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# Data-Driven Transformation in the Automotive Industry: The Role of Customer Usage Data in Product Development

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## Full research paper

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## Abstract

Automotive manufacturers are pressured to integrate customers into product development effectively to foster innovation and remain competitive. While traditional approaches to customer integration have relied on market research and the customer's intention to use, the digital transformation of the automotive industry increasingly enables manufacturers to leverage customer usage data for product development. However, we lack insights into how customer data influences automotive productive development. To close this gap, we investigated the role of customer usage data for product development at a leading car manufacturer. Drawing on 20 expert interviews, we derived three key dimensions that explain how customer usage data influence product development in automotive: "data-driven product evaluation," "data-driven product development," and "data-driven product innovations." Our findings shed light on the transformative role of customer usage data for product development and provide valuable guidance for practitioners to effectively leverage customer usage data as part of the automotive digital transformation.

**Keywords** Data-driven Transformation, Customer Usage Data, Customer Integration, Product Development, Automotive Industry.

# 1 Introduction

Manufacturing firms face digitally induced changes causing increasing external volatility, shorter product life cycles, global competition, and rapid technological advancements, but also opening up innovation trajectories in the digital space (Einhorn et al. 2021; Enkel et al. 2005; Füller et al. 2019). The automotive industry, in particular, has experienced a significant increase in vehicle digitization, leading to turbulent market dynamics and changes in business models (Chakravarty et al. 2013). New digital and electric manufacturers like Tesla, Nio, and BYD have entered the scene, and software companies like Google and Apple have entered the automotive industry to explore new ways to extend the customer's digital journey into the car. For example, the digital user interface within the car offers new customer channels and data-collection opportunities.

As the core of manufacturing's value creation, product development must adapt to these environmental changes and ensure customer satisfaction by addressing the changing customer needs (Einizadeh and Kasraei 2021). This is best achieved by integrating the customer directly into the product development process (Fuchs and Schreier 2011; Hoyer et al. 2010). A customer-centric approach reduces uncertainty in customer demands (Wang et al. 2021), enabling targeted resource allocation and the creation of concepts that precisely meet customer needs (Koushik and Mehl 2015). Traditional approaches to customer integration primarily rely on market research, however today, real-world customer data is increasingly available and can be used to understand the characteristics and behavior of actual or potential customers and transform the product development process (Einhorn et al. 2021; Enkel et al. 2005; Füller et al. 2019; Grieger and Ludwig 2019). Such customer usage data is already used for business model innovation (Baecker et al. 2021). For example, manufacturers can develop customer-oriented personalized functions that enable usage-based business models where customers follow a pay-per-use approach (Gassmann et al. 2016).

However, despite these advancements and an understanding of data-driven business models, car manufacturers still need a precise understanding of how customer usage data can be leveraged to enhance and improve product development (Grieger and Ludwig 2019; Günther et al. 2022). There still needs to be a greater understanding regarding precise customer usage of functions and how customer usage data can be leveraged to enhance these functionalities (Einhorn et al. 2021; Günther et al. 2017). Therefore, more research is required to analyze how the collection and analysis of customer usage data influence the product development process (Cappa et al. 2021; Füller et al. 2019).

To address this research gap, this study examines how an incumbent automotive manufacturer uses customer usage data and what challenges arise in handling and applying customer usage data. It analyzes the purposes for which data is used in product development and how this changes decisions and the development process. To provide a better understanding of the use of customer data to improve product development, based on the case of a car manufacturer, we aim to answer the following research question: *How does access to customer usage data change product development?*

We applied semi-structured interviews with twenty managers of an automotive manufacturer. By analyzing the interviews, we examine how an incumbent automotive manufacturer applies customer usage data and what challenges arise in handling this data. It analyzes the purposes for which data is used in product development and how this changes decisions and the development process. We derived three key dimensions that explain how customer usage data influence product development in the automotive industry. Our findings illuminate the transformative impact of customer usage data for product development and guide practitioners to properly leverage customer usage data as part of the automotive digital transformation.

# 2 Theoretical Background

This section introduces relevant literature on product development, customer integration, and customer usage data in the automotive industry.

