll give you deferment. It doesn't really make sense for pharma.

Niklas Staub: Yeah. Okay. Yeah, good point.

Expert E: All right, man.

Niklas Staub: Thank you very much.

Expert E: All the best.