OPERATION MANAGEMENT STRATEGIES FOR THE ELIMINATION OF WASTE IN THE VEHICLE MANUFACTURING INDUSTRY

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Abstract

Operational Management is an important part of an organization that helps in managing the operations of the manufacturing process of products from the very start to the end for an organization. Operational management helps in managing all the tasks of a manufacturing firm in an administrative way. Waste Management in Indian Automobile Manufacturing Companies is a difficult task. The operational management System is responsible for managing the whole task successfully. Understanding the significance of Operation management helps in understanding the research work more efficiently. This research aims to understand the strategies used by the operational management team to eliminate the waste produced in the Indian Vehicle Manufacturing Industries.

Finding the impact of operation management on managing waste in Indian Automotive firms is one of the main objectives of this research work. Recognizing the challenges of managing the waste of vehicle manufacturing firms is also an objective of this research. Strategies by which Indian Automotive firms overcome the challenges of managing Waste are presented in this paper with some recommendations to improve the Operational Strategies for getting a more effective result. An operational strategy used in managing the waste is also evaluated to improve the Operation management in this paper. Research information is collected and analyzed by some methods and theories for a successful outcome of this research work. The primary data collection method is used and a survey is conducted among 92 participants to collect data. Assessment of the effective strategies used by the Operational Management helps to get innovative ways of eliminating waste disposal in the Indian Automobile Industry. The research helps in identifying the techniques for reducing waste in Automobile Industries in India with the help of Operation Management.

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Chapter 1: Introduction

1.1 Research Background

Operation management works as an administrative Management to administer a complete production timeline for a product starting from the input to the finishing stage. In the manufacturing industry operation management has to administer different tasks to bring efficiency to the organizational operation. Operation management can ensure that the organization has met the requirements and demands of customers by maintaining the quality of the products (Iris, and Lam, 2019). Manufacturing organizations produce a vast amount of waste during the production process. It can impact the sustainability of the environment. Therefore a robust waste management system is the most important aspect for manufacturing companies to maintain sustainability. Operation management for this purpose can play a predominant role to develop an efficient waste management system to reduce the production of waste in the manufacturing process with proper planning and execution. With the growing consciousness about the environment and sustainability, the waste management system has become an inevitable concern for many manufacturing companies. The operation management for this purpose can plan, organize and supervise the entire manufacturing process and production process. Proper planning of the waste management system in the production process in the operation management department can bring efficiency. Operation management can help in improving the image of the manufacturing company and create a positive influence in maintaining waste management. The manufacturing firms can ensure that the production process has controlled waste with proper and efficient planning of the operation management to meet the expectations of customers and maintain the sustainability of the environment (Ivanov et al., 2021). Business efficiency can be brought with the proper management of waste in manufacturing companies. Therefore, operation management can play a big role in the waste management system.

Moreover, it can be found that there are 5 principles present in the systems that relates with the waste management on a whole which includes waste avoidance, re-use, recycling, recovery, removal all

associated with the waste management works besides these principles. Here prevention gives out the meaning of not only measures to be taken for lowering the quantity of the wastes that needs to be generated and this is inclusive of the re-use related to products with regards to the life span of products. But this even makes measurements that needs to be taken with a view to reduce the impacts of the wastes that have adversities over the environment and the human health.

1.2 Research Aims And Objectives

As operation management plays an important role in the organization, it can help in eliminating waste in the manufacturing industry. Operation management can develop effective strategies for the manufacturing industries so they can eliminate waste during the production process.

The primary aim of the research is to analyze the strategies of operation management to eliminate waste in the manufacturing industry. The aims and objectives of the research will help the researcher in finding the solutions to the problems of waste elimination by the strategies of operation management for manufacturing firms.

The objectives of the research are to:

- To recognize the importance of operation Management for manufacturing firms
- To assess the impact of operation management on waste elimination
- To recognize the challenges faced by manufacturing firms in waste management
- To identify the techniques used by operation administration for waste elimination
- Tu assesses effective Strategies for implementing waste elimination procedures within manufacturing companies

1.3 Research Questions

The research questions include:

1. What is the significance of operation Management within the manufacturing sector?
    - What is operation management?

- What is the importance and role of operation management in manufacturing industries?

2. What are the issues in terms of waste elimination encountered by manufacturing firms?
3. What are the efficient techniques for integrating procedures of waste elimination within the manufacturing sector?

1.4 Research Rationale

The manufacturing sector can be accounted for releasing a huge amount of waste generated during the manufacturing process all over the entire world. The sector also consumes a huge amount of resources for its production process. The stakeholders and regulatory bodies continuously put emphasis on maintaining sustainability in the environment in the manufacturing industries. With the help of the research, it will be possible to understand what strategies can be implemented by the operation management to reduce waste. The research can help manufacturing companies implement necessary strategies to eliminate waste release in the production process. Manufacturing companies need to maintain the sustainability of the environment by reducing the waste production (Awan, 2019). Maintaining a sustainable approach to the production process is important for the manufacturing industry to reduce waste production. The operation management in the manufacturing companies can develop a plan for implementing green manufacturing practices so the waste management system can be improved. Industry 4.0 Technology has provided a huge opportunity for manufacturing organizations to increase their performance (Kamble et al., 2019). Lean manufacturing practices with the purpose of reducing waste in the production process can help companies in maintaining sustainable performance (Iranmanesh et al., 2019). The importance of operation management to maintain proper waste management systems in manufacturing forms can also be understood. The rationale of the research is to analyze the operation management strategies to help manufacturing companies in reducing waste.

1.5 Research Significance

The research has great significance to be used by future researchers while dealing with similar types of research topics. The research on operation in management strategies to maintain a waste reduction in manufacturing firms can help the manufacturing companies understand different strategies they should apply to minimize waste production. They can understand the strategies of lean manufacturing practices to maintain waste management in the organization. The leaders of the operation management of the manufacturing companies can also enhance their knowledge of using the strategies to maintain waste produced during manufacturing. Industry 4.0 is important for manufacturing companies to maintain the sustainability of the organization (Culot et al., 2020). The research can open up new dimensions for the manufacturing company to go ahead to be sustainable. The reason behind this is that the research has discussed various approaches and strategies developed by operation management to maintain the waste Management process in the manufacturing industry. The leaders of manufacturing industries can get an idea of what approaches they can use to maintain the sustainability of the environment through their production process. Therefore, the research has created great significance to help manufacturing companies improve their performance by bringing sustainability to the manufacturing process with the help of operation management.

Even the research is found to be significant for the people outside of the organisation as waste management strategies that are being taken up as operational provides assistance to those by minimization of the harmful effects from the dispersal of wastes (Gedam, et. al., 2021). The research suggests eco-friendly ways of vehicle manufacturing that will be benefitting the society along with being sustainable towards the environment as well. In addition to this it also can be made sure that the raw materials used for the purpose of production needs to to be gathered from a reliable as well superior client who will not be making any kind of hassles in terms of the quality as well its durability,

1.6 Research Structure

The research has been conducted in different sectors that include an introduction, literature review, research methodology, and research findings. Each part has an equal and important contribution to help the researcher develop systematic research to draw an effective conclusion through it. In the introduction section, the research background, significance rationale, aims and objectives, and questions have been discussed to provide an overview of the research topic. The literature review is the most important part of the research because it provides information to strengthen the concept and knowledge about the research topic. Research methodology provides a systematic method that the researcher followed while conducting the research. It includes research strategy, design, philosophy, Data collection, and data analysis process. The last part is the findings and conclusion that is based on the discussion of what the researcher has found during the data analysis process.

1.7 Summary

Operation management has an important role in an organization to bring efficiency. The wisely made strategies of operation management in the manufacturing company can help in bringing solutions to manage waste. The research can help in developing a strong concept of sustainable waste management which is a growing issue for the manufacturing industry in the entire world. The strategies of operation management to deal with the waste management system in the manufacturing industry can be interpreted in the research.

Chapter 2: Literature Review

2.1. Introduction

The topic of operational strategies for waste elimination in Indian Vehicle manufacturing firms is an important research area because the automotive industry is a major contributor to environmental pollution and waste generation. This research aims to analyze the operational strategies used by Indian vehicle manufacturing firms to eliminate waste and improve sustainability The research's main goals are to understand the importance of operations management for Indian vehicle manufacturing firms, identify waste management challenges for these firms, and assess operational waste elimination strategies within Indian vehicle manufacturing companies. The findings of this study can assist firms in the automotive industry in implementing effective waste-elimination strategies, thereby contributing to a cleaner and more sustainable environment.

2.2. Operation Management

Operation Management theory is used to run a business efficiently. According to McClay, (2019), the main target of operation management is to strategize a business operating and production procedure efficiently. The Operation Management theory ensures that the use of the least amount of resources is necessary to operate a business in an efficient manner. Operation management also makes sure that the business meets the customers' requirements to the highest standard that is possible. Operation and Production Management, Quality management, inventory, and supply chain management are included in the operation management theory.

Operation management is also used in Vehicle Manufacturing industries to manage their waste. To make an effective strategy for Waste Management, Vehicle Manufacturing companies need to rely on operation management theories and reduce their use of excessive resources, (Goshime et al.,2019). Planning the way of reducing waste in vehicle manufacturing is the first part of operation

management. Strategizing the processing of the waste material is the most important task of operation management. Operation management procedure helps in planning the uses of recyclable materials in vehicle manufacturing. Planning the strategy of reducing overproduction by using Operation management helps in decreasing waste. Operation management helps in planning waste management with a minimum cost. This management procedure is very effective in managing a business.

For operations management, operation managers are recruited for the execution of their works. Here the Operations managers get involved in the process of coordination and development of a new process while revaluating the current structures. Organization and productivity are the two key drivers that initiates of being an operations manager, along with the work frequently requires adaptability and improvement as well (Kumar, 2022). As a part of their everyday accountabilities, the operations managers need to have a variation of the skill sets. Operations Management professionals are found to have been making an attempt for balancing the operating costs with revenue in order to maximize the net operating profit.

2.3. Theories Of Operation Management

Six sigma theory

This business methodology is used for operational improvement and quality enhancement by detecting defects and helping to introduce a systematic process to mitigate them. This framework also measures any deficiency in operation that restricts the business to reach its goal. The Six Sigma theory helps to eliminate waste in the vehicle manufacturing industry by detecting the areas of operational inefficiencies and introducing effective operational management, (McLaughlin, 2021).

This methodology focuses on collecting and analysing the data at the primary level to detect defects which need to be rectified. This framework emphasizes the specific point which ought to be mitigated to observe improved operational improvements.

Focusing on the customer and the evaluation of the gathered data is the key characteristic of this theory. Keeping in mind the above-stated features, the Six Sigma model can be implemented using two methods namely DMAIC and DMADV methodology.

Figure 1: Six sigma

(Source: McMenamin, 2018).

The DMAIC method is used to rectify defects in an existing process. At first, this method "Defines" the project goal of the company and then "Measures" the current performance of the individuals. Then this method "Analyse" the areas of improvement and detect the reasons for any defect. After that, this method tries to "Improve" the existing process to eliminate the defect and "Control" the future performance of the business. Applying the DMAIC method, the vehicle manufacturing industry can be easily found out the defects in the operation and manages to observe effective operational efficiency by reducing vehicle waste (Ranade et al., 2019).

The DMADV method is used to initiate the required process to mitigate the defects. This process also "defines" the project goal after "measuring" the current performance to "analyse" the root cause of

the defect. After that this process "designs" a required approach to meet the goal and also "verifies" its suitability.

After the successful implementation of this framework, the vehicle manufacturing industry efficiently detects the defects and successfully eliminates the waste experiencing a higher level of operational management efficiencies. Here are the five steps of six sigma where the implementation of the same solves any of the unsolvable problem like:

- Defining a team of people who chooses the focusing process while defining the problem it wishes to solve.
- Measures the performance initially about the process that creates a target while identifying the input list that impedes enactment.
- Analyzing the team development with inaccessibility of each participation for any type of disasters that gets tested as the potential cause of the problem.
- Improvement of the teamworks for implementation of changes that will be improving the system performance.
- Control over the process is added by the groups for ensuring that it does not regress and become ineffective again.

Lean manufacturing method

This method describes the process of minimising waste in production and ensuring higher customer value through a continuous process of development. This framework also helps businesses to experience more value which reflects in higher effectiveness in operational management (Daniel, 2023).

Figure 2: Lean principles

(Source: Do, 2017)

The principle of the theory is to identify the requirements of the customer before minimising waste. After this, the company can produce proper customer-centric products. Value stream mapping is one of the key characteristics of this theory (Palange and Dhatrak, 2021). It helps to maintain value in every step of production and reduce waste. Once the goal is set, this method focuses on the process improvement as required to observe better operational efficiency. This method also describes the importance of the pull system method to initiate operation when needed.

This method describes waste in seven different categories which are as follows:

1. Having defective products is a direct waste for the company which should be removed to minimise the waste in the vehicle manufacturing industry.

2. processing is such a manufacturing mistake it is not required in the production line. The addition of non-required features can be considered as this type of waste which must be minimised by the vehicle manufacturers to reduce waste.

3. assessing the demand and production accordingly is the key solution to the over-production waste issue. This waste must be carefully observed by the vehicle industry to reduce this type of waste.

4. waiting is also considered a type of waste in this theory. The vehicle manufacturing industry should keep an eye on the idle period of a machine and the waiting time of a worker for any resources.

