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REVOLUTIONIZING SERVICE QUALITY IN THE AUTOMOTIVE INDUSTRY: A TECHNOLOGICAL APPROACH THROUGH THE LENS OF TECHNOLOGY ACCEPTANCE MODEL AND INNOVATION DIFFUSION

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Abstract

This study explores the paradigm shift in service quality within the automotive industry through a technological lens, leveraging the Technology Acceptance Model (TAM) and Innovation Diffusion concepts. Integrating cutting-edge technologies has reshaped customer experiences and expectations in a rapidly evolving automotive landscape. The Technology Acceptance Model provides insights into user acceptance, emphasizing perceived ease of use and usefulness, while Innovation Diffusion elucidates the dynamics of technology adoption across diverse user segments. This research will uncover the challenges and opportunities of revolutionizing service quality strategies through a comprehensive analysis. This study captures Indonesia's automotive industry as a case study. By applying the TAM and Innovation Diffusion frameworks, the study delineates a roadmap for industry stakeholders seeking to enhance service offerings, ensuring a seamless and user-centric transition to a technologically advanced automotive era. This study found how the spread of technological innovations influences the implementation of service quality strategies across the automotive industry.

Keywords: Automotive Industry, Innovation Diffusion, Service Quality, Technological Approach, Technology Acceptance Model.

INTRODUCTION

The automotive industry is undergoing a transformative evolution driven by a convergence of technological advancements, changing consumer preferences, and a growing emphasis on sustainability. This evolution extends across various facets of the industry, reshaping how vehicles are designed, manufactured, and serviced. Several key trends characterize the dynamic landscape of the automotive industry, such as electrification and sustainable mobility (Gallo & Marinelli, 2020; Wittmann, 2017), autonomous and connected vehicles (Kopelias et al., 2020; Sun et al., 2022; Vaidya & Mouftah, 2020), digitalization and Industry 4.0 (Bhatia & Kumar, 2022; Llopis-Albert et al., 2021), mobility as a service (MaaS) (Genzlinger et al., 2020; Polydoropoulou et al., 2020; Wedeniwski, 2015), customer experience and personalization (Keskin et al., 2017; Sardjono et al., 2022), environmental regulations and corporate sustainability (Cioca et al., 2019; Kehbila et al., 2010; Moslehpour et al., 2023; Szász et al., 2021), global supply chain challenges (Sakuramoto et al., 2019; Z. Xu et al., 2020; Yadav et al., 2020), (Aalbers & Whelan, 2021; Dieguez et al., 2020), regulatory and policy changes (Pichler et al., 2021; Yang et al., 2019), and resilience and adaptability (Bentley et al., 2017).

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In electrification and sustainable mobility, a significant shift toward electric vehicles (EVs) as a response to environmental concerns and regulatory changes (Onn et al., 2018). This condition affects growing investments in battery technology and charging infrastructure to support the widespread adoption of electric mobility. There is an increasing focus on achieving higher levels of autonomous driving technologies in autonomous and connected vehicles. Integration of connected features, such as vehicle-to-vehicle communication and advanced driver assistance systems (ADAS), enhances safety and convenience. Today, in the digitalization and Industry 4.0, the implementation of Industry 4.0 principles (Ardito et al., 2019; X. Xu et al., 2021), including the use of artificial intelligence (AI), big data analytics, and the Internet of Things (IoT) are rapidly utilized in manufacturing processes. Digitalization of the automotive supply chain also improves efficiency and real-time monitoring.

Besides, new mobility models, such as ridesharing, car-sharing, and subscription-based services, challenge traditional ownership models for mobility as a service (MaaS) (Genzlinger et al., 2020). MaaS integrates various transportation modes into a seamless, interconnected mobility experience. In service quality, customer experience and personalization become crucial (Sardjono et al., 2022). Heightened focus on enhancing the overall customer experience, from vehicle purchase to after-sales service. Then, customization options, digital interfaces, and in-car technologies aimed at meeting diverse consumer demands. Environmental regulations and corporate sustainability must support the stringent emissions regulations driving the development and adoption of cleaner and more fuel-efficient technologies (Shao et al., 2020). Automotive manufacturers prioritize sustainability initiatives using recycled materials and eco-friendly production practices.

Global supply chain challenges such as increased awareness of supply chain vulnerabilities following global disruptions, prompting a reassessment of supply chain strategies, regionalization, and diversification to mitigate risks associated with unforeseen events must emphasized (Z. Xu et al., 2020; Zimmer et al., 2017). Moreover, the growing trend of collaborations between traditional automakers, technology companies, and startups to leverage each other's strengths is also important. The reason companies today are not solely relying on internal knowledge, technology, and resources such as employees and R&D departments for innovation. Rather, the concept of open innovation can be implemented by automotive companies in France and their subsidiaries in Brazil to create new products and technologies (Martins & Kaminski, 2019). It needs joint ventures focusing on research and development in the electric and autonomous vehicles area.

Regulatory and policy changes with governments incentivizing green technologies and setting targets for emissions reduction can encourage the development and deployment of advanced automotive technologies. The need for automotive companies to demonstrate resilience and adaptability in rapid technological changes and market dynamics can affect continuous innovation and agility as core competencies for sustainable success. This landscape in the automotive industry reflects a dynamic interplay of technological innovation, market forces, and societal trends. Automotive stakeholders must navigate these changes strategically to remain competitive and contribute to a more sustainable and connected future.

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The importance of service quality in maintaining customer satisfaction and loyalty in the automotive industry, or any industry, cannot be overstated. Key reasons why service quality plays a crucial role (Akbar et al., 2018; Ažman & Gomišček, 2015) such as customer expectations, customer satisfaction, brand image and reputation, differentiation in a competitive market, customer loyalty and retention, lifetime customer value, word-of-mouth marketing, increased customer engagement, repairing trust after issues, adaptation to changing customer needs, and enhanced employee morale.

Service quality directly influences customer expectations. When customers receive high-quality service, it aligns with or exceeds their expectations, leading to a positive brand perception. Quality service is a primary driver of customer satisfaction. Satisfied customers are more likely to be loyal and may become advocates for the brand, promoting it through positive word-of-mouth. Service quality contributes significantly to the overall brand image and reputation. A company that delivers excellent service will likely be perceived positively, enhancing its standing in the market. Service quality becomes a key differentiator in industries with intense competition, such as the automotive sector. Brands that consistently offer superior service can stand out in a crowded marketplace.

High service quality fosters customer loyalty. When customers have positive experiences, they are more likely to remain loyal to the brand, reducing the likelihood of switching to competitors. Satisfied customers tend to have higher lifetime value for a business. They are more likely to make repeat purchases, upgrade to newer products, and engage in long-term relationships with the brand. Quality service minimizes the risk of customer churn. When customers are consistently pleased with the service they receive, they are less likely to explore alternatives offered by competitors. Satisfied customers become advocates for the brand. They are more inclined to share positive experiences with friends, family, and colleagues, contributing to positive word-of-mouth marketing. Quality service enhances customer engagement. Engaged customers are more likely to provide feedback, participate in loyalty programs, and actively contribute to a brand's community.

In cases where issues or challenges arise, delivering exceptional service can help repair trust. Efficient resolution of problems and a commitment to customer satisfaction can turn negative experiences into positive ones. A commitment to service quality facilitates understanding and adapting to evolving customer needs. It allows businesses to stay responsive to changing market dynamics and customer expectations. Focusing on service quality often leads to employee satisfaction and pride in their work. Happy and motivated employees are likelier to deliver exceptional service, creating a positive feedback loop. In summary, service quality is not just a transactional aspect; it's a strategic imperative that permeates every interaction between a business and its customers. The positive impact of quality service resonates throughout the customer journey, fostering loyalty, positive brand perception, and sustained business success.

The automotive industry is revolutionizing service quality by focusing on various aspects such as technical quality (Canuto da Silva & Kaminski, 2017), tangibility, reliability, assurance, pricing, empathy, and responsiveness (Ahmad et al., 2020; Saidin et al., 2022). These factors

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have been identified as key drivers of service quality in after-sales services and automotive manufacturing (Akbar et al., 2018; Nguyen, 2022). Implementing quality management models and techniques, such as Predictive Quality of Service (PQoS) and Grey-DEMATEL, can help optimize service quality and improve customer satisfaction (Fathurohman et al., 2021). Additionally, strategies like Value Stream Mapping and the DMAIC method can be used to identify and address issues in lead time and service processes, leading to improved service quality and customer loyalty. By prioritizing these factors and implementing effective quality management practices, the automotive industry can enhance service quality, attract more loyal customers, and maintain competitiveness in the market.

One notable area for improvement in the approach used in these papers is the need for more generalizability. The studies focus on specific automotive service industries or brands, such as Toyota dealers in Indonesia or national carmakers in Malaysia, which limits the applicability of the findings to other context another drawback is the limited scope of the studies. Some papers only focus on specific aspects of service quality, such as lead time or technical quality, without considering other important factors that may influence customer satisfaction and loyalty. Additionally, the methodologies used in these papers may have limitations. For example, one study uses the Grey-DEMATEL model to evaluate service quality. Still, it needs to be clarified how well this model captures the complexity and nuances of the automotive service industry. Furthermore, some papers rely on self-reported data or subjective opinions, which may introduce bias and affect the reliability of the findings. Lastly, the studies need to comprehensively analyze the potential challenges and barriers to implementing the proposed improvements in service quality. Considering the practical feasibility and cost-effectiveness of the recommended actions would be beneficial.

Therefore, this research investigates directions and unanswered questions in the field of automotive service quality. This research explores the impact of service quality on customer loyalty in different contexts and industries beyond the automotive sector. This could provide a more comprehensive understanding of the relationship between service quality and customer loyalty. This research also highlights the need for further research on the factors influencing service quality in the automotive industry. There needs to be more consensus and detailed understanding of these factors, and more research is needed to identify and measure the weights of service quality factors. The primary objective of this study is to revolutionize service quality in the automotive industry by leveraging advanced technologies, with a specific focus on understanding and enhancing user acceptance through the Technology Acceptance Model (TAM) and fostering the diffusion of innovations. By combining these frameworks, the aim is to develop a comprehensive strategy that ensures the seamless integration of technological advancements and maximizes their acceptance among end-users, thereby elevating overall service quality standards in the automotive sector. This research seeks to provide actionable insights for industry stakeholders, guiding them in strategically adopting innovations to meet evolving consumer expectations and position themselves at the forefront of a technologically driven automotive landscape.

