Artificial Intelligence & Digital Ecosystems and Their Role in Shaping the Future of Automotive Aftersales

Mona Raudies

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Abstract

Title: Artificial Intelligence & Digital Ecosystems and Their Role in Shaping the Future of Automotive Aftersales

Autor: Mona Raudies

This thesis examines the role of artificial intelligence (AI) and digital ecosystems (DEs) in shaping the future of the automotive aftersales domain. This research addresses a gap in the existing literature, which has predominantly focused on broader digital transformation trends, thereby leaving the specific implications for aftersales services underexplored.

By employing a qualitative approach based on 11 semi-structured interviews with experts from the automotive and consulting sectors, the study identifies key use cases for AI and DE integration, including personalized customer experiences, AI-driven customer support chatbots, and predictive maintenance. Additionally, it explores the strategic role of aftersales DEs in enhancing the competitiveness of original equipment manufacturers (OEMs) by improving customer relationships, leveraging external skills and knowledge, and establishing entry barriers. Furthermore, the research identifies significant challenges in the integration process, including the harmonization of technology, data management and regulatory compliance. The study concludes with lessons learned for OEMs, emphasizing the importance of a holistic approach, workforce education and the need to balance technological innovation with human-centric strategies.

Overall, the findings contribute both to the academic discourse and provide actionable recommendations for industry practitioners aiming to leverage AI and DEs in the rapidly evolving automotive aftersales sector.

Key Words: Automotive Industry, Aftersales, Artificial Intelligence, AI, Digital Ecosystems, OEM, Customer Experience, Technology

Abstrato

Título: Inteligência artificial e ecossistemas digitais e o seu papel na definição do futuro da pós-venda automóvel

Autor: Mona Raudies

Esta tese analisa o papel da inteligência artificial (IA) e dos ecossistemas digitais (DEs) na definição do futuro do domínio do pós-venda automóvel. Esta investigação aborda uma lacuna na literatura existente, que se tem centrado predominantemente em tendências mais amplas de transformação digital, deixando assim subexploradas as implicações específicas para os serviços de pós-venda.

Ao empregar uma abordagem qualitativa baseada em 11 entrevistas semi-estruturadas com especialistas dos sectores automóvel e de consultoria, o estudo identifica os principais casos de utilização para a integração da IA e da DE, incluindo experiências personalizadas do cliente, chatbots de apoio ao cliente orientados para a IA e manutenção preditiva. Além disso, explora o papel estratégico dos DEs de pós-venda no aumento da competitividade dos fabricantes de equipamentos originais (OEMs), melhorando o relacionamento com o cliente, alavancando habilidades e conhecimentos externos e estabelecendo barreiras de entrada. Além disso, a investigação identifica desafios significativos no processo de integração, incluindo a harmonização da tecnologia, a gestão de dados e a conformidade regulamentar. O estudo conclui com as lições aprendidas para os OEM, salientando a importância de uma abordagem holística, a formação da força de trabalho e a necessidade de equilibrar a inovação tecnológica com estratégias centradas no ser humano.

No geral, os resultados contribuem tanto para o discurso académico como fornecem recomendações práticas para os profissionais da indústria que pretendem alavancar a IA e os DEs no sector pós-venda automóvel em rápida evolução.

Palavras chave: Indústria Automóvel, Pós-venda, Inteligência Artificial, IA, Ecossistemas Digitais, OEM, Experiência do Cliente, Tecnologia

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The submission of this thesis marks the end of my time at Católica Lisbon SBE. During my master´s degree I was not only able to expand my academic knowledge and lay the foundation for my professional career, but also to gain new experiences and form incredible friendships. None of this would have been possible without the support of several people.

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List of Abbreviations

OEM	Original Equipment Manufacturers
AI	Artificial Intelligence
ML	Machine Learning
DL	Deep Learning
DE	Digital Ecosystem

1. Introduction

"Disrupt yourself or risk being disrupted. That's true in every industry today. But when it comes to the automotive industry, disruption can be a massive opportunity" (Russell, 2024).

This statement reflects the current state of the automotive sector, in which the integration of artificial intelligence (AI) and digital ecosystems (DEs) is reshaping the industry. These technologies not only shape how Original Equipment Manufacturers (OEMs) operate but also present an opportunity for innovation and growth, particularly within the aftersales domain. The aftersales domain is of high significance to OEMs as it represents an important revenue stream and is also directly linked to customer satisfaction (Gaiardelli et al., 2007; Li et al., 2014; Rahim et al., 2021; Shokouhyar et al., 2020). In the context of today's competitive landscape and the accelerated pace of technological advancements, OEMs increasingly recognize the central importance of the aftersales area for their long-term success.

Despite the significance of the aftersales sector, the integration of AI and DEs in this area has been largely overlooked in both theory and practice. Prior research has predominantly focused on the broader implications of digital transformation within the automotive industry (Fabbe-Costes & Lechaptois, 2022), thereby overlooking the particular opportunities and challenges that emerge in the aftersales area. This limits the ability of the OEMs to fully leverage the potential of AI and DEs to enhance their aftersales offerings. This study therefore aims to fill this gap by investigating the role of AI and DEs in shaping the future of the aftersales area.

The dissertation begins in chapter two with a literature review on the key concepts in relation with the research questions, namely the automotive industry, AI and DEs. This review provides a comprehensive overview of the current state of literature and forms the basis for the identification of a research gap. Chapter three presents the research methodology including the sampling strategy, data collection method and data analysis. A qualitative research approach in the form of in-depth interviews is adopted in order to investigate the practical reality of implementing these technologies in aftersales operations. The fourth section then provides an overview of the four key results, namely the identification of key use cases for AI and DE integration, the strategic role of aftersales DEs in strengthening OEM competitiveness, the challenges OEMs face in this implementation process and lessons learned from ongoing efforts for OEMs. In the fifth section, these results are then linked back to the literature review and contributions to theory and practice are derived. Additionally, limitations are pointed out and a

future research agenda is proposed. Lastly, the research is concluded in chapter six which summarizes the main findings and contributions.

2. Literature Review

This section provides a comprehensive overview of the current body of literature on the key topics of this research. Relevant literature was identified based on a targeted search using keywords such as automotive industry, aftersales services, automotive supply chain, artificial intelligence and digital ecosystems, utilizing Google Scholar and EBSCO. The final review is based on 35 peer-reviewed journal articles, seven books, one conference proceeding, and two webpages, thereby ensuring a robust and diverse foundation for the review.

The literature review provides an overview of the automotive industry, with a particular focus on recent developments and the aftersales domain. Subsequently, the concept of artificial intelligence and digital ecosystems are introduced, and their application within the aftersales domain is examined. Finally, this section identifies a research gap, thereby establishing the theoretical and practical relevance of this thesis.

2.1 Automotive Industry

This section sets forth an overview of the industry structure as well as the evolving role of original equipment manufacturers (OEMs). Gaining an understanding of the automotive industry in general as well as the recent developments in the sector is crucial for the contextualization of the implementation of AI and DEs in the aftersales domain.

2.1.1 Automotive Supply Chain Overview

The automotive industry consists of a network of diverse stakeholders that fulfill individual roles along the supply chain (Reddy et al., 2021). From the perspective of car manufacturers, the activities can be summarized in upstream-, OEM- and downstream-activities (Fabbe-Costes & Lechaptois, 2022; Riasanow et al., 2017). First tier suppliers assist the OEM in the development, design and technology for the vehicles (Riasanow et al., 2017). Moreover, these first-tier suppliers are responsible for sourcing car components and transporting them to the OEM. Specialized second- and third-tier suppliers in turn provide the first-tier suppliers with other vehicle components and raw materials (Lempp & Siegfried, 2022; Riasanow et al., 2017). These pre-production processes can be summarized as upstream activities (Reddy et al., 2021). The OEM then utilizes the components provided by first-tier suppliers in the internal manufacturing and assembly process to produce the final vehicle. In addition, the OEM engages

in research and development of its vehicles as well as in marketing, sales and aftersales activities (Reddy et al., 2021; Riasanow et al., 2017). Alternatively, the sales and distribution can also be conducted downstream through a car dealer (Fabbe-Costes & Lechaptois, 2022; Reddy et al., 2021). Furthermore, additional downstream stakeholders include workshops that provide repair and maintenance services to customers (Gaiardelli et al., 2007).

All activities that are provided to the customer subsequent to the delivery of the vehicle with the objective of supporting the utilization of the product can be summarized as aftersales services (Gaiardelli et al., 2007; Shokouhyar et al., 2020). These services include customer support, value added services accessible to the customer as well as vehicle repair and maintenance (Balinado et al., 2021; Riasanow et al., 2017; Rigopoulou et al., 2008). The aftersales domain is becoming an increasingly significant focus area for OEMs for two reasons: One the one hand, these activities enable the OEMs to differentiate themselves from competition by proactively addressing customer needs with its aftersales product and service offering and can therefore be a source of competitive advantage. On the other hand, the aftersales domain represents an important revenue stream for the OEMs often surpassing the generated profits from the sale of the vehicle. Furthermore, the aftersales area is closely linked to product acceptance as well as customer satisfaction. These factors are in turn related to customer retention which is central to the long-term success of OEMs (Gaiardelli et al., 2007; Li et al., 2014; Rahim et al., 2021; Shokouhyar et al., 2020).

2.1.2 Digital Transformation of the Automotive Industry

The automotive industry has undergone a significant transformation over the past few decades, largely driven by technological advancements (Fabbe-Costes & Lechaptois, 2022). This digitalization process began 1950-1970 with the utilization of computer-based systems in the internal production management process of the OEMs. As the development and diffusion of computers and digital systems advanced in the 1980s, OEMs integrated digitalization and automation into each stage of the internal manufacturing process. Moreover, OEMs proceeded to digitize the logistics operations associated with the sourcing and distribution processes, with the objective of enhancing transparency and exerting greater control over their operations (Fabbe-Costes & Lechaptois, 2022; Veltz, 1986). New technological advancements in the 1990s facilitated the standardized inter-organizational exchange of data, thereby enabling closer collaboration along the value chain. A prominent example of this is the adoption of the “just in time” strategy where data from first-tier suppliers and internal assembly processes are

integrated to enhance logistics and production efficiency (Fabbe-Costes & Lechaptois, 2022; Fawcett & Birou, 1992). The rise of the internet in the 2000s led to the further digitization of upstream and downstream activities. Upstream, the development of web-based platforms facilitated seamless communication and data sharing with first-tier suppliers. In the downstream sector, the establishment of e-commerce and the adoption of multichannel sales strategies marked a notable shift in vehicle distribution, with a particular emphasis on enhancing customer relationships and experiences (Fabbe-Costes & Lechaptois, 2022; Gereffi, 2001). Since 2010 the digitalization of the automotive industry is accelerating further driven by the integration of advanced technologies like the Internet of Things, Big Data and AI. The aim behind integrating these technologies is to establish fully integrated and interoperable processes along the entire value chain (Fabbe-Costes & Lechaptois, 2022; Ramos et al., 2020). This development also leads to a change of the vehicle design as the increasing integration of digital components into the automobile is becoming the norm (Bohnsack et al., 2021; Rahim et al., 2021).