## 2.1 Product Development and its Customer Integration

Product development encompasses a series of activities involved in creating, designing, and marketing a product (Blackhurst et al. 2005; Eppinger and Ulrich 2015). It requires responding to customer needs, adapting to environmental changes, and providing solutions that ensure customer satisfaction (Einizadeh and Kasraei 2021). Decision-making regarding which products to develop is crucial for a company's success. However, digitalization has introduced disruptive changes to businesses, characterized by increased external volatility, shorter product life cycles, intensified global competition, and exponential technological advancements (Edmondson and Nembhard 2009; Huang

et al. 2022; Kagermann 2015; Nijssen and Frambach 2000). These changes have heightened the uncertainty and unpredictability of product development, particularly regarding idea generation and evaluation (Kim and Wilemon 2002; Van Rijmenam et al. 2019).

Increasing customer integration in product development is critical for enhancing customer satisfaction and gaining a competitive advantage (Fuchs and Schreier 2011; Hoyer et al. 2010). A customer-centric approach aims to reduce uncertainty in customer demands (Wang et al. 2021), enabling the targeted allocation of resources and the development of concepts that precisely align with customer needs and exhibit a high frequency of use (Cappa et al. 2021; Koushik and Mehl 2015). By involving customers in the product development process, companies can gain valuable insights into the preferences and needs of their target market, identify potential issues or opportunities, and create products that are more likely to succeed in the market (Enkel et al. 2005). Customer integration primarily relies on market research conducted through customer surveys and lead user workshops (Enkel et al. 2005). The results of market research often reflect the intention to use the product (as discussed in the literature on the Technology Acceptance Model (TAM)) (Davis 1985). Therefore, product development is primarily driven by the intention to use. However, with the digitization of products, companies can now leverage vast amounts of customer usage data, allowing them to utilize actual usage data rather than solely relying on intention data.

## 2.2 Customer Usage Data in the Automotive Industry

In the automotive industry, there is an increasing emphasis on leveraging customer usage data for product development (Micus et al. 2022). Automotive manufacturers have access to various types of customer usage data, including social, sensor-based, or machine-generated data (Abbasi et al. 2016; Gao et al. 2016). These data encompass GPS locations, seat positions, and speeds, which can be used to derive information such as customer driving behavior, user profiles, and traffic conditions. This information serves as a basis for objectively analyzing customer needs and making decisions for product development (Höhn et al. 2017; Johanson et al. 2014).

To gain a deeper understanding of customer needs, companies can analyze customer usage data to ascertain the actual product usage by customers. Incorporating customer usage data into product development enables the integration of actual usage patterns (Enkel et al. 2005). It is important to note that usage data reflects the behavior of current customers and may not necessarily align with the behavior of the target customer segment (Cappa et al. 2021; Seddon et al. 2017). This creates a conflict between departments that may base product development decisions on an imagined target customer and those that prefer to consider the current customer (Abbasi et al. 2016; Cappa et al. 2021). Information technology and data processing play a crucial role in capturing business events and responding swiftly to changes, resulting in significant transformations in how businesses employ data in their decision-making processes (Abbasi et al. 2016; Cappa et al. 2021; Chakravarty et al. 2013; Günther et al. 2017; Jones 2019; Seddon et al. 2017). Consequently, leveraging customer usage data for product improvement holds great potential for designing and developing more user-centric products.

However, despite these advancements and an understanding of data-driven transformation, car manufacturers still need a precise understanding of how customer usage data can be leveraged to enhance and improve product development (Grieger and Ludwig 2019; Günther et al. 2022). The following study analyzes how access to customer usage data changes product development.

# 3 Research Approach

In order to gain a detailed, empirical understanding of the role of customer usage data, we conducted an exploratory case study at a leading car manufacturer (Yin et al. 2018). This approach is suitable when the unit of analysis can only be regarded in its context and surrounding (Benbasat et al. 1987; Yin et al. 2018), which is the case for the customer usage data from an automotive manufacturer and the ecosystem of actors around it. We conducted interviews with an automotive manufacturer to gain insights into the role of customer usage data and how this will develop in the future. Before interviewing employees, we investigated the current process, what role customer usage data currently has, and for what parts of a decision process it is being used.

