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IMPACT OF EMERGING TECHNOLOGIES AND INDUSTRY DISRUPTION IN AUTOMOBILE INDUSTRY

Mrs.Gayathri S* **Ms.Saranya** C **
**Assistant Professor, Department of Business Administration, Chevalier.T. Thomas Elizabeth College for Women, Tamil Nadu, India.*
***Student, Department of Business Administration, Chevalier.T.Thomas Elizabeth College for Women, Tamil Nadu, India.*

Abstract
In the present scenario, due to technological advancement the automobile industry is undergoing digital transformation. Artificial intelligence (AI) applications are being used in automotive assembly lines and manufacturing areas in a variety of ways. These include sophisticated quality assurance techniques, human-machine interaction, and new generations of intelligent robots. Automobile manufacturers are currently utilising AI and machine learning (ML) in their manufacturing processes, in addition to the extensive usage of AI in vehicle design. Robotics are already used in assembling line. Robots carry out repetitive tasks and cobots work in collaboration with humans[1]. Globalisation is one of the top reasons for the digital revolution in the automobile industry. Almost all the industries such as health, education etc, are undergoing digital transformation and the automobile industry has no exemption from digitalisation. This research paper aims to investigate the impact of recent technological development and industry disruption in the Automobile Industry. This study focuses on the car segment in the automobile industry and analyses whether the digital transformation has met changing customer expectations and behaviour. The results of the study reveal that customer expectations are satisfied by automobile manufacturers through the innovative approach called "features on demand " where customers have the option to add parts and functionalities and update them using over the air just like operating system or software in smartphone or laptops.[2]

Keywords: Digital Technology, Innovation, Automobile, Customer Expectation and Preference.

Introduction

Since its origin, automakers have used innovations in mechanical and electrical engineering to gain a competitive advantage, making the automotive industry a wide playground for constant innovation. Despite this, the auto industry is still mostly controlled by the vehicle manufacturers, making it rather closed off today. It is not easy to enter the automobile industry like any other industry. The sector is dealing with several challenges, including the need to adapt to new technology, growing competition, and shifting customer expectations. Like many other industries, the auto industry is poised to undergo a dramatic transformation that will affect the previous state of the market. The digital revolution, which was sparked by a confluence of technology factors like cloud computing, big data and analytics, mobile device socialisation, and the Internet of Things (IoT), is largely responsible for the

[1]Slanky, D. (2021). Manufacturing trends and technologies in the automotive industry. https://www.automationworld.com/business-intelligence/article/21579012/manufacturing-trends-and-technologies-in-the-automotive-industry.
[2] Technologies, A. (n.d.). *Features on demand: The evolution of software-defined vehicles*. LinkedIn. https://www.linkedin.com/pulse/features-demand-evolution-software-defined-vehicles-acsiatech/

developments. In recent years traditional industries are transformed to be digital industries.[3] In contrast to domestic automobile manufacturers, overseas competitors use cutting-edge technology in their products, and all business operations are now digital. The adoption of more sophisticated technologies results in an increase in the sale of automobile products. It improves the standard of the products and after-sales services, which eventually results in consumer loyalty to the brand.With the advent of artificial intelligence; digitization will grow to be crucial in the coming years.

Objectives of the study

- To study the impact of recent technological development and industry disruption in the Automobile Industry.
- To analyse whether the digital transformation has met changing customer expectations and behaviour.

Significance of the study

The success or failure of the business entirely depends on its ability to meet customer expectations and satisfy them. In the digital era, people prefer to adopt digital technologies in their lifestyle. The businesses which don't adapt to the changing digital environment cannot survive. Consumers expect innovation and creativity in the product or service they use. People prefer to own a car as a symbol of social status and wealth even today. Therefore, customers expect digital innovations in their prestigious goods they procure.

Limitation of the study

The following are the limitations identified for this study:

- This study is restricted to few respondents who own and are willing to own a car in Chennai district.
- The responses of the samples are subjective in nature.
- The accuracy of the study would be more, when more samples are considered.

Review of Literature

Llopis-Albert, C., et al. (2021) examined the effects of digital transformation on the automotive sector from the perspectives of many stakeholders, including governments, automakers, service providers, and suppliers of public transit.The methodology has been effectively utilised in an intricate empirical analysis based on a case study. It showcases a cutting-edge use of fsQCA for digital transformation in Spain's automotive sector.The findings demonstrate that manufacturers will benefit financially and gain a competitive edge by investing in the right strategies for adjusting to the digital revolution. Customers will have more access to better services and be more satisfied with the necessary services, in their opinion.[4]

Turienzo, J. (2023) investigated the influence of business models during disruptive times: the (unpredictable) domino effect of connected and autonomous automobiles. The study adopted a qualitative tack and conducted in-depth interviews with senior managers across several businesses.