OEMs therefore need to adapt their traditional business models in order to account for the convergence of the physical product with user systems and to be able to effectively create and capture value from their new customer offering (Bohnsack et al., 2021; Riasanow et al., 2017). As such, OEMs are shifting away from a sole product focus towards including a service-oriented approach into their offering (Riasanow et al., 2017). In addition to the technological development, customer expectations for OEMs are evolving, as customers demand a variety of digital services and expect a seamless experience in the utilization of the interconnected physical products and digital services (Llopis-Albert et al., 2021; Suuronen et al., 2022). Consequently, the shifting OEM business model and evolving customer expectations will lead to an expansion of the aftersales service portfolio. Accordingly, the aftersales domain will become an increasingly pivotal area for OEMs (Fabbe-Costes & Lechaptois, 2022).

2.2 Artificial Intelligence

As previously outlined, the continued digitalization of the automotive industry and the corresponding growth in collected data will contribute to the increased relevance of AI in this sector (Beverungen et al., 2022). This is due to the fact that in order for the OEMs to harness the potential of data to make informed decisions, they require the use of AI for sophisticated data analysis (Brusset et al., 2022). In light of the significance of this topic, the following section will provide a comprehensive review of the concept of artificial intelligence, as well as an overview of the application of AI in the automotive industry.

2.2.1 Definition

The term Artificial Intelligence (AI) was originally defined as "the science and engineering of making intelligent machines" (Collins et al., 2021; McCorduck & Cfe, 2004). In this initial phase, AI revolved around high level cognition including the general understanding or engaging in a multi-step reasoning process (Collins et al., 2021; Russell & Norvig, 2020). As the ability of AI evolved over time, the definition was also adapted. The European Union (2024) defined AI as "a machine-based system that is designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment, and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments."

Machine learning (ML) represents a prominent subfield of AI, which enables systems to identify patterns in large data sets and make predictions based on them. ML provides the ability for systems to learn from data rather than relying on explicit programming (Brusset et al., 2022). Deep learning (DL) in turn is a branch of ML that employs an artificial multi-layer neural network to model complex patters of a dataset (Brusset et al., 2022). The application of ML and DL algorithms is a crucial element for deriving predictions, recommendations and enabling automated decision-making based on historical and real-time data (Brusset et al., 2022).

Although this section provides an extended overview of AI and the subfields ML and DL, it is important to note that the subsequent sections will only address AI as the overarching theme. This approach was taken to focus on the broader impact of AI within the aftersales domain without delving into the specific technological implementations of ML and DL.

2.2.2 AI in the Automotive Industry

AI has been integrated into key areas of the automotive supply chain (Mueller & Mezhuyev, 2022; Rahim et al., 2021). OEMs employ AI in the sourcing of vehicle components to analyze extensive historical procurement and customer purchase data. Based on this information, AI algorithms are able to forecast the optimal sourcing of car components. This process enables OEMs to increase procurement speed as well as reduce manual labor (Jackson et al., 2024; Rahim et al., 2021; Rožanec et al., 2023). The real-time insights about the number of sourced materials and components are then leveraged to optimize associated logistics and inventory management. This ensures the timely distribution to assembly lines as well as enables continuous production (Rahim et al., 2021; Rai et al., 2021). Moreover, AI is incorporated to

enable a smart manufacturing process. A digital representation of all machines, processes and systems, referred to as a digital twin, can be developed to optimize the current production process through the utilization of real-time simulations (Rai et al., 2021). This involves production scheduling of tasks and resources in order to achieve predetermined manufacturing goals and prevent production bottlenecks (Leng et al., 2024; Suuronen et al., 2022). In addition, predictive maintenance and fault diagnosis based on AI algorithms are employed to identify the root cause of a machine fault at an early stage, thereby preventing significant damage and machine downtime. This ensures the reliability of the manufacturing process (Fabbe-Costes & Lechaptois, 2022; Leng et al., 2024). These prominent examples illustrate the importance of AI in improving overall efficiency and productivity of the processes (Rai et al., 2021).

As previously established through the analysis of existing literature on the automotive industry, the aftersales sector is becoming increasingly significant for the OEMs. The anticipated digital expansion within this domain presents a promising opportunity for the integration of AI into the aftersales services. The current body of literature identifies a number of potential avenues for the integration of AI. Such applications include AI-based trend analysis and examination of past purchasing behaviors, which could identify the optimal timing for product and service recommendations (Leng et al., 2024). Furthermore, the integration of customer feedback allows the provision of tailored experience (Rahim et al., 2021). For instance, the introduction of sophisticated chatbots with the ability to examine and interpret images, video, and audio enables the provision of an appropriate response to customer requests and the tone of the caller (Brusset et al., 2022). Moreover, the implementation of predictive maintenance algorithms for customers could facilitate the proactive identification and resolution of vehicle issues, thereby preventing more significant damage (Rahim et al., 2021). These applications illustrate the potential for AI to considerably enhance customer experience and improve service efficiency (Brusset et al., 2022).
Given the significance and rapid advancements of the aftersales service offering as well as AI, a comprehensive analysis of current developments in practice could yield invaluable insights.

2.3 Digital Ecosystems

The formation of digital ecosystems (DE) enables firms to establish a network with the objective of connecting and integrating their individual products and services (Bohnsack et al., 2021; Rahmati et al., 2021). The review of the literature on the automotive industry as well as AI has revealed that the aftersales service portfolio is likely to expand. This expansion

emphasizes the importance of considering digital ecosystems as a means to further refine aftersales services. Consequently, the following section will explore the definition of digital ecosystems and examine their integration within the automotive industry and the aftersales domain in particular.

2.3.1 Definition

The term ecosystem originally stems from the field of biology but was later adapted to the business context (Barykin et al., 2020; Moore, 1993). A business ecosystem was then defined as a group of independent entities, organizations and individuals that collectively contribute towards an intended outcome (Mann et al., 2022; Suuronen et al., 2022). As companies increasingly undergo a digital transformation, they are integrating digital technology into all aspects of their business processes and operations (Kraus et al., 2022; Vial, 2019). In line with this development, digital ecosystems have become the prominent organizational form across many domains (Barykin et al., 2020; Koch et al., 2022). A digital ecosystem is based on a digital platform that enables organizations to collaborate with a variety of independent service providers as well as customers. The digital platform is the technical foundation of the DE and connects a suitable service provider with a consumer as well as enables member collaboration (Koch et al., 2022; Suuronen et al., 2022).

2.3.2 DEs in the Automotive Industry

Many upstream activities of the automotive industry are increasingly integrated into digital ecosystems. Being part of a digital ecosystem helps OEMs and suppliers to leverage the opportunities arising from increasing digitalization and the integration of AI. As previously described, information about customer purchases and sourced components are tracked to forecast production quantity and deduct inventory needs as well as plan logistics accordingly (Jackson et al., 2024; Rahim et al., 2021; Rai et al., 2021). The DE builds the foundation to share information and resources between the OEMs and first-tier suppliers. The collaboration of OEMs with upstream stakeholders has the potential to enhance the efficiency of the sourcing and manufacturing processes.

OEMs are transitioning towards a digital service-oriented approach driven by the increasing integration of digital components into vehicle design (Bohnsack et al., 2021; Rahim et al., 2021; Riasanow et al., 2017). Consequently, the aftersales domain presents a promising field for further DE integration. Several external factors contribute to the expansion of digital

ecosystems into the aftersales domain: Firstly, customers increasingly demand a more digital and wider variety of products and services offering (Suuronen et al., 2022). This trend on the demand side presents new business opportunities for OEMs, which may be leveraged through the development of an aftersales DE. This is the case as the combination of internal and external knowledge of digital ecosystem members into a common data basis improves decision making and enables the identification of customer needs (Suuronen et al., 2022). In addition, the DE enables OEMs to address customer needs better as complementary services from DE members can be integrated into the OEMs service offering or new services can be developed through DE collaboration (Hein et al., 2020; Suuronen et al., 2022). Moreover, by including customers in an aftersales DE, the OEMs can incorporate their feedback into the development of new products and services. This loop is vital as innovation is increasingly driven by technologies and consumers rather than by manufacturing companies (Reddy et al., 2021; Suuronen et al., 2022). Secondly, the review of the automotive industry indicated that market conditions are evolving rapidly in response to the accelerated pace of technological advancement (Fabbe-Costes & Lechaptois, 2022). For an OEM to exploit new market conditions and address new customer demands in a timely and cost-effective manner, it is necessary for the company to encompass a diverse range of skills. However, a single OEM is unable to possess all the necessary resources and knowledge (Fabbe-Costes & Lechaptois, 2022; Suuronen et al., 2022). Thus, partnerships that arise through DEs may complement OEMs' capabilities in an effective way. Thirdly, the automotive industry is experiencing a rise of new market entrants which are also emerging from other industries and are competing with the OEMs (Rahmati et al., 2021). The increasing digitalization provides new actors with the opportunity to enter the automotive market and gain an increasingly important role (Llopis-Albert et al., 2021). An illustrative example is the entry of the software firms Google and Apple the automotive industry with their car infotainment platform offering (Rahmati et al., 2021). In response to the rise of new market entrants, the development of DEs may become crucial for OEMs as they facilitate close collaboration with external actors and thereby strengthen their market positioning.

Given the identified potential for the establishment of an aftersales DE a detailed investigation of current industry practices could provide a thorough understanding of the subject matter.

2.4 Research Gap

A review of the relevant literature reveals a considerable evolution within the automotive industry, particularly with regards to the digital transformation, the growing adoption of AI, and the significance of DEs. However, there is a notable gap in the existing research regarding the

practical application of these technological developments within the aftersales sector. The aftersales domain is emerging as a critical area for OEMs, as reflected in the literature, not only as a significant source of revenue, but also as a means of improving customer satisfaction and retention (Gaiardelli et al., 2007; Li et al., 2014; Rahim et al., 2021; Shokouhyar et al., 2020). Therefore, research focusing on the practical application of AI and DE within the aftersales sector would facilitate a more holistic understanding of the subject matter. To address this gap, this dissertation investigates the current aftersales practices of AI and DE. The opportunities and challenges associated with the adoption of these technologies in the aftersales context will be identified to establish a comprehensive overview.