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METHOD

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a well-established theoretical framework developed to understand and predict how users adopt and accept new information technologies (Holden & Karsh, 2010; Marangunić & Granić, 2015). Originally proposed by Fred Davis in the late 1980s, TAM has since evolved and been widely applied in various domains, including the automotive industry. The relevance of TAM in assessing user acceptance of technology within the automotive sector can be discussed through several key aspects (Hiraoka, 2009; Koul & Eydgahi, 2018; Seuwou et al., 2020):

1. Ease of Use and Perceived Usefulness

TAM posits that users' intention to accept and use technology is influenced by two primary factors: perceived ease of use and perceived usefulness. In the context of automotive technology, these factors become pivotal. Users are more likely to accept new technologies if they find them easy to use and perceive them as beneficial or useful in enhancing their driving experience, safety, or overall convenience.

2. User Attitudes and Behavioral Intention

TAM suggests that user attitudes toward a technology mediate the relationship between perceived ease of use, perceived usefulness, and their intention to use the technology. Positive attitudes toward advanced features, such as autonomous driving or connected car services, can indicate greater acceptance and willingness to adopt these technologies in the automotive industry.

3. External Variables Influencing Acceptance

TAM acknowledges external variables that can influence users' perceptions and attitudes. These may include social influence, facilitating conditions, and individual differences. In the automotive context, social norms, peer influence, and the availability of supporting infrastructure (facilitating conditions) can impact the acceptance of innovative automotive technologies.

4. Continuous Adaptation and Evolution

TAM recognizes that users' perceptions and acceptance of technology are not static; they can change over time. This is particularly relevant in the rapidly evolving automotive industry, where continuous technological advancements require users to adapt to new features and functionalities. TAM provides a framework to assess and understand how users adapt to and accept these ongoing technological changes.

Applying TAM to specific automotive features involves examining how users perceive technologies such as in-car infotainment systems, advanced driver assistance systems (ADAS), and autonomous driving capabilities. Understanding user perceptions of these features is crucial for automakers to design products that align with user expectations and preferences. TAM aligns with the concept of the technology adoption lifecycle, recognizing that different

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user segments may adopt innovations at different rates. This could mean tailoring technology acceptance strategies to different customer segments in the automotive industry, considering age, technological literacy, and preferences.

The acceptance of technology, as assessed through TAM, directly affects service quality in the automotive industry. If users embrace and find value in the technological offerings, it can positively impact overall satisfaction with the vehicle and associated services, contributing to higher service quality. In conclusion, TAM provides a robust framework for understanding the intricacies of user acceptance of technology in the automotive industry. By examining ease of use, perceived usefulness, and external factors, researchers and industry practitioners can gain valuable insights into how users will likely receive new technologies, guiding the development of strategies to enhance service quality and overall user satisfaction.

Innovation Diffusion

The diffusion of innovation within the automotive industry involves studying how new technologies, products, and practices are adopted, spread, and integrated across various industry stakeholders. Innovation diffusion in the automotive sector is multifaceted and influenced by several factors. The key aspects related to the diffusion of innovation in the automotive industry (Meir, 1981; Schulze et al., 2015):

1. Innovations in Vehicle Technology

The automotive industry experiences constant innovation in-vehicle technologies, including advancements in electric vehicles (EVs), autonomous driving systems, connectivity features, and fuel-efficient technologies. The rate at which these innovations are adopted varies, and studying their diffusion provides insights into the evolving landscape of automotive technology.

2. Early Adopters and Innovators

The diffusion process often starts with innovators and early adopters willing to embrace new technologies. In the automotive industry, this may include tech enthusiasts, forward-thinking companies, and consumers eager to experience the latest advancements in vehicle features and performance.

3. Technology Adoption Lifecycle

The diffusion of innovation aligns with the concept of the technology adoption lifecycle, which includes stages such as innovators, early adopters, early majority, late majority, and laggards. Understanding where specific automotive innovations fall within this lifecycle helps tailor marketing and adoption strategies accordingly.

4. Consumer Acceptance and Perceptions

Consumer perceptions and acceptance significantly influence the adoption of innovations in the automotive industry. Factors such as perceived benefits, ease of use, safety, and environmental impact play crucial roles in determining the rate at which consumers embrace new automotive technologies.

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5. Regulatory and Policy Drivers

Regulatory and policy frameworks can either accelerate or hinder the diffusion of innovation in the automotive industry. Government incentives for electric vehicles, emission standards, and safety regulations often shape the industry's direction and drive the adoption of specific technologies.

6. Industry Collaboration and Partnerships

Collaboration between automotive manufacturers, technology companies, and other industry stakeholders accelerates the diffusion of innovation. Joint ventures, partnerships, and collaborative research and development efforts contribute to faster integrating new technologies into vehicles.

7. Market Competition and Differentiation

Market competition is a driving force for innovation diffusion in the automotive industry. Automakers strive to differentiate themselves by incorporating cutting-edge technologies, leading to a competitive environment that encourages the rapid adoption of innovations to stay ahead in the market.

8. Challenges of Infrastructure and Standardization

The diffusion of innovations faces challenges related to infrastructure and standardization. For example, the widespread adoption of electric vehicles depends on the development of charging infrastructure, and standardization of communication protocols is crucial for the seamless integration of connected vehicle technologies.

9. Technological Interdependencies

Innovations in the automotive industry often exhibit interdependencies. For instance, adopting autonomous driving technology may rely on sensor technologies, artificial intelligence, and communication systems advancements. Understanding these interdependencies is essential for predicting and facilitating innovation diffusion.

10. Consumer Education and Awareness

The diffusion process is influenced by consumer education and awareness about new technologies. Automotive companies invest in marketing and educational campaigns to inform consumers about the benefits and functionalities of innovative features, influencing their decision to adopt or resist the innovations.

11. Economic Factors and Affordability

Economic considerations, including the affordability of new technologies, influence their adoption. For instance, the initial high cost of electric vehicles may impact their diffusion, but as costs decrease and incentives increase, adoption rates are likely to rise.

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12. Globalization and Regional Variances

Globalization trends and regional variances in consumer preferences and regulatory environments influence the diffusion of innovation. Strategies for innovation diffusion may need to be tailored to accommodate diverse markets and cultural differences.

In conclusion, examining the diffusion of innovation within the automotive industry provides a comprehensive understanding of how various stakeholders embrace technological advancements. This examination is crucial for industry players, policymakers, and researchers seeking to navigate the dynamic landscape of automotive technology adoption.

RESULT AND DISCUSSION

Service Quality in the Automotive Industry

Service quality in this context goes beyond the actual manufacturing of vehicles and extends to the various services provided throughout the customer lifecycle, from pre-sales to after-sales support. Based on Figure 1, some distinctive features of service quality in the automotive industry are collected based on pre-sales, sales, and after-sales.

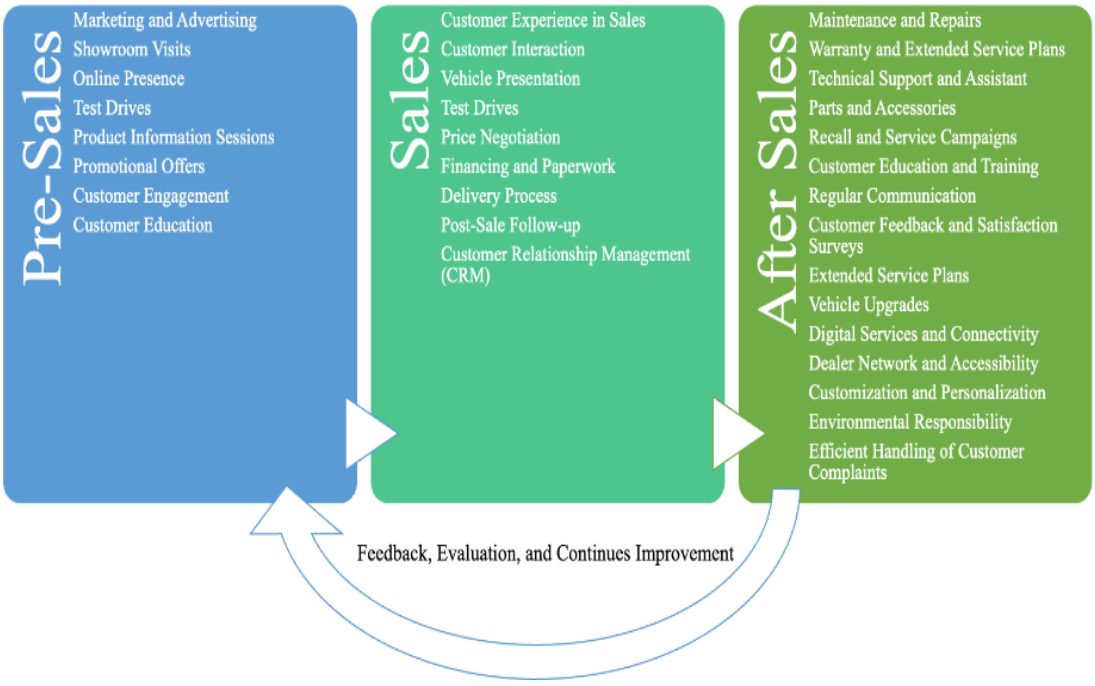

Figure 1: Features of service quality in the automotive industry

Service quality in the automotive industry encompasses a broad range of activities beyond the manufacturing of vehicles. It involves creating a positive and holistic customer experience that begins at the point of sale and extends throughout the entire ownership lifecycle. Meeting or exceeding customer expectations in these various service dimensions is vital for building brand loyalty and maintaining a positive industry reputation.

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1.1.1. Pre-Sales of Service Quality

In the automotive industry, the pre-sales phase plays a crucial role in shaping a potential buyer's decision-making process before purchasing. The pre-sales activities in the automotive sector are designed to create awareness, generate interest, and provide information to potential customers about the available vehicles. Here are some key aspects of pre-sales in the automotive industry:

1. **Marketing and Advertising:** Automotive manufacturers and dealerships use various marketing and advertising strategies to promote their vehicles. This includes television and radio commercials, online advertising, social media campaigns, and other promotional activities.
2. **Showroom Visits:** Potential buyers often visit dealerships to explore different vehicle models, examine features, and take test drives. This hands-on experience is crucial in influencing their decision-making process.
3. **Online Presence:** With the growth of online platforms, customers research and gather information about vehicles online. Automotive companies maintain a strong online presence, providing detailed information about their products, features, pricing, and customer reviews.
4. **Test Drives:** Offering test drives is a common pre-sales activity in the automotive industry. It allows potential buyers to experience the vehicle firsthand, assess its performance, and determine if it meets their preferences.
5. **Product Information Sessions:** Dealerships may organize events or information sessions to educate potential buyers about their vehicles' features, technology, and safety aspects. This helps customers make informed decisions.
6. **Promotional Offers:** Special promotions, discounts, or financing options are often part of pre-sales strategies to attract potential customers and encourage them to purchase.
7. **Customer Engagement:** Building relationships with potential customers through effective communication and engagement is crucial. Responding to inquiries promptly and providing relevant information can positively influence the customer's perception.
8. **Customer Education:** Pre-sales efforts also involve educating customers about the automotive brand, the unique selling points of specific models, and the overall value proposition.