5. Unnecessary transport of people, and equipment is also considered a type of waste which must be reduced.

6. Excessive inventory is also mentioned as waste according to this theory.

7. Unused talent is also a waste according to this theory.

With the help of this theory, the vehicle manufacturing industry effectively detects waste and can eliminate them to have a higher level of operational efficiency. Apart from that there is a five-step thought process that provides guidance for the implementation of lean techniques. The principles are:

- Value - Value gets defined always by the needs of the customer's for the purpose of a specific product.
- Value Stream – is the next step which includes all the steps and processes involved in taking a specific product from raw materials and delivering the final product to the customer.
- Flow – here comes the flow where the steps are smooth without any interruptions, delays or bottlenecks.
- Pull – this is to make the customers pull out the product from an organisation based on the requirement.
- Perfection – here perfection comes with the involvement of an employee for the implementation of Lean.

Business process management in operation management

Business Process Management is a procedure of supervising the business processes which are existing in the company. This method is used to control all the processes. Business management procedure is used to increase the effectiveness and efficiency of the business procedure. This procedure helps in earning more profitability for the business. This procedure uses various tools and methods to make the design and model of the business process and to execute that by monitoring and optimizing the existing processes of the business, (De Ramon Fernandez et al.,2020). The Business Management process is used to run a business successfully by monitoring all the activities which are related to the business-like marketing, accounts, Human resource, sales, etc.

On the other hand, the operation management procedure is related directly to the business operating and production procedure. Operation management is part of the Business management Procedure. The main focus of Operation management is to reduce the cost of production by improving the strategies of business process management, (Olsen and Tomlin, 2020). In the Waste Management of Vehicle Manufacturing, business organizations need to improve their business process management by using the operation management procedure. This will help in getting the most effective result in this matter. The operation management procedure can increase the effectiveness of the Business process management and make a successful strategy which helps to get more profit margin from the business.

Moreover, here it will be discussed about the 5 steps associated with Business process management the delivery of better products and services to the customers.

1. Analyse: The process as it is now must be evaluated as the first step towards the optimisation of the process. Consider about how it relations to other tasks or processes, as well as what works well and where there are difficulties, mistakes, or blockages.

2. Model: Analyse techniques for improving the process and come up with the ideal way to carry them out. Use this process model to learn how the new strategy would work under many potential situations and aspects.
3. Carry out: After the process has been modelled, changes can be made. Remember to note the alterations and the reasons for them.
4. Monitor: After the new process has been put in place, it is needed keep an eye on it to see whether something has altered for the better over time. Collect statistics for comparing performance against business plan. Do you detect a boost in its efficacy? Have prices reduced? Are goods arriving more quickly?
5. Automate and improve the process: After using BPM technique, you must continuously track and enhance the process. BPM should be ongoing because processes may require time to evolve and outcomes can vary. Keep an eye out for fresh approaches to get better. If the new procedure is successful, think about automation any procedures that can.

2.4. Role Of Operations Management For Indian Vehicle Manufacturing Firms

Operations management is the administration of business practices that aim to achieve the highest level of efficiency within an organisation (Sousa and Voss, 2008). It entails managing assets and procedures to provide products or services to customers. Operations management is critical in the context of vehicle manufacturing companies to make sure that all production methods run smoothly, efficiently, and price. As perGhosh, Mandal and Ray, (2022) Indian vehicle manufacturing firms, operations management can have an important impact on waste elimination. Effective operations management can assist in identifying areas where waste is generated and developing strategies to eliminate or reduce that waste. Operations management, for example, can assist in identifying inefficient manufacturing processes, overproduction, excess inventory, and product defects, all of which can result in waste generation. Here it has been presented a list of operations management roles that it plays within any of the vehicle manufacturing firms in India:

- Improvement in the amount of profitability
- Increase in the quantity of customer retention
- Reduction in the complaints lodged by customers along with claims associated with warranty
- Reduction in cost through less amount of waste, rework, and many others as well
- Greater amount of market share
- Increase in the number of employees that get involved along with satisfaction, lowering the turnover
- Increase in the capability for attracting new customers
- Improvement in the field of competitiveness
- Improvement in satisfaction for the customers
- Improvement in relations among management and the employees
- Improvement in the focus over the key goals
- Improvement in the field of communication
- Improvement in teamwork
- Improvement in the morale of the employees
- Improvement in the image of the company
- Improvement in the generation of revenue
- Improvement in customer service that is internal and external as well
- Improvement in having effectiveness
- Adaptability at its Great
- Improvement in the field of planning
- Improvement in the environment related to work
- Improvement in making decisions that are proper

Operations management can impact waste elimination

Implementing operations management principles in vehicle manufacturing firms can result in significant waste reduction. Implementing lean manufacturing principles, for example, can help reduce waste by improving manufacturing processes, reducing inventory, and eliminating unnecessary activities. Similarly, implementing total quality management (TQM) can result in a decrease in product defects, reducing waste generation.

Effective operation management can improve the efficiency of waste management in the vehicle manufacturing industry. By adhering to the various norms of operation management like detecting the waste, following different frameworks of this process can help the leaders to reduce the waste and mitigate it effectively. According to Sahoo (2020), this process also helps in identifying the not-so-necessary features of the vehicle securing lower the cost of manufacturing. Also, strategic approaches like green procurements and sustainable methods of development help this industry to manage waste strategically. Moreover, with the help of different theories of operation management, the company can assess the demand of the market and can solve the issues of over-inventory manufacturing.

Also, by the several frameworks of operation management, the vehicle manufacturing industry can be able to procure sustainably which reduces the carbon footprint of the industry and also reduces the consumption of the resources. According to Giampieri et al. (2020), effective operation management can introduce technical expertise in the product line to make it fully automated which increases the productivity level as well as minimize the chance of human-made error occurrence effectively. Further, the idea of making a common type and being able to generate alternative cheaper sources of raw material leads to significantly reducing the waste generation in the vehicle manufacturing industry in India.

Furthermore, operations management can assist businesses in implementing sustainable practices that reduce waste generation. Green manufacturing practices, for example, can help businesses reduce energy consumption, greenhouse gases, and waste generation while also trying to promote sustainable manufacturing processes (Tayyab, Sarkar and Ullah, 2018).

Decrease in the amount of wastes ought to be over any of the rundown related to the producer along with significances. Primarily, there are three fundamental sorts of waste as per the diversification that gets created by the advancement nature belonging to that of assembling. The sort that seems to be underlying, along with the preparation of squanders, are those that results from the changing of input materials with low regards that is intended to be into higher-esteemed items from the last. From that point onwards, utility squanders, are the ones that has the outcome from the frameworks associated with utility and these get expected for controlling the strategy related to assembling (Kleindorfer, 2005). Another results that can be sorted from new companies and shutdowns, along with support and different unconstrained operations. Some of the advantages for minimization of wastes are:

- Reduction in the cost of acquiring metals and other crude materials
- Minimization of waste treatment and transfer costs
- Increase in the gainfulness
- Reduction in natural effects related with perilous substance makes a proper utilization, transfer of the squander and utilization of crude materials
- Improvement in the notoriety of the business as well as worker fulfillment through advancement of a naturally dependable picture

Successful operations management in Indian vehicle manufacturing firms

In recent years, Indian vehicle manufacturing firms have proved successful in implementing principles from operations management. Maruti Suzuki India Limited, for example, has incorporated a lean manufacturing system that emphasises waste reduction, process optimisation, and continuous improvement. This system has resulted in significant gains in manufacturing efficiency, quality, and waste reduction. Tata Motors has put in place a total quality management (TQM) system that prioritises customer satisfaction, participative management, and continuous improvement. This system has assisted Tata Motors in enhancing the quality of its products, reducing defects, and

reducing waste. Similarly, Mahindra & Mahindra has implemented a green manufacturing strategic plan that promotes environmentally friendly practices (Panwar et al., 2013).

Moreover, Operations Management has the goal of maximizing the levels of efficiency within an organization, along with an increase in the productivity of the organization, increase in profits while reducing the costs, along with ensuring the production as well as the delivery of products with high-quality or the services that suits the need of the consumers (Gopal and Thakkar, 2016). It needs to be noted importantly that the operations management makes it sure to believe that each of the daily operations that takes place within an organization provides support along with helping for the achievement of the unique goals set for an organization. Below mentioned are some of the assistances that are provided by operations management at the basic:

- **Quality of product and service**

  The operations management unit makes an examination of the robustness and consistency of every product before it gets delivered to the users.

- **Satisfaction of the customers**

  The job operations manager is there to ensure that the product is of high quality and meets the consumers' needs. Operations management also ensures that customers are treated well.

- **Productivity**

  It makes sure that all the resources gets utilized in an adequate manner during the process of production. The outcome of this is related to increased productivity that can be ensured through effective management of operations.

- **Competitive advantage**

  Better outputs can be achieved through operations management success, which means the products and services will become better and market-tailored.

- **Cost of operations get reduced**

  Maximization of productivity, quality products production, and satisfaction of the customers reduces the cost of produced products or services rendered. This even leads to waste reduction.

2.5. Challenges Faced By Indian Vehicle Manufacturing Firms In Waste Management

Indian Automobile Manufacturing firms have to face challenges in waste disposal for the inadequate waste management facilities in India. Manufacturing an automobile product increases the carbon emission into the environment. According to Sharma et al. (2020), reducing carbon emissions by managing waste materials is also a challenge for organizations. Plastic products, batteries, metal, glass, and much other waste are produced in automobile manufacturing firms. Production of large amounts of waste is itself a challenge in managing the waste for the automobile manufacturers of India. The lack of better waste disposal techniques affected the environment. Collecting the waste and recycling them is also a challenge for the firm because of the lack of proper facilities.

According to Upadhye, Deshmukh and Garg (2010), Waste management is a challenge for Indian vehicle manufacturers. The lack of proper waste disposal facilities and regulatory frameworks is one of the major challenges. In the absence of sufficient waste management processes and regulations, firms may struggle to manage waste effectively, resulting in increased waste production and disposal issues. Another issue is the high cost of systems for handling waste, which may prove prohibitively expensive for small and medium-sized businesses. These difficulties may have a significant impact on the firms' overall operational efficiency. For example, waste generation can result in higher production costs, reduces efficiency, and lower profitability. Inefficient waste management can also harm the environment, which can harm a company's reputation and impact consumer perception. The Impact of these challenges on the overall operational efficiency of the Firms The waste management challenges that Indian vehicle manufacturers face can have a significant effect on their general operational efficiency. Inefficient waste management can result in higher production costs, lower efficiency, and lower profitability, as well as negative environmental implications that can harm the company's reputation and affect customer perception.

The current status of Waste Management in India stands to be poor for the reason that the methods which is best and most appropriate coming from waste collection to disposal are not at all being used. There is a subsequent lack in the training session for Waste Management along with the accessibility of qualified professionals associated with waste management which is limited. There even has been found a lack in the field of accountability in the current systems of Waste Management all over throughout India. The authorities of Municipality are held responsible for the management of municipal solid waste in India but consists of certain budgets that probes to be insufficient about covering the costs associated with the development of proper systems for waste collection, storage, treatment and disposal (Kulkarni, et. Al., 2014). Therefore, lacking in strategic MSW plans, waste collection or segregation along with a framework of government finance regulatory are the major barriers for the achievement of effective Waste Management in India. Limited awareness about the environment combined with low amount of motivation inhibits innovation as well as the adoption of new technologies that might transform the waste management in India. Attitudes of Public to the wastes also poses as a major barrier in the field of improving SWM in India.

Examples of firms that have overcome these challenges and their strategies

The three main Automobile Firms in India plan some successful strategies with the help of trained professionals to overcome the challenges occurred in managing the waste produced in the time of manufacturing automobile products. According to Yadav et al. (2020), Maruti Suzuki India Limited takes a step forward to reduce the pressure on nature by understanding green technology. The company uses sustainable products in manufacturing the products and in the operation of the supply chain to reduce waste and improve the recycling of waste materials. Tata Motors takes the step of reducing the energy consumption in manufacturing their products which helps in reducing the waste in the production. Their strategy is to use renewable energy in their Automobile Manufacturing Firms to eliminate waste. Mahindra & Mahindra takes the initiative to reduce the use of natural resources and materials and recover the resources by recycling the waste material which helps in reducing waste and helps in managing waste disposal for the Operational Management.

Maruti Suzuki India Limited has put in place a zero-landfill waste management system, Tata Motors has put in place a waste-to-energy system, and Mahindra & Mahindra has implemented a closed-loop manufacturing system. These strategies include recycling and reusing materials, encouraging sustainable practices, and reducing waste generation, all of which contribute to a more sustainable and environmentally friendly future (Ramirez, 2012). Moreover, the waste management programme has introduced making of waste segregation at sources as that is intended to allow efficacy in the field of extracting value and recycling as well. Separating the dry called organic and the wet called Bio-degradable waste would have benefits that have significance and the waste producer will be completely having the responsibility. In the state of Nagpur in India, the government there has introduced a great system that deals with sweeping of the roads by the sweepers at a fixed length. The waste management companies are able to earn revenue from the imposition of waste tax.