This study therefore aims to answer the following research questions:

- What are the key use cases for integrating AI within the aftersales domain and how can aftersales DEs enhance the competitiveness of OEMs?
- What challenges do OEMs face in the implementation of AI and DEs in aftersales services and what lessons learned can guide future efforts?

Answering these questions may contribute to fill the gap in existing literature on this topic. The results could therefore help extend current theoretical frameworks and provides new insights into the role of AI and DE in shaping the aftersales domain. Furthermore, the findings of this study have practical implications for managers at OEMs in their AI and DE implementation efforts in the aftersales area.

3. Methodology

There are three main research methods that are commonly used, namely quantitative, qualitative and mixed methods approach (Mulisa, 2022). On the one hand, quantitative research involves the systematic collection and analysis of numerical data, aided by mathematical and statistical techniques, with the objective of identifying relationships between variables. The aim of qualitative research, on the other hand, is to gain a comprehensive understanding of social phenomena through the perspective of research participants (Bell et al., 2022). Lastly, a mixed method approach entails the combination of both qualitative and quantitative research (Mulisa, 2022).

This research adopts a qualitative research method for the following reasons. Firstly, the exploratory nature of a qualitative approach is suited to addressing an identified gap in the literature (Mulisa, 2022). By aggregating diverse perspectives and insights, this method allows

a comprehensive understanding of the subject matter (Bell et al., 2022). In addition, the inherent flexibility of the qualitative research approach allows the discovery of emerging themes and unexpected findings, which is important with a novel research focus (Mulisa, 2022; Rowley, 2012). Moreover, qualitative approach is able to account for the complexity and multifaceted impact of the subject matter on various processes and stakeholders (Bell et al., 2022). Therefore, gaining insights into subjective perspectives on the studied phenomenon is important to properly assess the internal and external impact of the integration process (McCusker & Gunaydin, 2015). By adopting a qualitative approach this research aims to provide a comprehensive overview that contributes both to theory and practice.

3.1 Sample Strategy

The sample of interviewees was chosen based on a non-probabilistic sampling method based on specific criteria (Mulisa, 2022; Vehovar et al., 2016). The interviewees all have a minimum of four years of working experience in the automotive industry with a focus on the aftersales domain and/or the integration of AI and/or DE. Moreover, the research participants hold positions either directly at the OEM or at a consulting firm to ensure diverse perspectives on the subject matter. Furthermore, in the European context, local and regional standardization bodies play a pivotal role in the adoption of new technologies in the automotive industry (Fabbe-Costes & Lechaptois, 2022). Therefore, to ensure that all participants are subject to the same regulatory framework, the search was limited to individuals working in Germany.

In addition, a convenient sample was chosen due to time constraints of the research project as well as the availability and accessibility of the interview partners (Vehovar et al., 2016). The researcher leveraged her personal and professional networks to contact 21 potential interview participants. In addition, the platform LinkedIn was utilized to identify 57 suitable candidates for interviews. The result of these search efforts is a sample of 11 interview participants. To ensure confidentiality, the names and companies of the interview partners are kept anonymous, but an overview of the respective roles and tenure can be found in Appendix 1.

3.2 Data Collection Method

The qualitative research data was collected in the form of semi-structured interviews with a duration between 30 and 70 minutes. These interviews were conducted online via video calls over Microsoft Teams and were recorded and transcribed. Additionally, the interviews included open-ended questions that allowed the participants to freely express their experiences and insights while still providing a the necessary structure (Gioia et al., 2013; Mulisa, 2022).

Furthermore, the questions were formulated in a non-leading manner to avoid bias of the researcher (Gioia et al., 2013). The detailed interview guide of the semi-structured interviews is attached in Appendix 2. The interview structure included an introduction into the interview procedure as well as a brief overview of the participant´s background. Subsequently, the interviews aimed to explore participants' perspectives on the current relevance and practical applications of DEs and AI in the aftersales domain. Then, the interview followed a detailed investigation into the benefits and challenges associated with AI and DEs as well as lessons learned for OEMs. Finally, the interview concluded with an outlook to future potentials of AI in aftersales DEs as well as offering the participant the opportunity to add additional insights that could be important for the subject matter, in case they have not been previously addressed.

3.3 Data Analysis

The collected data from the semi-structured interviews was analyzed based on the methodology of Gioia et al. (2013). This method provides a structured approach and entails three sequential steps. The first step includes the review of the interview transcripts and the extraction of meaningful insights from the interviewees (Gioia et al., 2013). This process was repeated to identify emerging themes and patterns. In order to ensure that the analysis reflects exactly the perspective of the interviewees, direct quotes were utilized as first-order concepts (Gioia et al., 2013). These first-order concepts are then grouped into second-order concepts based on identified similarities and differences between the individual perspectives and insights (Gioia et al., 2013). By analyzing the data across interviews deeper and more abstract patterns can be identified which have relevance beyond the research participants (Gioia & Chittipeddi, 1991; Gioia et al., 2013). The third and final step involves the merging of individual second-order concepts into aggregated dimensions (Gioia et al., 2013). The aggregated dimensions are established based on the interpretation and reflection of the relationship between the individual second-order themes by the researcher (Gioia et al., 2013). This sequential process depicts the systematic and data-driven approach of the data analysis based on the methodology of Gioia et al. (2013). By utilizing this approach novel concepts and insights relevant to the research agenda can be derived from the data while maintaining the integrity of qualitative research (Gioia et al., 2013).

The interpretation of the qualitative interviews by the researcher plays a significant role in shaping the conclusions derived from the data (McCusker & Gunaydin, 2015). To reduce the risk of subjectivity and personal bias in the data analysis it is crucial for the researcher to stay

as closely aligned with the data as possible (Gioia et al., 2013; McCusker & Gunaydin, 2015). This requires a careful and systematic approach to ensure that the findings are based solely on the evidence provided in the interviews (Gioia et al., 2013).

4. Results

The comprehensive analysis of the 11 semi-structured interviews following the methodology of Gioia et al. (2013) reveals several key themes and insights can be found in Appendix 3. A condensed version of the hierarchical structure of first- and second- order concepts as well as aggregated dimensions, is visualized in Figure 1 below. The four identified key aggregated dimensions reflect the central insights for the integration of AI and DE within the automotive aftersales domain. These dimensions entail key use cases for AI and DE integration in the aftersales domain, the role of aftersales DEs in enhancing OEM competitiveness, challenges in implementing AI and DEs in the aftersales domain, and lessons learned for OEMs. The following sections will examine each of these dimensions in depth, providing further elaboration on the core themes and drawing upon evidence from the interviews to substantiate the analysis.

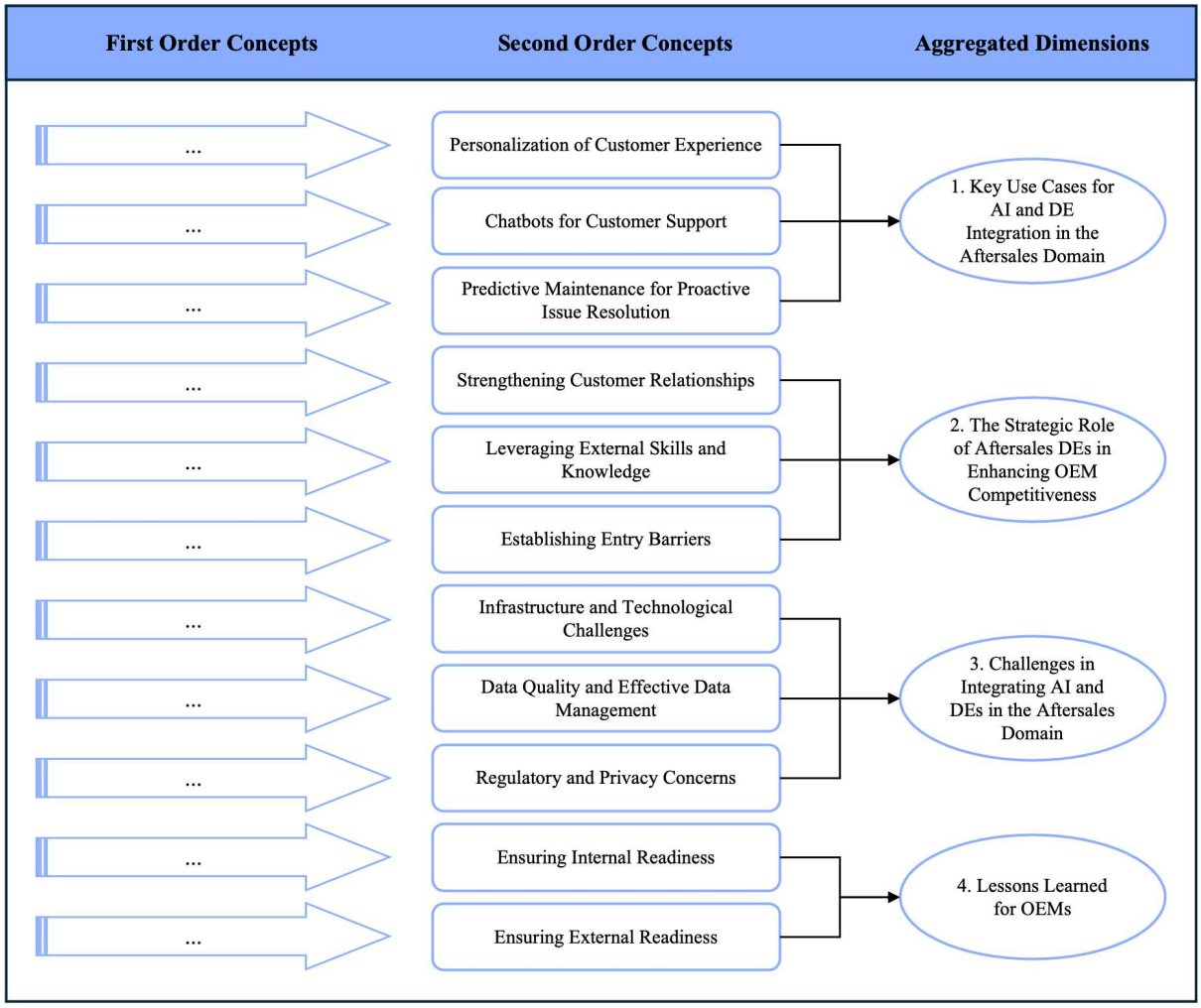

Figure 1: Visualization of the thematic data analysis of the interviews
Source: Own illustration based on the data structure of Gioia et al. (2013)

4.1 Key Use Cases for AI and DE Integration in the Aftersales Domain

The insights of the interviewees regarding the potential of integration of AI in an aftersales DE revealed three main use cases. These include personalization of customer experience, chatbots for customer support as well as predictive maintenance for proactive issue resolution.