Pre-sales activities in the automotive industry aim to create a positive customer experience, establish trust, and guide potential buyers toward making a well-informed decision when choosing a vehicle. This phase sets the foundation for a successful sales transaction and contributes to customer satisfaction throughout the ownership lifecycle.

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1.1.2. Sales of Service Quality

In the automotive industry, the sales phase is the critical step where potential buyers transition into actual customers by purchasing a vehicle. The sales process in the automotive sector involves various stages and interactions between the customer and the dealership or sales representative. Here are key aspects of the sales process in the automotive industry:

1. **Customer Experience in Sales:** the sales process in the automotive industry involves more than just the transaction. It includes the entire experience of purchasing a vehicle, from the showroom ambiance to the professionalism of sales representatives. A positive sales experience contributes significantly to overall service quality.
2. **Customer Interaction:** sales professionals engage with customers to understand their preferences, needs, and budget constraints. Establishing a rapport and addressing customer concerns is crucial for a successful sale.
3. **Vehicle Presentation:** salespersons provide detailed presentations of the vehicles, highlighting features, specifications, and benefits. They may also emphasize safety ratings, fuel efficiency, and technology features.
4. **Test Drives:** Offering test drives is a crucial part of sales. It allows potential buyers to experience the vehicle firsthand, assess its performance, and get a feel for its handling.
5. **Price Negotiation:** Negotiating the price is a common aspect of the sales process. Sales professionals work with customers to reach a mutually agreeable price, considering trade-ins, financing options, or additional services.
6. **Financing and Paperwork:** Once the customer agrees to purchase, the sales team assists in financing. This includes completing the necessary paperwork, discussing financing options, and addressing customer questions regarding terms and conditions.
7. **Delivery Process:** The vehicle is prepared for delivery after the sale is finalized. This may include detailing, final inspections, and explaining vehicle features to the customer. The sales team ensures a smooth vehicle handover to the new owner.
8. **Post-Sale Follow-up:** Many dealerships engage in post-sale follow-up activities to ensure customer satisfaction. This could involve checking in with the customer, addressing any concerns, and inviting them for service appointments in the future.
9. **Customer Relationship Management (CRM):** Maintaining a positive ongoing relationship with customers is crucial for customer retention and future business. Dealerships often use CRM systems to track customer interactions and provide personalized services.

The sales process in the automotive industry is dynamic and involves a combination of interpersonal skills, product knowledge, and effective communication. Building trust and delivering a positive customer experience during the sales process contributes to immediate sales and long-term customer loyalty and brand advocacy. It's important for sales professionals in the automotive industry to be knowledgeable about the products they are selling and to adapt

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their approach based on each customer's individual needs and preferences.

1.1.3. After Sales of Service Quality

After-sales services in the automotive industry are crucial for maintaining customer satisfaction, ensuring the longevity of the customer relationship, and building brand loyalty. This phase begins after the customer has made a purchase and continues throughout the ownership lifecycle of the vehicle. Key aspects of after-sales services in the automotive industry include:

1. **Maintenance and Repairs:** provide ongoing maintenance services and address any repairs or issues that may arise during the vehicle's ownership. This includes routine services such as oil changes, tire rotations, and more complex repairs. Maintenance and after-sales services are critical components of service quality in the automotive sector. This includes the efficiency of repair services, availability of spare parts, and the overall customer experience when seeking assistance or maintenance.
2. **Warranty and Extended Service Plans:** many vehicles come with manufacturer warranties that cover certain repairs and services for a specific period. After-sales services involve honoring these warranties and supporting customers in case of covered issues. The clarity and effectiveness of warranty programs and extended service plans contribute to quality. Customers expect transparent terms and conditions and a hassle-free process if they need to avail of warranty services.
3. **Technical Support and Assistant:** offering technical assistance and support to customers who may have questions or concerns about the operation of their vehicles. This could include guidance on using advanced features, troubleshooting, or addressing technical issues. As vehicles become more complex with advanced technologies, providing effective technical support and assistance is crucial. This involves addressing customer queries, troubleshooting issues, and ensuring customers feel supported using and maintaining their vehicles.
4. **Parts and Accessories:** Providing a reliable supply of genuine parts and accessories for the vehicle. This includes the availability of replacement parts for maintenance and repairs and offering accessories to enhance the vehicle's functionality or appearance.
5. **Recall and Service Campaigns:** Addressing any recalls or service campaigns initiated by the manufacturer to rectify potential issues or improve safety. Ensuring that affected vehicles are promptly brought in for necessary adjustments or repairs. A critical aspect of service quality is how efficiently a company handles recalls and communicates safety measures. Customers appreciate prompt and clear communication and proactive measures to address safety concerns.
6. **Customer Education and Training:** Offering educational resources and materials to help customers understand their vehicles better. This may include workshops, online resources, or printed materials that provide information on maintenance, safety, and other relevant topics.

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7. **Regular Communication:** Maintaining open lines of communication with customers through newsletters, emails, or other channels to keep them informed about service reminders, updates, and relevant promotions.
8. **Customer Feedback and Satisfaction Surveys:** Collecting customer feedback about their after-sales service experiences. This information can be valuable for improving processes, addressing any issues, and ensuring overall customer satisfaction.
9. **Extended Service Plans:** Offering extended service plans or service packages to provide customers with additional coverage beyond the standard warranty period.
10. **Vehicle Upgrades:** Providing options for customers interested in upgrading their vehicles through trade-ins or purchasing new accessories and features.
11. **Digital Services and Connectivity:** with the integration of digital technologies in vehicles, there is an increasing focus on digital services and connectivity. This includes in-car technologies, mobile apps, and online platforms that enhance the ownership experience.
12. **Dealer Network and Accessibility:** the accessibility and quality of the dealer network are important. A well-distributed and competent dealer network ensures customers can easily access service facilities and support, regardless of location.
13. **Customization and Personalization:** providing options for customization and personalization, both in the vehicle itself and in the services offered, contributes to service quality. Tailoring services to individual customer preferences enhances the overall ownership experience.
14. **Environmental Responsibility:** as sustainability becomes a key focus, automotive companies incorporate environmentally responsible practices into their services. This includes eco-friendly disposal of old parts, recycling programs, and initiatives to reduce the environmental impact of their operations.
15. **Efficient Handling of Customer Complaints:** a robust system for handling customer complaints is crucial. Resolving issues promptly and professionally contributes to overall customer satisfaction and can turn a potentially negative experience into a positive one.

Effective after-sales services contribute significantly to customer loyalty and positive word-of-mouth marketing. Customers who feel supported and satisfied with the after-sales experience are likelier to become repeat buyers and brand advocates. Therefore, automotive manufacturers and dealerships build robust after-sales service infrastructures to ensure a positive and lasting relationship with their customers.

Application of TAM to Evaluate the Adoption of New Technologies in Automotive Service Settings

The Technology Acceptance Model (TAM) is a valuable framework for assessing user acceptance of new technologies, and its application in the automotive service sector is crucial for understanding how innovations are adopted and embraced. Figure 2 presents how TAM can

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be applied to evaluate the adoption of new technologies in automotive service settings.

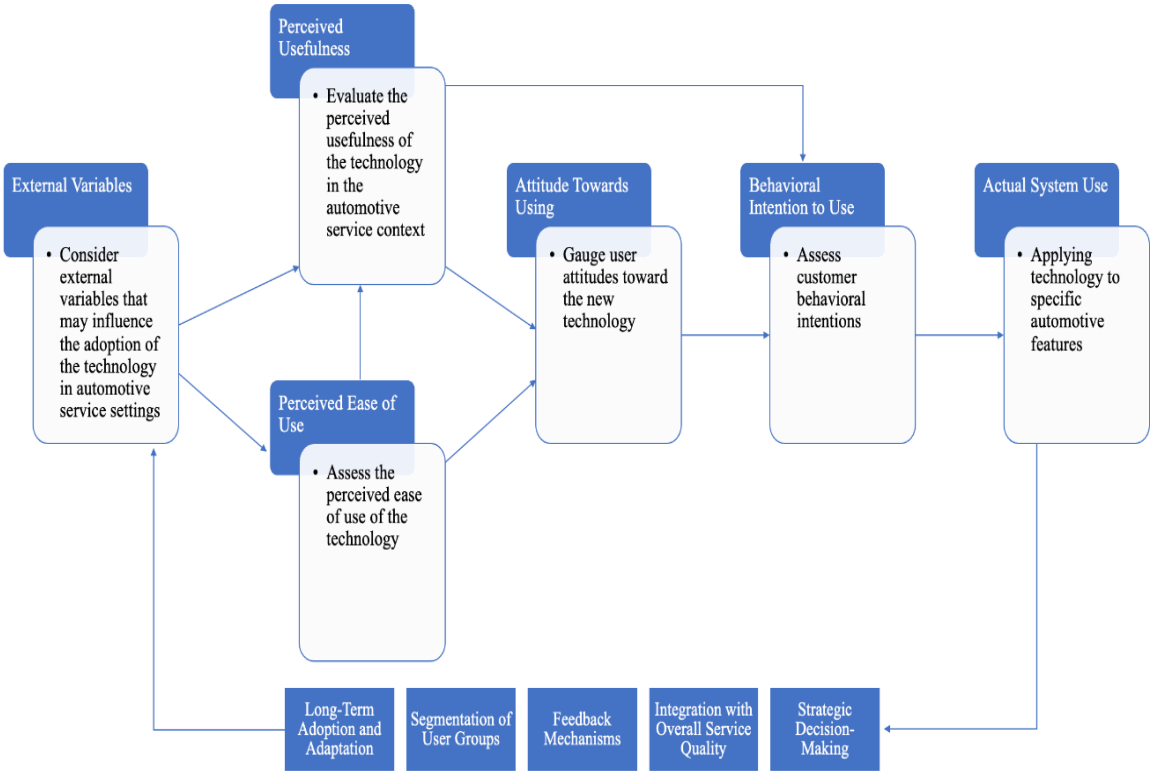

Figure 2: TAM for new technology in an automotive service setting

TAM adoption begins with identifying the target technology and clearly defining the new technology or innovation within automotive services you want to evaluate. This could be a digital service platform, a diagnostic tool, a mobile application for service appointments, or any other technology to enhance the service experience. Based on Figure 2, the requirement of each TAM framework for the automotive industry includes:

1. External Variables

Consider external variables that may influence technology adoption in automotive service settings. This could include factors such as management's support, adequate training programs, or the influence of colleagues and peers. TAM allows for examining these external factors in shaping users' perceptions.

