

Automotive industry technology development implications on consumer purchasing behaviour

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Abstract. The automotive industry, characterised throughout history by its reliance on technological innovation, is currently undergoing a major transformation driven by relentless technological advancements. These technological changes are fundamentally reshaping the industry, changing the process of design, construction, operation, and user experience. This paper analyses and highlights the impacts and important applications of technology in the automotive industry from its inception until the present. Because manufacturers are always on the path of evolution, they must ensure that they keep up to date with the latest technology in order to maintain their position in this constantly changing industry.

Keywords: automotive industry, customer behaviour, autonomous vehicles, evolution, autonomous Driving

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Introduction

Technology refers to the tools, processes, and techniques used to design, produce, and communicate goods and services. Technology can span a wide range of devices, software, hardware, and networks. It may also require the use of science and technology to solve problems and develop new products or services. [1]

Technology has played a central role in the development of human society and has contributed to significant changes in the way that people live, work and travel. It has enabled us to communicate, and access information more easily, and has also enabled the creation of new products and services that have improved our quality of life. The term "technology evolution" refers to the way new and better technologies arise over time. This might include the development of brand-new technologies as well as the advancement and modification of existing ones, all of which have had an enormous impact on society and have changed the way of living.

The history of cars and the automotive sector is one of continuous changes that has shaped the way we travel. The impact of vehicles on society is unmeasurable, evolving from horse carriages to the modern marvels of high technology.

The beginning of the automotive industry can be traced back to the late 19th century when inventors and engineers began exploring the possibilities of motor-powered vehicles. The crucial moment came once with the invention of the internal combustion engine. [2]

Today, the automobile sector finds itself at a turning point. Global governments are setting aggressive goals to cut carbon emissions, while electric vehicles are increasing market dominance. Automakers are investing in sustainable energy solutions, renewable materials, and environmentally friendly production processes as a result of the drive toward sustainable practices.

The field of autonomous driving is constantly developing as businesses work to get past obstacles in the form of regulations and technical difficulties. The concept of shared mobility is gaining momentum, with ride-sharing services and car-sharing platforms becoming integral parts of urban transportation ecosystems. [3]

Challenges persist, including the need for robust charging infrastructure for electric vehicles, addressing cybersecurity concerns, and navigating the complexities of global trade and geopolitics. However, the automotive industry has demonstrated resilience and adaptability throughout its history, and it is well-positioned to embrace the opportunities and challenges that lie ahead.

Literature review

Automotive industry evolution

The automotive industry has undergone a profound transformation over the years, largely driven by advancements in technology. From the early days of handcrafted vehicles to the current era of smart and connected automobiles, technology has played a pivotal role in shaping the industry's trajectory. As time went past, technological developments continued to redefine the automotive landscape. The mid-20th century witnessed the emergence of innovations like power steering, automatic transmissions, and safety features, enhancing the driving experience and making cars safer and more user-friendly. In recent years, however, the pace of technological evolution in the automotive industry has accelerated dramatically. The development of electric vehicles (EVs) and autonomous vehicles (AVs) has gained momentum, driven by breakthroughs in battery technology and a growing awareness of the environmental impact of traditional combustion engines.

The development of autonomous vehicles represents a revolutionary advancement in the automotive industry. Companies like Tesla, Waymo (Google), and Uber are at the forefront of AV technology, aiming to transform transportation and mobility as we know it. The potential impact of AVs extends beyond personal transportation to industries such as ridesharing, logistics, and delivery services. As autonomous technology evolves, it presents a variety of opportunities for innovation, efficiency, and new business ideas and models. Autonomous vehicles have the potential to revolutionize transportation and create entirely new business models. Ridesharing companies, for example, envision a future where fleets of autonomous vehicles provide on-demand transportation services. [4] This concept could significantly reduce costs, improve efficiency, and enhance the overall passenger experience. Automakers, tech companies, and start-ups are collaborating to develop the necessary technologies, including advanced sensors, computer vision, machine learning algorithms, and high-definition mapping. While fully

autonomous vehicles are still being developed, the gradual introduction of semi-autonomous features has already had a positive impact on safety and driver convenience. [5]

Technologies embedded in today's industry

The automobile sector now has new opportunities due to the Internet of Things (IoT) and vehicle integration. Improved connection between automobiles, infrastructure, and other devices is made possible by connected cars, which opens the door to the creation of several services. A few instances of how connection is changing driving include vehicle-to-vehicle communication, remote diagnostics, predictive maintenance, and real-time navigation. Furthermore, connectivity is essential for increased safety features and for laying the foundation for upcoming innovations like vehicle-to-everything (V2X) communication. [6].