The first identified use case is the incorporation of personalization into the customer offering. As MR shared, AI can be utilized to "model different types of customer personas. I can run customer segments through various journeys, have them analyzed, and then draw a conclusion as to which touchpoints have the greatest impact on these customers." This information can then be combined with an analysis of the individual customer´s behavior to identify the optimal customer approach (LS, MR). Based on this, the OEMs are then able to target the customer at the optimal touchpoint with personalized offers and promotions (LS). LS additionally outlined that this approach can be optimized further through the enrichment of the data set: "To further

personalize the customer approach, to further adapt it, to further enrich it with data and, of course, to use methods such as AI or similar approaches in this context." As greater quantities of information could be made available and shared through a digital ecosystem, this data could be employed by AI in order to personalize the aftersales offering in an optimal manner.

The increasing amount of data also presents an opportunity for the enhancement of customer support, which emerged as the second use case highlighted by interviewees. AI-based chatbots can be directly integrated into the customer interaction to optimally serve the individual customer´s need (LS). Following the insight of JR, AI enables the global dissemination of knowledge. Therefore, in the event of a recurring customer issue, AI can access the necessary information on the problem solution, leading to a quicker and more efficient problem resolution (JR, SH). Moreover, when a customer is confronted with an unfamiliar issue, AI is able to direct the information to the appropriate individual or department (SH). To this point, SH emphasizes that "ultimately, we want to use AI to create an intelligent assistant that will be able to solve a known topic immediately and direct an unknown topic to the right place in our target solution." As a result, customers receive timely and accurate responses. Furthermore, AI is language-agnostic and is continuously accessible as highlighted by SH: "So the main advantage over call centers is that a chatbot never sleeps. It also answers immediately. They are also language-agnostic models, so they can do any language." Additionally, AI is capable of processing diverse types of media including text, image, video, and audio input (SH). Consequently, customers can interact with AI in their natural language and via their preferred format, which simplifies the interaction (MR, SH). According to LS, the interaction with AI will also assume greater importance as external services and features are integrated into an aftersales DE.

The third use case that was acknowledged is the deployment of AI for predictive maintenance. Following the insights of OB, rather than regular service appointments, AI-based prediction of service requirements will become the norm. OB further outlines that "the result is a customer experience with much better customer transparency, much more evidence-based servicing. The customer can understand much better what we have done and why." In general, proactive servicing has the potential to prevent significant damage to the automobile and extend its lifespan. This is especially important for electric vehicles as emphasized by OB: "This is extremely important, especially for electric vehicles, because when battery damage occurs, it is similar to a cancerous tumor. It starts somewhere and this malfunction spreads throughout the battery. If we recognize relatively early on that there is a problem with the battery, the repair

requirement is really marginal compared to what we would have to spend to replace the entire battery." Moreover, the utilization of remote diagnostics enables the assessment of the vehicle's condition (JG). In certain instances, it is possible to repair maintenance issues remotely, thus resolving the issues before the customer becomes aware of them and eliminating the need for the customer to visit the workshop (JR). Furthermore, AI can be employed to forecast and optimize the process flow of workshops based on historic maintenance data, thereby enhancing efficiency and capacity. This allows the workshop to address maintenance requests quicker (BB, OB). The integration of AI into an aftersales DE can further facilitate faster maintenance repairs by transferring the failure codes identified by remote diagnostics to the workshop which is then able to address the maintenance issue in a more targeted way (BB, JG, OS).

Summarizing, the integration of AI and DE in the aftersales area offers OEMs a variety of opportunities to enhance the customer experience, optimize services and increase efficiency. By focusing on personalization, chatbots and predictive maintenances, OEMs can significantly improve their aftersales services, thereby fostering long-term customer loyalty and satisfaction.

4.2 Strategic Role of Digital Ecosystems in Enhancing OEM Competitiveness

Interviewees suggest that the relevance of aftersales DE for OEMs is becoming increasingly apparent, as emphasized by OB: "That is the future. We are currently building digital media and digital features into our cars. In the short term, we will build cars around this digital ecosystem." According to interviewees, this trend is due to DEs becoming a critical factor in the competitiveness of OEMs in the aftersales area. Such ecosystems allow OEMs to strengthen customer relationships, leverage external skills and knowledge as well as establish entry barriers.

Firstly, interviewees emphasize that OEMs can enhance and sustain the relationship with customers through an aftersales DE. As noted by MR, "car manufacturers are increasingly realizing that they ultimately have an interface with their vehicles and the embedded digital technology that they make available to end customers. And this gives them many points of contact through a wide variety of products and services that an end customer can access through the use of the vehicle." An aftersales DE offers OEMs the ability to maintain ongoing interactions with their customers. The continuous engagement is facilitated by the integration of third-party offerings that address a diverse range of customer needs (LS). This enables the OEMs to "stay in touch permanently" (JF). The aftersales DE therefore supports "the ultimate

goal … to create added value for the customer, to retain the customer as intrinsically as possible." (JR). Moreover, the customer behavior can be analyzed throughout the whole service portfolio of the aftersales DE and customers that want to churn can be identified (DU). As explained by DU, "I would say forward-looking analysis of the recorded activities to proactively identify trends. As I mentioned earlier, a good example is how to recognize when a customer is ready to switch brands. I can see this from the digital user behavior, for example if they visit third-party websites." OEMs then have the opportunity to address those customers in order to retain them. Consequently, OEMs can improve customer loyalty, retention and the overall customer relationship through an aftersales DE (JR, PK). This is crucial for the OEMs in the increasingly competitive aftersales market.

Secondly, OEMs are able to leverage external expertise by integrating third party stakeholders into an aftersales DE. Following the insights of PK: "OEMs are realizing that, on the one hand, they can't do everything themselves and, on the other, it's not necessarily efficient to do everything themselves because there are various partners or companies that have significantly greater expertise in the individual digital products." Therefore, as digital services are increasingly integrated into the aftersales offering, it is essential for OEMs to cooperate with external stakeholders as they lack the necessary skills to develop the complete digital offering by themselves (JR, PK). These external actors have greater knowledge and skills in their area of expertise (JG, PK). Apart from integrating third party services in their service offering, OEMs can develop new services and features together with the external partners based on the large amount of data available in an DE (LS, PK). The integration of external knowledge and skills therefore facilitates innovation in the form of new aftersales offerings as well as new business models, for example new subscription-based services (OS). "To tap into that [new business models] was not possible in the past because they now have access to data outside of their original area of expertise." (LS). Overall, the access to external skills and information helps the OEMs to extend their aftersales offering and therefore differentiate themselves from the competition.

Finally, aftersales DEs enhanced the OEMs competitiveness by establishing entry barriers. The collaboration in the digital ecosystem strengthens the relationships between the members (PK). "As a result, there will also be higher entry barriers. This means that they can of course generate more value themselves and players who are not part of it will not be able to generate as much."

(PK). The close cooperation thus presents an opportunity for the OEMs to gain a competitive advantage and to strengthen their market position through the establishment of entry barriers.

In conclusion, the establishment of a digital aftersales ecosystem plays a significant role for the competitiveness of OEMs by strengthening customer relationships and avoiding churn, leveraging external skills and knowledge to improve the aftersales offering, and enhancing the market position by creating entry barriers to newcomers. As these DE continue to evolve, their importance for the strategy of OEMs is likely to increase due to their role in driving both innovation and growth.

4.3 Challenges in Integrating AI and DEs in the Aftersales Domain

The integration of AI and DEs into the aftersales domain presents a variety of opportunities for OEMs. However, it also entails a number of challenges that must be addressed to ensure successful implementation. These challenges can be broadly categorized into three key areas: infrastructure and technological challenges, data quality and effective data management and regulatory and privacy concerns.

The initial area of concern identified by the interviewees is related to technological and infrastructure challenges. As OB emphasized: “Process harmonization is a huge challenge, it sounds completely trivial, but one of our biggest challenges is to have uniform interfaces and uniform systems. System harmonization is a huge project, a huge effort.” This underlines the complexity associated with aligning systems and processes within the OEMs. According to interviewees, it is crucial “to take on a holistic approach” (OB) in the digitalization of the firm as this will provide the basis for successful implementation. In contrast, a partial digitalization would only result in increased complexity and uncertainty across the entire organization (OB). Furthermore, MR pointed out the “need to consider what it [the system harmonization] actually means for an operating model. I am also intervening in processes. I intervene in IT structures. I'm interfering in employees' workflows and that needs to be considered from the start.” This harmonization process therefore has a big impact on the operations of the OEMs and must be aligned with the overarching strategic goals (MR). Moreover, to incorporate external stakeholders into an aftersales DE and achieve scalability, it is essential to implement standardized interfaces (LS, OB). OEMs further need to ensure that the AI is adequately trained with sufficient data to guarantee accurate responses and prevent the emergence of hallucinations (JR, MR, PK). Measures must be implemented to prevent any potential misuse of the AI

algorithm (SH). Consequently, establishing a sound infrastructure and technology base poses a challenge for OEMs in their efforts to integrate AI and DEs in the aftersales domain.

In addition to the infrastructure and technological challenges that need to be addressed, data quality and effective data management must also be ensured. JF acknowledged that "AI is only as intelligent as how I feed it." This highlights the importance of high-quality data as the foundation for AI. However, MR noted that: "we often hear that AI is only as good as the data available - data is often available, but the quality of the data is not sufficient to generate something useful from it." Interviewees note that it is imperative that the OEMs harmonizes the internal systems to merge all the information into one database, as previously outlined in the first challenge. This will facilitate transparency regarding the availability of data (LS). In addition, OEMs need to ensure that the dataset is cleansed to guarantee that it is available in a "well-structured form" (OS). Hence, as articulated by OB, "sometimes a lot of data is more of a curse than of a victory." This is applicable to OEMs, which have a substantial array of data to draw upon but need to determine which information is relevant and organize it in a systematic manner (LS, MR, OB). This establishes the foundation to leverage AI effectively to realize the full potential of the data and to integrate an aftersales DE (LS). As interactions within an ecosystem increase, the importance of effective data management grows (LS). This is the case because it is essential to maintain an overview of the available data to identify and to act upon opportunities presented by the data (LS, OB, SH). Therefore, the effective management of data and the establishment of a high-quality database represents a significant obstacle for OEMs seeking to integrate AI and DEs in the aftersales area.