2. Perceived Ease of Use

Assess the perceived ease of use of the technology. In automotive services, users (both customers and service personnel) should find the technology user-friendly and simple enough. Evaluate factors such as the intuitiveness of the interface, ease of navigation, and the simplicity of service interactions facilitated by the technology.

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3. Perceived Usefulness

Evaluate the perceived usefulness of the technology in the automotive service context. Users should perceive the technology as beneficial and adding value to the service experience. For instance, does the technology streamline service processes, provide relevant information, or improve the overall efficiency of service interactions?

4. User Attitudes and Behavioral Intentions

Use TAM to gauge user attitudes toward the new technology. Conduct surveys, interviews, or observations to understand how users feel about incorporating the technology into automotive services. Assess their behavioral intentions—are they willing to use the technology regularly, and do they see it as a positive addition to the service setting?

5. Actual System Use

The actual system used in applying technology to the automotive industry refers to the practical implementation and utilization of various technological solutions. In the context of the automotive sector, technology is applied across various domains, contributing to advancements in vehicle manufacturing, design, connectivity, safety, and overall operational efficiency.

6. Long-Term Adoption and Adaptation

TAM recognizes the dynamic nature of technology acceptance over time. Assess how users adapt to the technology in the long term. Are there changes in their attitudes or perceptions as they gain more experience with the technology? Evaluate whether the initial acceptance translates into sustained use and integration into routine service operations.

7. Segmentation of User Groups

Apply TAM to segment user groups within the automotive service setting. Different user groups may have varied perceptions and acceptance levels based on their roles, responsibilities, and familiarity with technology. Tailor strategies to address the specific needs and concerns of each user segment.

8. Feedback Mechanisms

Implement feedback mechanisms to gather user input on the technology continuously. TAM encourages a feedback loop to understand user experiences and make iterative improvements. This can involve regular surveys, focus group discussions, or direct communication channels for users to express their opinions and suggestions.

9. Integration with Overall Service Quality

Relate the findings from TAM assessments to the broader concept of service quality. Evaluate how adopting the technology contributes to or detracts from the overall service quality in automotive service settings. Consider factors such as efficiency, customer satisfaction, and the impact on service delivery timelines.

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10. Strategic Decision-Making

Use insights from the TAM application to inform strategic decision-making. If certain aspects of the technology receive lower acceptance, consider targeted interventions such as additional training programs, user interface enhancements, or communication campaigns to address concerns and improve acceptance.

In summary, applying TAM to evaluate the adoption of new technologies in automotive service settings provides a structured approach to understanding user acceptance dynamics. It enables stakeholders to identify strengths and weaknesses in the adoption process and implement targeted strategies to enhance overall service quality and user satisfaction.

Impact of Innovation Diffusion on the Evolution of Service Quality Strategies

The diffusion of innovation significantly influences the evolution of service quality strategies within various industries, including the automotive sector. An exploration of how the spread of innovations can impact service quality strategies, including:

1. Enhanced Customer Experience

Adopting innovative technologies in the automotive industry, such as advanced in-car connectivity and personalized services, can greatly enhance the overall customer experience. Service quality strategies evolve to incorporate these technologies, aiming to provide customers a seamless and technologically advanced experience.

2. Personalization and Customization

Innovations that allow for greater personalization and customization, such as configurable vehicle features and digital interfaces, can impact service quality strategies. Strategies may shift towards offering personalized services tailored to individual customer preferences, creating a more engaging and satisfying customer experience.

3. Efficient Communication and Engagement

With the diffusion of communication technologies, service quality strategies evolve to incorporate efficient communication channels. This includes leveraging mobile apps, chatbots, and real-time notifications to inform customers about service updates, vehicle status, and other relevant information.

4. Adoption of Sustainable Practices

Innovations related to sustainability, such as electric and hybrid vehicles, influence service quality strategies. Automotive companies may incorporate eco-friendly service practices, such as sustainable materials, recycling programs, and energy-efficient service facilities, aligning with the environmentally conscious preferences of consumers.

5. Integration of Autonomous Features

The diffusion of autonomous driving features prompts a shift in service quality strategies. Strategies may focus on ensuring the reliability and safety of autonomous features and

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providing effective training and support for customers to understand and use these advanced technologies.

6. Predictive Maintenance and Proactive Service

Innovations in predictive maintenance technologies, facilitated by data analytics and IoT sensors, lead to proactive service quality strategies. Automotive service providers can anticipate and address potential issues before they escalate, enhancing vehicle reliability and customer satisfaction.

7. Data Security and Privacy Assurance

The diffusion of innovations that involve data collection and connectivity underscores the importance of data security and privacy. Service quality strategies evolve to include robust data protection measures, transparency in data usage, and mechanisms for gaining customer trust in handling sensitive information.

8. Collaboration with Technology Providers

The evolution of service quality strategies involves collaborations with technology providers. Automotive companies may partner with tech firms to leverage their expertise, ensuring the seamless integration of innovations and maintaining high service standards.

9. Continuous Training and Skill Development

As innovative technologies become integral to automotive services, service quality strategies prioritize continuous training and skill development for service personnel. Ensuring that employees are proficient in handling new technologies contributes to a higher level of service quality.

10. Rapid Adaptation to Market Trends

The diffusion of innovations often leads to rapid changes in market trends. Service quality strategies evolve to keep pace with these trends, enabling automotive companies to remain competitive and responsive to shifting consumer preferences and expectations.

11. Agile Service Delivery Models

Adopting innovative service delivery models, such as on-demand and subscription-based, influences service quality strategies. Companies may adapt by implementing more agile and flexible service approaches to meet the changing demands of customers.

12. Feedback Loops and Continuous Improvement

Innovations in customer feedback mechanisms, such as real-time feedback through digital platforms, contribute to service quality strategies. Companies can use this feedback to improve services, promptly address issues, and enhance overall service quality.

In summary, the diffusion of innovation profoundly impacts the evolution of service quality strategies in the automotive industry. Embracing technological advancements strategically allows automotive companies to meet customer expectations and stay ahead in a competitive

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and dynamic market.

Integration of TAM and Innovation Diffusion

TAM and Innovation Diffusion concepts can complement each other in understanding and implementing service quality strategies. Integrating the Technology Acceptance Model (TAM) and Innovation Diffusion concepts can provide a comprehensive framework for understanding and implementing service quality strategies in the automotive industry. Table 1 shows an analysis of how these two concepts (TAM and innovation diffusion) can complement each other.

Table 1: Integration of TAM and Innovation Diffusion for the Automotive Industry

Service Quality Strategy	TAM Focus	Innovation Diffusion	Integration
User-Centric Approach	TAM centers on user acceptance, emphasizing perceived ease of use and perceived usefulness.	Considers how innovations spread among users over time	By combining TAM and Innovation Diffusion, service quality strategies can adopt a user-centric approach. Understanding user perceptions (TAM) and the stages of innovation adoption (Innovation Diffusion) helps tailor strategies to different user segments, ensuring that technologies are not only adopted but also positively experienced.
Early Adoption Strategies	Identifies early adopters and factors influencing individual adoption decisions	Examines the characteristics of early adopters and the innovation adoption curve.	Service quality strategies can target early adopters by addressing specific concerns identified by TAM. This integration ensures that innovations are embraced by influencers in the market, facilitating a smoother diffusion process.
Technology Acceptance Lifecycle	Considers individual user intentions and attitudes.	Examines the collective adoption lifecycle: innovators, early adopters, early/late majority, and laggards.	Aligning TAM with the broader Innovation Diffusion curve helps create a comprehensive lifecycle view. Strategies can be crafted to appeal to different user segments, acknowledging that acceptance dynamics evolve as innovations diffuse through the market.
Strategic Timing of Implementation	Emphasizes the timing of user acceptance.	Highlights optimal times for innovation introduction to different user segments.	Service quality strategies benefit from insights into when and how to introduce innovations. Understanding TAM helps determine the readiness of users,

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Service Quality Strategy	TAM Focus	Innovation Diffusion	Integration
			while Innovation Diffusion guides the strategic timing of broader implementation.
User Feedback and Continuous Improvement	Incorporates user feedback for technology improvements.	Recognizes the need for continuous improvement over the diffusion process.	Combining TAM and Innovation Diffusion allows for a feedback loop. Strategies can involve regular user feedback (TAM) to adapt and refine innovations, ensuring they align with changing user preferences throughout the diffusion process.
Influence of External Factors	Acknowledges external variables affecting user acceptance.	Considers external factors influencing innovation adoption at a societal level.	Understanding external factors helps shape service quality strategies. By integrating TAM with Innovation Diffusion, strategies can account for external influences, such as regulatory changes or market trends, ensuring a more holistic approach.
Agile Service Delivery Models	Adapting services based on user preferences.	Recognizes the need for agility as innovations diffuse through the market.	TAM insights on user preferences contribute to an agile service delivery model. Innovations can be adapted iteratively to align with changing user needs, ensuring continuous improvement and maintaining service quality standards.
Predictive Service Planning	Predicting user behavior based on attitudes and intentions.	Predicts the diffusion of innovations through market segments.	By integrating TAM and Innovation Diffusion, service quality strategies gain predictive capabilities. This allows for proactive planning based on user expectations and the anticipated trajectory of innovation adoption.

In conclusion, the integration of TAM and Innovation Diffusion concepts provides a robust framework for developing and implementing service quality strategies in the automotive industry. It enables a nuanced understanding of user acceptance, considers the broader innovation adoption lifecycle, and allows for strategic planning that aligns with the evolving dynamics of technology adoption in the market. This integrated approach enhances the effectiveness of service quality strategies in a rapidly changing technological landscape. By following this roadmap, automotive industry stakeholders can navigate the intersection of service quality, technology acceptance, and innovation diffusion effectively, fostering a digital era where customer expectations are met, and the industry remains at the forefront of technological advancements.