2.6. Operational Strategies For Waste Elimination Within Indian Vehicle Manufacturing Companies

Various strategic operational methods can eliminate the waste produced in the vehicle manufacturing industry in India. As per Chaurasia et al. (2019), the industry can assess the demand of the market and can introduce the demanded features in the vehicle rather than delivering unnecessary features. The automated process of manufacturing can eliminate faulty products from the manufacturing process and help to reduce manufacturing waste. The Indian vehicle manufacturing industry may focus on the process of recycling and reuse of the materials which can be beneficial to observe sustainable procurement. Creating a common chassis for different types of vehicles can be also helpful to lower the cost of design expressing the reduction in waste generation.

According to Singh and Singh (2020), as strategic implementation of various theories of operation management has proved its significance in reducing waste, the vehicle manufacturing industry can be also implemented the same to minimize the generation of waste by adopting methods like increasing the usability of recycled products, using environment-friendly paint options and focusing

on the demanded features of the market rather than concentrating on the less-attractive features of a vehicle. The leaders of the Indian vehicle manufacturing industry may follow the path of sustainable development to procure in a more green way to reduce the carbon footprint as well as reduce the consumption of natural resources.

As per Bhamu and Singh, (2014), waste elimination strategies have been implemented by various Indian vehicle manufacturing companies. Adopting lean manufacturing systems, implementing total quality management, promoting green manufacturing, and utilising closed-loop manufacturing systems are among these strategies. Process optimisation, reducing waste, and continuous improvement are core to lean manufacturing systems. Customer satisfaction, employee involvement, and continual improvement are all emphasised in quality management practices. Green manufacturing inspires environmentally friendly practices such as conserving energy, waste reduction, and the use of recyclable materials. Closed-loop manufacturing systems recycle and reuse materials to reduce the generation of waste. In India, the Manufacturing firms these days are quite concerned with the wastes that get produced after the manufacturing of products. Here comes the importance of waste management with a view to protect the society as well as the environment. Here is the list of some of the ways that are considered as operational strategies for waste elimination.

- Recycling- here garbage is not disposed of in landfills or water sources by creating practical litter components.
- Incineration - here the waste materials gets disposed of by burning.
- Landfill - It includes gathering, carrying, discarding and concealing of waste in selected property.
- Biological Reprocessing - this is commonly used for industrial waste disposal.
- Animal Feed- Food can be preserved by manure and livestock feed and this is also one of the ecological types of waste management methods.

Effectiveness of these strategies in waste reduction

Different strategies that are being used by the vehicle manufacturing industry in India have proven effective to reduce waste strategically. Assessing the demand of the market helps this industry to predict the demand of the market and produce the products accordingly. According to Zorpas (2020), methods of green procurements have significantly reduced the carbon footprint and resource consumption following the sustainable way of development. Rectifying the production process and utilising intelligent automated technology with the help of different theories of operation management impacted this industry to reduce every kind of waste generation and securing high amount of productivity as well.

Waste reduction has been achieved through the operations and maintenance strategy employed by Indian vehicle manufacturing firms. Lean manufacturing processes have assisted businesses in optimising their procedures, reducing waste generation, and increasing efficiency. Total quality management practices have assisted businesses in improving product quality, reducing defects, and reducing waste. Green manufacturing practices have assisted businesses in lowering their impact on the environment and promoting sustainability. Closed-loop production systems have assisted businesses in recycling and reusing materials, reducing waste generation. Overall, these strategies have allowed businesses to reduce waste, minimize their ecological footprint, and promote green manufacturing (Singh, Brueckner and Padhy, 2015).

Among the above mentioned strategies, the animal feed strategy stands quite useful in terms of waste reduction as food can get preserved as manure and livestock feed along with it is also one of the ecological waste management methods types. Food waste is such an issue that needs serious attention. The country is facing serious issues all over the world in terms of food waste, and the behind cause is self-explanatory. Apart from that recycling is also there which enables waste reduction at its best. It has economic as well as environmental advantages.

Case studies of firms that have implemented successful waste-elimination strategies

As perBal and Dhal (2019),Maruti Suzuki India Limited is a prime example of a company that has achieved waste-reduction strategies. In all of its manufacturing facilities, the company has implemented a zero-landfill waste management system in which waste has been segregated and reprocessed, and any residual waste is converted into fuel. This strategy has enabled Maruti Suzuki to recycle 99.7% of its waste, reduce its carbon emissions, and promote sustainability (Sharma, 2011). Tata Motors has put in place a waste-to-energy system at its Pune plant, in which refuse is converted into energy via gasification, reducing this same company's reliance on fossil fuels and reducing waste generation. To reduce waste generation and promote sustainable practices, Mahindra & Mahindra has put in place a closed-loop manufacturing system in which materials are reused and recycled. These strategies have assisted these businesses in reducing waste generation and promoting sustainability.

2.7. Literature Gap

This section of the research paper defines the gaps in the research that may fulfil the overall requirements of the research successfully. As in the case of this research, the researcher may want to use more in-depth analysis of the data to critically evaluate the data to conclude. Also, the researcher could have used more sources for validated data to conclude the actual scenario more prominently. The researcher could use the discussed frameworks of operational management more elaborately to express a better understanding of the fact of real life more accurately.

2.8. Summary

It can be summarised upon the fact that the aim of this research is about analyzing the operational strategies that are used by Indian vehicle manufacturing firms for the elimination of waste while improving sustainability. The research even explains about the challenges faced, the outcomes for those challenges as well. Waste reduction methods are also been explained here. The findings of this research study have assisted the firms operating in the automotive industry for the implementation of effective operational strategies to eliminate wastes, thereby making contribution towards a cleaner, greener and more sustainable environment for all.

The Literature review part of this research paper includes the operational strategies used in managing the waste of Indian Automobile Manufacturing Firms. The definition of operational management in the context of managing the waste of Indian Vehicle Manufacturing Companies is explained in this paper. Six Sigma Theory and Lean Manufacturing Method are used in this paper to understand the research work in depth. Business process management of the Operational management is also presented in this paper. Strategies and challenges of managing waste are also described here in this paper. The example of the firms who have overcome the challenge of waste disposal and their strategies are presented for further studies.

Chapter 3: Methodology

3.1. Introduction

Research methodology refers to the process of explaining the method a researcher intends to carry out to conduct the research. It is a systematic way of resolving particular issues in research. It is an important part because it helps the researcher in making a systematic plan to direct the entire research process. This research has used a research philosophy, a design, an approach, strategies, a Data collection method, and data analysis along with ethical considerations to make the research a systematic and logical outcome. In this part, all these factors are discussed to ensure that the valid outcomes address research objectives.

An evaluation of several processes, including Research Philosophy, Research Approach, Research Strategy, Choices, Time Horizon, and Techniques & Procedures, is aided by a methodology section, claim Saunders, Lewis, and Thornhill (2007). All of These procedures are in charge of assisting the project in comprehending how data might be gathered and assessed to provide long-term study outcomes.

3.2. Research Philosophy

Research philosophy refers to the belief about a particular method in which the researcher collects data and analyzes it. Research pillows of four types including positivism, interpretivism philosophy, pragmatism philosophy, and realistic philosophy. The pragmatism research philosophy includes different concepts. The researcher uses innovative and changing approaches to find a particular solution to address the research problem. The realism research philosophy depends on the assumption of a particular scientific approach for the development of ideas and knowledge (Hürlimann, and Hürlimann, 2019). Interpretivism research philosophy relies on the assumption of subjective and socially constructed reality. Positivism research philosophy depends on factual knowledge obtained from observation.

Justification

The research has used positivism research philosophy. With the help of this research philosophy, the researcher has provided the greatest attention to understanding the importance and impact of operation and management for waste reduction in vehicle manufacturing in firms. The main advantage of this positivism philosophy in the research is that it helps the researcher in understanding reality in a subjective way (Alharahsheh, and Pius, 2020). The researcher has understood the main problems of waste management in the manufacturing industry and how the operation in management can help in tackling the situation. It has become simple to interpret the research topic in a subjective manner using positivism philosophy. Research philosophy helps the researcher in maintaining a philosophy and based on that philosophy the researcher can find or address research solutions. It helps in developing knowledge about the research. Adoption of a particular research philosophy for this research is important because it helps in maintaining the thoughts of the researcher. Depending on this thought, some knowledge can be obtained regarding the research object (Alharahsheh, and Pius, 2020). It has become fundamental for this research including research strategy, Data collection method, and data analysis process.

3.3. Research Design

Research Design is the plan or design of operating research. Research Design includes different tools, methodologies, and techniques used by the researcher to complete the research in a proper way. The design helps in recognizing and addressing issues the researcher may face during the research process. Four types of research designs include descriptive, correlational, experimental, and exploratory. Experiment to Research Design carries out a scientific approach and two different types of variables including a constant and measured set. It helps in collecting information to make a better judgment in the research (Asenahabi,2019). The correlational Research Design relies on the correlations between different variables. The researcher cannot manipulate or control the variables in this type of design. Exploratory research is developed to explore research phenomena that have not been started

before. The purpose of this design is to notify the researcher when they get any information. A broad notion can be obtained with this design that the researcher can use to make a quick and effective judgment (Carter et al., 2019). A descriptive Research Design can explain a particular situation in a detailed manner. It is based on a theoretical basis where the researcher can collect information, analyze it and prepare for drawing a conclusion.

Justification

The researcher has used an exploratory Research design in this research. It acts as a low-cost design helping the researcher develop a foundation for the research. It can enable the researcher in understanding whether the research can be led to further investigation. Following this exploratory Research Design, the research has got a wide range of flexibility to progress the research process in the right direction (Carter et al., 2019). With this flexibility, the researcher can adapt to the necessary changes required for systematically addressing the research solutions. By using this exploratory Research Design, the researcher has explored the research-based questions in a detailed manner.

3.4. Research Approach

The research approach is the method for analyzing, collecting, and interpreting information. Inductive, deductive, and abductive Research approaches are mainly used by the researcher to conduct a research process. The inductive research approach includes starting with some observations and moving from the particular experience to a general set of assumptions regarding the experience. In simple language, it can be stated that inductive research approaches the researcher in moving from information to theory or specific to a general set of assumptions. The deductive research approach is different from the inductive research approach (Young et al., 2020). In this type of research approach, the researcher can create new theories or knowledge and can also develop the current theories. The abductive research approach is a logical way of observation and searching for a hypothesis fit for the research. The researcher makes incomplete observations in this type of research approach to create a better assumption.

Justification

In this research, the researcher has used a deductive research approach. The primary goal of using the approach is that it can allow the researcher to maintain flexibility for the entire research process. It can also help in generating new theories based on the statistics and numbers. The researcher has got flexibility in the data collection process with the help of this research approach. Adoption of a particular research philosophy is very important for conducting research and reaching the research objectives and goals (Young et al., 2020). The main reason for using the deductive research approach for this research is that it enables the researcher to develop knowledge and resource-based theories that can help in improving knowledge and concept about the existing theories related to the research topic. The deductive research approach has started with the general assumption about the research topic and the researcher in this case has applied logic and knowledge and also tested the logic so concluding becomes easy.

3.5. Research Strategy

The strategy includes a direction for the entire research involving the research process through which the research and conduct it. Some of the research strategies that a researcher can implement for the research process include case study, experiment, action research, grounded theory, survey, and ethnography. The research has used a thematic research strategy to analyze the quantitative data. The research will use statistical analysis which is the method to analyze quantitative data. The main purpose of using this strategy is that the researcher can identify, analyze, organize, describe, and report different statisticss based on the data collected for the research (Sundler et al., 2019).

Justification

Research methods are three types quantitative approach, qualitative and mixed methods. All these three methods have a significant impact on the research process. The quantitative research methods use a fact and observation-based method. The quantitative research method uses numerical and statistical types of information for the research. In the mixed research method, the researcher uses

both the qualitative and quantitative research methods which means both the fact and statistical information are collected (Sundler et al., 2019). The quantitative research method is a systematic investigation into social phenomena. It includes the experience of people, their behavior, and the functions of an organization. The research has used quantitative research method which uses statistical technique. The quantitative research method has helped the researcher in different ways to use statistical information about the research. As it is based on statistics and numerical values, it becomes easy for the researcher in getting the data to solve the research problem. Analysis of the quantitative data helps the researcher in identifying, analyzing, describing, and explaining different numeric values and data so the research objectives can be obtained.

3.6. Data Collection

It is an important part of research because it provides the necessary data collected for the research process. In general, data is collected from primary and primary data collection processes. Primary data collection is the process in which the data is collected from interviews, surveys, and questionnaires. In the secondary data collection process, researchers use different journals, articles, online contents books, and magazines for collecting data suitable for the results topic. This research has used a primary data collection method. Quantitative data has been collected from primary data collection sources. Quantitative data is the fact in survey-based data. The survey result based on the functions of operation Management for waste reduction have been used for the data collection process (Ruggiano, and Perry, 2019). The primary quantitative method is suitable for this research because the researcher needs to accumulate information, knowledge, and ideas about the research topic to address the problems in the research.

Justification

Without a particular Data collection method, it becomes difficult for the researcher to collect necessary information and lead the research in the way that it achieves the goals. Using the primary

data collection method the researcher can get the necessary information from the participating candidates (Ruggiano, and Perry, 2019). It can help the researcher understand what the candidates think about the research problem. Based on their responses the researcher can use the information for addressing the research problem.