Finally, the interviewees highlighted a significant challenge related to regulations and privacy concerns. DU emphasized the need for OEMs to ensure that data protection is guaranteed. Additionally, OB highlighted the needs to be transparent with customers regarding data usage: "Transparency and trust are the most important things. No matter what we do, we have to explain to the customer at all times what we are doing with their data and that we are not misusing the data." The evolving regulatory landscape, such as the recently introduced EU Data Act or the AI Act, add further complexity and the impact of these regulations must be taken into consideration (MR). LS was confident that the EU Data Act would facilitate information sharing between DE members and thereby help establish a broad data foundation. SH, however, acknowledged that the full impact of the regulation is not yet clear and pointed out that it is still too early to identify any potential benefits. Consequently, the continuous analysis and

compliance with regulations and data privacy add an additional layer of complexity in the implementation process of AI and DEs in the aftersales domain.

Concludingly, the interviews highlighted the key challenges that OEMs may be faced with in the implementation of AI and the establishment of an aftersales DE. By overcoming technological and infrastructural challenges, ensuring data quality and effective management, and addressing regulatory and privacy concerns, OEMs can fully realize the potential of AI and DE in enhancing their aftersales services.

4.4 Lessons Learned for OEMs

Additional to the potential benefits and challenges of incorporating AI and establishing an aftersales DE, the interviewees shared their insights about lessons learned for OEMs. These can be broken down into ensuring internal and external readiness.

To ensure internal readiness for the integration of AI and the establishment of an aftersales DE, OEMs need to address the above-mentioned challenges. In this regard, a holistic approach to the digitization (OB) and harmonization of systems and processes is recommended, to ensure a high level of data quality. Otherwise, an increase in complexity and uncertainty might be expected (OB). The OEMs can leverage this foundation to facilitate the integration of AI into the aftersales domain. However, PK emphasized that it “has already been shown several times in the digital sector that they simply can't get it on the road as quickly as when they either work with a tech company or with start-ups or whatever that specialize in it [digital service offering].” Consequently, the OEMs should focus on their core competencies and develop only “individual digital lighthouse projects” (PK). To further extend the digital portfolio, external partners should be included in an aftersales DE. Furthermore, an initial testing of AI applications by the OEMs is essential to ensure a high-quality service offering from the beginning (JR, MR). This is significant as the initial interaction with the AI is critical as highlighted by JR: “So it's a make-or-break point. Yes, it has to be very, very good right from the start. It has to be a better answer than the customer is used to at the moment.” Moreover, customers have high expectations for the service experience, regardless of whether the service is physical or digital (JR). Interviewees also add that it is imperative to not overlook the human element in all the technical considerations (OB, LS, SH). The OEMs need to ensure that all employees are included in the transformation process. This encompasses the provision of educational

resources, the investment in upskilling initiatives for the workforce, and the alignment of employee mindsets with the strategic objectives of the OEMs (LS, SH).

During the implementation of AI and establishment of the aftersales DE, external readiness needs to be established. Firstly, PK emphasized that “You just have to find the sweet spot so that it doesn't get kind of creepy for the customer.” This underscores the importance of the incremental introduction of novel offerings, to ensure that customers become accustomed to interacting with AI and receiving personalized offerings and services (PK). It is imperative to consider customer preferences, given the varying expectations and acceptance of AI among different generations (OS). Additionally, OEMs need to ensure that all operations comply with relevant regulations. As previously discussed, the impact of newly introduced regulations must be evaluated and if needed operations must be adapted accordingly. Moreover, customer sovereignty needs to be taken into consideration and the customer´s control over the individual data must be ensured (OB). Lastly, the human factor must also be considered with all external members of the aftersales DE (OB, OS). An illustrative example of these considerations for workshops was outlined by OB: “everyone should be picked up on this digital journey: training, persuasiveness and also really, when we explain the added value of the customer, also explain the added value for the workshop, for the work in the workshop. What is the benefit, why should I do this and how can we win together? What we have at the moment is a very strong system-related debate and way of thinking, where the human factor, how things went at the end of the day, is being pushed a little to the side.”

In conclusion, OEMs that seek to integrate AI and establish an aftersales DE can derive guidance from these lessons learned and apply them to achieve internal and external readiness.

5. Discussion

This study has explored the potential of integrating AI and DEs within the aftersales domain of OEMs. The findings, which are aligned with the research questions, provide a nuanced understanding of the key use cases for AI integration, the role that aftersales DEs can play in enhancing OEM competitiveness, the challenges that OEMs face in implementing these technologies, and the lessons learned from ongoing efforts. This section will discuss the implications of these findings for both theory and practice, as well as present the limitations of this study and propose directions for future research.

5.1 Theoretical and Managerial Contributions

A comparison of the literature review with the findings of this qualitative research reveals confirmations of established theories as well as novel insights. This comparison as well as a clear outline of both theoretical and managerial contributions will be discussed in the following section.

This study uncovered the synergistic relationship between AI and DEs in the aftersales domain as evidenced by the findings from the first and second aggregated dimensions. Although previous literature has highlighted the individual potential of AI and DEs, this study revealed how the integration of AI within a digital ecosystem can amplify the effectiveness of the application in the aftersales domain. While the literature acknowledges the importance of data in driving AI applications (Beverungen et al., 2022), the findings illustrate how the combination of DEs and AI can lead to the development of more sophisticated, data-driven services (LS). AI can be incorporated into a broader array of service offerings provided through the DE thereby enhancing overall customer experience through tailored services and interactions (JF, MR). Moreover, the interviews shed light on the role of DEs in providing a broader foundation of data for the AI which in turn increases the accuracy of AI-based predictions and solutions (LS). This is particularly important in the aftersales domain which is directly linked to customer satisfaction (Gaiardelli et al., 2007). The combination of AI and DEs in the aftersales domain therefore not only facilitates better customer experiences and thus stronger customer relationships but also allows Al to be fully leveraged when integrated across the entire aftersales offering (JR, LS). By tapping into the diverse skills and knowledge within the digital ecosystem, OEMs can further refine their aftersales services (JG, PK). This enhanced aftersales offering, and strengthened customer relationship, can then contribute to an elevation of the market position through establishing entry barriers, which provide OEMs with a competitive advantage over new market entrants (PK). The interview findings offer novel insights, through providing practical evidence of the identified potential of DEs in literature, and especially through exploring the role of aftersales DEs in establishing entry barriers, which has not been investigated in the aftersales context.

In addition to these novel insights, the study also confirms the theoretical perspectives. The identified core use cases of AI and DE integration in the aftersales domain in the qualitative interviews are consistent with existing literature. Prior research outlined the potential of AI to personalize the customer offering and experiences (Leng et al., 2024; Rahim et al., 2021), introduce chatbots for customer support (Brusset et al., 2022) and utilize predictive

maintenance (Rahim et al., 2021). These use cases were consistently highlighted by the interviewees. The interviewees emphasized that the implementation of AI-driven personalization has the potential to notably enhance the customer experience, through the alignment of services and recommendations with individual preferences and behaviors (LS, MR). Similarly, the integration of chatbots for customer support was recognized as an efficient and user-friendly mean to provide timely and accurate problem resolution (JR, SH). These insights confirm the usefulness of integrating AI to interact with customers to deal with service demands (Brusset et al., 2022). Also, the advantages of incorporating predictive maintenance were reinforced by the interviewees (BB, OB, OS). The research confirms the potential identified in literature to prevent more significant damage and to improve service efficiency thereby enhancing customer satisfaction (Brusset et al., 2022). In addition, the findings of the interviews align with the literature regarding the identified potential of integrating DEs in the aftersales domain. The literature outlined the shift of OEMs towards a more digital business model which is facilitated through the incorporation of external partners in an DE (Bohnsack et al., 2021; Riasanow et al., 2021). As outlined by MR, the DE creates novel touchpoints with the customer which is essential to deepen the customer relationship. In addition to facilitating contact between OEMs and customers (JF), the DE enables OEMs to retain customers through the expansion of their service offering (JR). This confirms the findings of previous literature that OEMs needs to leverage external skills in order to extend their service portfolio and address changing customer expectations (Fabbe-Costes & Lechaptois, 2022; Suuronen et al., 2022). Moreover, the interviews confirmed that collaboration within the DE can contribute to innovation as DE members can jointly develop new services (Hein et al., 2020; Suuronen et al., 2022). The interviews further revealed that the establishment of aftersales DEs is still in progress. This led to the identification of implementation challenges which are summarized in the third key aggregated dimension.

The third aggregated dimension elaborated on the distinctive challenges encountered by OEMs in the aftersales domain when integrating AI and DEs. While the difficulties associated with technology, infrastructure, data management, and regulatory concerns are well-documented in the context of digital transformation, this study delves into a more detailed examination of how these issues specifically affect the aftersales sector. The literature underscores the significance of connecting individual systems, procedures, and DE members across the value chain to ensure the seamless integration of services (Bohnsack et al., 2021; Fabbe-Costes & Lechaptois, 2022; Llopis-Albert et al., 2021). Nevertheless, this qualitative research revealed that OEMs face

significant challenges in implementing this in the aftersales domain (LS, MR, OB). According to the interviewees the harmonization of internal systems and processes is a particularly critical aspect of aftersales, to provide seamless coordination between the various stakeholders, including workshops, external service providers and customers (JR, LS, MR). As the aftersales domain directly effects customer satisfaction the importance of this area to OEMs is increased (Gaiardelli et al., 2007). The harmonization process is closely linked with data quality and effective data management which is therefore identified as the second key challenge. The quality of the data foundation directly impacts the effectiveness of AI-based services outlined in the three key use cases (Beverungen et al., 2022; Brusset et al., 2022; LS; OS). Furthermore, while regulatory challenges are widely acknowledged, the implications of new regulations, such as the EU Data Act and the AI Act, introduce additional uncertainty for aftersales operations in particular. The interviews emphasize the need for OEMs to assess and adapt to these regulations accordingly, since their specific impact on aftersales operations is yet to be fully understood (LS, SH).

Finally, the research revealed lessons learned for OEMs. The interviewees outlined the importance for OEMs to focus on their core competencies and integrate external stakeholders into an aftersales DE to be able to leverage external skills and knowledge (PK). This is consistent with the theoretical perspective that individual OEMs typically are not equipped to optimally leverage changing market conditions and evolving customer expectations (Fabbe-Costes & Lechaptois, 2022; Suuronen et al., 2022).
The research further revealed novel insights regarding incrementally integrating AI in the customer solution (PK). This process ensures that the technological foundation is sound and provides accurate responses (JR, MR) which is vital since the initial interaction between the AI and the customer plays a critical role in determining their acceptance, with customers expecting superior quality (JR). Moreover, the research shed light on another important aspect that has not been addresses in detail in the literature: The human element needs to be taken into account in the process of integrating AI and establishing an aftersales DE. The interviewees emphasized the need to educate and upskill the workforce (LS, SH), to allow for adaption of the implementation approach to the preferences of individual customers (OS, PK) and to address the concerns of external stakeholder such as workshops (OB, OS).