Additionally, automotive companies can leverage this data to develop new revenue streams through targeted advertisements, in-car entertainment, and subscription-based services. The integration of IoT technology in vehicles also enables over-the-air software updates, reducing the need for physical recalls and improving the customer experience. [7].

Modern cars are equipped with a set of technologies called Advanced Driver-Assistance Systems (ADAS) that function as a virtual co-pilot. In order to sense their surroundings, alert drivers to possible dangers, and in some cases, even partially operate the car, these systems make use of sensors, cameras, software, and computers. The ultimate objectives of ADAS are to improve driving comfort, lower human error, and increase road safety. ADAS technologies are built on AI.

The incorporation of ADAS features not only improves road safety but also presents business opportunities for companies specializing in sensor technology, software development, and hardware integration. Moreover, the demand for retrofitting older vehicles with ADAS capabilities offers another option for growth in the aftermarket segment. [8]

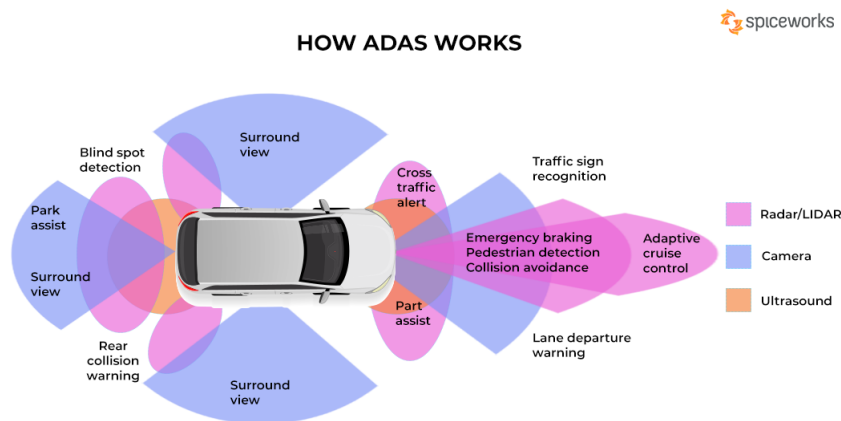


Figure 1: Advanced Driver Assistance System (ADAS) explained.

Source: <https://www.spiceworks.com/> accessed on March 3, 2024)

ADAS represents a significant leap forward in vehicle technology. By enhancing safety, reducing human error, and paving the way for autonomous vehicles, ADAS is transforming the driving experience. However, it's important to remember that ADAS is a tool, and active driver engagement remains essential.

Data analytics and artificial intelligence (AI) play a pivotal role in the automotive industry. Companies utilize AI to analyse vast amounts of data, gain insights into customer

behaviour, and enhance manufacturing processes. Predictive maintenance, quality control, and autonomous driving algorithms all benefit from the power of AI. AI algorithms can identify trends, optimize manufacturing processes, and enable predictive maintenance, improving operational efficiency and reducing costs.

Additionally, AI-powered autonomous driving systems continue to advance, allowing vehicles to perceive and react to complex dangers and obstacles. [9] [10]. Autonomous driving technology has the potential to increase accessibility and mobility for individuals who cannot drive, such as the elderly, disabled, or those without a driver's license. [11]

Also, driver monitoring systems and emotion recognition are two applications of AI technology. These devices analyse facial expressions, eye movements, and other behavioural clues using cameras and artificial intelligence (AI) algorithms to spot indicators of fatigue, distraction, and other risky driving situations. Algorithms driven by artificial intelligence (AI) can issue warnings or take action to stop accidents brought on by tired or distracted drivers. These solutions help reduce the probability of accidents and improve road safety. [12]

Methodology [Times New Roman, 14, bold, capitalise first word, justified]

A research method uses a series of steps or stages that guide a project from its initial conception to its final analysis and actions. This methodological approach offers a structured, scientific framework for conducting research, ensuring that all aspects are interrelated and interdependent.

The purpose of this survey is to research if the technology embedded in today's vehicles influences the buyer's behaviour when deciding to buy a modern automobile and gain insights into their preferences and expectations for future car technology. By understanding these factors, automakers can make critical decisions in developing and marketing their vehicles. The survey will collect feedback from current drivers and vehicle owners, but also from people looking to buy a new car.