## 3.1 Data Collection

Our data collection concentrates on 20 semi-structured interviews within the organization of an automotive manufacturer. The company is the leading car manufacturer in the premium segment. Since 2018, it has been working with the transmission of live customer usage data via the backend of its customer vehicle fleet. In this context, automotive manufacturers have social, sensor-based, or

machine data at their disposal (Abbasi et al. 2016; Gao et al. 2016). The collected data include e.g., GPS locations, function usage, seat positions, weather, and speeds. This currently involves around 8.5 million vehicles, sending vehicle data to the manufacturer several times a second. Information such as customer driving behavior, user profiles, and traffic conditions can be derived based on these data. Due to the data-driven transformation of the automotive manufacturer and the ongoing transition to a digital company, this automotive manufacturer is particularly well suited to explore the influences of customer usage data for product development. This information can be used to analyze customer needs and derive decisions for product development objectively (Höhn et al. 2017; Johanson et al. 2014). To gain a comprehensive perspective, we purposefully sampled our interview partners to cover different departments and roles involved in product development and decision-making processes. Most interviewees were department managers, data analysts, customer insight managers, and product goal managers. All respondents were selected on specific criteria, which included working in product development, having at least two years of job experience, and actively working with customer usage data. All interviewees were experts in their field and deal with customer usage data in product development, as seen in Table 1 overview. Each interview took around 30 to 45 minutes.

| **Role** | **Tasks** | **N (∑= 20)** |
|---|---|---|
| Data Analyst | Analysis of early development phase data, Car assistant data, Traffic data | 7 |
| Customer Insight Manager | Market research, Customer orientation; Strategy | 5 |
| Product Target Manager | Derivation of product targets | 4 |
| Principal | Analysis of car fleet data; Data transformation cockpit; Connected company insight center | 2 |
| Benchmark Analyst | Analysis of competitors and new players | 1 |
| Product Owner | Used vehicle remarketing | 1 |

*Table 1. Overview of the Roles and Tasks of the Interviewees.*

Our semi-structured interview guidelines aim to explore customer usage data's current and future role in product development. Therefore, we first asked the interviewees to explain the current product development and decision-making process and which sources of information are being used. We then specifically asked for the use of customer usage data to support these processes. We were particularly interested in identifying potential challenges and outcomes of using customer usage data, such as faster insights. We further explored how customer usage data potentially conflicts with other sources (e.g., surveys or key performance indicators) and how those conflicts can be resolved. Finally, we asked open questions about the future role and impact of customer usage data and analytics for product development.

## 3.2 Data Analysis

The 20 transcribed interviews were coded and evaluated according to Mayring (Mayring and Fenzl 2019). The qualitative text modules were assigned to three dimensions, divided into several categories. The category, e.g., “Influencing factors," recorded all statements regarding factors influencing product decisions. Another category, “Previous & current changes in data analytics," deals with the changes in data analytics concerning usage data in recent years or can currently be observed. In addition, it included how the influence of the customer factor on product decisions has changed in recent years and what changes may have occurred in the data-based description of customers. Coding units vary in size, such that the smallest unit consists of only a word, such as a job title, whereas the largest coding unit comprises a complete sentence. In some cases, coding units also consist of the question and the answer if the answer is not understandable, for example, in a response with "yes" or "no." After a total of 784 coded contributions had been created from the 20 interviews, these were divided into categories in a second coding step. This resulted in 18 categories. This procedure was repeated until three superordinate dimensions were formed for the categories. To each of the three dimensions, six categories were assigned.

# 4 Results

In this chapter, we present our interview results about the role of customer usage data in an incumbent automotive manufacturer. First, we show how the use of vehicles and customer usage data is changing in different areas and what role customer usage data play in the automotive industry. Second, we identify factors influencing product decisions and highlight the advantages and disadvantages of classic customer studies and results from customer usage data. We also look at how a combination of effects can improve product decisions. Finally, we look at how data analytics has evolved in the past, how it is being used today, and how it will be used in the future. From the interviews, we could categorize the results of the impact of customer data on product development into three key dimensions: data-driven product evaluation, data-driven product development process, and data-driven product innovation.

## 4.1 Data-Driven Product Evaluation

Our interviews suggest that data is also heavily used to gain a thorough understanding of the customer besides obtaining insights about the product. Understanding the customer lays the foundation for an evaluation of the existing products. For example, data analyst 6 stated that a company should have its highest priority in customer-oriented decisions, which are facilitated by a deep understanding of the customer. Customer data analysis can lead to valuable insights previously unavailable or requiring an expensive study. Likewise, a deep understanding of customer usage can be achieved, and market usage changes can be responded to. Data analyst 1 describes the benefits of using data analytics: “We will get a better sense of what our customers are doing with the cars”. It also explains how the company wants to position itself in the future in terms of decision-making: “We simply have to become leaner, we have to become more customer-centric, we have to understand what the customer wants, what he is upset about, what he likes and what he does not like. And that is where we come in, if we look at the data, understand what the customer is doing in the field, and thus offer better options, so to speak, also in the direction of quality”.