[3] Digital Disruption and the future of the automotive industry - IBM. (n.d.). https://www.ibm.com/multimedia/portal/H752407R29967B14/IBMCAI-Digital-disruption-in-automotive.pdf.

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

The results highlight the significance of data management to have a deeper understanding of customer demands and vehicle specifications to give differential value. There are two possible answers that have surfaced: first, forming partnerships amongst businesses that compete in diverse markets; and second, using digital platforms to improve the consumer experience.[5]

Dhanabalan, T.et al(2018) investigated the Factors Influencing Consumers' Car Purchasing Decision in Indian Automobile Industry. The objective of this research is to investigate the characteristics that most influence the consumer's choice to acquire a car. Due to the availability of both domestic and international brands and growing competition, the Indian automotive market is currently very competitive. Expectations of customers both before and after the sale are high. The investigation was carried out in Tamil Nadu. 547 consumers who had bought the cars in total were contacted for data collection. Both primary and secondary data form the study's foundation. Data analysis has been done using Structural Equation Model. According to the findings of the research showing that consumer perceived value, the targeted research variable, was positively impacted by technical considerations, design, utility, brand, cost, and quality. These elements have forced the buyer to choose and purchase.[6]

Sommer, S.et al (2021) studied digital transformation in the global automotive industry. This study examined 167 international automobile firms by measuring digitalization through the theoretical derivation of an index of digital maturity. According to the findings, digital transformation is essentially a strategic change. However, it frequently fails to proceed as intended because larger businesses have intricate structures that are frequently put together through joint ventures and acquisitions, and organisational units test discrete, largely disconnected pilot applications of digital technologies in various organisational processes, products/services, and business models. As a result, managing digital disruption in the automobile sector requires a thorough transformational effort. [7]

From the perspective of environmental psychology, the authors examined the reasons behind German households' adoption of electric cars. Using an online survey with n = 220 German household members interested in purchasing a new car, the authors examined the significance of several reasons. The questionnaire asked about potential norm-related and logical predictors of adoption of electric vehicles. An adjusted norm activation model (NAM), an adjusted technology acceptance model (TAM), and an integrative model incorporating predictors from both models were the three action models that the authors examined to explain adoption intention. The authors used path analysis to examine the proposed models. Every model accounted for a significant portion of the variation in adoption intention. In comparison to the integrated model, the explained share of variation in the NAM was larger than that of the TAM. The findings show how moral and social considerations play a significant influence in household investing decisions. An additional reasonable motivation for the technology was its apparent utility. The authors discussed how the results rely on the context since, in the early phases of a technology's diffusion, family members may not know much about the new

[5]Turienzo, J., Cabanelas, P., &Lampón, J. F. (2023). Business models in times of disruption: The connected and autonomous vehicles (uncertain) domino effect. *Journal of Business Research*, *156*, 113481.
[6]Dhanabalan, T., Subha, K., Shanthi, R., & Sathish, A. (2018). Factors influencing consumers' car purchasing decisions in the Indian automobile industry. *International Journal of Mechanical Engineering and Technology*, *9*(10), 53-63.
[7]Sommer, S., Proff, H., &Proff, H. (2021). Digital transformation in the global automotive industry. *International Journal of Automotive Technology and Management*, *21*(4), 295-321.

technology. The findings clearly point to the need to expand political support programmes, like awareness and public relations efforts, to promote the adoption of electric vehicles more successfully.[8]

Research Methodology

The study is descriptive in nature, which represents the characteristics of the population. Secondary data were used for the purpose of literature review and profile of the study area and the main study was carried out using primary data. Questionnaire consists of close-ended questions. Data is collected using simple random sampling methods. The study is carried out with 62 samples in Chennai District. Chi-square, Correlation and Percentage analysis methods were adopted for the purpose of data analysis and interpretation of primary data.

Data analysis and Interpretation

Table:1 Relationship between Age and Customer preference to purchase smart car

Age/Smart Car preference	Yes	No	Total
21-30	19	2	21
31-40	6	6	12
41-50	2	12	14
above 50	2	13	15
Total	29	33	62

Chi Square Value: 29.24, Degree of freedom:3, Table value: 7.815

Result

The result of the Chi square test reveals that the calculated chi square value 29.24 is higher than the table value 7.815 at 5% level of significance and therefore, there is a relationship between age and Customer preference to purchase a smart car. Thus, an alternate hypothesis is accepted.

Table 2: Correlation between Income level and factors considered to purchase a brand-new car

X	$X=x-\bar{x}$	X^2	y	$Y=y-\bar{y}$	Y^2	X Y
10	-5.5	30.25	21	5.5	30.25	210.8
20	4.5	20.25	13	-2.5	6.25	260.4
27	11.5	132.25	12	-3.5	12.25	324
5	-10.5	110.25	16	0.5	0.25	80.2
Σx =62	$\Sigma(x-\bar{x})$	$\Sigma X^{2=}$293	Σy=62	$\Sigma y-\bar{y}=0$	$\Sigma Y^{2=}$49	ΣX Y=875.4

Correlation between two variables r=0

[8]Bobeth, S., & Kastner, I. (2020). Buying an electric car: A rational choice or a norm-directed behavior?.*Transportation Research Part F: Traffic Psychology and Behaviour*, *73*, 236-258.