The survey objectives were to assess the importance of technology in car buyer's decision-making process; identify specific technological features that are most appealing to car buyers; gauge willingness to pay for advanced car technology; evaluate the impact of technology on safety, ease and enjoyment of driving; uncover concerns and expectations of the consumers regarding car technology and gain insights into the future of car technology. The survey targeted people of all age categories who currently drive and own cars, as well as those looking to buy one. The survey had 35 respondents and was distributed electronically via social platforms such as LinkedIn, Facebook, Instagram, WhatsApp, and email, available between 17.04.2024 and 22.04.2024. The data was analyzed using Microsoft Excel

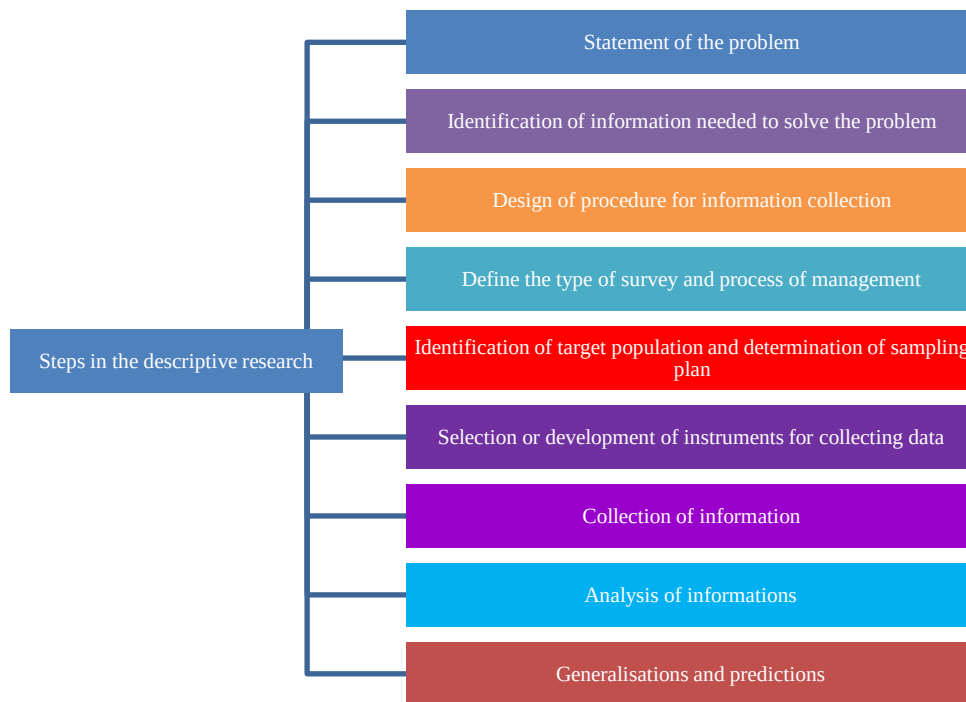


Figure 2: Research methodology
Source: Author's own contribution

Results and further discussions

The survey conducted aimed to analyze if the technology embedded in today's vehicles influences the buyer's behaviour when deciding to buy a modern automobile and gain insights into their preferences and expectations for future car technology. Regarding the responders, the demographics show that 51.4 % of the responders were males. This balance between males and females shows that the answers given won't indicate a significant disparity in the analyzed data. Regarding the age of the responders, more than 40% were between 18 – 25 years of age, while just 8% represented responders with the age between 51 to 60 years old.

When asked if they own a car just 91% percent said yes. Just 59% of the responders were on their first owned car, while 30% had more than 3 cars.

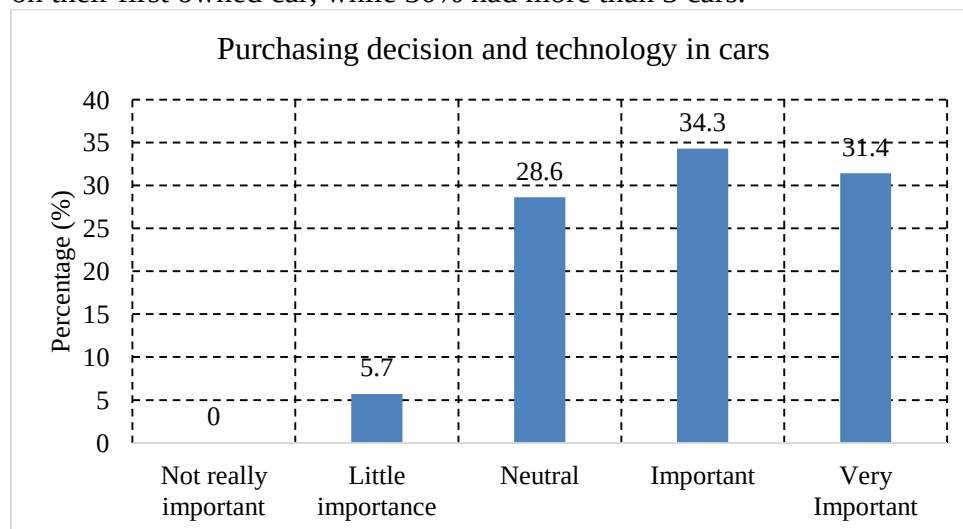


Figure 3: Technology influence over the respondents' behaviour

Source: Author's own contribution

Continuing to analyze the results we could see that 34.3% of respondents consider technology very important in their decision-making process for buying a car. Also, more than 57% consider that cars are safer with technology embedded. When asked about what kind of technology they said that blind spot monitoring is one of the most important (table 1) followed by Automatic Emergency Braking, Adaptive Cruise Control, Parking Assist Systems, and Night Vision Assist. Lane Departure Warning is the least important feature among the respondents.

