Application of Data Analytics in Automobile Manufacturing--
Evidence from Existing Literature

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Abstract. The auto manufacturing industry is one of the most dynamic business industries and is extremely competitive. Since auto manufacturing is technology-intensive as well as competition-intensive, making data-based decisions has become an important part of the industry to make the right business strategies to achieve competitive advantage. Across the auto manufacturing process, human resources, function sales and marketing, product design, and support services use data analytics to extract useful insights from the immense amount of data on customers, employees, and market trends. However, the use of new technologies in the automotive industry is still not addressed in the automotive industry-based research works of literature. Analysis of the old and growing analytics techniques, this article proposes that applications of more advanced analytics, such as reinforced learning, deep learning, and cognitive learning, will play an important role in the future of the automotive industry to make driverless cars a reality.

Keywords: Competitive advantage, Reinforced learning, Deep learning, Data Analytics.

1. Introduction

The auto manufacturing industry or automotive industry comprises organizations associated with the manufacturing of cars, SUVs, sedans, electric vehicles, and so on. Just like any other industry, the use of data analytics has been increasing in the automotive manufacturing industry. The use of data analytics techniques is documented in various kinds of literature but the future scope of the data analytics method is still under-represented in the research. as of now new data analytics techniques and methods such as deep learning, machine learning, artificial intelligence, and cognitive learning are being used in many industries. In this paper, current applications of data analytics will be studied, and some recommendations will be provided for the future of the automotive industry.

2. Literature Review and Analysis

The automotive manufacturing industry started in the late 19th century when Karl Benz produced the first automobile (Chamberlain and Ede, 2013). Simply automotive means those kinds of vehicles that are powered by gasoline. According to Statista.com, a leading consumer and market data provider, the United States of America, Japan, Germany, China, and India were the leading automotive manufacturers in 2021 (Statista Research Department, 2022). These countries manufacture automobiles that are powered by the combustion of petroleum products such as diesel, petrol, and gasoline.

As of now, electric vehicles and self-driving cars are in the limelight because electric vehicles are assumed to reduce carbon emissions and help in tackling the climate change problem, and self-driving cars are assumed to reduce collisions making safer transportation for consumers (Li et al., 2015; Howard & Dai, 2014). Tesla, NIO, Toyota, Ford, and many other companies are trying to manufacture effective and efficient electric vehicles in order to make electric vehicles the new norm. In the future, cars will most probably be run on electricity rather than petroleum products in order to create a sustainable environmental future.

Apart from that, the auto manufacturing industry is also making use of big and raw data to understand customer expectations and make self-driving cars a reality through the use of Artificial intelligence and machine learning (Hoffman, Neukart, and Back, 2017). Self-driving cars are known to be effective in reducing accidents and also help in changing the automotive industry for good.
Deep learning is one of the newest techniques that utilize neural networks which can help in creating automotive datasets (Lucknow et al. 2017). These automotive datasets can be used in advanced driving assistance systems. There is a gap in the existing literature on the subject of the automotive industry and data analytics use. Apart from that, what technologies are being developed is also not addressed well in the existing literature.

3. Research Methods

Thematic analysis of different pieces of literature on the existing use of data analytics will be done in order to understand how exactly data analytics is being used in the different operations in the automotive industry. Moreover, works in computer science regarding machine learning, Artificial intelligence, and deep learning will also be done to understand the possible use of the technology in the automotive industry. Therefore the research method used in this paper is the thematic analysis of the pertinent literature on the subject and summarizing of the findings.

4. Research results

The thematic analysis of the various kinds of literature on the subject of the use of data analytics in the automotive industry suggests that data analytics is being used in shaping business processes and making business decisions by understanding customers' expectations and the data taken by the vehicle's sensor to improve functionality and security of the automotive. The findings of the research are summarized below as current applications of data analytics and the future use of data analytics in the automotive industry.

4.1 Current Application Of Data Analytics By Functions Within Organizations

Every industry can gain much from data analytics, and raw data, and the automotive industry is no exception. Data analytics is a field that focuses on analyzing raw data and extracting useful insights from it. According to CIO, a leading IT and data analytics concentrated digital magazine, “Data analytics has become increasingly important in the enterprise as a means for analyzing and shaping business processes and improving decision-making and business results” (Olavsrud, 2022). For example, the number of customers entering the hotel per month per year, the number of days customers remain in the hotel, the types of service they ask and how much they pay per visit to the hotel are data.

With data, hotels can gain useful insights and understand how to provide valuable and convenient service to their customers. This is also true in the field of auto manufacturing. Human resources, accounting and finance, product design, supply chain, sales and marketing, and customer services are the most important departments in the automotive industry. Therefore, the importance of data analytics in the above-mentioned areas will be discussed briefly in the following section.

4.1.1 Human Resources

Although the advancement in technology has given rise to considerable automation processes, there are still humans working in important positions. And where there are humans working in the company, there is a necessity for the human resource department in order to manage the well-being of the employees and recruit the right people for the jobs. Often human resource officers do not make data-based decisions. Data analytics can be used by human resource managers to evaluate the performance of employees (Ofori- Boateng, 2020). For example, taking records of the salesperson’s sales per month, per day and per year can help the HR manager to make better decisions to promote employees.

Data analytics can also help HR managers to determine how much raise an employee should get based on performance. Similarly, data analytics can also help HR managers increase employee retention by eliminating the loss of the resources needed to replace employees. With data analytics
tools and data visualization tools, HR can evaluate employee engagement by asking for feedback and then using that data to collect actionable insights.