In conclusion, this research contributes to both theory and practice by confirming established concepts with practical evidence and by introducing novel insights that enhance our

understanding of the role of AI and DEs in shaping the future of automotive aftersales. This research builds upon existing literature by outlining the distinctive opportunities and challenges associated with aftersales DEs. These areas have not been comprehensively addressed in existing literature, and thus represent a valuable contribution to the field. The gathered empirical evidence reinforces the proposition that aftersales DEs will strengthen OEMs' market positions and enhance customer relationships. It also reveals the critical importance of an incremental and human-centered AI implementation process. Additionally, this study outlines the importance of ensuring the harmonization of internal processes, data quality management, and regulatory compliance. From a managerial perspective, the findings highlight the importance of OEMs balancing the incorporation of external expertise with a focus on their core competencies. Furthermore, this research provides actionable guidance for OEMs, emphasizing the necessity of introducing AI-driven services only after establishing a robust technological foundation and ensuring their alignment with customer expectations. In addition, OEMs need to prioritize workforce education and external stakeholder engagement throughout this process. These contributions are fundamental to the success of OEMs, as they aim to not only improve customer satisfaction but also to maintain a long-term competitive advantage in an increasingly digital and interconnected market landscape.

5.2 Limitations and Future Research Agenda

This research contributes to theory and practice by providing distinctive insights for the implementation of AI und DEs in the aftersales domain. However, despite reviewing existing literature and critically analyzing the qualitative findings of the research certain limitations need to be acknowledged.

Firstly, the qualitative research design inherently introduces potential biases based on the subjective nature of the data collection and analysis (McCusker & Gunaydin, 2015). Given that the insights are derived from personal experiences the collected data might not fully capture broader industry trends. Future research could extend these insights with quantitative methods to validate the research results and enhance the generalizability. In addition, the sample size of 11 interviewees, while providing valuable and detailed insights, is relatively small. This limitation is further amplified by the non-probabilistic sampling method, which constrains the generalizability of the findings (Mulisa, 2022). Although the study achieved a high level of internal validity through the in-depth exploration of the participants' perspectives, it would therefore be beneficial to expand the sample size to enhance the applicability of the results.

Moreover, the interviewees hold positions in the automotive as well as in the consulting industry. In order to gain a more comprehensive view on the research topic further studies should incorporate external partners that could be integrated in an aftersales DE such as professionals working at software firms or workshops. This would help diversify the insights. Furthermore, all the research participants are working in Germany to ensure that their insights are based on the same contextual factors. However, as OEMs are operating in different regions where contextual factors might vary significantly, the research would benefit from an expansion of the geographical scope.

Therefore, future research can address the limitations by employing a complementary quantitative approach, expanding the sample size as well as increasing the diversity in terms of profession and geographical scope. Moreover, a few additional directions for future research are proposed. The process of aligning internal systems and processes was highlighted as prominent issue for OEMs. However, this is a prerequisite for optimal AI integration and establishment of an aftersales DE. Future research could therefore examine best practices for this harmonization process. Furthermore, future research could investigate the long-term effects of the integration of AI and DEs on OEM competitiveness in terms of enhancing customer relationships, leveraging external skills and knowledge for innovation and growth as well as boosting the market position. In addition, the interviews revealed that the impact of recently introduced regulations, such as the EU Data Act or the AI Act, on the efforts to implement AI and an aftersales DE remains unclear. Future research could therefore examine the effect of these regulations on OEMs' integration efforts. Lastly, the interviews highlighted the importance of considering the human element in the integration efforts. It could be valuable to investigate the influence of company culture on the success of the implementation of AI and establishment of an aftersales DE.

6. Conclusion

This research has thoroughly investigated the transformative impact of artificial intelligence and digital ecosystems on the automotive aftersales sector, motivated by a recognized gap in existing literature and practice. By employing a qualitative approach, in the form of 11 semi-structured interviews, the research identified key use cases for the integration of AI and DEs in the aftersales domain, explored how aftersales DEs can enhance the competitiveness of OEMs, examined the challenges faced during implementation, and derived lessons learned from ongoing efforts.

The research findings underscore the strategic importance of integrating AI and DEs into the aftersales domain. The interviewees shed light on key use cases for AI integration in an aftersales DE: offering personalized customer experiences, integrating AI-based chatbots in the customer support domain as well as utilizing predictive maintenance to identify service demands. These applications not only streamline aftersales processes but also extent the service offering for customers, thereby increasing customer satisfaction and loyalty. Moreover, aftersales DEs play a critical role in the increasingly digitized market landscape as they enable OEMs to strengthen the relationship with customers. In addition, the incorporation of external resources and knowledge exchange in the aftersales DEs enable OEMs to extend their aftersales offering as well as fosters innovation. The collaboration within aftersales DEs also facilitates the establishment of entry barriers that help OEMs to stay competitive. The research further shed light on challenges in the integration process. The harmonization of systems and processes was identified as key issue that OEMs are faced with. This is especially important as it builds the basis for establishing a high-quality data foundation that is key for successful AI utilization. In addition to the harmonization process and data management, the adherence of regulations and privacy concern was identified as third main challenge in the process of integrating AI and establishing an aftersales DE. The lessons learned for OEMs emphasized the need to address these challenges in order to ensure a successful integration process. The interviewees further stressed that a holistic approach in the integration of AI and establishment of an aftersales DE needs to be adopted. Moreover, the interview participants highlighted the importance to consider the human element in this integration process. It is essential to involve both employees as well as external stakeholders such as workshops and customers.

This research advances the academic discourse by providing empirical insights into the intersection of AI, DEs, and aftersales services within the automotive sector. It extends theoretical understanding by outlining the synergistic effects of AI and DE integration and identifying factors that influence successful implementation. From a practical perspective, the research offers actionable recommendations for OEMs, guiding them in strategically leveraging these technologies to enhance their aftersales service offering as well as customer relationships, thereby strengthening their competitive positioning.

In conclusion, this research highlights the pivotal role of AI and DEs in transforming the automotive aftersales sector. By enhancing operational efficiency, fostering innovation, and improving customer satisfaction, these technologies offer substantial benefits for OEMs. As

Russell (2024) stated, "Disrupt yourself or risk being disrupted", this study reinforces the notion that OEMs must embrace the opportunity presented by AI and DEs to stay competitive in a rapidly evolving landscape. The insights provided by this research therefore offer valuable guidance for both academic scholars and industry practitioners in their efforts to leverage the full potential of AI and DEs in the aftersales domain.

7. References

Balinado, J. R., Prasetyo, Y. T., Young, M. N., Persada, S. F., Miraja, B. A., & Redi, A. A. N. P. (2021). The effect of service quality on customer satisfaction in an automotive after-sales service. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(2), 116.

Barykin, S. Y., Kapustina, I. V., Kirillova, T. V., Yadykin, V. K., & Konnikov, Y. A. (2020). Economics of digital ecosystems. *Journal of Open Innovation: Technology, Market, and Complexity*, *6*(4), 124.

Bell, E., Bryman, A., & Harley, B. (2022). *Business research methods*. Oxford university press.

Beverungen, D., Hess, T., Köster, A., & Lehrer, C. (2022). From private digital platforms to public data spaces: implications for the digital transformation. *Electronic Markets*, *32*(2), 493-501. https://doi.org/10.1007/s12525-022-00553-z

Bohnsack, R., Kurtz, H., & Hanelt, A. (2021). Re-examining path dependence in the digital age: The evolution of connected car business models. *Research Policy*, *50*(9), 104328.

Brusset, X., La Torre, D., & Broekaert, J. (2022). Algorithms, Analytics, and Artificial Intelligence: harnessing data to make supply chain decisions. In *The Digital Supply Chain* (pp. 93-110). Elsevier.

Collins, C., Dennehy, D., Conboy, K., & Mikalef, P. (2021). Artificial intelligence in information systems research: A systematic literature review and research agenda. *International Journal of Information Management*, *60*, 102383.

European Union. (2024). *Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act) (Text with EEA relevance)*. Retrieved August 10, 2024 from https://eur-lex.europa.eu/eli/reg/2024/1689/oj

Fabbe-Costes, N., & Lechaptois, L. (2022). Automotive supply chain digitalization: Lessons and perspectives. In *The Digital Supply Chain* (pp. 289-308). Elsevier Inc. https://doi.org/10.1016/B978-0-323-91614-1.00017-4

Fawcett, S. E., & Birou, L. M. (1992). Exploring the logistics interface between global and JIT sourcing. *International Journal of Physical Distribution & Logistics Management*, *22*(1), 3-14.

Gaiardelli, P., Saccani, N., & Songini, L. (2007). Performance measurement of the after-sales service network—Evidence from the automotive industry. *Computers in industry*, *58*(7), 698-708.

Gereffi, G. (2001). Beyond the producer-driven/buyer-driven dichotomy the evolution of global value chains in the internet era. *IDS Bulletin (Brighton. 1984)*, *32*(3), 30-40. https://doi.org/https://doi.org/10.1111/j.1759-5436.2001.mp32003004.x

Gioia, D. A., & Chittipeddi, K. (1991). Sensemaking and sensegiving in strategic change initiation. *Strategic management journal*, *12*(6), 433-448.

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational research methods*, *16*(1), 15-31.

Hein, A., Schreieck, M., Riasanow, T., Setzke, D. S., Wiesche, M., Böhm, M., & Krcmar, H. (2020). Digital platform ecosystems. *Electronic Markets*, *30*, 87-98.

Jackson, I., Ivanov, D., Dolgui, A., & Namdar, J. (2024). Generative artificial intelligence in supply chain and operations management: a capability-based framework for analysis and implementation. *International Journal of Production Research*, 1-26.

Koch, M., Krohmer, D., Naab, M., Rost, D., & Trapp, M. (2022). A matter of definition: Criteria for digital ecosystems. *Digital Business*, *2*(2), 100027.

Kraus, S., Durst, S., Ferreira, J. J., Veiga, P., Kailer, N., & Weinmann, A. (2022). Digital transformation in business and management research: An overview of the current status quo. *International Journal of Information Management*, *63*, 102466.

Lempp, M., & Siegfried, P. (2022). *Automobile Disruption und die urbane Mobilitätsrevolution*. Springer Books.

Leng, J., Zhu, X., Huang, Z., Li, X., Zheng, P., Zhou, X., Mourtzis, D., Wang, B., Qi, Q., & Shao, H. (2024). Unlocking the power of industrial artificial intelligence towards Industry 5.0: Insights, pathways, and challenges. *Journal of Manufacturing Systems*, *73*, 349-363.

Li, G., Huang, F. F., Cheng, T., Zheng, Q., & Ji, P. (2014). Make-or-buy service capacity decision in a supply chain providing after-sales service. *European Journal of Operational Research*, *239*(2), 377-388.