Survey research is a key component of both quantitative and useful social research. It involves a variety of procedures that call for asking particular respondents questions. Surveys are one of the most cost-effective ways to get quantitative data at the moment. One choice is to use self-administered questionnaires in place of in-person interviews. Researchers can quantify survey responses, and the results are then utilised to compare and contrast the results of other research studies. Because of the way surveys are designed, a lot of data is produced, some of which may be difficult to classify and assess. However, the method has been chosen as the main method for collecting data in this study due to its overall advantages.

One of the main data gathering techniques employed in this study was primary data collection; nevertheless, primary data sources also play a crucial role in presenting direct information sources. Thus its significance cannot be denied. The most direct sources of data are ultimately in charge of improving the whole research. On the other hand, this study used the questionnaire method to collect accurate information and data. On the other hand, the main data collecting method is supplying sources from direct sources without a biased answer.

3.7. Data Analysis

Data analysis refers to the process of cleaning, analyzing, and interpreting data suitable for the research. In this research, the accumulated data is collected to find the most relevant information about the impact of operation management on waste reduction in manufacturing firms (Kiger, and Varpio, 2020). Data analysis is one of the major segments that can systematically lead the researcher to get suitable data and accomplish the research goals. The data analysis part has become very crucial

for this research topic because the researcher has identified the appropriate information with the help of an in-depth analysis.

Justification

The complete data analysis procedure depends on the quantitative data analysis technique, which offers accurate ideas about the statistical results with accurate supporting data on the subject. The researcher is able to give accurate information and results that accurately direct all of the data by applying quantitative data analysis. This section describes the steps involved in gathering data, including the methods used to gather information, and it also defines the study topics. Additionally, the research approach offers comprehensive learning, whereby the findings of the study topics are accomplished in an exhaustive way. This aids the research in achieving all of its targets and goals.

This section of research work deals with collecting the required data to perform the research and validating the data to increase the authenticity factor. Amalgamating huge amounts of data can be observed to evaluate the critical impact of the topic of the research work efficiently (Moraga et al., 2020). The paper selected a quantitative method of data analysis which validate the statistical inputs related to the topic of the research to detect the impacts of managing the waste in the vehicle industry in India. After validating the data, this section of the research helps the researcher to get the actual scenario with the help of an in-depth analysis of the collected data.

This section of the research also depicts the actual scenario of the facts taken from the real world by critically evaluating the information. As this paper deals with the quantitative method of data analysis, the statistical angle of the data can be validating undoubtedly. The data analysis also sanitises the data by validating it properly. This way, the crucial part of the research which is the evaluation of the data to conclude a conclusion can have a higher degree of authentication (Mishra et al., 2019). Also, the data analysis section of the research paper helps the researcher to get rid of improper data on the research topic and also supports the research job by providing necessary validated data inputs.

3.8. Research Sampling

Using a particular data sampling method, the researcher has greatly benefited to analyze the data and uncover the most suitable information regarding the research topic. The data sampling method follows probability and non-probability sampling methods which are crucial for the data analysis process.

Justification

The project's use of the convenience sampling method has helped it gather pertinent data on the chosen subject, which has helped it manage the participants and the information gathered precisely. This study's primary data collection method, based on an online survey with 92 participants, was employed to achieve its goals. Prior to completing the surveys, participants were chosen using the convenience sample approach. Respondents were then provided with an online survey with details about the study, and their informed consent was obtained. The project has been able to better comprehend the process used to get a better result thanks to the selection of an accurate data management technology.

3.9. Ethical Considerations

In a reliable and valid result, ethical considerations play a predominant role. When the research follows ethical guidelines it becomes valid. In this research, the survey approach has been used, and for that maintaining the confidentiality and security of the participants while sharing information is very important (Sivasubramaniam et al., 2021). The researcher has followed all ethical guidelines to generate reliability of the research. Informed consent has been taken from the participants. They have also been provided an opportunity to withdraw from the survey when they want to do that.

Ethical guidelines should be maintained in research to make it valid and reliable research. As the researcher has used different sources for collecting data for the research, it is necessary that the data protection act is maintained in the research. The researcher has taken permission for the authors to

collect data. Data confidentiality is also maintained in the research. Without following the ethical guidelines, the research may be considered invalid. Therefore, ethics have an important role in the research. The research can also be authentic due to maintaining ethics. Copyright acts and rules have been maintained by the researcher to maintain data confidentiality and security. While using information from previous research journals, the researcher tried to maintain data protection and security. In this way, the research can maintain validity and reliability.

In view of the research about managing as well as reducing waste generation in the vehicle manufacturing industry in India, ethical consideration plays an integral part in generating the reliability and validity of the research. It also helps the data collection methods to be more authenticated by including different necessary data protection acts and security norms to restrict the misuse of the data (Ducato, 2020). Another important role of this part of the research is to establish a connection between resource validity and data integrity. Ethical consideration helps to protect the lawful rights of the research applicants to secure their legal rights as well as mental health purposefully.

3.10. Summary

Methodology in the process helps in meeting the entire day sister a systematic way. The primary data collection method has had been collected the necessary information related to the research topic. The researcher has used the quantitative method and descriptive research design. The descriptive research design has helped in analyzing and describing the injustice concept and theories in detail. By adopting a systematic research method, appropriate research approach, data collection, and analysis process and using ethics for the research, valid and reliable research can be created.

Chapter 4: Data Analysis & Findings

4.1. Introduction

Data analysis is a vital constituent of any research project, as it permits scholars to draw meaningful assumptions from the evidence collected. In the case of the automotive industry, studying data to identify plans for waste reduction is serious for attaining sustainable and well-organized manufacture procedures (Pandey and Pandey, 2021). This development includes examining data groups, looking for patterns, and making well-versed choices based on the results. The outcomes of the data analysis can be obtainable in the form of statistical examination, allowing investigators to validate the meaning of their results and make informed endorsements for upcoming action. By leading thorough data study, investigators can contribute to the growth of more effective operative management approaches, resultant in better-quality sustainability, condensed expenses, and improved competitiveness in the automotive industry. The most crucial part of any research project is the data analysis. The process of compiling information is known as data analysis. It comprises using logical and analytical thinking to the analysis of collected data in order to find connections, linkages, or patterns. The current "operation management strategies for the elimination of waste in the vehicle manufacturing industry" will not be used in data analysis.

4.2. Survey Analysis

What Is Your Age?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-24 Years	8	8.7	8.7	8.7
	25 - 34 Years	63	68.5	68.5	77.2
	34 - 44 Years	15	16.3	16.3	93.5
	45- 54 Years	4	4.3	4.3	97.8
	Above 55	2	2.2	2.2	100.0
	Total	92	100.0	100.0	

Table 1: Age

(Source: Created By Author)

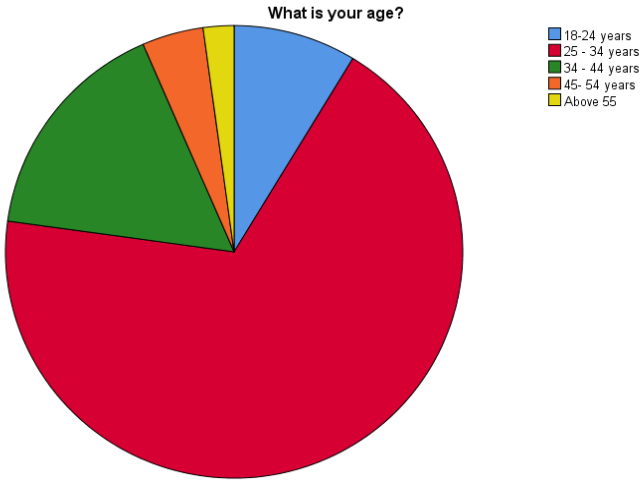

Figure 3: Age

(Source: Created By Author)

What Is Your Gender?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	65	70.7	70.7	70.7
	Female	26	28.3	28.3	98.9
	Prefer Not To Say	1	1.1	1.1	100.0
	Total	92	100.0	100.0	

Table 2: Gender

(Source: Created By Author)

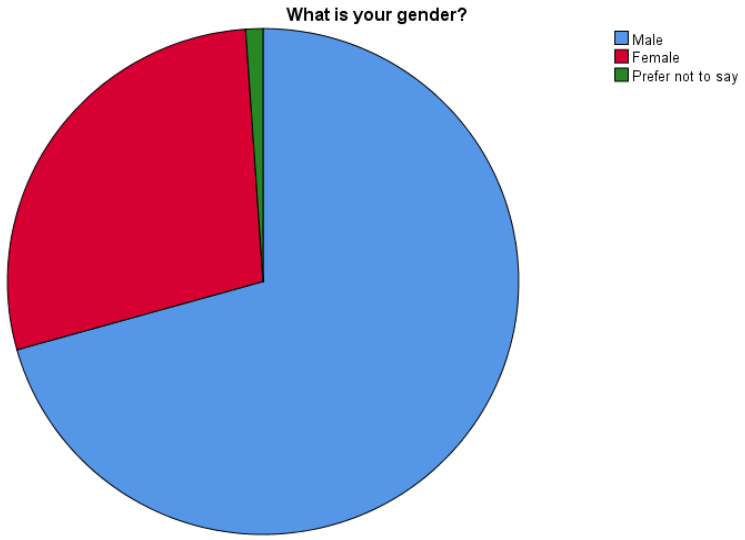

Figure 4: Gender

(Source: Created By Author)

What Is Your Academic Background?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	University	48	52.2	52.2	52.2
	College	44	47.8	47.8	100.0
	Total	92	100.0	100.0	

Table 3: Academic Background (Source: Created By Author)

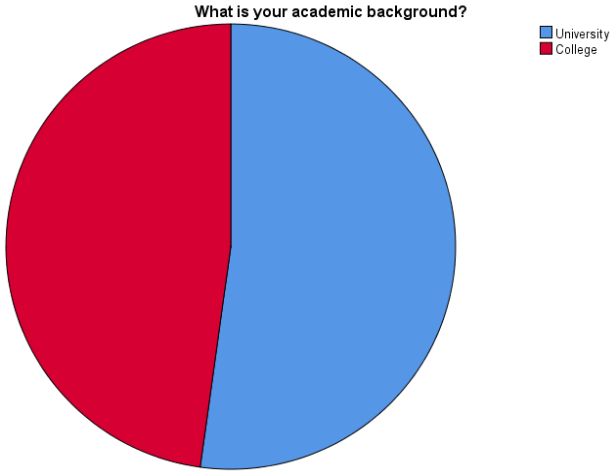

Figure 5: Academic Background

(Source: Created By Author)

How Many Years You Working In Automobile Industry					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-2 Years	36	39.1	41.4	41.4
	3-4 Years	22	23.9	25.3	66.7
	5-7 Years	16	17.4	18.4	85.1
	10 Years And Above	13	14.1	14.9	100.0
	Total	87	94.6	100.0	
Missing	System	5	5.4		
Total		92	100.0		

Table 4: Years Of Working In Automobile Industry

(Source: Created By Author)

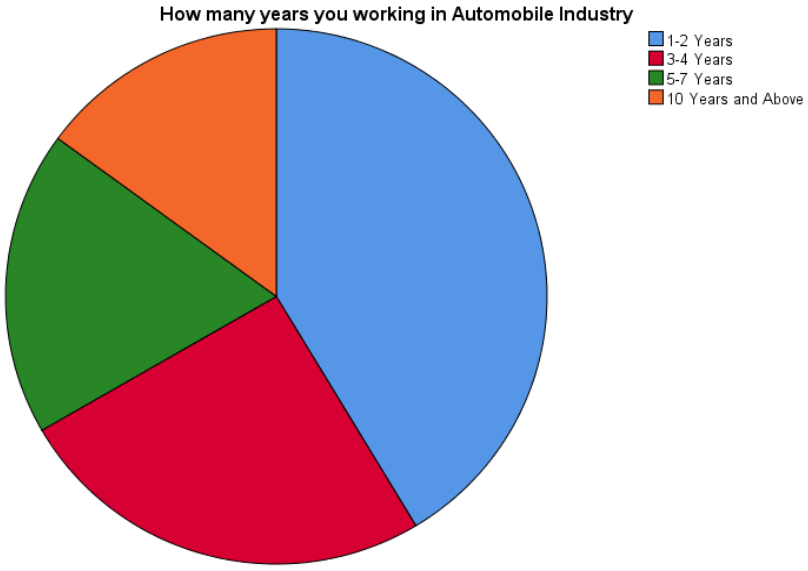

Figure 6: Years Of Working In Automobile Industry

(Source: Created By Author)

Automation technologies can assist reduce waste in automobile production

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	19	20.7	21.1	21.1
	Agree	66	71.7	73.3	94.4
	Neutral	5	5.4	5.6	100.0
	Total	90	97.8	100.0	
Missing	System	2	2.2		
Total		92	100.0		

Table 5: Automation technologies can assist reduce waste in automobile production

(Source: Created By Author)

The above table and following pie chart reflect that, Automation technologies can assist reduce waste in automobile production as 20.7 % strongly agreed with this, 71,7 % agreed with this, and 5.4 % remains neutral.

That signify the importance of the development of waste management practice in the automobile production in a positive way.