Table 1: Most important technology features chosen by respondents

Features	Percent (%)	Valid Percent (%)	Cumulative percent (%)
Forward Collision Warning	54.3	54	46
Automatic Emergency Braking	60	60	40
Adaptive Cruise Control	57.1	57	43
Lane Departure Warning	31.4	31	69
Blind Spot Monitoring	74.3	74	26
Parking Assist Systems	57.1	57	43
High Beam Assist	34.4	34	66
Night Vision Assist	57.1	57	43
Automatic Emergency Calling	40	40	60

Source: Authors' own research.

Considering the importance of technology and the evolution it has in the automotive industry, the responders mentioned that, in a percentage of more than 34%, they are willing to pay more for a car with the latest technology. Also, a larger group of respondents (45.7%) when asked "Do you think the technology used in cars is making them more convenient for the driver?" chose "Yes," indicating that they strongly believe that the technology used in cars is making them more convenient for the driver. This illustrates a high level of satisfaction and appreciation for automotive technology.

In addition, the responders were asked if they had any concerns regarding the technology used in cars, and 28% said YES. Respondents who answered "Yes" to having concerns provided some of the following arguments regarding their answer:

- Too much control from the outside.
- Reliability can be affected by advanced technology and limits on self-repairs.
- Technology is not 100% reliable and can omit important functions.
- Potential issues with software updates and errors while driving.
- Touchscreen controls are distracting.
- Over-reliance on technology might reduce driver attention and reflexes.

The concerns revolve mainly around control, reliability, distractions, and over-reliance on technology. These are important areas for manufacturers to address in order to reduce consumer fears. Regarding their thoughts on the future of technology in cars their expectations revolve mainly around increased technological reliance, enhanced comfort and safety, regulatory considerations, and the shift towards sustainable and automated driving solutions.

- People will rely more on technology and less on their driving skills.
- Cars will have more features to make driving more comfortable.

- The future of cars includes autonomous driving, electrification, connected systems, advanced safety features, sustainable materials, V2X communication, AI integration, shared mobility, enhanced user experience, and energy innovations.
- Microtransactions to access certain features, potentially with lower quality materials but more technological advancements.
- Governmental bodies might regulate self-driving technology more strictly if beta systems continue to cause accidents.
- The future looks brighter, with potential alternative fuels to gasoline, allowing for longer drives.
- Fully automated driving cars.

The responders' general attitude towards the efficiency of these systems showed that the majority of respondents (65.7%) believe that the increasing complexity of car technology will make it easier for consumers. However, the rest of 40% who expect difficulties suggest that there are notable concerns about the potential distractions and complications associated with advanced car technology.

Conclusion

This paper has thoroughly examined the significant impact of technological advancements in the automotive industry, particularly focusing on consumer purchasing behavior. The research highlights several key findings.

Firstly, advanced technologies such as autonomous driving, electric powertrains, and connectivity features significantly influence consumer purchasing decisions. These technologies are perceived to enhance safety, convenience, and environmental sustainability, which are critical factors for modern consumers. Secondly, the integration of digital technologies within the automotive industry is directly linked to increased market share, revenue, and customer loyalty. Companies that effectively adopt and implement these technologies are better positioned to meet consumer demands and remain competitive in a rapidly evolving market. Additionally, technological advancements play a crucial role in shaping consumer trust and improving brand perception. Consumers are more likely to remain loyal to brands that they perceive as innovative and responsive to new technological trends. Furthermore, the adoption of new technologies not only enhances operational efficiency and productivity but also opens new revenue streams for automakers. By leveraging technology, companies can improve customer satisfaction. Looking ahead, as technology continues to advance at an unprecedented pace, the automotive industry is set for further transformation. Companies that embrace a data-driven approach and continuously innovate will be well-positioned to shape the future of mobility and redefine the automotive experience for generations to come.

In conclusion, the unstoppable advancement of technology is a driving force in the evolution of the automotive industry. The findings of this dissertation underscore the importance of technological innovation in meeting consumer expectations, enhancing brand loyalty, and driving business growth. As the industry continues to evolve, constant research and adaptation will be essential to showcase the full potential of technology and maintain a competitive edge in the market.

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