Result

The correlation between two variables is zero. Therefore, income levels and factors considered to purchase a brand-new car do not have any association with each other which means that income levels of the respondents do not determine the factors they consider to buy a brand-new car.

Findings of the Study

From the analysis and interpretation of the primary data collected, the findings are summarised as below:

- The sample consisted of 34% of respondents between 21 – 30 years of age, followed by 19% of respondents between 31-40 and 23% of respondents between 41 to 50 years and 24% above 50 years of age.
- 77% of respondents are male and 23% of respondents are female.
- Out of the samples analysed, 62% were employees, 20% were self-employed and the rest of the respondents were retired.
- Monthly income of the 16 % of respondents are above Rs.20,001-30,000, 32% of respondent's income is between Rs.30,001-60,000, 43% of the respondent's income is between Rs.60,001 to 90,000 and the monthly income level of remaining respondents is above Rs.90,000.
- 83% of the respondents prefer to physically inspect and feel the happiness of buying a new car and the 17% of the respondents prefer to buy online.
- 54% of the respondents like to buy fuel cars, 33% of the respondents like to buy hybrid cars and the rest of the respondents prefer to buy electric cars.
- Major portion of the respondents do not prefer autonomous self-driving cars and very few prefer the same.
- 51% of the respondents choose to buy an automatic car and 49% of the respondents choose a manual car.
- 78% of the respondents feel that a dealer's role is crucial in either purchasing a car online or offline.
- 51% of the respondents feel the automotive infotainment system in a car is very useful and the balance 49% of the respondents said it leads to visual and mental distractions.
- 47% of the respondents prefer to own a smart car and 53% of them do not prefer the same.
- 35% of the respondents said that the quality, cost of ownership and reliability are the factors they consider for purchasing a new car. 21% of the respondents said fuel efficiency and safety ,19% said maintenance, and balance, 25% said smart features.
- 90% of respondents said that their expectations on features and functionalities are satisfied by the dealers/manufacturers and the balance 10% were against this concept.

Suggestions

Based on the findings of the study, the following suggestions were given

- Majority of the respondents said that they do not prefer to buy a car online, nowadays the dealers use augmented and virtual reality which helps the prospective customer to see and experience the car. It saves time and cost. Purchase can be done in any convenient hour and it considerably reduces paperwork.
- Major portion of the respondents prefer fuel-based vehicles. It is suggested that electric vehicles have substantially lower operating costs than a comparable fuel or diesel vehicle. Maintenance cost is relatively low and helps to reduce the environmental impact due to its

lower carbon footprint. Compared to fuel or diesel automobiles, electric vehicle registration fees and road tax are less.

- Majority of the respondents said that the automotive infotainment system leads to visual and mental distractions. It is suggested that automotive infotainment systems provide a variety of functions such as radio operation, playing music files that are stored locally,listening to music via a streaming service, and live traffic updates are included in the streaming video display navigation, hands-free communication via smartphones and internet connectivity ,electric range and driving efficiency data are included in telematics, smartphone mirroring , Engine power configuration , visible climate control controls and voice-activated automotive systems which are highly beneficial .[9]
- From the findings it is analysed that very less portion of the respondents considered fuel efficiency and safety for automobile purchase. Therefore, it is recommended to consider fuel efficiency and safety as priority in automobile purchase because an automobile that uses less fuel will emit fewer pollutants and cost less to operate.Car buyers should think about safety features including reverse parking sensors, dual airbags, and anti-lock brake systems (ABS).It is necessary to take into account extra safety measures like steering, autonomous emergency braking, and electronic stability control.[10]

Conclusion

Customer expectations and demands give rise to innovation. In the present era of digital revolution, where technology is widely used in everyday life, none of the industry can survive without upgradation because customer preferences changes rapidly and technology grows exponentially. From the study, it is very clear that digitalisation in automobile industry enables it to streamline its manufacturing process. Digital technologies in automotive industry monitor the machines and equipment to prevent fault or error before they occur. Therefore, there is high impact of emerging technologies and industry disruption in Automobile Industry.

[9]Chaudhary, U. (2023a, July 24). *How important is a car's infotainment system for a customer: Team-bhp*. Team. https://www.team-bhp.com/news/how-important-cars-infotainment-system-custom

[10]*5 factors to consider while buying a new car in India*. The Economic Times. (n.d.). https://economictimes.indiatimes.com/wealth/insure/motor-insurance/5-factors-to-consider-while-buying-a-new-car-in-india/articleshow/70228145.cms