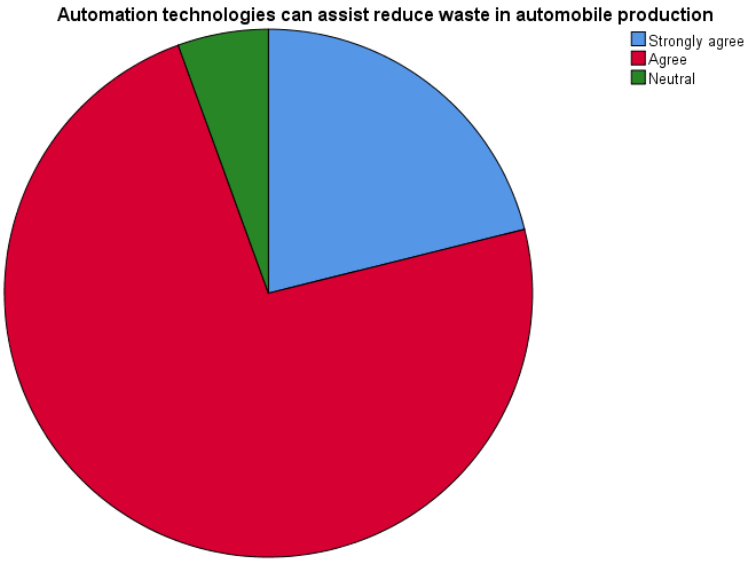

Figure 7: Automation technologies can assist reduce waste in automobile production

(Created by Author)

Q. In the car manufacturing business, predictive maintenance can assist minimize machine malfunctions and decrease waste					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	25	27.2	27.2	27.2
	Agree	60	65.2	65.2	92.4
	Neutral	7	7.6	7.6	100.0
	Total	92	100.0	100.0	

Table 6: In the car manufacturing business, predictive maintenance can assist minimize machine malfunctions and decrease waste

(Source: Created By Author)

The above table and following pie chart reflect that, In the car manufacturing business, predictive maintenance can assist minimize machine malfunctions and decrease waste as 27.2% strongly agreed with this, 65.2% agreed with this, and 7.6% remains neutral.

That signify the importance of the development of waste management practice in the automobile production in a positive way.

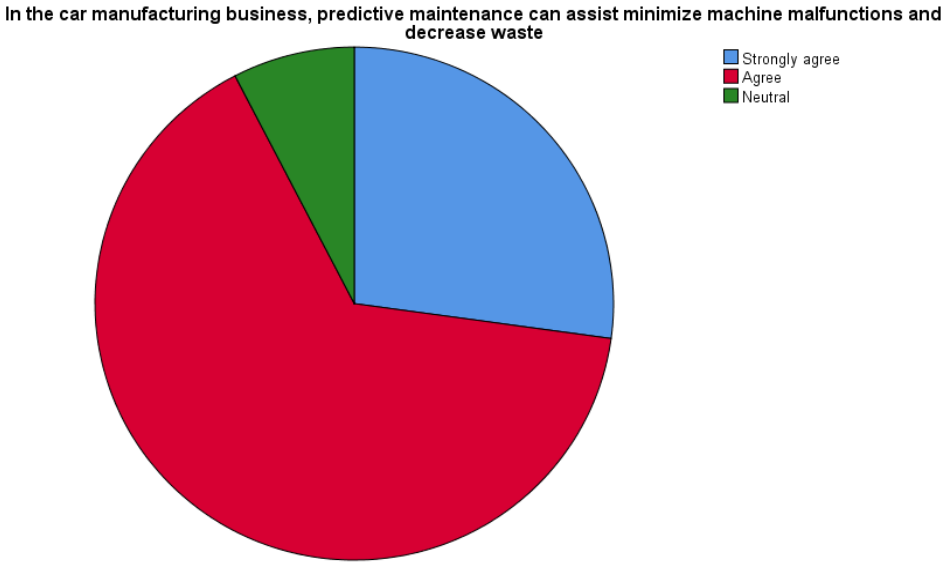

Figure 8: In the car manufacturing business, predictive maintenance can assist minimize machine malfunctions and decrease waste

(Source: Created By Author)

Q. Do you believe in the basic advantages of technology in vehicle industry waste elimination?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	20	21.7	21.7	21.7
	Agree	62	67.4	67.4	89.1
	Neutral	9	9.8	9.8	98.9
	Disagree	1	1.1	1.1	100.0
	Total	92	100.0	100.0	

Table 7: Do you believe in the basic advantages of technology in vehicle industry waste elimination?

(Created by the author)

In this question the researcher wanted to know about the customer's belief in the basic advantages of technology in vehicle industry waste elimination. 20 people, about 21.7% of the participants strongly agreed with this statement. 62 people or 67.4% of the total participants agreed with this statement. 9 people constituting 9.8% of the participants were neutral. 1 person (1.1%) of the total participants disagreed with this question.

So, most people agreed with this statement in this article.

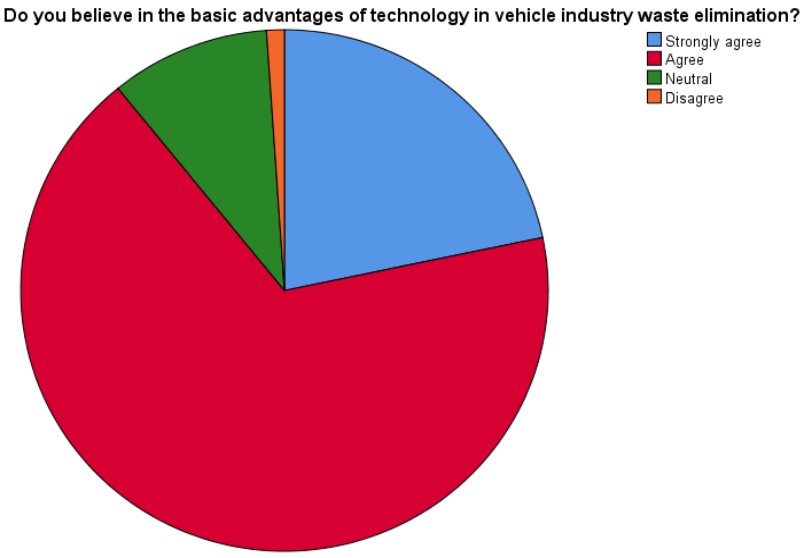

Figure 9: Do you believe in the basic advantages of technology in vehicle industry waste elimination?

(Created by the author)

Technology plays an important role in vehicle industry waste elimination efforts?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	23	25.0	25.0	25.0
	Agree	64	69.6	69.6	94.6
	Neutral	5	5.4	5.4	100.0
	Total	92	100.0	100.0	

Table 8: Technology plays an important role in vehicle industry waste elimination efforts?

(Created by the author)

With the help of the question, it can be identified whether technology plays an important role in vehicle industry waste elimination efforts. 23 people who are about 25.0% of the participants strongly agreed with this statement. 64 people constituting 69.6% of the participants agreed with this statement. 5 people constituting 5.4% remained neutral. 92 is the total number of people who participated in the survey. Furthermore, most people agreed with this statement.

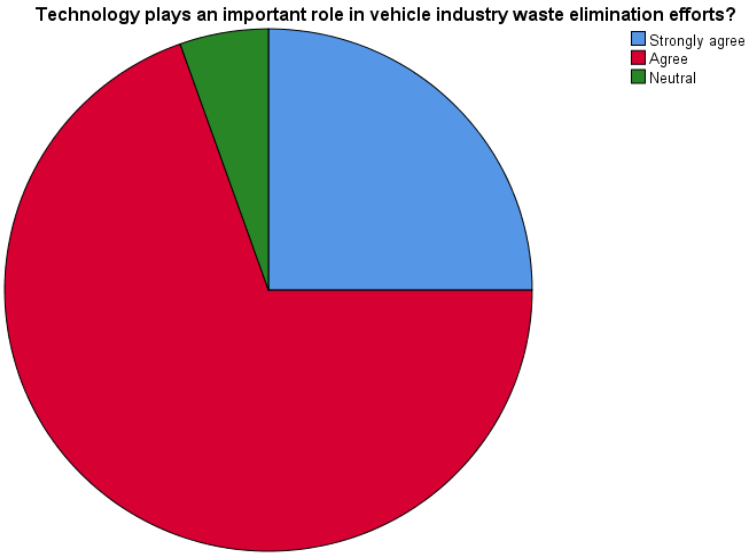

Figure 10: Technology plays an important role in vehicle industry waste elimination efforts?

(Created by the author)

By assuring timely and proper shipment of supplies, collaboration with manufacturers may help decrease waste in the automobile manufacturing business.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	20	21.7	21.7	21.7
	Agree	62	67.4	67.4	89.1
	Neutral	8	8.7	8.7	97.8
	Disagree	2	2.2	2.2	100.0
	Total	92	100.0	100.0	

Table 9: By assuring timely and proper shipment of supplies, collaboration with manufacturers may help decrease waste in the automobile manufacturing business.

(Created by the author)

The 7th question of the survey was whether by assuring timely and proper shipment of supplies, collaboration with manufacturers may help decrease waste in the automobile manufacturing business. 20 people who are about 21.7% of the participants strongly agreed with this statement. 62 people constituting 67.4% of the participants agreed with this statement. 8 people constituting 8.7% remained neutral. 2 people constituting 2.2% disagreed with this article. So, most people (62) agreed with this statement in this article.

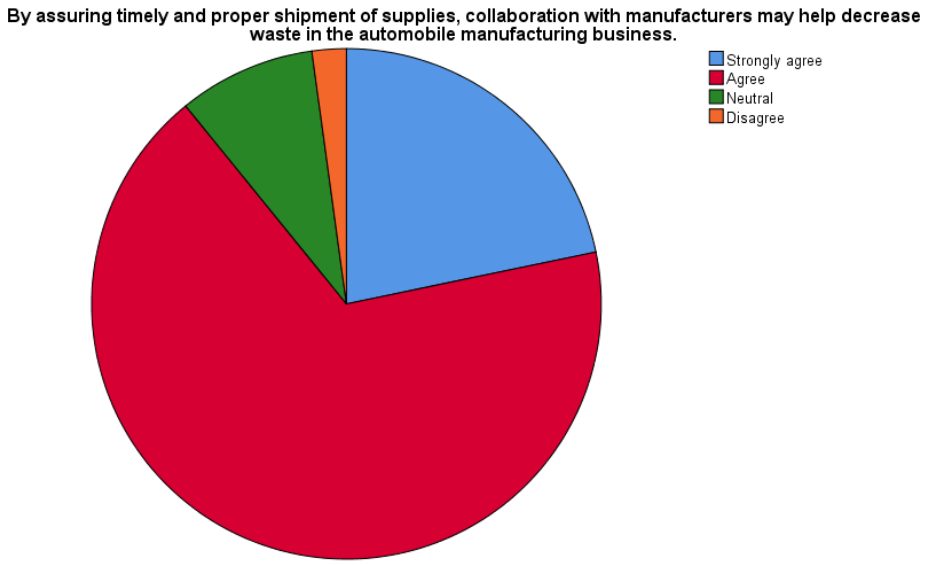

Figure 11: By assuring timely and proper shipment of supplies, collaboration with manufacturers may help decrease waste in the automobile manufacturing business.

(Created by the author)

Total Quality Management (TQM) adoption can aid in the identification and elimination of waste in the automobile manufacturing business					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	18	19.6	19.6	19.6
	Agree	67	72.8	72.8	92.4
	Neutral	7	7.6	7.6	100.0

	Total	92	100.0	100.0	

Table 10: Total Quality Management (TQM) adoption can aid in the identification and elimination of waste in the automobile manufacturing business

(Created by the author)

The purpose of the question was to understand whether total Quality Management (TQM) adoption can aid in the identification and elimination of waste in the automobile manufacturing business. 18 people constituting 19.6% of the total customers strongly agreed with this statement. 67 candidates or 72.8% of the total customers agreed with this statement. 7 people who are about 7.6% of the total candidates remained neutral with this statement. Here, 92 people are the total people in this survey.

Furthermore, the highest number of people agreed with this statement.

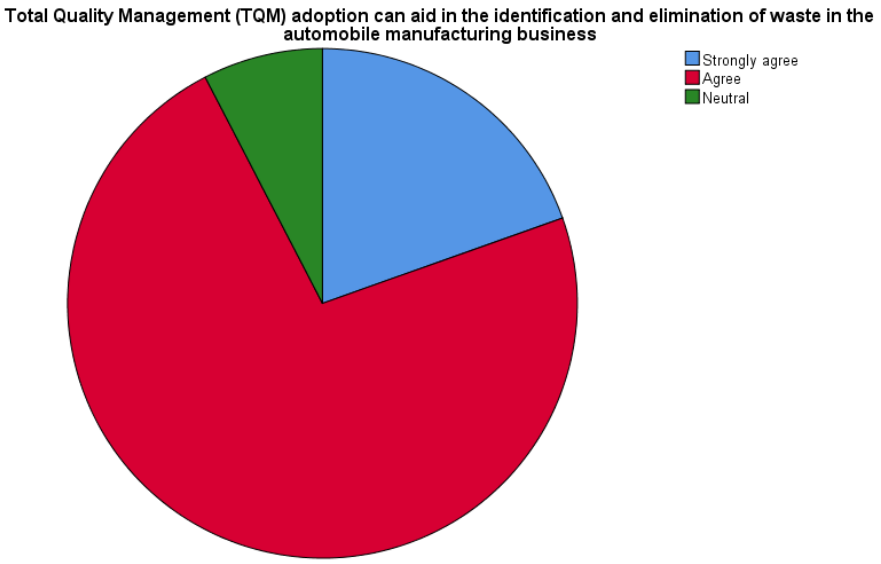

Figure 12: Total Quality Management (TQM) adoption can aid in the identification and elimination of waste in the automobile manufacturing business

(Created by the author)

Sustainable development practices can aid in the reduction of waste produced in the vehicle manufacturing business					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	21	22.8	23.1	23.1
	Agree	62	67.4	68.1	91.2
	Neutral	8	8.7	8.8	100.0
	Total	91	98.9	100.0	
Missing	System	1	1.1		
Total		92	100.0		

Table 11: Sustainable development practices can aid in the reduction of waste produced in the vehicle manufacturing business

(Created by the author)

In this question researchers asked whether sustainable development practices can aid in the reduction of waste produced in the vehicle manufacturing business. 21 people who are about 22.8% of the total candidates strongly agreed with this statement. 62 people constituting 67.4% of the total people agreed with this statement. 8 people constituting 8.7% remained neutral. 91 people or 98.9% is the people who responded in this qusestion. And 1 person who is about 1.1% did not answer.