Llopis-Albert, C., Rubio, F., & Valero, F. (2021). Impact of digital transformation on the automotive industry. *Technological forecasting and social change*, *162*, 120343.

Mann, G., Karanasios, S., & Breidbach, C. F. (2022). Orchestrating the digital transformation of a business ecosystem. *The Journal of Strategic Information Systems*, *31*(3), 101733.

McCorduck, P., & Cfe, C. (2004). *Machines who think: A personal inquiry into the history and prospects of artificial intelligence*. CRC Press.

McCusker, K., & Gunaydin, S. (2015). Research using qualitative, quantitative or mixed methods and choice based on the research. *Perfusion*, *30*(7), 537-542.

Moore, J. F. (1993). Predators and prey: a new ecology of competition. *Harvard business review*, *71*(3), 75-86.

Mueller, C., & Mezhuyev, V. (2022). AI models and methods in automotive manufacturing: a systematic literature review. *Recent innovations in artificial intelligence and smart applications*, 1-25.

Mulisa, F. (2022). When Does a Researcher Choose a Quantitative, Qualitative, or Mixed Research Approach? *Interchange*, *53*(1), 113-131.

Rahim, M. A., Rahman, M. A., Rahman, M. M., Asyhari, A. T., Bhuiyan, M. Z. A., & Ramasamy, D. (2021). Evolution of IoT-enabled connectivity and applications in automotive industry: A review. *Vehicular Communications*, *27*, 100285.

Rahmati, P., Tafti, A. R., Westland, J. C., & Hidalgo, C. (2021). When all products are digital: Complexity and intangible value in the ecosystem of digitizing firms. *MIS quarterly*.

Rai, R., Tiwari, M. K., Ivanov, D., & Dolgui, A. (2021). Machine learning in manufacturing and industry 4.0 applications. *International Journal of Production Research*, *59*(16), 4773-4778. https://doi.org/10.1080/00207543.2021.1956675

Ramos, L., Loures, E., Deschamps, F., & Venâncio, A. (2020). Systems evaluation methodology to attend the digital projects requirements for industry 4.0. *International Journal of Computer Integrated Manufacturing*, *33*(4), 398-410.

Reddy, K. R. K., Gunasekaran, A., Kalpana, P., Sreedharan, V. R., & Kumar, S. A. (2021). Developing a blockchain framework for the automotive supply chain: A systematic review. *Computers & Industrial Engineering*, *157*, 107334.

Riasanow, T., Galic, G., & Böhm, M. (2017). Digital transformation in the automotive industry: towards a generic value network. European Conference on Information Systems (ECIS),

Riasanow, T., Jäntgen, L., Hermes, S., Böhm, M., & Krcmar, H. (2021). Core, intertwined, and ecosystem-specific clusters in platform ecosystems: analyzing similarities in the digital transformation of the automotive, blockchain, financial, insurance and IIoT industry. *Electronic Markets*, *31*, 89-104.

Rigopoulou, I. D., Chaniotakis, I. E., Lymperopoulos, C., & Siomkos, G. I. (2008). After-sales service quality as an antecedent of customer satisfaction: The case of electronic appliances. *Managing Service Quality: An International Journal*, *18*(5), 512-527.

Rowley, J. (2012). Conducting research interviews. *Management research review*, *35*(3/4), 260-271.

Rožanec, J. M., Novalija, I., Zajec, P., Kenda, K., Tavakoli Ghinani, H., Suh, S., Veliou, E., Papamartzivanos, D., Giannetsos, T., & Menesidou, S. A. (2023). Human-centric artificial intelligence architecture for industry 5.0 applications. *International Journal of Production Research*, *61*(20), 6847-6872.

Russell, S. (2024). *What The Automotive Industry Can Learn From The Next Wave Of Digital Transformations*. Forbes. Retrieved 29.08.2024 from https://www.forbes.com/sites/sap/2024/02/21/what-the-automotive-industry-can-learn-from-the-next-wave-of-digital-transformations/

Russell, S. J., & Norvig, P. (2020). *Artificial intelligence: a modern approach*. Pearson.

Shokouhyar, S., Shokoohyar, S., & Safari, S. (2020). Research on the influence of after-sales service quality factors on customer satisfaction. *Journal of Retailing and Consumer Services*, *56*, 102139.

Suuronen, S., Ukko, J., Eskola, R., Semken, R. S., & Rantanen, H. (2022). A systematic literature review for digital business ecosystems in the manufacturing industry: Prerequisites,

challenges, and benefits. *CIRP Journal of Manufacturing Science and Technology*, *37*, 414-426.

Vehovar, V., Toepoel, V., & Steinmetz, S. (2016). *Non-probability sampling* (Vol. 1). The Sage handbook of survey methods.

Veltz, P. (1986). Informatisation des industries manufacturières et intellectualisation de la production. *Réseaux. Communication - Technologie - Société*, *4*(18), 65-84. https://www.persee.fr/doc/reso_0751-7971_1986_num_4_18_1218

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, *28*(2), 118-144. https://doi.org/10.1016/j.jsis.2019.01.003

8. Appendix

8.1 Appendix 1: Overview Interview Participants

Overview Interview Participants				
#	**Identification**	**Company**	**Current Position Title**	**Total Industry Tenure**
1.	PK	Consulting Firm	Manager	4 years
2.	MR	Consulting Firm	Director Digital Automotive & Mobility	12 years
3.	LS	Consulting Firm	Senior Manager Enterprise Data & Analytics	7 years
4.	JF	OEM 1	Interface Mangement Purchasing for Spotlight Automotive Ltd. at BMW Group	16 years
5.	DU	OEM 2	Head of Fleet Aftersales Management ONE.Aftersales	30 years
6.	OS	Consulting Firm	Senior Consultant	4 years
7.	BB	OEM 3	Aftersales Operations Manager	7 years
8.	OB	OEM 4	Manager for Retail Fitness and Aftersales Operations and Manager for Extended Service Business and Loyalty	11 years
9.	JG	OEM 5	Manager Aftersales Engineering	19 years
10.	SH	OEM 1	Data Scientist	10 years
11.	JR	OEM 1	Head of Strategy Development Aftersales	13 years

8.2 Appendix 2: Semi-Structured Interview Guide

Semi-Structured Interview Guide		
#	**Topic**	**Questions**
1.	Introduction	Thank you for taking the time and participating in this interview for my master thesis. I want to assure you that all information shared during this interview will be treated confidentially. I will not disclose any identifiable information without prior sanitization. If you prefer, I can ensure that your responses are used anonymously, protecting your identity throughout my work. Could you briefly introduce yourself, your current role and tasks? Could you share your experience related to AI/ DEs in the automotive industry?
2.	Topic 1: Status Quo of DEs in the automotive industry and the aftersales domain specifically	Do you agree with the following definiton of DE? A digital ecosystem may be defined as "a network of companies and players that are connected by a digital platform. This enables organizations to collaborate with a variety of independent service providers as well as customers." From your perspective, what role does the DE currently play in the aftersales domain? In which manner and for what motivatin is the aftersales domain integrated in the digital ecosystem?
3.	Topic 2: Status Quo of AI in the aftersales domain	Do you agree with the following definiton of AI? AI can be summarized as “a machine-based system that operates autonomously, adapts over time, and uses input data to generate outputs like predictions, content, recommendations, or decisions that can influence both physical and virtual environments." From your perspective, what role does AI currently play in the automotive aftersales domain?
4.	Topic 3: Impact of the integration of AI in an aftersales DE	What are the primary benefits associated with integrating AI into the digital ecosystem for aftersales services? What are the primary challenges you see in integrating AI into the digital ecosystem for aftersales services? How does the integration of AI impact the customer experience? (Do you have any specificexamples you can think of? What are the main use cases?) Based on your experience, what recommendations would you give to OEMs looking to integrate AI into their aftersales DE?
5.	Outlook	What further potential do you see for AI integration in aftersales DEs?
6.	Closing	Are there any additional insights you would like to share that we haven't covered? Thank you for your time and for sharing your insights

8.3 Appendix 3: Thematic Interview Analysis

First Order Concepts - Direct Quotes	Second Order Concepts - Core Themes	Aggregated Dimensions
It's intelligent to tailor the solution to the customer. There are so many possibilities in the personal experience area. I don't have to worry about a thing. I get suggestions for what to use in the car, for example. There are now 10,000 functions in the car and no one really knows what it can all do. So this activation of what is actually technically possible which is intelligently tailored to the customer. There are really many possibilities. Or in the app area, where this app is not standardized for everyone. You have different widgets that you can organise or they are organised automatically, and you get suggestions. (PK)	Personalization of Customer Experience	1. Key Use Cases for AI and DE Integration in the Aftersales Domain
We do both in the customer support. We sell things, but we also offer assistance and that is possible in a much, much more targeted way with AI. (JR)		
I can model different types of customer personas. I can run customer segments through various journeys, have them analyzed and then draw a conclusion as to which touchpoints have the greatest impact on these customers. (MR)		
Therefore, future customers are given recommendations based on an underlying algorithm which is able to analyze all the customer behavior. Therefore, user-personalized offers and promotions will become the norm. You can do it with marketing campaigns, you can do it with special offers. (DU)		
To further personalize the customer approach, to further adapt it, to further enrich it with data and, of course, to use methods such as AI or similar approaches in this context. (LS)		
Incorporate this information directly into interaction with the customer and perhaps to identify directly from a conversation that was initially only about new summer tires or something like that, okay, perhaps there are further opportunities to identify customer needs, and to serve them accordingly. (LS)	Chatbots for Customer Support	
And then the topic of AI is of course also a big topic in customer support, which I mentioned at the beginning, and has a lot to do with customer interaction. And it is precisely at the customer interface that I believe that AI can deliver huge added value again. That is, in answering questions, because the knowledge base is simply much, much larger. For example, if I have a case that somehow happened in South Africa, I don't know, and then the same case somehow happens in America, then without		