To gather such detailed customer insights requires practitioners to use multiple data sources, such as usage data, studies, benchmarking, customer feedback, and additional external references. Customer insights manager 4 states, “It is essential for us that we do not make decisions on one data source, but have at least two, rather three or even four, that we create as much as possible a 360-degree view”. The interviewees described the desire to know what the driver does in the car and what he thinks is a high priority. These insights would lead to a holistic understanding of the customer, making it feasible to evaluate the usage of certain features or functions. Experts that were interviewed stressed the aspect of combining multiple data sources and linking them together.

In addition, there is often a discrepancy between what customers say and what the data shows, making it difficult to verify the data. In this case, practitioners try to understand the customer better and the reasoning behind the decision. Whether measured or qualitative data is more critical was answered equally without showing a visible trend. The interviewees also clarified that a closer linkage of subjective and objective data is necessary to add value to data analysis and studies. Preferably multiple data sources come to the same conclusion to underline a decision.

## 4.2 Data-Driven Product Development Process

In developing new products or features, the interviewees addressed the current or recent changes in data analytics in the context of customer requirements and product decisions. Overall, an increased awareness of data was observed among the interviewees, which also led to better accessibility and an increasing influence on, e.g., product decisions through better results from analysis of customer data. Almost all respondents explicitly mentioned that information from data analytics could be used for faster and more targeted development. Customer insights manager 3 also describes its future perspective and the advantages of a profound use of data analytics: “I believe that there is a massive future in the area of big data, to evaluate more and more, to understand the customer better and better, and perhaps to understand him more cost-effectively so that I can save myself specific study analyses because I can simply evaluate everything. I believe this is a vast field of the future, and whoever masters it will be very successful in the market; that is just the basic principle."

The amount of data that can be accessed is the foundation of developing products more accurately based on data insights. It can support, e.g., in choosing a function to develop further and making decisions in development processes. By continuously analyzing usage data, it is possible to have a quick reaction time to changes in the market or the usage behavior of customers. This was declared as an explicit goal of product target manager 2 when mentioning that “….it would be a dream come true

to react very quickly" in the development process. Especially since the time-to-market can last up to 7 years, it is very challenging to understand the customer's demands so far in advance and quickly react to changes.

Especially highlighted were dashboards and a database that uses continuous data to map the usage behavior of customers or individual customer groups. Data analyst 6 compares this approach to startup product development, "Then you have a KPI dashboard where you can map that easily and where you can also click in quickly when you have a decision to make. That is how I always imagine it with startups, they have a big dashboard, and the management also proactively goes in there and looks at how it is with the numbers, data, facts." Data analyst 5 also points out that the period in which a decision is made in the product development process is becoming shorter and shorter, and decisions have to be made based on the information provided as to which products the customer wants.

### 4.3 Data-Driven Product Innovations

In the future, respondents hope to use artificial intelligence to develop new functions whose function parameters are created based on customer data. Large amounts of data about the behavior could lead to designing differentiated product offerings according to clusters of customer groups. Analyzing the behavior of segmented customer usage groups, automotive manufacturers develop mass-customized and mass-personalized products. The goal to become more customer-centric, to deeply understand what different customer groups want and what they are upset about, can be achieved by looking into the collected data, as supported by data analyst 1 and others. The focus here is on the personalization of functions and the customer-oriented development of functions. The most frequently suggested use case was proactive function recommendation. Proactive function recommendations are not played out based on fixed conditions but on the usage behavior of other customers using these functions. Road sections can be labeled to determine how well a function performs there, and it can be predicted how well a function will perform on the following road sections. The function information can also be displayed per usage group so that, for example, a commuter or a very sporty driver is offered different functions than a comfortable driver who lives in the city.

More and more data analyses are being used for function development and the targeted design of function parameters. For example, it is possible to simulate how many customers can use a driver assistance system and how long. Mainly when designing the speeds at which functions can be used, this helps save the customer effort and costs. As product target manager 4 reported, "Here, for example, we use road topology information from the HD map to deduce which roads we can topologically activate our Commute Pilot function. This also included simulating the speeds and durations the function should work up to. This simulation can be studied for specific markets and countries but also for specific cities. This way, functions can also be offered in or developed for specific countries.