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Case Studies: Automotive Industry in Indonesia

Some potential areas where technology-driven strategies could be implemented and examples from the global automotive industry that may serve as inspiration for the Indonesian context. The specific initiatives mentioned here may need verification for their current status, as the automotive industry is dynamic, and developments occur over time.

1. Digital Customer Service Platforms

Many global automotive companies have implemented digital platforms and mobile apps to enhance customer service. These platforms allow customers to schedule service appointments, receive real-time updates on their vehicle's maintenance, and access information about their vehicle's health. Similar initiatives in Indonesia could leverage mobile apps to offer convenient and personalized service experiences. Digital customer service platforms for automotive in Indonesia have become increasingly important due to the growth of the middle class and the rise of online purchases in the country (Ekasari et al., 2023). The automotive industry in Indonesia has turned to digital services and marketing systems to understand customer behavior and improve customer satisfaction (Wijaya et al., 2022). E-commerce and digital platforms have provided opportunities for online car sales. However, there still needs to be a gap in the digital transformation for buying new cars online in Indonesia (Suhartini et al., 2023). Companies in the service sector, including e-commerce agencies, must provide good service to ensure customer satisfaction (Siswadi et al., 2023). In the online transportation sector, digital marketing, word of mouth, perceived value, and perceived quality have significantly impacted customer satisfaction and loyalty (Prasetyo et al., 2022). In the Tokopedia marketplace, electronic and overall service quality have been shown to affect customer satisfaction and loyalty.

2. Predictive Maintenance Solutions

Predictive maintenance solutions use IoT sensors and data analytics to anticipate vehicle maintenance needs. For instance, BMW's ConnectedDrive platform provides real-time information about the vehicle's condition and alerts drivers about potential issues. In Indonesia, automotive service providers could implement similar solutions to offer proactive maintenance services. Predictive maintenance solutions for the automotive industry in Indonesia are being implemented as part of the country's commitment to building a strong manufacturing sector. Implementing Industry 4.0 technologies, such as the Internet of Things (IoT), big data analytics, and artificial intelligence, is expected to improve productivity and competitiveness globally (Suharto, 2023). One specific area of focus is ball bearing production, which is important for the automotive industry. Machine learning models are being developed based on sensor condition data and product quality information to ensure the manufacturing process produces products that meet quality standards. Predictive maintenance using sensor data and machine learning is expected to reduce machine downtime and maintenance costs compared to corrective and preventive maintenance approaches (H. G. P. Putra et al., 2021).

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3. Augmented Reality (AR) for Vehicle Inspections

Some global automotive companies use AR technology for virtual vehicle inspections. Service technicians can use AR glasses to receive real-time guidance and support during inspections and repairs. Implementing AR-based inspection processes in Indonesia could improve the efficiency and accuracy of service operations. Augmented Reality (AR) technology is used for vehicle inspections in Indonesia's automotive industry. This technology combines virtual and real-world elements to create an immersive user experience. It allows users to view virtual objects, such as 3D models or videos, in their environment. AR applications for vehicle inspections can help users easily identify and learn about classic vehicles in the city of Medan without the need to search the internet or other social media platforms (Andriano et al., 2022). Additionally, AR technology can be integrated with the Industrial Internet of Things (IoT) platform to collect and present data from the production line, supporting visual inspection tasks in an industrial environment (Chouchene et al., 2022). Hand-held devices (HHD) enhance the accuracy and effectiveness of the AR-based inspection system (Crequer et al., 2022).

4. Online Vehicle Diagnostics and Remote Assistance

Example: Tesla's over-the-air updates enable remote diagnostics and software fixes, reducing the need for customers to visit service centers for certain issues. Similar remote assistance and diagnostic capabilities could be integrated into the Indonesian automotive service sector, providing convenience for customers. The automotive industry in Indonesia has seen increased car sales, leading to a need for efficient car diagnostics and remote assistance systems. One approach is the development of expert systems that utilize artificial intelligence technology to diagnose car engine damage (Haryanto et al., 2022). Additionally, the COVID-19 pandemic has impacted the automotive business in Indonesia, prompting the development of mobile applications to support automotive business people and car workshop owners (Wijayanto & Suyoto, 2020). Remote vehicle diagnostics have also been explored, allowing for transmitting diagnostic data packets between a diagnostic device and a vehicle through remote communication (Liu et al., 2018). Furthermore, a machine-failure diagnostic system has been developed to predict car engine damage, using a waterfall system development model and the Research and Development (RnD) method (Budianto et al., 2018). These advancements aim to improve the diagnosis and maintenance of car engines in the Indonesian automotive industry.

5. Connected Car Technologies

Many modern vehicles come with connected car technologies that offer remote vehicle monitoring, navigation assistance, and emergency services. Implementing and expanding connected car technologies in Indonesia could enhance the driving and service experience. Connected car technologies can improve driver awareness and increase efficiency in the Indonesian automotive industry (Hakim et al., 2023). Visible Light Communication (VLC) and infrared communication are two technologies that can be applied for car-to-car communication, allowing the exchange of data such as vehicle speed, throttle position, and brake stepping indicator (Ardi et al., 2020). These technologies have been tested and shown to effectively transmit data between cars day and night, with communication distances ranging from 0.7 to

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11 meters depending on the technology used (Wijayanto & Suyoto, 2020). Implementing connected car technologies can help reduce car accidents, especially during car convoys, a common cause of accidents in Indonesia (Irawati, 2010). Furthermore, mobile applications can provide information and maps specifically for automotive business people in Indonesia, offering an alternative to normal business operations during the COVID-19 pandemic (Hidayatno et al., 2019).

6. Electric Vehicle (EV) Charging Infrastructure

Example: Automakers invest in charging infrastructure as electric vehicles become more prevalent globally. In Indonesia, initiatives to develop a robust EV charging network could be part of a technology-driven service quality strategy to support the adoption of electric vehicles. Developing EV charging infrastructure in Indonesia faces challenges such as large capital investment, higher EV prices than conventional cars, and limited charging infrastructure (Regina & Ulmi, 2023). Understanding the characteristics of EV charging station (EVCS) users in Indonesia is crucial for optimizing their utilization. Factors influencing the usage of EVCS include social networks, technology knowledge, ease of access, convenience, and price. However, an attitude of caring for the environment and charging electronic devices at home overnight harms EVCS usage (Haryadi et al., 2023). A dense network of charging stations is needed to accelerate the commercialization of Electric Motorcycles (EM) in Indonesia. The placement of charging stations can be optimized using centrality index and scalogram calculations and validated with the Maximal Covering Location Problem. The benefits and costs of constructing charging stations are analyzed to determine feasibility (Istiqomah et al., 2022). Implementing integrated EV charging with modular substations and photovoltaic shelters can address charging station limitations and support the renewable energy sector. Financial simulations show that this approach is economically viable and can contribute to Indonesia's target of net-zero carbon neutrality by 2060 (Amilia et al., 2022; Pradana et al., 2022)

7. Customer Feedback Analytics

Automotive companies use advanced analytics to analyze customer feedback from various channels. In Indonesia, implementing analytics tools could help automotive service providers gain insights into customer preferences, identify pain points, and continuously improve service quality. Customer feedback analytics in the Indonesian automotive industry is important for enhancing customer experiences and gaining a competitive advantage (Santoso & Bukit, 2019). Implementing customer relationship management (CRM) strategies can help companies in the automotive industry maintain market share and improve customer satisfaction (Dudi Abdullah, 2023; Soediono, 2014). By analyzing customer feedback and reviews, companies can gather insights and feedback to improve their products and services (R. Putra et al., 2012). Additionally, sentiment analysis using machine learning techniques can be used to automatically analyze customer sentiment in product reviews (Park & Kim, 2008). This research contributes to developing automatic sentiment analysis models for Indonesian product reviews, which can further enhance customer feedback analytics in the automotive industry.

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8. Blockchain for Service History and Parts Authentication

Blockchain technology can create transparent and secure service histories for vehicles. This ensures the authenticity of parts and service records. Implementing blockchain in Indonesia's automotive service industry could enhance trust and transparency. Blockchain technology can be used for service history and parts authentication in the Indonesian automotive industry (Ab Razak et al., 2023; G & Mathew, 2021; Meyliana et al., 2021). It can help record vehicle identities and track spare parts in vehicles, improving the quality of vehicles and reducing the possibility of fraud and counterfeiting documents (Balachander & Murugan, 2022; Gîrbacia et al., 2022). The use of blockchain can provide transparency, security, and high speed of operations, making it suitable for various applications in the automotive domain, such as better protection against counterfeit spare parts, effective preventive maintenance, monitoring of cars by rental companies, and safe storage of data used by intelligent navigation systems. By adopting blockchain technology, the automotive industry in Indonesia can benefit from improved service history records, enhanced parts authentication, and the development of modern business models.

9. Mobile Payment and Contactless Services

Contactless payment options are increasingly popular in the automotive service sector. Mobile payment solutions, integrated with service processes, offer convenience and safety. Similar contactless payment options could be implemented in Indonesia for a seamless service experience. Mobile payment and contactless services have grown significantly in Indonesia's automotive industry. The traditional mode of transportation has shifted to application-based services, providing advantages such as flexibility, convenience, speed, and security (Christian et al., 2023). This shift has also influenced payment methods, with transportation service providers promoting cashless methods through loyalty programs and promotions (Anggraini et al., 2022). The adoption of mobile payment methods, such as e-wallets and QRIS-based systems, has been explored to improve efficiency and security in the payment process for bus fares (Widayani et al., 2022). Additionally, the adoption of mobile payment methods, like LinkAja, has been studied using the Unified Theory of Acceptance and Use of Technology (UTAUT) framework, highlighting the impact of performance expectancy, social influence, and facilitating conditions on behavioral intention and actual use (Labib & Wibawa, 2019). The mobile payment industry in Indonesia is highly competitive, with numerous direct and indirect competitors.