So, the total number of people is 62 who agree with this paper.

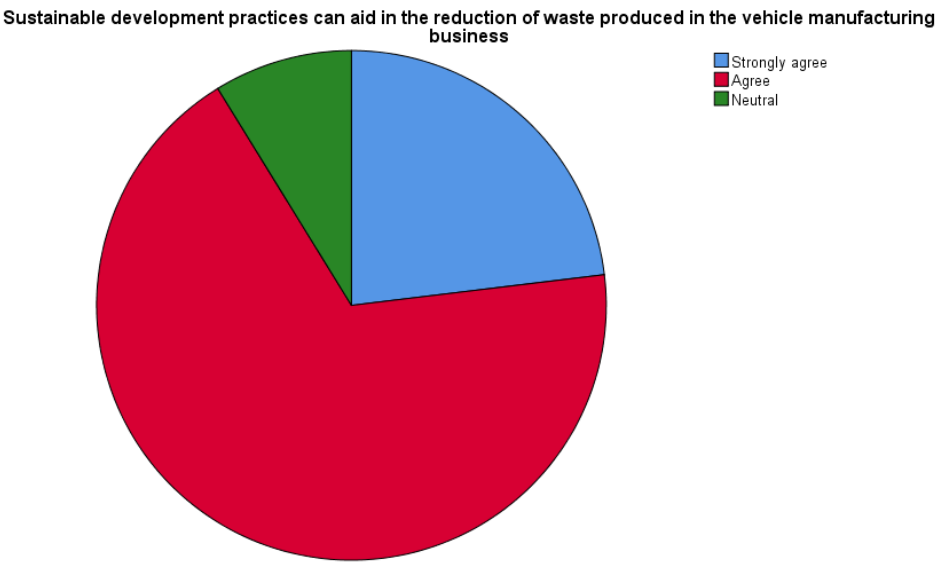

Figure 13: Sustainable development practices can aid in the reduction of waste produced in the vehicle manufacturing business

(Created by the author)

Employee engagement and training may aid in the identification and elimination of waste in the car manufacturing business					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	22	23.9	24.2	24.2
	Agree	61	66.3	67.0	91.2
	Neutral	8	8.7	8.8	100.0
	Total	91	98.9	100.0	
Missing	System	1	1.1		
Total		92	100.0		

Table 12: Employee engagement and training may aid in the identification and elimination of waste in the car manufacturing business

(Created by the author)

In this question, the purpose of the researcher was to understand whether employee engagement and training may help in the identification and deduction of waste in the car manufacturing business. In

response to this question, it has been found that 22 candidates constituting 23.9% of the total participants strongly agreed with this question. 61 candidates who are about 66.3% of the total participants agreed. Only 8 candidates were neutral and could not provide any answer. A total of 91 candidates have responded to this question. It can be stated that most people think that employee engagement and training are necessary and can help in identifying and reducing waste in the car manufacturing business.

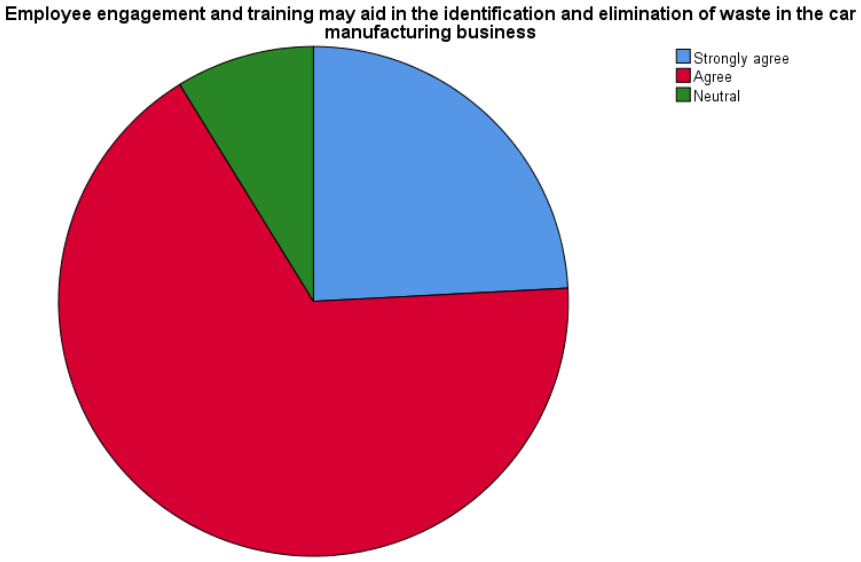

Figure 14: Employee engagement and training may aid in the identification and elimination of waste in the car manufacturing business

(Created by the author)

Using a visual organizational structure in the car manufacturing business can aid in the identification and elimination of waste					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	13	14.1	14.3	14.3
	Agree	68	73.9	74.7	89.0
	Neutral	9	9.8	9.9	98.9
	Disagree	1	1.1	1.1	100.0

	Total	91	98.9	100.0	
Missing	System	1	1.1		
Total		92	100.0		

Table 13: Using a visual organizational structure in the car manufacturing business can aid in the identification and elimination of waste

(Created by the author)

This question was about using visual organization structure in the car manufacturing business to help in identifying and eliminating waste. A total of 91 participants have responded to this question. In response to the question, it has been found that 13 candidates who constitute about 14.1% of the total participants strongly agreed. The total number of people who agree with this question is 68 constituting 73.9%. 9 people who are about 9.8% of the total participant could not provide any specific answer and remained neutral. On the other hand, only one candidate disagreed with the question. Therefore, it can be stated that the majority of the participants think that organizational structure can help in the identification and elimination of waste in the car manufacturing business.

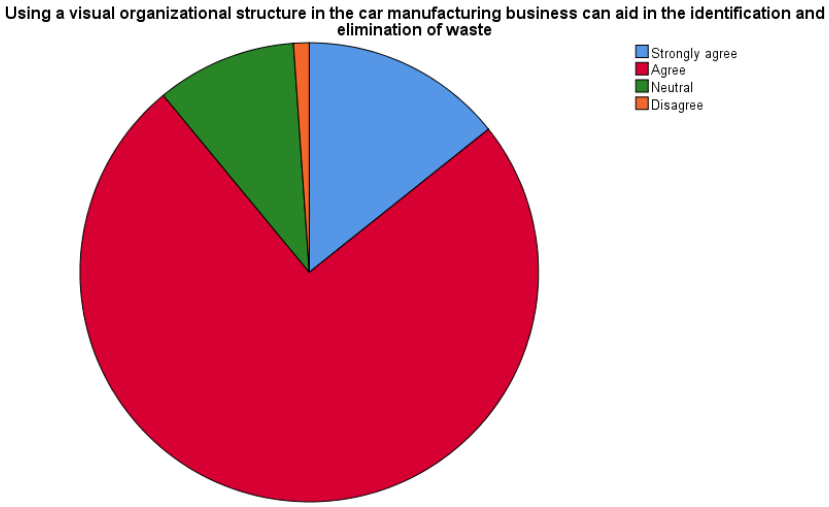

Figure 15: Using a visual organizational structure in the car manufacturing business can aid in the identification and elimination of waste

(Created by the author)

Adopting an adaptable manufacturing process can aid in waste reduction in the car manufacturing business by allowing for customisation and decreasing excessive production.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	71	77.2	78.0	78.0
	Neutral	11	12.0	12.1	90.1
	Disagree	2	2.2	2.2	92.3
	Strongly disagree	7	7.6	7.7	100.0
	Total	91	98.9	100.0	
Missing	System	1	1.1		
Total		92	100.0		

Table 14: Adopting an adaptable manufacturing process can aid in waste reduction in the car manufacturing business by allowing for customisation and decreasing excessive production.

(Created by the author)

The question was whether adopting an adaptable manufacturing process can help in waste reduction for the car manufacturing industry. The researcher also wanted to know whether this adaptable manufacturing process can allow customization and decrease excessive production. 71 people constituting 77.2% of the total participants agreed with this question. 11 people constituting 12% of the total participants remained neutral. 2 candidates constituting 2.2% of the total participant disagreed. 7 people constituting 7.6% of the total candidates strongly disagreed. Therefore the majority of the candidates agree that the adoption of an adaptable manufacturing process can reduce waste in the car manufacturing business.

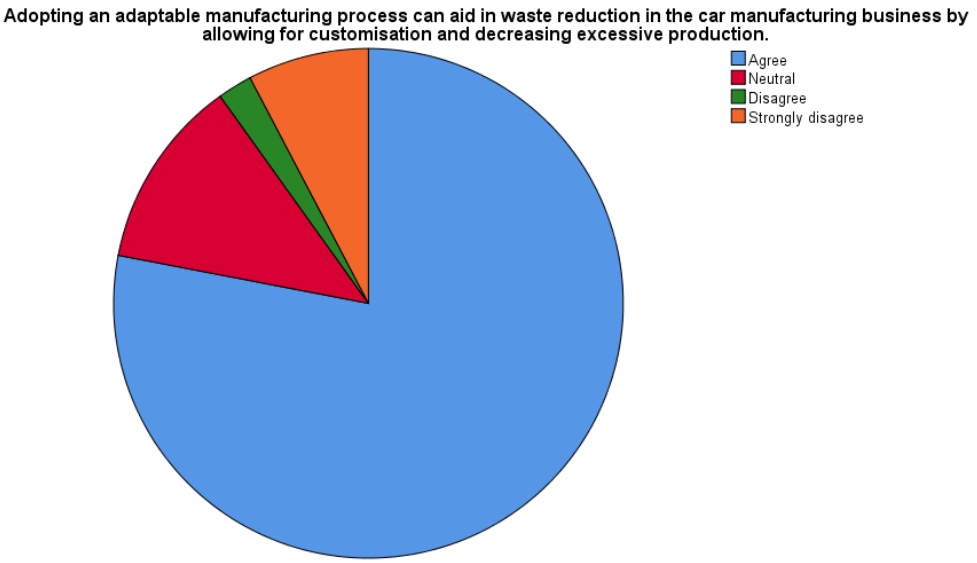

Figure 16: Adopting an adaptable manufacturing process can aid in waste reduction in the car manufacturing business by allowing for customisation and decreasing excessive production.

(Created by the author)

Implementing an ongoing effort to improve can aid in the identification and elimination of waste in the car manufacturing business					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	10	10.9	11.0	11.0
	Agree	72	78.3	79.1	90.1
	Neutral	8	8.7	8.8	98.9
	Disagree	1	1.1	1.1	100.0
	Total	91	98.9	100.0	
Missing	System	1	1.1		
Total		92	100.0		

Table 15: Adopting an adaptable manufacturing process can aid in waste reduction in the car manufacturing business by allowing for customisation and decreasing excessive production.

(Created by the author)

In this question, the main purpose of the researcher was to identify whether the implementation of an ongoing effort to improve can help in the identification and elimination of waste in a car manufacturing business. 10 people constituting 10% of the total candidates strongly agreed. 72 people constituting 78.3% of the total participants agreed. 8 people constituting 8.7% of the total participants remained neutral. Only one candidate disagreed with this question. Therefore the majority of the participants agree that implementation and ongoing efforts to improve can have been elimination and identification of waste in the car manufacturing business.

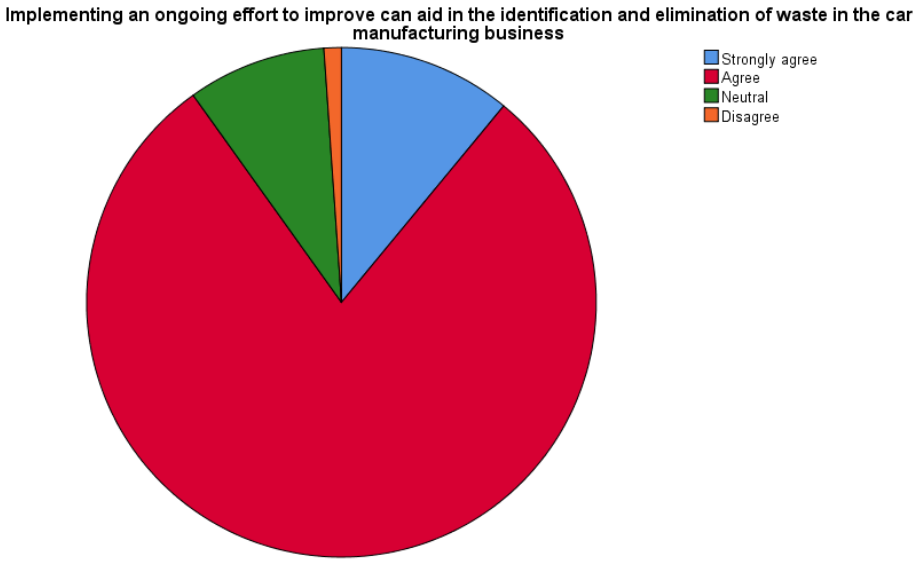

Figure 17: Adopting an adaptable manufacturing process can aid in waste reduction in the car manufacturing business by allowing for customisation and decreasing excessive production.