The ability to add new features over the air without the need to visit a car shop is being rolled out more and more. This offers a significant chance to modify, adjust or add new features based on the customer's usage and preferences. The goal is to find the most fitting feature for the customer through data evaluation and lead them to interact with the automotive app store, where they can purchase further features. The interviewees recommend that customer usage data be used to leverage features for individual customers to try or buy via new pay-per-use or digitalin post-sales. This possibility brings in additional cash flow throughout the product development process.

## 5 Discussion

The data-driven transformation is changing the product development in the automotive industry. Based on our qualitative results, we reveal three dimensions of using customer data in the product development; "data-driven product evaluation," "data-driven product development process," and "data-driven product innovations," which are influenced by the data-driven transformation. We identified application potentials for the three dimensions and described them with examples from the literature and the interviews (Figure 1). The following discusses how data analytics creates new customer insights and their development benefits. Second, we outline how the integration of data analytics changes the development process and what benefits arise from the shortening of the development process. Finally, we examine the new possibilities of data-based product innovations and the personalization of individual functions.

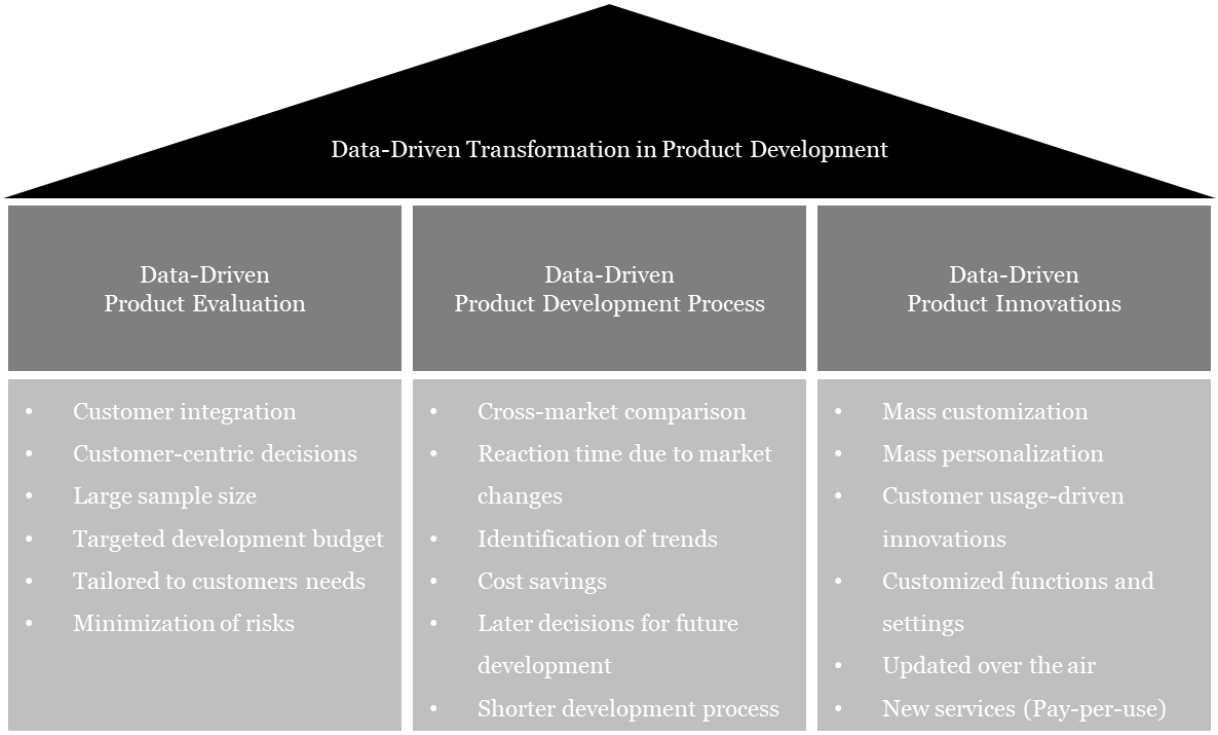


*Figure 1. Three Dimensions and their Application Potentials for the Data-Driven Transformation in Product Development.*