10. Virtual Showrooms and Test Drives

Amidst the COVID-19 pandemic, some automakers introduced virtual showrooms and online test drive experiences. In Indonesia, such virtual experiences could be implemented to engage customers and provide a safe way to explore and test vehicles. Virtual showrooms and test drives are becoming increasingly popular in Indonesia's automotive industry. Virtual and augmented reality (VR/AR) technology allows for creating and evaluating virtual prototypes, as well as immersive presentation and interaction with 3D cars in a virtual environment (Mursyidah, 2022). This technology provides an alternative for automotive businesses during

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the COVID-19 pandemic, allowing customers to view and experience cars without physically visiting a showroom (Dudi Abdullah, 2023). The development of mobile applications and online platforms has enabled companies to showcase their products and provide information to potential customers (R. Putra et al., 2012). These technological advancements aim to improve customer satisfaction by enhancing the quality of service provided in showrooms (Wijayanto & Suyoto, 2020). Overall, virtual showrooms and test drives offer a convenient and innovative solution for the automotive industry in Indonesia, allowing for increased sales and customer engagement.

In exploring the results of technology-driven service quality strategies in Indonesia, it's essential to consider factors such as local preferences, infrastructure, and regulatory considerations. Collaborations with local technology providers and startups may also be crucial in successful implementations.

Challenges and Opportunities

The automotive industry faces several challenges when implementing technological solutions. These challenges arise from technological, economic, regulatory, and market factors. The key challenges faced by the automotive industry in implementing technological solutions, among others:

1. For high initial investment, implementing advanced technologies often requires significant upfront investment in research, development, and infrastructure. The automotive industry faces the challenge of balancing the need for technological innovation with the substantial initial costs associated with adopting new technologies.
2. Complex ecosystem integration: the automotive industry operates within a complex ecosystem involving manufacturers, suppliers, dealers, and service providers. Integrating new technologies seamlessly across this ecosystem poses challenges regarding interoperability, communication standards, and collaboration among various stakeholders.
3. Rapid technological obsolescence: technology evolves rapidly, and innovations can quickly become obsolete. Given the potential for rapid obsolescence, the automotive industry must navigate the challenge of investing in relevant technologies over the product lifecycle.
4. Regulatory compliance and standards, stringent regulatory requirements, and varying standards across regions create challenges for the automotive industry. Ensuring compliance with safety, emissions, and cybersecurity regulations and meeting industry standards adds complexity to implementing new technologies.
5. Data security and privacy concerns, the increasing reliance on connected vehicles, and data-driven technologies raise data security and privacy concerns. Protecting sensitive customer data from cyber threats and ensuring compliance with privacy regulations are significant challenges for the industry.

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6. Consumer acceptance, education, and convincing consumers to adopt and trust new can be challenging. Lack of awareness, concerns about reliability, and resistance to change pose hurdles in the widespread acceptance of innovative automotive technologies.
7. Infrastructure limitations: successfully implementing technologies such as electric vehicles (EVs) relies on adequate infrastructure, including charging stations. The lack of a robust infrastructure, especially in emerging markets, challenges the widespread adoption of certain technologies.
8. Global supply chain disruptions the automotive industry relies on a global supply chain, and disruptions, as seen during the COVID-19 pandemic, can impact the timely availability of components. Supply chain challenges, including shortages and logistics issues, can affect the implementation of technological solutions.
9. Talent shortages, skills gaps, and the rapid pace of technological advancements create a demand for skilled professionals in areas such as data science, artificial intelligence, and cybersecurity. The automotive industry faces challenges in attracting and retaining talent with the necessary expertise to implement and manage advanced technologies.
10. Cultural resistance to change, within organizations and among consumers, may exist. This resistance can manifest as a reluctance to adopt new technologies, adhere to new processes, or embrace innovative business models.
11. Liability and legal challenges: as vehicles become more autonomous and connected, issues related to liability in the event of accidents or malfunctions arise. Clear legal frameworks and liability standards are essential, and navigating the legal landscape challenges the automotive industry.
12. Environmental and sustainability concerns and the push for greener technologies, such as electric vehicles, present challenges related to manufacturing processes' environmental impact and batteries' disposal. Striking a balance between technological innovation and sustainability is an ongoing challenge.

Navigating these challenges requires a strategic and adaptive approach from the automotive industry. Collaboration between industry players, proactive engagement with regulators, and a commitment to addressing consumer concerns are essential in successfully implementing technological solutions in the automotive sector. Further innovation in service quality strategies in the automotive industry in Indonesia involves identifying areas where technological advancements, customer experience improvements, and market demands intersect.

The innovation opportunities, such as developing comprehensive digital platforms and mobile applications that enhance customer engagement, include features such as online appointment scheduling, real-time service updates, and personalized communication, which can create a seamless and convenient customer experience. Implementing predictive maintenance solutions that utilize IoT sensors and data analytics can also be a strategic innovation. These solutions can proactively identify potential vehicle issues, schedule maintenance, and reduce customer downtime, enhancing overall service quality.

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Innovating the vehicle purchase process by offering online sales platforms and digital showrooms, providing virtual test drives, and facilitating online transactions, making the entire vehicle purchase and delivery process more convenient for customers, can enhance service quality. Then, investing in and expanding connected car technologies that offer features like remote monitoring, navigation assistance, and emergency services can enhance the connectivity experience for customers, providing valuable services and information through the vehicle's connected systems.

In the future, a focus on developing and expanding EV charging infrastructure is needed to support the growing demand for electric vehicles. Offering a robust charging network enhances the service quality for electric vehicle owners and encourages the adoption of eco-friendly technologies. Besides, integrate augmented reality (AR) technology for customer support and vehicle troubleshooting. Use AR applications to guide customers through basic maintenance tasks, provide virtual assistance, and enhance the service experience. Moreover, exploring the use of blockchain can create transparent and secure service records. Implementing blockchain technology ensures the authenticity and transparency of vehicle service histories, enhancing trust between customers and service providers.

Another service quality for customer engagement is implementing contactless service options, including digital payment methods, online service bookings, and touchless vehicle drop-off and pick-up. It can minimize physical contact points to meet changing customer expectations for safety and convenience. Innovating service delivery models by introducing subscription-based services also can be an effective strategy. Customers can subscribe to comprehensive service packages covering routine maintenance, repairs, and other vehicle-related needs for a fixed monthly fee.

Data analytics for personalized services, such as leveraging data analytics to understand customer preferences and behaviors, are important to conduct. Use this information to personalize service offerings, such as recommending specific maintenance schedules, providing tailored vehicle insights, and offering targeted promotions. Then, enhance remote diagnostics capabilities to troubleshoot vehicle issues without physical inspections. Utilize telematics and remote monitoring to diagnose problems, leading to quicker resolution and improved customer satisfaction.

Sustainable and eco-friendly initiatives by integrating sustainable practices into service operations, including eco-friendly materials, waste reduction, and energy-efficient facilities, can resonate with environmentally conscious consumers. Offer localized customer support and communication channels to cater to Indonesia's diverse linguistic and cultural preferences. Providing services in regional languages and understanding local customer needs can significantly enhance service quality.

Another important aspect is continuous employee training and skill development. Invest in continuous training programs for service personnel to keep them updated on the latest technologies and service techniques. Well-trained staff contribute to a higher level of service quality and customer satisfaction.

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Last, collaborate with local technology startups to explore innovative solutions. Partnerships with startups can bring fresh perspectives and accelerate the adoption of cutting-edge technologies in the automotive service sector.

In summary, the automotive industry in Indonesia has various opportunities to innovate its service quality strategies by embracing digital technologies, sustainability initiatives, and customer-centric approaches. These innovations can enhance customer satisfaction, efficiency, and a competitive edge in the evolving automotive market.

CONCLUSION

This scientific article aims to provide valuable insights into the intersection of service quality, technology acceptance, and innovation diffusion. It offers a roadmap for automotive industry stakeholders seeking to enhance their service offerings in an increasingly digital era. The intersection of service quality, technology acceptance, and innovation diffusion presents challenges and opportunities for stakeholders in the automotive industry.

Based on key findings, several implications, and a roadmap emerge to guide industry participants in enhancing their service offerings in the digital era. In conclusion, the automotive industry stands at the crossroads of technological innovation and user-centric service quality.By embracing a holistic approach, stakeholders can navigate this intersection successfully, creating a digital era where innovative services meet customer expectations and drive the industry toward a future of sustainable growth and enhanced user satisfaction. By addressing these research recommendations and implementing practical applications, the automotive industry can stay at the forefront of innovation, enhance customer experiences, and contribute to the sustainable development of the automotive ecosystem.

In conclusion, the automotive industry is poised for transformative technological advancements, user experience, and innovation. Future research endeavors should explore understanding user behaviors in emerging technologies, ethical considerations in autonomous vehicles, and the broader impacts of electric vehicle adoption. Practical applications should prioritize user training, collaborative industry standards, awareness campaigns, and investment in cutting-edge technologies like augmented reality and sustainable practices.

Key considerations include the need for continuous cybersecurity training, ethical frameworks for autonomous systems, and the development of localized marketing strategies for diverse markets. Industry stakeholders are encouraged to establish standardized protocols for interoperability, invest in subscription-based service models, and implement eco-friendly certifications to align with environmental goals.

This comprehensive approach, encompassing both research and practical applications, will empower the automotive industry to navigate the complexities of the digital era successfully. By fostering innovation, enhancing service quality, and embracing sustainable practices, the industry can meet evolving consumer expectations, drive widespread adoption of advanced technologies, and contribute to a more resilient and customer-centric automotive landscape.

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References

1) Aalbers, R. (H. L.), & Whelan, E. (2021). Implementing digitally enabled collaborative innovation: A case study of online and offline interaction in the German automotive industry. Creativity and Innovation Management, 30(2), 368–383. https://doi.org/10.1111/caim.12437

2) Ab Razak, N. S., Mansor, H., & Sharmin, S. (2023). A Secure Framework for Vehicle Maintenance Service using Blockchain. Proceedings of the 2023 12th International Conference on Software and Computer Applications, 267–272. https://doi.org/10.1145/3587828.3587868

3) Ahmad, S., Miskon, S., Alabdan, R., & Tlili, I. (2020). Towards Sustainable Textile and Apparel Industry: Exploring the Role of Business Intelligence Systems in the Era of Industry 4.0. Sustainability, 12(7), 2632.

4) Akbar, J., Shaharudin, M. R., Hassam, S. F., Zainal, N. N., & Zainoddin, A. I. (2018). Quality of Service Practices within Business Market: An Automotive Industry Experience. International Journal of Supply Chain Management, 204–220.