(Created by the author)

Implementing lean manufacturing concepts is an efficient technique to eliminate waste in the automotive sector					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	17	18.5	18.7	18.7

	Agree	62	67.4	68.1	86.8
	Neutral	11	12.0	12.1	98.9
	Disagree	1	1.1	1.1	100.0
	Total	91	98.9	100.0	
Missing	System	1	1.1		
Total		92	100.0		

Table 16: Implementing lean manufacturing concepts is an efficient technique to eliminate waste in the automotive sector

(Created by the author)

In this question, the researcher wanted to know if implementing lean manufacturing concepts is an effective technique to eliminate waste in the car manufacturing business. 17 people constituting 18.5% of the total participants strongly agreed. 62 people agreed and they constituted 67.4% of the total participants. 11 candidates who are about 12% of the total participants remained neutral and could not provide any answer. On the other hand, only one candidate disagreed. Therefore it can be stated that implementing the lean majority concept is an effective technique as per most of the candidates.

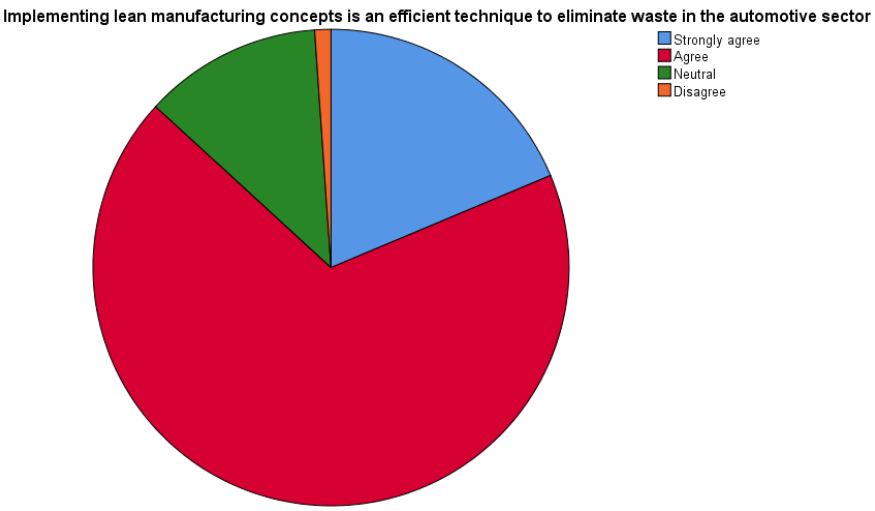

Figure 18: Implementing lean manufacturing concepts is an efficient technique to eliminate waste in the automotive sector

(Created by the author)

4.3. Finding

In research, the finding section is important to figure out what the researcher has found from the data analysis process. Findings help in improving knowledge about the research topic. Based on the findings the research and make the conclusion. It also helps the researcher in understanding whether the data collected from the data collection method has the potential to address the research problems (Björkdahl, 2020). The main purpose of the finding section is to develop the knowledge and understanding on the research. Moreover, another key purpose of the findings is to develop results of the research procedure. That includes overall gathering and evaluating information, and drawing conclusions by focusing on the information (Björkdahl, 2020). The entire finding of this research is based on the operation management strategies for the elimination of waste in the vehicle manufacturing industry. It is shaped its outcomes by considering the survey results which is gathered from the employees of the vehicle manufacturing industry. The process is discussing in the following section of the study.

The survey reflects that technology plays an important role in vehicle industry waste elimination efforts as 25% and 69.6% of the participants agreed with it. It develops the overall understanding on how to improve the entire structure of the vehicle industry to adopt more technologies.

The findings of the survey obviously validate that technology has a vital role to play in the abolition of waste in the vehicle manufacturing. With 25% of contributors well-disposed that technology is central and an important 69.6% strongly supportive, the industry wants to rank the implementation of new skills to recover competence and condense excess waste.

The usage of technology in the vehicle business can lead to numerous aids, including augmented automation, better tracking and monitoring of manufacture procedures, and improved data analysis competences. These tools might aid to recognize areas of excess and wastefulness in the manufacture

procedure, permitting for more battered waste lessening approaches. Moreover, technology might also ease the growth of new resources and manufacture methods that are more bearable and ecologically friendly (Sanguesa et al., 2021). The survey outcomes propose that the car manufacturing wants to place a greater stress on the acceptance of novel technologies to drive waste abolition exertions.

It shows that, by assuring timely and proper shipment of supplies, collaboration with manufacturers may help decrease waste in the automobile manufacturing business as 21.7% and 67.4% agreed with this. It signifies the relativity of the supply chain management of the industry.

The outcomes of the survey obviously highlight the status of operative supply chain management in the lessening of waste in the automobile business. With 21.7 per cent of applicants approving and 67.4% powerfully agreeing that partnership with creators can help reduce waste by safeguarding timely and appropriate consignment of provisions, it is obvious that supply chain organization plays a vital role in waste removal hard work. The automobile manufacturing is complex and includes frequent providers and investors, making operative logistics chain organization vital for attaining effectual and maintainable production procedures. By cooperating carefully with producers, automobile manufacturers can recover the timely and correct distribution of supplies, reducing the peril of postponements and other problems that can lead to waste and disorganization (Marodin et al., 2019).

Effective supply chain management might also aid to identify possible areas of waste and incompetence in the manufacture process, letting for more targeted waste reduction approaches. Furthermore, by evolving close firms with creators and other suppliers, car manufacturers might guarantee a stable supply of sustainable constituents, reducing the ecological impression of their manufacturing procedures. The survey outcomes prove the rank of actual supply chain management in waste exclusion hard work in the automobile industrial manufacturing (Mao et al., 2021).

The survey represents that, total quality management adoption can aid in the identification and elimination of waste in the automobile manufacturing business as 19.6% and 72.8% agreed with this. It develops the relevance and importance of the total quality management in the industry (Rehman et al., 2021). Another finding of the survey represents the sustainable development practices can aid in the reduction of waste produced in the vehicle manufacturing business as 22.8% and 67.4% are agreed with this. That signify the overall development of the sustainable practices. The key findings also represent that employee engagement and training may aid in the identification and elimination of waste in the car manufacturing business as 23.9% and 66.3% are agreed with this.

The survey findings validate that employee engagement and training are significant factors in the credentials and removal of waste in the car manufacturing professional. With 23.9% of contributors agreeing and 66.3% strongly supportive that worker meeting and training might help in waste removal, it is obvious that the engagement and training of personnel can play a serious role in refining the competence and sustainability of manufacture procedures.

Involved and well-trained personnel can aid classify potential extents of waste and disorganization in the manufacture procedure, allowing for more targeted waste lessening approaches. Moreover, by providing personnel with the tools and exercise they need to make informed choices, automobile manufacturers can authorize them to take possession of waste reduction efforts, foremost to additional sustainable and well-organized production procedures (Raweewan and Kojima, 2020).

Employee engagement and training might also help to adoptive an ethos of sustainability in the society, with workers being more conscious of the influence of their activities on the situation. This increased consciousness might lead to more maintainable practices being accepted across the entire society, resulting in reduced waste and superior ecological accountability.

Overall, the survey outcomes suggest that worker engagement and training are critical components of waste removal efforts in the car manufacturing business. By ranking engagement and training,

automobile producers might progress a more knowledgeable and authorized staff, reduce waste and disorganization, and improve their attractiveness in the international marketplace.

There are several other findings that also effecting the entire research accordingly.

Other findings represent that, application of a visual organizational structure in the car manufacturing business can aid in the identification and elimination of waste. Adopting an adaptable manufacturing process can aid in waste reduction in the car manufacturing business by allowing for customisation and decreasing excessive production. Implementing an ongoing effort to improve can aid in the identification and elimination of waste in the car manufacturing business (Buer et al., 2021). Most importantly, it also represents that, lean manufacturing concepts is an efficient technique to eliminate waste in the automotive sector.

The survey outcomes also highlight numerous other key findings associated to waste elimination in the car manufacturing commercial. These comprise the acceptance of a pictorial structural construction, the appeal of flexible manufacturing procedures, and the application of an continuing effort to recover.

Visual structural constructions might aid in the identification and removal of waste by providing a vibrant and effortlessly comprehensible outline for the manufacture procedure. This can aid to recover communication and teamwork among staffs, leading to more well-organized and maintainable manufacture procedures.

Adjustable manufacturing procedures can help in waste lessening by permitting for customization and diminishing extreme production. By applying flexible manufacture procedures that can respond rapidly to altering client demands and marketplace situations, automobile manufacturers might decrease the menace of overrun and waste.

The application of an ongoing effort to recover can aid in the identification and exclusion of waste by encouraging a culture of continuous improvement and revolution. By inspiring personnel to

continuously try to find out novel and improved ways to do things, automobile builders can classify and discourse possible areas of waste and inadequacy, leading to more sustainable and well-organized production procedures ().

The survey outcomes suggest that lean manufacturing perceptions are a well-organized method to eliminate waste in the automotive sector. By concentrating on the elimination of excess in all its arrangements, lean manufacturing might help vehicle manufacturers to decrease costs, recover competence, and improve their attractiveness in the international marketplace.

Automation technologies can assist reduce waste in automobile production as 20.7 % strongly agreed with this, 71,7 % agreed with. That signify the importance of the development of waste management practice in the automobile production in a positive way. In terms of the car manufacturing business, predictive maintenance can assist minimize machine malfunctions and decrease waste as 27.2% strongly agreed with this, 65.2% agreed with this, and 7.6% remains neutral (Basheer et al., 2019). That signify the importance of the development of waste management practice in the automobile production in a positive way.

Based on the understanding of the survey analysis, it can be stated that significant waste reduction can be achieved in businesses that manufacture vehicles by implementing operations management ideas. By enhancing manufacturing procedures, lowering inventory, and eliminating pointless tasks, lean manufacturing concepts, for instance, can help minimize waste. The generation of waste can also be decreased by using total quality management (TQM), which can lead to a decrease in product flaws.

4.4. Summary

The results of this study can help businesses in the automotive sector develop efficient waste-elimination strategies, helping to create a more sustainable and cleaner environment. The development of trash reduction or elimination initiatives might be aided by identifying the regions where waste is produced. For instance, operations management can help identify waste-producing

factors such as ineffective manufacturing procedures, overproduction, surplus stock, and product flaws.

Chapter 5: Discussion

5.1 Introduction

This data analysis and discovery will help to identify the many obstacles, and suggestions for operational management techniques for waste reduction in the automotive industry will be made. In addition, several consequences will be discussed in the form of statistical analysis for the given numerical data.

5.2 Discussion

The entire section of discussion is mainly based on the main purpose of discussion is to alter the core concept and viewpoints of the particular subject which is used in the research. It helps to gain a profound understanding on the issues that are also associated with the research subject. Discussion helps the people who can distribute the information, experiences, as well as insights in the topic to shape a constructive argument on the findings of the research. In addition, it also helps to reflects the operational strategies used by Indian vehicle manufacturing firms to eliminate waste and improve sustainability approaches.

The research includes a large amount of information on the operational strategies used by Indian vehicle manufacturing firms to eliminate waste and improve sustainability. That can develop the reliability and overall validity of the research in an according way. It represents the efficiency of operation management theory that confirms the application of the least number of resources is necessary to operate a business in an efficient manner (Reid, and Sanders, 2023). Operation management helps in planning waste management with a minimum cost. Focusing on the customer and the evaluation of the gathered data is very much essential to develop the research's outcomes and relevance.

The entire process of operational management in the context of manufacturing business mainly also helps to make sure the distribution of major services and goods. It also decreases the costs, along with

upsurges the overall customer satisfaction (Basheer et al., 2019). In terms of adoration and wide-ranging process management practices, manufacturing businesses can recover the overall competitiveness, upsurge productivity, as well as endure long-term growth. That helps the modern business establishments to improve their capabilities to work accordingly and purposefully to gain further development. The findings also represent that, the sustainable practices are essential to improve the entire research.

Implementation of lean manufacturing concepts for the automobile sector is a very efficient technique to avoid waste. Lean manufacturing mainly can maximize the productivity and performance of a business by reducing the waste from the manufacturing process (Palange, and Dhatrak, 2021). The finding suggests that it is one of the most crucial approaches for maintaining the waste reduction process in the production system. It has also been found in the research that implementation of an ongoing effort can help in identifying the major areas that produce west and so the organizations can make decisions for eliminating waste.