## 5.1 Impact of Data Analytics on Product Evaluations

Manufacturers can acquire insights into a new product's target market and potential users by analyzing customer usage data. This analysis facilitates more precise identification of product functions with the most significant customer value across diverse markets, providing a solid basis for decision-making (Aurambout et al. 2019). Incorporating this additional information channel enables the identification of novel customer insights about the actual behavior and handling of vehicles. As a result, the customer perspective and their needs can be integrated more deeply into the development process (Fuchs and Schreier 2011; Hoyer et al. 2010). Deep customer integration empowers automotive manufacturers to allocate their budgets in a customer-centric manner and align them with the interests of their customers. In particular, the various perspectives on customer behavior play a significant role. Traditional market research typically relies on customers' self-reported intentions to use a product, whereas customer usage data analysis reveals their usage patterns. This approach ensures product development is primarily driven by real-world usage rather than mere intentions (Einhorn et al. 2021; Enkel et al. 2005; Füller et al. 2019; Grieger and Ludwig 2019). The discrepancy arises due to common method variance between intention and actual use. Leveraging actual usage data can mitigate the problem of common method variance in product development research.

A large sample size of customer usage data can accurately depict customer behavior's diverse and intricate nature (Cappa et al. 2021). Moreover, it can offer insights into consumer behaviors and preferences that are challenging to capture through conventional market research methods. Based on the analysis of customer usage data, manufacturers can expedite the development of personalized product features and functions that cater to customers' needs more effectively and at a lower cost compared to market competitors who do not leverage such data (Davenport and Harris 2017; Gebauer et al. 2020; Hagiu and Wright 2020; Nambisan et al. 2019). The utilization of customer usage data empowers companies to develop products that are better tailored to customers' needs and preferences.

Functions with significant customer benefits can be identified easily and quickly using the available data. Consequently, functionalities within the product development process can be reprioritized, and resources for customer-oriented product development can be allocated more efficiently (Grover et al. 2018). Additionally, if necessary, extensive data analysis can be conducted on a single computer repetitively over time, eliminating the need for expensive market research.

### 5.2 Influence of Data Analytics on the Process of Development

Market research can be time-consuming and expensive, whereas utilizing global customer usage data offers valuable insights for global product development strategies and enables cross-market comparisons (Micus et al. 2022). An example is that the parking behavior changes between the different markets, and by applying a data-driven approach to determine the parking behavior, it is easy to compare markets and analyze the parking behavior in detail. Automotive manufacturers can make different market decisions (Micus et al. 2022). Moreover, customer usage data can be leveraged to identify market trends and changes. By analyzing this data, automotive manufacturers can detect emerging trends and develop innovative products that cater to these evolving demands. Accurate capture of actual customer usage is facilitated by analyzing customer usage data. Additionally, live data can be continuously collected and analyzed, enabling prompt response to market changes and customer usage patterns. This approach is less time-consuming and more cost-effective than large-scale market research analysis. For example, analysis of customer usage data can uncover new trends in connectivity, electromobility, or mobility services, leading to data-based product innovations.

Accelerating the development process fosters the innovative process of automotive manufacturers. Agile responses to evolving customer needs and market trends enable automotive manufacturers to streamline the entire development process, reducing the time between idea generation and vehicle launch, which increases customer satisfaction and loyalty. Continuous data analysis and trend identification enable companies to cultivate novel product ideas and drive innovation, empowering manufacturers to create relevant products that fulfill customer needs. Consequently, the company can gain a competitive edge by proactively meeting these needs and anticipating trends, leading to introducing innovative products before competitors.

### 5.3 Implementation of Data-Driven Product Innovations

Regarding product development and innovation, car manufacturers aspire to implement mass personalization and mass customization by analyzing customer usage data, thereby gaining a deeper understanding of individual customer needs and preferences. Leveraging customer usage data facilitates the development of intelligent and personalized solutions tailored to individual customers, thus enabling mass customization (Kaiser et al. 2021). Using customer usage data enables the precise categorization of customers in a highly personalized manner, leading to the development of mass-personalized solutions that enhance the customer experience (Hasenjäger et al. 2019). Through analyzing customer usage data, manufacturers can identify patterns in driving behavior, the usage of specific features, or customer preferences. These patterns can inspire new product ideas tailored to customers' behaviors and preferences. For instance, new driver assistance systems could be developed to adapt to individual driving styles based on analysis results. Consequently, personalized, proactive function recommendations exemplify solutions where automotive manufacturers can recommend the appropriate driver assistance systems to specific customer segments at the right time (Hasenjäger et al. 2019). Similarly, manufacturers can provide personalized presets or functions that cater to individual drivers' needs and preferences. For instance, seat positions, climate controls, or entertainment settings could be adjusted according to individual driver preferences. Companies can boost customer satisfaction and establish long-term customer loyalty by offering personalized solutions based on customer usage patterns. Satisfied customers are more likely to engage in repeat purchases and generate positive word-of-mouth recommendations. Functions can also be adapted to customer preferences through over-the-air updates, or new product innovations can be retrofitted to existing vehicles.