5) Amilia, N., Palinrungi, Z., Vanany, I., & Arief, M. (2022). Designing an Optimized Electric Vehicle Charging Station Infrastructure for Urban Area: A Case study from Indonesia. 2022 IEEE 25th International Conference on Intelligent Transportation Systems (ITSC), 2812–2817. https://doi.org/10.1109/ITSC55140.2022.9922278

6) Andriano, I., Suendri, S., & Ikhwan, A. (2022). Pengenalan Kendaraan Klasik Dengan Memanfaatkan Mobile Augmented Reality. JISTech (Journal of Islamic Science and Technology), 7(2). https://doi.org/10.30829/jistech.v7i2.14666

7) Anggraini, F., Wijayanti, R. A., & Taufik, M. (2022). Mobile Payment for "PO Tentrem" Bus Rates Based on E-Wallet. Jartel, 166–171. https://doi.org/10.33795/jartel.v12i3.419

8) Ardi, A. P., Aulia, I. S., Priramadhi, R. A., & Darlis, D. (2020). VLC-Based Car-to-Car Communication. Jurnal Elektronika Dan Telekomunikasi, 20(1), 16. https://doi.org/10.14203/jet.v20.16-22

9) Ardito, L., Petruzzelli, A. M., Panniello, U., & Garavelli, A. C. (2019). Towards Industry 4.0. Business Process Management Journal.

10) Ažman, S., & Gomišček, B. (2015). Functional form of connections between perceived service quality, customer satisfaction and customer loyalty in the automotive servicing industry. Total Quality Management & Business Excellence, 26(7–8), 888–904. https://doi.org/10.1080/14783363.2014.909172

11) Balachander, S., & Murugan, A. (2022). Assessing the feasibility of Blockchain Technology in Automotive Industry. 2022 IEEE 9th Uttar Pradesh Section International Conference on Electrical, Electronics and Computer Engineering (UPCON), 1–6. https://doi.org/10.1109/UPCON56432.2022.9986381

12) Bentley, G., Bailey, D., & Braithwaite, D. (2017). Resilience, adaptation and survival in industry sectors: remaking and remodelling of the automotive sector. In Creating Resilient Economies. Edward Elgar Publishing. https://doi.org/10.4337/9781785367649.00011

13) Bhatia, M. S., & Kumar, S. (2022). Critical Success Factors of Industry 4.0 in Automotive Manufacturing Industry. IEEE Transactions on Engineering Management, 69(5), 2439–2453. https://doi.org/10.1109/TEM.2020.3017004

14) Budianto, A., Djoko, D., & Widodo, A. (2018). Sistem Pakar Diagnosa Gangguan Mesin Mobil. Edu Komputika, 5(1). http://journal.unnes.ac.id/sju/index.php/edukom

15) Canuto da Silva, G., & Kaminski, P. C. (2017). Proposal of framework to managing the automotive product development process. Cogent Engineering, 4(1). https://doi.org/10.1080/23311916.2017.1317318

The Seybold Report
ISSN 1533-9211

16) Chouchene, A., Ventura Carvalho, A., Charrua-Santos, F., & Barhoumi, W. (2022). Augmented Reality-Based Framework Supporting Visual Inspection for Automotive Industry. Applied System Innovation, 5(3), 48. https://doi.org/10.3390/asi5030048

17) Christian, M., Yulita, H., Girsang, L. R., Wibowo, S., Indriyarti, E. R., & Sunarno, S. (2023). The Impact of Cashless Payment in Application-Based Transportation on Gen Z User Behavior in Jakarta. 2023 International Conference on IT Innovation and Knowledge Discovery (ITIKD), 1–6. https://doi.org/10.1109/ITIKD56332.2023.10100198

18) Cioca, Ivascu, Turi, Artene, & Găman. (2019). Sustainable Development Model for the Automotive Industry. Sustainability, 11(22), 6447. https://doi.org/10.3390/su11226447

19) Crequer, S., Hunter, M. J., Hille, H. T., & Langley, S. M. (2022). Vehicle inspection using augmented reality (AR). Google Patents.

20) Dieguez, T., Ferreira, L. P., Silva, F. J. G., & Tjahjono, B. (2020). Open Innovation and Sustainable Development through Industry-Academia Collaboration: A Case Study of Automotive Sector. Procedia Manufacturing, 51, 1773–1778. https://doi.org/10.1016/j.promfg.2020.10.246

21) Dudi Abdullah, M. (2023). VUCA Prime Impact on Performance Automotive Industry in Indonesia. International Journal of Advanced Research, 11(01), 263–274. https://doi.org/10.21474/IJAR01/16016

22) Ekasari, R., Arif, D., & Nurcholis, M. (2023). Service Quality and After-Sales Service on IoT-Based Car User Satisfaction and Repeat Purchases Services in Indonesia. ABAC Journal, 43(3). https://doi.org/10.59865/abacj.2023.33

23) Fathurohman, D. M. H., Purba, H. H., & Trimarjoko, A. (2021). Value Stream Mapping and Six Sigma Methods to Improve Service Quality at Automotive Services in indonesia. Operational Research in Engineering Sciences: Theory and Applications, 4(2), 36. https://doi.org/10.31181/oresta20402036f

24) G, V. G. P., & Mathew, G. (2021). Blockchain Based Verification Of Vehicle History For Pre-owned Vehicle Industry. 2021 International Conference on Communication, Control and Information Sciences (ICCISc), 1–6. https://doi.org/10.1109/ICCISc52257.2021.9484896

25) Gallo, M., & Marinelli, M. (2020). Sustainable Mobility: A Review of Possible Actions and Policies. Sustainability, 12(18), 7499. https://doi.org/10.3390/su12187499

26) Genzlinger, F., Zejnilovic, L., & Bustinza, O. F. (2020). Servitization in the automotive industry: How car manufacturers become mobility service providers. Strategic Change, 29(2), 215–226. https://doi.org/10.1002/jsc.2322

27) Gîrbacia, F., Voinea, D., Boboc, R., Duguleană, M., & Postelnicu, C. C. (2022). Toward blockchain adoption for the automotive industry. IOP Conference Series: Materials Science and Engineering, 1220(1), 012026. https://doi.org/10.1088/1757-899X/1220/1/012026

28) Hakim, I. M., Singgih, M. L., & Gunarta, I. K. (2023). Critical Success Factors for Internet of Things (IoT) Implementation in Automotive Companies, Indonesia. Sustainability, 15(4), 2909. https://doi.org/10.3390/su15042909

29) Haryadi, F. N., Asi Simaremare, A., Rohmatul, S. R., Hakam, D. F., & Mangunkusumo, K. G. H. (2023). Investigating the Impact of Key Factors on Electric/Electric-Vehicle Charging Station Adoption in Indonesia. International Journal of Energy Economics and Policy, 13(3), 434–442. https://doi.org/10.32479/ijeep.14128

30) Haryanto, H., Fridayanthie, E. W., Nadhir, J. A., Dhiana, A. S., & Susila, M. N. (2022). Metode Forward Chaining Untuk Mendiagnosa Kerusakan Mesin Mobil Toyota Innova Berbasis Web. Swabumi, 10(2), 101–106. https://doi.org/10.31294/swabumi.v10i2.12253

31) Hidayatno, A., Rahman, I., & Daniyasti, D. L. (2019). Conceptualizing the Promise of Industry 4.0 Technology Adoption. Proceedings of the 2019 5th International Conference on Industrial and Business Engineering, 334–338. https://doi.org/10.1145/3364335.3364350

The Seybold Report
ISSN 1533-9211

32) Hiraoka, C. (2009). Technology Acceptance of Connected Services in the Automotive Industry. Gabler. https://doi.org/10.1007/978-3-8349-8309-1

33) Holden, R. J., & Karsh, B.-T. (2010). The Technology Acceptance Model: Its past and its future in health care. Journal of Biomedical Informatics, 43(1), 159–172. https://doi.org/10.1016/j.jbi.2009.07.002

34) Irawati, D. (2010). Challenges for the Indonesian Automotive Cluster. Regional Insights, 1(1), 6–8. https://doi.org/10.1080/20429843.2010.9628234

35) Istiqomah, S., Sutopo, W., Hisjam, M., & Wicaksono, H. (2022). Optimizing Electric Motorcycle-Charging Station Locations for Easy Accessibility and Public Benefit: A Case Study in Surakarta. World Electric Vehicle Journal, 13(12), 232. https://doi.org/10.3390/wevj13120232

36) Kehbila, A. G., Ertel, J., & Brent, A. C. (2010). Corporate sustainability, ecological modernization and the policy process in the South African automotive industry. Business Strategy and the Environment, 19(7), 453–465. https://doi.org/10.1002/bse.669

37) Keskin, F. D., Ventura, K., Soyuer, H., & Kabasakal, I. (2017). From mass customization to product personalization in automotive industry: potentials of industry 4.0. Pressacademia, 4(3), 244–250. https://doi.org/10.17261/Pressacademia.2017.486

38) Kopelias, P., Demiridi, E., Vogiatzis, K., Skabardonis, A., & Zafiropoulou, V. (2020). Connected & autonomous vehicles – Environmental impacts – A review. Science of The Total Environment, 712, 135237. https://doi.org/10.1016/j.scitotenv.2019.135237

39) Koul, S., & Eydgahi, A. (2018). Utilizing Technology Acceptance Model (TAM) for driverless car technology Adoption. Journal of Technology Management & Innovation, 13(4), 37–46. https://doi.org/10.4067/S0718-27242018000400037

40) Labib, Moch. A. M., & Wibawa, B. M. (2019). Analisis Peta Kompetitor Industri Mobile Payment di Indonesia. Jurnal Sains Dan Seni ITS, 8(1). https://doi.org/10.12962/j23373520.v8i1.41789

41) Liu, J., Chen, Z., Xiu, C., Shelin, S., Zhang, L., Zhang, W., & Jingrui, L. I. (2018). Vehicle remote diagnosis method and device. Google Patents.