4.1.2. Accounting and Finance

Within the accounting and finance department of an automotive manufacturing organization, data analytics is used to get a deeper and broader perspective of business operations (Maryville University, n.d). Moreover, the accounting and finance departments are also able to use data analytics to predict accurate future markets and trends. Similarly, the use of data analytics is also highly used to automate routine tasks improving accuracy and reducing costs.

The visualization tools of data analytics can provide insights into the expenditure of the company and the need for the finances of the company. The accounting and finance department can record the sales made per day, per month, and per year and also the expenses of the company. By using data analytics, the accounting and finance department can predict the higher volume of sales and expenses in the following month and year based on the previous year's data.

4.1.3. Product Design and Development

Paul Planung (2020), a data analytics expert, suggests that auto manufacturers have been using data science to improve their business processes. Auto manufacturers install the proper sensors in a vehicle and start taking the data in order to predict the potential issues before they surface or change into bigger problems. Similarly, data analytics is also used by auto companies to design better-performing cars. Data analytics is helping companies to design by taking the feedback of the customers, the performance of the vehicles, and so on.

4.1.4. Supply Chain and Logistics

Most auto manufacturing companies supply their products in the national as well as international markets. Therefore auto manufacturers need sound global supply chain management. By analyzing the huge amount of data, the auto manufacturing companies can identify the potential international markets early hence giving them a first movers advantage (Deloitte, n.d). Similarly, the data is also helping companies to realize the correlations between various factors dealing with supply chain management and identify patterns so that companies can prevent future problems.

Apart from that, automobile manufacturers can gather data about the sales of different products. The data gathered can then be used to predict the future demand for the particular vehicle and the company can discontinue the product which is not giving the desired results. For example, Ford can use supply chain analytics and understand which of its products are selling more in the market and in which month. With this insight, Ford can increase the production and shipping of the product to sellers and also work on customer requirements by gathering customer feedback.

4.1.5. Sales and Marketing

There is a huge flow of data on the internet about customers and their search history. Data analytics use this data to gain useful insights. Based on these insights, auto manufacturing companies can target ads for customers. Based on the data of the customer’s expectations and where potential customers mostly get their news and information, the automakers can pitch their sales and marketing to their potential customers.

Moreover, targeting advertisements based on demographic data could also be useful for automobile manufacturers. For example, if a car manufacturer has no data on what consumers of different ages and gender want in a particular area and what they value, there is no way a car manufacturer company could launch a successful marketing campaign.

4.1.6. Support Services

Data analytics is known to reduce the expenses of support services. Moreover, the consistency of increased customer satisfaction and revenue generation, along with the increased optimization, are also provided by the data analytics used in the support services. Data analytics in short help every major department of the company to understand the core areas they are most concerned with and
make decisions based on facts and data rather than on their gut feelings. Data analytics can be used in the support services of the automobile industry to gain practical insights from the customer’s post-purchase experience and use that feedback loop to improve product quality in the future.

4.2 Future Application and Analytics

The future of the automotive industry, according to McKinsey & Company, is based on “electric mobility, driverless cars, automated factories, and ridesharing” (Hofstätter et al., 2020). Moreover, McKinsey & company report also suggests that the companies after COVID-19 need to focus on online sales offerings and contactless self-drives (Hofstätter et al., 2020). The industry growth in the future will most importantly be related to electric vehicles due to the increased focus by the government on electric mobility and the public support for the cause of climate change.

Moreover, the automation and the use of data analytics to make important decisions and the improvement in driverless cars will also determine the automotive industry’s future. In order to remain ahead in the game and attain strategic competency, auto manufacturing companies need to use advanced efforts to make better decisions in design and production, sales and marketing, accounting and finance, and so on. Machine learning and AI can be integrated within the auto manufacturing company by using reinforced learning, deep learning, and cognitive computing. These advanced data analytics techniques, through the help of machine learning, can impact the value delivered to consumers, employees, and investors.

I think the use of data analytics in the automotive industry is all about understanding the expectations of the customers. The more an automotive company knows about its customers’ expectations with their automobiles, the more the company can build better products for them. Similarly, the company which uses data analytics can make decisions about appraisals, promotions, rewards for their employees with the help of data and hence reducing the error and negative feelings about the company’s view and behavior towards their employees. In the end, if the consumers are happy and are buying from the company, and if employees are happy in the company and giving good performances, then the investors are the ones who reap the benefits of the increased revenue and profits.

5. Conclusion

The automotive industry is one of the critical industries, as it is associated with human needs for transportation. The automotive industry makes use of data analytics to improve the quality of products and also understand customer expectations. Data analytics also provides useful insights into the need to improve the security of vehicles. However, the existing use of data analytics in the automotive industry is not represented in the pertinent pieces of literature. Apart from that, future use of deep learning, machine learning, and AI is also not documented well. In this paper, the existing use of data analytics in all areas of the automotive industry is presented in a lucid manner.

Moreover, the future of data analytics in the automotive industry is also presented, which is largely absent in contemporary research articles on the subject. The demand and necessity of self-driving cars, automated manufacturing, electric cars, and ridesharing will be fulfilled by the use of deep learning, machine learning, and AI in the near future, which reinforces the argument of Hofstätter et al.’s (2020) report published in the reputed Mckinsey & Company. This paper is not without limitations because this paper does not include the mechanism of how machine learning and other techniques will be used to make self-driving cars.

References