Furthermore, a comprehensive understanding of customer usage enables innovation beyond the product. Business model innovation has become a major source of competitive advantage. In product-oriented industries, there is the trend of servitization, where products are not sold, and ownership changes, but customers pay for the usage (Kaiser et al. 2021; Sorescu 2017). This business model is also based on customer usage data and taps into new and often more price-sensitive customer segments. However, to implement such a business model, the product development process needs to be adapted to create a product enabling this business model.

## 6 Contributions to Research and Practice

This study contributes to theory and practice. This study identifies gaps in current big data analytics research by revealing insights into how data-driven transformation changes product development. To close this gap, we investigated the role of customer usage data for product development at a leading car manufacturer. Drawing on insights from these interviews and relevant literature, we identified

three key dimensions influenced by the data-driven transformation in product development: "data-driven product evaluation," "data-driven product development," and "data-driven product innovations." For each dimension, we examined the application potentials of integrating customer usage data in the product development process and provided illustrative examples from the automotive industry. Our findings shed light on the transformative role of customer usage data for product development and provide new insights into current academic research on which levels the use of data analytics improves product development. With the proliferation of data and the ever-increasing opportunities to use customer usage data, it is necessary to reveal how the application data analytics can be applied to which output for product development. We also contribute to customer integration research by demonstrating the value of actual usage data instead of merely intending to use market research data.

In practice, we contribute by inspiring automotive companies to implement customer usage data into product development. We provide valuable guidance for practitioners to leverage customer usage data effectively as part of the automotive digital transformation. Drawing on insights from this paper, we examined application potentials and how analyzing customer usage data enables automotive manufacturers to align their products and services more effectively with individual customer needs and preferences, facilitating mass personalization and customization by recognizing and incorporating individual preferences and usage patterns. This potential enables an efficient and customer-value-oriented focus in developing future features.

# 7 Limitations and Future Research

Our study has certain limitations. First, we interviewed 20 employees of a leading automotive manufacturer in Germany. The information is limited to the subjective views of those involved. While we ensured that the experts come from many backgrounds and a broad representation of the processes and information, slight variations may occur with different interviewees or companies. For further studies, we propose an expansion of multiple automotive manufacturers. Second, our analysis focused on the automotive industry with a unique product development process. Nevertheless, from the findings of the product development process, generalizations about any product development process can be made. Finally, handling customer usage data is subject to applicable data protection regulations. Companies must ensure that customer data is anonymized and protected to preserve customer privacy.

Our research provides several opportunities for further studies. Further analysis can be conducted for which methods were used in product development. This would serve as a basis for future investigations (Micus et al. 2023). Subsequently, how data analytics affects the three dimensions could be shown. This could include demonstrating how customer usage data creates new customer insights (Micus et al. 2022) and the benefits of analytics for product decisions. Next, we suggest improving products through data-driven mass personalized development, and thereby customer satisfaction and loyalty can be achieved. Finally, analyzing the discrepancy between qualitative customer studies and quantitative data analytics results would be interesting.

# 8 Conclusion

The findings of this study highlight the crucial role of customer usage data in the data-driven transformation of the automotive industry's product development practices. The integration of customers into the development of products and business models is essential for fostering innovation in this rapidly evolving landscape. While traditional approaches heavily rely on market research and customers' intention to use, they fail to harness the full potential of actual usage data. Through in-depth interviews with industry experts and a thorough review of relevant literature, we identified three key dimensions that are influenced by the data-driven transformation: "data-driven product evaluation," "data-driven product development," and "data-driven product innovations." Within each dimension, we explored the advantages of integrating customer usage data, providing tangible examples from the automotive industry to illustrate its impact. The results underscore the value of incorporating customer usage data into the product development process. By leveraging this data, manufacturers can make informed decisions, optimize product features, and develop innovative business models that align with customers' real-world needs and preferences. Furthermore, integrating customer usage data offers cost-effective insights, reducing the risk of investing in unsuccessful products or models.

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