42) Llopis-Albert, C., Rubio, F., & Valero, F. (2021). Impact of digital transformation on the automotive industry. Technological Forecasting and Social Change, 162, 120343. https://doi.org/10.1016/j.techfore.2020.120343

43) Marangunić, N., & Granić, A. (2015). Technology acceptance model: a literature review from 1986 to 2013. Universal Access in the Information Society, 14(1), 81–95. https://doi.org/10.1007/s10209-014-0348-1

44) Martins, M. B., & Kaminski, P. C. (2019). Differences in open innovation practices between headquarters and subsidiaries in the automotive industry: The French case. Cogent Engineering, 6(1). https://doi.org/10.1080/23311916.2019.1684806

45) Meir, A. (1981). Innovation diffusion and regional economic development: The spatial diffusion of automobiles in Ohio. Regional Studies, 15(2), 111–122. https://doi.org/10.1080/09595238100185131

46) Meyliana, Surjandy, Fernando, E., Widjaja, H. A. E., Cassandra, C., Tan, A., Carolina, M., & Carolina, M. (2021). Blockchain Technology for Vehicle Maintenance Registration. 2021 International Conference on Information Management and Technology (ICIMTech), 608–613. https://doi.org/10.1109/ICIMTech53080.2021.9534974

47) Moslehpour, M., Ekowati, D., & Sulistiawan, J. (2023). Corporate Sustainability Practices in Indian Automobile Industry: Enhancing Government Initiatives, Economic Improvements, and Environmental Practices. Engineering Economics, 34(4), 456–469. https://doi.org/10.5755/j01.ee.34.4.33160

The Seybold Report
ISSN 1533-9211

48) Mursyidah, D. S. (2022). Kualitas Pelayanan Dalam Meningkatkan Kepuasan Konsumen Di Showroom X Kota Bandung. MBIA, 20(3), 222–234. https://doi.org/10.33557/mbia.v20i3.1569

49) Nguyen, P.-H. (2022). Automotive Service Quality Investigation Using a Grey-DEMATEL Model. Computers, Materials & Continua, 73(3), 4779–4800. https://doi.org/10.32604/cmc.2022.030745

50) Onn, C. C., Mohd, N. S., Yuen, C. W., Loo, S. C., Koting, S., Abd Rashid, A. F., Karim, M. R., & Yusoff, S. (2018). Greenhouse gas emissions associated with electric vehicle charging: The impact of electricity generation mix in a developing country. Transportation Research Part D: Transport and Environment, 64, 15–22.

51) Park, D. H., & Kim, S. (2008). The effects of consumer knowledge on message processing of electronic word-of-mouth via online consumer reviews. Electronic Commerce Research and Applications. https://doi.org/10.1016/j.elerap.2007.12.001

52) Pichler, M., Krenmayr, N., Schneider, E., & Brand, U. (2021). EU industrial policy: Between modernization and transformation of the automotive industry. Environmental Innovation and Societal Transitions, 38, 140–152. https://doi.org/10.1016/j.eist.2020.12.002

53) Polydoropoulou, A., Pagoni, I., Tsirimpa, A., Roumboutsos, A., Kamargianni, M., & Tsouros, I. (2020). Prototype business models for Mobility-as-a-Service. Transportation Research Part A: Policy and Practice, 131, 149–162. https://doi.org/10.1016/j.tra.2019.09.035

54) Pradana, O. S. P., Jati, D. W., & Facta, M. (2022). Integration Scheme for Electric Vehicles Charging with Modular Substation and Photovoltaic Shelter. 2022 International Conference on Technology and Policy in Energy and Electric Power (ICT-PEP), 156–161. https://doi.org/10.1109/ICT-PEP57242.2022.9988772

55) Prasetyo, K. W., Pratamal, R. P., & Aditya, A. (2022). Analyzing e-Service Quality and e-Satisfaction Effects on Customer Loyalty at An Indonesian Digital Marketplace. Journal Of Informatics And Telecommunication Engineering, 6(1), 126–134. https://doi.org/10.31289/jite.v6i1.7265

56) Putra, H. G. P., Supangkat, S. H., Nugraha, I. G. B. B., Hidayat, F., & Kereta, P. (2021). Designing Machine Learning Model for Predictive Maintenance of Railway Vehicle. 2021 International Conference on ICT for Smart Society (ICISS), 1–5. https://doi.org/10.1109/ICISS53185.2021.9533201

57) Putra, R., Nawangwulan, I. M., Seancho, W., & Pitaloka, E. (2012). Maintaining Customers: Evidence of CRM in Indonesian Automotive Industry. JAMS-Journal of Management Studies, 1(1), 128–146.

58) Regina, D., & Ulmi, N. M. (2023). Tantangan Pengembangan Mobil Listrik Menuju Transportasi Berkelanjutan di Indonesia. Jurnal Penelitian Sekolah Tinggi Transportasi Darat, 14(1), 32–39. https://doi.org/10.55511/jpsttd.v14i1.605

59) Saidin, Z. H., Wan Abdul Rahman, W. A., Mohd Nafi, S. N., Saad, R., & Mohd. Mokhtar, S. S. (2022). Examining Industry-Specific After-Sales Service Quality Towards the Level of Customer Loyalty: a Case of Malaysian National Carmakers. E-Bangi Journal of Social Science and Humanities, 4. https://doi.org/10.17576/ebangi.2022.1904.05

60) Sakuramoto, C., Di Serio, L. C., & Bittar, A. de V. (2019). Impact of supply chain on the competitiveness of the automotive industry. RAUSP Management Journal, 54(2), 205–225. https://doi.org/10.1108/RAUSP-07-2018-0051

61) Santoso, M. R., & Bukit, R. B. (2019). The determinant factors of automotive industry investment decision in Indonesia.

62) Sardjono, W., Kusnoputranto, H., Utomo, H., & Sukardi, S. (2022, July 19). Connectivity as a Future of Customer Experience Management in Automotive Industry in Industrial Revolution 4.0. Proceedings of the 3rd South American International Industrial Engineering and Operations Management Conference.

The Seybold Report
ISSN 1533-9211

63) Schulze, A., Paul MacDuffie, J., & Taube, F. A. (2015). Introduction: knowledge generation and innovation diffusion in the global automotive industry--change and stability during turbulent times. Industrial and Corporate Change, 24(3), 603–611. https://doi.org/10.1093/icc/dtv015

64) Seuwou, P., Chrysoulas, C., Banissi, E., & Ubakanma, G. (2020). Measuring Consumer Behavioural Intention to Accept Technology: Towards Autonomous Vehicles Technology Acceptance Model (AVTAM) (pp. 507–516). https://doi.org/10.1007/978-3-030-45688-7_51

65) Shao, S., Hu, Z., Cao, J., Yang, L., & Guan, D. (2020). Environmental Regulation and Enterprise Innovation: A Review. Business Strategy and the Environment, 29(3), 1465–1478. https://doi.org/10.1002/bse.2446

66) Siswadi, S., Jumaizi, J., Supriyanto, S., & Dewa, A. L. (2023). Indonesian Online Transportation (Go-Jek) Customers Satisfaction and Loyalty: How the Role of Digital Marketing, Word of Mouth, Perceived Value and Perceived Quality? Journal of Law and Sustainable Development, 11(2), e362. https://doi.org/10.55908/sdgs.v11i2.362

67) Soediono, W. (2014). Customer Relationship Management Industri Mobil Indonesia. Media Bisnis, 6(1), 27–34.

68) Suhartini, S., Mahbubah, N. A., & Basjir, M. (2023). Quality analysis of e-commerce services in Indonesia. 020012. https://doi.org/10.1063/5.0111303

69) Suharto, T. (2023). Predictive Maintenance in Bearing Production based on Machine Condition and Product Quality Data using Machine Learning Approach. Proceedings of the International Conference on Industrial Engineering and Operations Management, 465–466. https://doi.org/10.46254/AP03.20220072

70) Sun, X., Yu, F. R., & Zhang, P. (2022). A Survey on Cyber-Security of Connected and Autonomous Vehicles (CAVs). IEEE Transactions on Intelligent Transportation Systems, 23(7), 6240–6259. https://doi.org/10.1109/TITS.2021.3085297

71) Szász, L., Csíki, O., & Rácz, B.-G. (2021). Sustainability management in the global automotive industry: A theoretical model and survey study. International Journal of Production Economics, 235, 108085. https://doi.org/10.1016/j.ijpe.2021.108085

72) Vaidya, B., & Mouftah, H. T. (2020). IoT Applications and Services for Connected and Autonomous Electric Vehicles. Arabian Journal for Science and Engineering, 45(4), 2559–2569. https://doi.org/10.1007/s13369-019-04216-8

73) Wedeniwski, Dr. S. (2015). The Mobility Revolution in the Automotive Industry. Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-47788-5

74) Widayani, A., Rachmawati, I., Normawati, R. A., & Latifah, N. (2022). The Adoption of Mobile Payment Linkaja in Indonesia. BISMA: Jurnal Bisnis Dan Manajemen, 16(2), 99. https://doi.org/10.19184/bisma.v16i2.29390

75) Wijaya, A., Winoto Tj, H., & Wahyoedi, S. (2022). The Effect of Car Sales E-Commerce Platform on New Car Buying Decisions Mediated by Digital Advertising Media and Youtube Media. Daengku: Journal of Humanities and Social Sciences Innovation, 2(5), 596–607. https://doi.org/10.35877/454RI.daengku1182

76) Wijayanto, E., & Suyoto. (2020). Development of Smart Workshop Mobile Application As Information. 2020 Fourth World Conference on Smart Trends in Systems, Security and Sustainability (WorldS4), 98–102. https://doi.org/10.1109/WorldS450073.2020.9210307

77) Wittmann, J. (2017). Electrification and Digitalization as Disruptive Trends: New Perspectives for the Automotive Industry? In Phantom Ex Machina (pp. 137–159). Springer International Publishing. https://doi.org/10.1007/978-3-319-44468-0_9

The Seybold Report
ISSN 1533-9211

78) Xu, X., Lu, Y., Vogel-Heuser, B., & Wang, L. (2021). Industry 4.0 and Industry 5.0—Inception, conception and perception. Journal of Manufacturing Systems, 61, 530–535. https://doi.org/https://doi.org/10.1016/j.jmsy.2021.10.006

79) Xu, Z., Elomri, A., Kerbache, L., & El Omri, A. (2020). Impacts of COVID-19 on Global Supply Chains: Facts and Perspectives. IEEE Engineering Management Review, 48(3), 153–166. https://doi.org/10.1109/EMR.2020.3018420

80) Yadav, G., Luthra, S., Jakhar, S. K., Mangla, S. K., & Rai, D. P. (2020). A framework to overcome sustainable supply chain challenges through solution measures of industry 4.0 and circular economy: An automotive case. Journal of Cleaner Production, 254, 120112. https://doi.org/10.1016/j.jclepro.2020.120112

81) Yang, D., Qiu, L., Yan, J., Chen, Z., & Jiang, M. (2019). The government regulation and market behavior of the new energy automotive industry. Journal of Cleaner Production, 210, 1281–1288. https://doi.org/10.1016/j.jclepro.2018.11.124

82) Zimmer, K., Frohling, M., Breun, P., & Schultmann, F. (2017). Assessing social risks of global supply chains: a quantitative analytical approach and its application to supplier selection in the German automotive industry. Journal of Cleaner Production, 149, 96–109.