AI the two agents who handled the case will never talk to each other. But with AI, I have a much, much higher chance of somehow making knowledge available globally. (JR)		
So the main advantage over call centers is that a chatbot never sleeps. It also answers immediately. They are also language-agnostic models, so they can do any language. I think this is also an issue in Europe, for example, where we have quite a few small countries. (SH)		
AI offers a new communication channel, meaning that an end customer can talk to a virtual assistant in natural language and can deal with a wide variety of his or her needs there, which is an enormous potential. And that could just be for a customer service topic. (MR)		
You can definitely achieve a better customer experience with AI by solving cases better and faster. (JR)		
So a variety of different media are exchanged, text descriptions, sometimes videos, audio recordings, images. Exactly. And ultimately, we want to use AI to create an intelligent assistant that will be able to solve a known topic immediately and direct an unknown topic to the right place in our target solution. (SH)		
I think this can be expanded really well in the direction of customer sentiment or customer sentiment based on audio input. (MR)		
That is certainly this proactive servicing, that we are moving away from the customer having to go for a service every two years, instead we are recommending to the customer based on data and evidence that a vehicle should now have a maximum of 4,000 kilometres within the next two months. The result is a customer experience with much better customer transparency, much more evidence-based servicing. The customer can understand much better what we have done and why. (OB)	Predictive Maintenance for Proactive Issue Resolution	
Intelligent recognition of service requirements. In other words, before they occur at the customer's premises. So today there are many components that can fail, where the customer only notices when the problem is already there and we try to recognize the problem in advance by evaluating the data and inform the customer beforehand so that the problem can be solved before the customer notices. (SH)		

With which a relatively high probability can be predicted that the timing belt will break or that the oil pressure or battery performance will decrease. This is extremely important, especially for electric vehicles, because when battery damage occurs, it is similar to a cancerous tumor. It starts somewhere and this malfunction spreads throughout the battery. If we recognize relatively early on that there is a problem with the battery, the repair requirement is really marginal compared to what we would have to spend to replace the entire battery. (OB)		
Topics such as predictive maintenance, which can then extend the lifespan of cars, are becoming increasingly important in this context. (OS)		
In other words, predicting which components could fail in the future. Remote diagnostics which means that cars can be diagnosed remotely and, if necessary, repaired remotely. That's a path we also want to take. (JR)		
I can optimize processes at the workshops by having the orders and then using AI, based on past experience, to indicate the optimum sequence for my workshop. And we can gain so much capacity and efficiency through AI. That also means that we can offer a solution more quickly and, if there really is a problem with the vehicle, we can find out much more quickly what the cause of the problem is and how we can resolve it. (OB)		
We are using a kind of like a diagnostic system, diagnostic tool to connect it to the truck and see the failure codes. And then regarding the failure codes, the mechanics are taking some actions. (BB)		
AI chatbot that helps coordinate appointments or can provide initial information on what kind of problem you might have. (OS)		
In terms of the automotive industry specifically, car manufacturers are increasingly realizing that they ultimately have an interface with their vehicles and the embedded digital technology that they make available to end customers. And this gives them many points of contact through a wide variety of products and services that an end customer can access through the use of the vehicle. (MR)	Strengthening Customer Relationships	2. The Strategic Role of Aftersales DEs in Enhancing OEM Competitive-ness
So they could not only generate revenue, so revenue is a topic that you can also generate, but purely by generating a personalized customer experience in aftersales. That's also a huge opportunity in terms of customer loyalty, which in turn generates indirect revenue. (PK)		
Actually, in my view, it is a very good way to stay in touch permanently. (JF)		

A good example is how to recognize when a customer is ready to switch brands. I can see this from the digital user behavior, for example if they visit third-party websites. (DU)		
Our ultimate goal is, of course, to create added value for the customer, to retain the customer as intrinsically as possible. (JR)		
OEMs are realizing that, on the one hand, they can't do everything themselves and, on the other, it's not necessarily efficient to do everything themselves because there are various partners or companies that have significantly greater expertise in the individual digital products. (PK)	Leveraging External Skills and Knowledge	
OEMs can't do this themselves, even using AI, it will come from partners or other companies. So for this reason alone, the ecosystem must grow and cooperation must also be strengthened. (PK)		
And the expertise? That lies only partly with the vehicle manufacturer, because the strategic direction still comes from the vehicle manufacturer, probably in collaboration with external partners. (JG)		
I mean, of course they can also learn from each other. In other words, any company that approaches a car company with an innovative use case. They use the data and learn from it and then further use cases can be developed together. (PK)		
Ecosystems give us the opportunity to bring together more data than has ever been possible. And then, on the other hand, using AI applications to ensure that this data is also utilized. (LS)		
This will definitely change and, of course, offer completely new possibilities for offering things beyond the classic business. Business models that OEMs may be able to tap into that were not possible in the past because they now have access to data outside of their original area of expertise. (LS)		
The collaboration or this ecosystem will grow closer together. As a result, there will also be higher entry barriers. This means that they can of course generate more value themselves and players who are not part of it will not be able to generate as much. (PK)	Establishing Entry Barriers	
We need to strengthen this ecosystem through partnerships, thereby generating barriers to entry. (PK)		
Process harmonization is a huge challenge, it sounds completely trivial, but one of our biggest challenges is to have uniform interfaces and uniform systems. System harmonization is a huge project, a huge effort. (OB)	Infrastructure and Technological Challenges	3. Challenges in Integrating

You really have to take a holistic approach to digitizing the entire organization. If you only partially digitize individual areas, it creates more complexity and more uncertainty in the entire organisation. (OB)		AI and DEs in the Aftersales Domain
This is one of the biggest challenges system integration and integration of knowledge in the direction of retail. (JR)		
A central factor is actually to choose a centralized approach and to consider a strategy and also a certain governance structure, to ensure that the initiatives that are launched contribute to the right strategic goals accordingly. (MR)		
We need to consider what it actually means for an operating model. I am also intervening in processes. I intervene in IT structures. I'm interfering in employees' workflows and that needs to be considered from the start. (MR)		
But then the idea is to further standardize these interfaces and ensure that the whole thing is scalable and that there is a similar standard between all the different players, so that the supplier can provide the information to [company's name] in the same format or via the same interface as to a [company's name] or [company's name] or whoever. (LS)		
We're not just talking about offering the feature, offering this online service booking, but also really offering the customer experience in the workshop that the customer has chosen. (OB)		
The OEMs have endless amounts of data, but the algorithms are not yet well trained. (PK)		
So I, I'm going to take AI in particular, is the topic of hallucination. In other words, an AI if you don't program it accordingly. There is always a solution, but it can also be the wrong solution. (JR)		
There are still certain challenges, for example hallucinations of AI models are still prevalent. (MR)		
One risk with AI is that there is simply potential for misuse. In other words, that data can be hacked. (SH)		
I think we agree that an AI is only as intelligent as how I feed it. (JF)	Data Quality and Effective Data Management	
And the question is rather whether the OEMs are in a position to implement this, because AI naturally requires a lot of data and this must be available in a well-structured form. And most OEMs don't have that at the moment. (OS)		

The problem this creates is that they don't have the data in one place. Many OEMs are currently working hard to centralise it somewhere and at least get into reporting, in order to actually collect the data in the first place and then enable all these functions. And that is a major obstacle, which of course has not been considered in the individual development of functions, products and so on and so forth. (PK)		
OEMs need to organize themselves internally to the extent that they are able to join such an ecosystem and have an internal overview of what data they have access to, what data exists and to classify or describe this data accordingly, as well as the technical capabilities to exchange data, share data or process data internally that they receive from participants in this ecosystem. (LS)		
Bringing together systems that previously did not communicate with each other, merging data, describing data accordingly, maintaining metadata, creating transparency about what data I actually have. (LS)		
Here is the issue of data and data availability, which is also very relevant. We often hear that AI is only as good as the data available - data is often available, but the quality of the data is not sufficient to generate something useful from it. This means that data cleansing plays a major role. (MR)		
In reality, you very often find that you either don't have the data you need or that the data you do have is often still very flawed if you have to make a lot of corrections. (SH)		
Another issue is that there is too much data available. We have far too much data, we have all kinds of data. The challenge, and we also need AI for this, is to filter out the important, relevant data. Sometimes a lot of data is more of a curse than a victory. (OB)		
Data protection is something that has to be ensured, of course. (DU)	Regulatory and Privacy Concerns	
So, long story short, there are a bunch of legal checks that significantly slow down various use cases where we actually wanted to use personal data somehow to provide them with intelligent offers. (PK)		
Transparency and trust are the most important things. No matter what we do, we have to explain to the customer at all times what we are doing with their data and that we are not misusing the data. (OB)		
We know that in the course of the drafting of the EU Data Act by the Commission, it was primarily the after-sales associations that lobbied particularly strongly in favor of the law. (LS)		

The EU Data Act can also help to break down these internal data silos and make data shareable with external parties, which is not really possible today. We can use the infrastructure that we are now setting up in the context of the Data Act to share data from all areas of the company with third parties outside the company via a standardised interface. And the whole thing can also work the other way round. We can integrate data from third parties into our systems. That will also change a lot. (LS)		
I think we need to see how this unfolds, as it is still quite new and the consequences are still being evaluated. So I, we, cannot see any advantage for us at the moment. (SH)		
You really have to take a holistic approach to digitizing the entire organization. If you only partially digitalize individual areas, it creates more complexity and more uncertainty throughout the entire organization. (OB)	Ensuring Internal Readiness	4. Lessons Learned for OEMs
OEMs are also not as fast as the other development cycle that they are used to. This has already been shown several times in the digital sector that they simply can't get it on the road as quickly as when they either work with a tech company or with start-ups or whatever that specialize in it. (PK)		
And then the core competence of OEMs is still the vehicle with perhaps individual digital lighthouse projects. (PK)		
Start small. With a limited scope to first confirm the technical aspects of the case and test it with customers or end users at an early stage. (MR)		
So it's a make or break point. Yes, it has to be very, very good right from the start. It has to be a better answer than the customer is used to at the moment. (JR)		
Because in the customer's eyes, they don't make a difference between the channels, whether they're using digital or physical. They simply expect the same high level of customer experience. (JR)		
And especially, let me just say, the older generation of employees are not always aware of everything that is possible. And sometimes you just have to sensitise them a little. (SH)		
Mindset and skillset of employees to recognize the corresponding possibilities, possibly even to apply them themselves and to have the skills in the company to deal with these issues. (LS)		
Even when you're browsing the internet, the personalised advertising you get whether you want it or not. The possibilities are just huge. You just have to find the sweet spot so that it doesn't get kind of creepy for the customer. (PK)	Ensuring External Readiness	

I ensure that the customer has the sovereignty, has the feeling and not just the feeling, but also the control over the data? But at the same time, there are also opportunities to create new added value for the customer from this data by exchanging it with each other, by sharing it in an ecosystem. (LS)		
Of course, the younger generation has different requirements. (OS)		
Yes, and also with regard to workshops. You have to convince people, because things are going really well for the workshops right now. They are working at full capacity. (OS)		
And everyone should be picked up on this digital journey: training, persuasiveness and also really, when we explain the added value of the customer, also explain the added value for the workshop, for the work in the workshop. What is the benefit, why should I do this and how can we win together? What we have at the moment is a very strong system-related debate and way of thinking, where the human factor, how things went at the end of the day, is being pushed a little to the side. (OB)		