An adaptable manufacturing process needs to be adopted. In this process, the business leaders can make necessary changes in the manufacturing process which can lead to waste reduction. At the same time, they can also customize the manufacturing and production process in the automobile sector so it can decrease waste production (Jiang et al., 2019). Employee engagement and training are also associated with the purpose of waste elimination for the car manufacturing business. In this process, the organizations can engage with reliable and skilled employees who have knowledge about managing and reducing unnecessary waste in the production process (Wiradirja et al., 2020). The managers of the car manufacturing businesses can provide necessary training and educational coaching for employees to have them understand the importance and approach through which they can eliminate waste in the production system.

Most importantly, car manufacturing business leaders need to adopt sustainable development practices. Sustainable business practices can create a significant impact on the organization to become

sustainable and environmentally friendly (Reinhardt et al., 2019). These approaches can also help business leaders make strategies to reduce waste production. Management of the quality of the products is also an important factor for waste elimination. When business leaders try to provide the best quality products to customers, they can adopt a total quality management process which can lead to maintaining the high quality of products (Saragih et al., 2020). Quality products can adjust customers and therefore the manufacturing business can reduce the problem of waste elimination because quality products can avoid the generation of waste production.

In addition, adaptation of modern technologies is equally effective to gain a fruitful outcome of the research. It shows how a sustainable approach to the production process is important for the manufacturing industry to reduce waste production. The research also represents that a visual organizational structure in the car manufacturing business can aid in the identification and elimination of waste (Niaki, Torabi, and Nonino, 2019). On the other hand, the key findings of this research, also highlights that an effective manufacturing process can aid in waste reduction in the car manufacturing business by allowing for customisation and decreasing excessive production. Each of these findings are puta a direct impact on the outcomes of the research.

This elaborative research exhibits the methods of reducing the generation of waste by implementing various effective measures in the vehicle manufacturing industry in India. This paper also emphasizes the impacts of waste reduction to observe a higher level of productivity as well as a green method of procurement. Introducing innovative ideas like a fully automated production lineup and common chassis design can help to reduce waste generation and also help to reduce manufacturing-related waste generation (Kumar et al., 2020). This study described how with the help of the various frameworks of effective operation management can assess the demand of the market by securing the inventory issues effectively.

In addition, with the in-depth analysis of this research paper, the vehicle manufacturing industry in India can also predict the demand of the market and reduce the cost of delivering non-popular features

of the vehicle. Also, the industry can implement a proper scrappage policy to mitigate all the waste systematically depicting the sustainable way of development. This research also focuses on the identification and elimination of waste in the production line to reduce manufacturing waste (Gupta et al., 2019). Also, various strategies in terms of green procurement like alternative sources of raw materials, and cost-effective methods of generating less-pollutant materials are beneficial to manage waste generation.

5.3 New Contribution Of The Research

The finding and decisions of the research topic based on the survey and quantitative analysis are helping the project understand the ways in which long-term utilization of the topic can be understood in a clear manner.

Businesses can implement sustainable practices that minimize waste generation with the help of operations management (Panwar et al., 2013). Green manufacturing techniques, for instance, can assist companies in lowering their energy usage, greenhouse gas emissions, and waste production while also attempting to encourage sustainable manufacturing methods. Indian automobile manufacturing companies have demonstrated success applying operations management ideas in recent years. For instance, Maruti Suzuki India Limited used a lean manufacturing strategy that prioritizes waste reduction, system optimization, and continuous improvement, which led to appreciable improvements in the efficiency of production, quality, and waste reduction (Ramirez, 2012). Customer satisfaction, participatory management, and continuous improvement are prioritized by the total quality management (TQM) system that Tata Motors has put in place. This approach has helped Tata Motors improve the value of its goods while lowering flaws and waste (Singh, Brueckner and Padhy, 2015).

Using sustainable products in manufacturing Automobile products can be a solution in managing waste disposal for the operation management team of Indian automobile industries. Sustainable Development is a recent need of society. Indian Automobile Industries understood this very well.

They use sustainable products to reduce the waste produced during the time of manufacturing automobile parts which helps to manage the operational system of Waste Management (Goswami et al., 2020). Recycling the waste materials and using them to produce new products is a great step for the operational management team in managing the waste to reduce the stress on nature. Improvement of Operational management strategies helps in planning and successfully reducing the waste created by the automobile manufacturers of India.

2.4 Summary

The automobile industry is a significant source of waste generation and environmental degradation. Hence operational solutions for waste elimination in Indian vehicle manufacturing enterprises are a crucial research topic. This study aims to examine the operational tactics utilized by Indian automobile manufacturing companies to reduce waste and enhance sustainability. The main objectives of the study are to comprehend the significance of operations management for Indian vehicle manufacturing firms, to pinpoint waste management difficulties for these businesses, and to evaluate operational waste elimination techniques within these organizations (Singh, Brueckner and Padhy, 2015).

Chapter 6: Conclusion

6.1 Conclusion

The discussion of the entire research can lead to the conclusion that it has accomplished all the objectives. The objectives of the research were to identify the importance of operation Management and its impacts on waste elimination. The challenges that manufacturing organizations face in waste management have been identified. The techniques that the operation administration can use for waste elimination along with some effective Strategies for implementing waste elimination have also been identified. The research has provided enough information to answer all the research questions. Operation management administrators complete the production timeline for any particular product ranging from input to output. The vehicle manufacturing industries can be greatly benefited from different approaches to operation management to reduce waste.

One aspect that operation management administers is to ensure that the organization has met the needs and requirements of customers to a great standard. By improving and managing the quality of the products, enhancing the inventory process, strengthening production and operation management, and boosting supply chain management, operation management can play a crucial role in the vehicle manufacturing industry (Feng, and Ye, 2021). The vehicle manufacturing forms can use the procedures of operation Management to make plans for how to use recyclable materials. Making plans for the reduction of overproduction can help organizations reduce the amount of waste released in the production process. So, it helps in cutting down the excessive amount of waste in the manufacturing industry. The research also found that operation management can work with minimum cost which is effective for the vehicle manufacturing industry to make plans for minimizing their waste.

The research has also used various theories related to operation Management which can help manufacturing firms implement those theories for managing waste. The Six Sigma theory helps in minimizing waste for the industry by detecting operational inefficiency and planning for effective

operation and Management (Delic, and Eyers, 2020). The lean manufacturing method also minimizes waste during the production process. Lean manufacturing focuses on reducing customer-oriented products which can reduce overproduction of the products that are not required by the customers. In this way, it helps in maintaining value for the customers by also reducing waste.

From the research, it has also been found that operation management has a significant role for the Indian vehicle manufacturing firm. Indian vehicle manufacturing firms need to use effective operation management to identify the areas in which the firms generate the highest amount of waste. They can also develop Strategies for reducing waste. With the help of operation Management, the firms can identify overproduced products, excessive inventory defects in the products, and inefficient manufacturing processes (Delic, and Eyers, 2020). By identifying this area, the operation management can assist the vehicle manufacturing forms of India reduce waste.

6.2 Objective Realization

The selected research topic had been extensively examined in the body of literature before the investigation started. Based on that, specific goals for this study are established.

Objective 1: The Impact Of Operation Management On Waste Elimination.

The research and data analysis support achieving the selected objective and define Significant waste reduction that can be achieved in businesses that manufacture vehicles by putting operations management ideas into practice. By enhancing manufacturing procedures, lowering inventory, and eliminating pointless tasks, lean manufacturing concepts, for instance, can help minimize waste. The generation of waste can also be decreased by using total quality management (TQM), which can lead to a decrease in product flaws (Khan, 2020).

Objective 2: The Challenges Faced By Manufacturing Firms In Waste Management.

The research and analysis of data help accomplish the selected objective and define Vehicle makers in India face an issue with waste management. One of the biggest problems is the absence of

appropriate disposal infrastructure and legal frameworks (Huang, 2020). Businesses may find it difficult to manage the trash successfully in the lack of adequate waste management procedures and laws, which could lead to increased waste generation and disposal problems. Another problem is the high cost of waste management systems, which may be too expensive for small and medium-sized firms to afford.

Objective 3: Strategies For Implementing Waste Elimination Procedures Within Manufacturing Companies.

Numerous Indian vehicle manufacturing companies have implemented waste elimination strategies after conducting research and analyzing data to help them achieve the chosen objective. Among these tactics are the use of closed-loop manufacturing systems, complete quality management, green manufacturing, and lean manufacturing systems. Lean manufacturing systems are built on the optimization of processes, waste reduction, and continual improvement (Zachiang, 2017).

6.3 Recommendation

Indian vehicle manufacturing organizations need to develop sufficient regulations and processes for waste management. Maintaining those regulations and processes can help in managing waste in organizations. An appropriate production process can result in reducing waste production and other disposal issues.

Adoption of lean manufacturing systems in the vehicle manufacturing industry can be a recommendation for those organizations to reduce the number of waste products (Khan et al., 2019). The lean manufacturing process can work by identifying the needs and requirements of the customers and therefore the company can reduce only customer-oriented products which can result in less or no production of waste products. Implementation of lean manufacturing processes can allow the producers in vehicle manufacturing companies to make continuous improvements to their production process as per the requirement. Continuous improvement can therefore reduce the chances of releasing waste products (Kumar et al., 2020).

The organizations can also implement effective Technology to make the operation management in control. Technology systems like Industry 4.0 can help organizations in digitizing the manufacturing environment and greeting and digital value chain. Vehicle manufacturing organizations can be beneficial to communicate between different business partners and the products (Javaid et al., 2021). The automation process reduces dependency on people for operating different operational activities. In this way, vehicle manufacturing organizations can make fast decisions. Automation also helps in improving the efficiency and quality of the products. Organizations can use the volume of data using industry 4.0 Technology. The data from the market trends, patterns, customer behavior, and the position of competition in the market can help the vehicle manufacturing industries in making decisions to be competitive in the market (Javaid et al., 2021).

The Indian vehicle manufacturing companies can also implement a total quality management process to improve the quality of the products that will help the customers get the desired products. Waste management can be possible if the maximum number of products are sold to the customers (Souza et al., 2022). It is only possible when the manufacturers developed customer-oriented products. Improving the quality and developing customer-oriented products can also satisfy the customers which will help the vehicle manufacturing companies increase a strong customer base and make their products to be sold at the maximum number.

Green manufacturing processes can also be implemented by the Indian vehicle manufacturing company to reduce waste. With the help of environmentally friendly approaches like waste reduction, conservation of energy, and usage of recyclable materials, the company can reduce unnecessary generation of waste. Companies can use closed-loop production systems for the waste management process. This system helps in assisting organizations to reuse and recycle materials so they can minimize waste generation. Use of the recyclable products is one of the most crucial options for vehicle manufacturing companies to reduce waste (Balaji et al., 2020). They can also reuse the materials for their production process to eliminate waste.

6.4 Future Scope

The research has a scope to be used by the automobile industries for getting an idea of how they can eliminate waste in the production process. The companies can get strategies for waste minimization with the help of the operation Management process. The organizations can also understand how the companies can implement successful waste elimination strategies. Moreover, various organizations can understand the usage of recycled and reused materials for the manufacturing system. Another scope of the research is that it focuses on implementing ideas for waste elimination which is crucial for promoting environmental sustainability. The manufacturing industries can use the research for making strategies about how they can minimize waste production. Therefore organizations can minimize waste materials appropriately. It can also promote the sustainability of the environment through waste management. The Future researcher can also use the research to get an idea of how they can implement Strategies for conducting similar research. It will help future researchers in overcoming their limitations and challenges in their research conduction process.

The results will aid related studies in comprehending and assessing potential data gathering and assessment methods from a comprehensive perspective free of any biased value in following research or potential conceptions. The initiative will act as a template for future literary studies that will need to appropriately manage the subject matter in order to increase the importance of the results for further investigation. The practical application of the research will provide a clear understanding of the approaches and tactics that could be used to produce long-term value. Future research on a related subject will carefully take the findings of this study into account.

6.5 Limitations

The primary limitation that the researcher has faced in this research is a lack of time strategy. The research has not followed any time strategy for conducting different research activities. Without having a proper time plan the researcher took much time in some areas and less time for some other areas. It also leads to delays in the research process. The researcher faces problems in managing the

Data collection process appropriately due to a lack of time plan for the process. It became difficult for the researcher to gather data and identify relevant sources of information within a short period.

After receiving the data and information, the researcher met many difficulties as a result of more necessary information and resources required. The researcher had trouble gathering data. secondary data, but was unable to proceed due to grave concerns over COVID-19. The potential time and cost restrictions that could have affected the project's conclusion may be affixed to them. The research may have quickly finished collecting data if not due to time and money limitations. Additionally, it was unable to evaluate the relevant data, resulting in a negative impact on the project's value. In addition, the project only utilized a primary the project's total value was negatively impacted by the data collection approach.

6.6 Summary

Operation management has a significant contribution to the vehicle manufacturing industries to eliminate waste. The Strategies and techniques adopted by the operation management can shape the entire manufacturing process which can lead to minimizing the waste production. Adoption of lean manufacturing and implementation of effective Technology can be suitable for the vehicle manufacturing industries. They need to develop a customer-oriented production strategy which is also crucial for reducing waste production.

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Declaration

I declare that this thesis has been composed solely by myself and that it has not been submitted, in whole or in part, in any previous application for a degree. Except where states otherwise by references or acknowledgment, the work presented is entirely my own.