A Project Report On

LOGISTICS IN INDIAN AUTOMOBILE INDUSTRY

Submitted for the partial fulfilment of the requirement for the degree of

MASTER OF BUSINESS ADMINISTRATION
(INTERNATIONAL TRANSPORTATION & LOGISTICS MANAGEMENT)

By

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SCHOOL OF MARITIME MANAGEMENT

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CERTIFICATE

This is to certify that the Project titled "LOGISTICS IN INDIAN AUTOMOBILE INDUSTRY" submitted by SABIAN LUIZ register number 2105305027 student of MBA (ITLM) is a bonafide record of his Project report and submitted to the School of Maritime Management, Indian Maritime University, Kochi campus, under the supervision of Dr. SREEJITH , Faculty IMU, Kochi campus. It is also certifying that the above work has not previously formed or submitted for the award of any degree, diploma, associateship, fellowship or other similar titles, and it is an independent work done by the candidate.

Dr. SREEJITH.U

(Project Guide)

SELF DECLARATION

I, **SABIAN LUIZ** (Registration No: 2105305027) student of School of Maritime Management, INDIAN MARITIME UNIVERSITY-KOCHI hereby declares that this project report titled "**LOGISTICS IN INDIAN AUTOMOBILE INDUSTRY"** submitted in partial fulfilment of the requirement for the degree of Master of Business Administration in International Transportation & Logistics Management is my original work carried under the guidance of Dr. Sreejith.

I also confirm that the report is only prepared for my academic requirement, not for any other purpose. It might not be used with the interest of the opposite party of the corporation.

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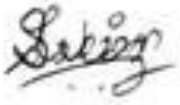
Place: Kochi



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I would like to sincerely thanks our guide Dr.SREEJITH for giving necessary advices and guidance throughout the preparation of this project report.

My thanks and appreciation to my Institution in developing the project and people who have willingly helped me out with their abilities.

I perceive as this opportunity as a big milestone in my career development. I will strive to use gained skills and knowledge in the best possible way, and I will continue to work on their improvement, in order to attain desired career objectives. Hope to continue cooperation with all of you in the future.

I also thank my family and friends for the continuous support in completing my project work.

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EXECUTIVE SUMMARY

The Indian automobile sector is a significant contributor to the country's economy and has been growing rapidly over the years. Logistics plays a crucial role in this sector, as it is responsible for the transportation of raw materials and finished goods between different parts of the supply chain.

One of the biggest challenges faced by logistics in the Indian automobile sector is the inadequate infrastructure, which leads to delays and higher transportation costs. However, with the government's focus on building better roads and highways, this situation is expected to improve.

Another issue is the lack of standardization and coordination among different players in the logistics network. This can result in inefficiencies and increased costs. To address this, many automobile companies are now working with logistics service providers to create more integrated and streamlined supply chains.

Many automakers are now collaborating with logistics service providers to develop more streamlined and integrated supply chains as a solution to this problem.

Additionally, it is anticipated that emerging technologies like blockchain, AI, and the Internet of Things will completely transform the logistics sector. These technologies can increase productivity, lower costs, and improve supply chain visibility.

In conclusion, while the Indian automobile industry's logistics sector faces difficulties, there are also ways to make improvements, including stronger infrastructure, better coordination, and the adoption of new technologies.

OBJECTIVES OF THE STUDY

- To identify the current landscape of logistics in the Indian automobile industry, including market trends, consumer behavior, and government policies.
- To analyze the opportunities and challenges facing of logistics activities in the Indian automobile industry.
- To examine the strategies and initiatives taken by the Indian automobile industry companies to promote their logistics activities like transportation of finished products and spare parts.
- To evaluate the impact of government policies and incentives on Indian automobile industry.
- To provide recommendations and insights for the Indian automobile industry on how to overcome challenges and leverage opportunities for successful adoption of their logistics activities .

RESEARCH METHODOLOGY

Secondary data will be gathered for conducting the study. Data that has previously been gathered and examined by another party for a different goal is referred to as secondary data.

Examples of secondary data include:

- Published research studies or reports
- Census data and other public records
- Company financial reports
- Marketing research studies
- Existing datasets in various fields of study

Secondary data can be a valuable resource for researchers as it can provide access to data that may not be feasible or practical to collect on their own. Additionally, secondary data can allow for comparisons across different studies or datasets, which can enhance the validity of research findings. However, secondary data also has limitations. It may not precisely fit the research question or goals of the researcher, or the quality of the data may be questionable. Therefore, researchers need to critically evaluate the secondary data they use and ensure that it is appropriate and reliable for their research purposes.

Qualitative Analysis

Qualitative analysis is a research methodology used in social sciences, humanities, and other fields that involves the study of non-numerical data such as words, images, and observations. This type of analysis aims to understand the meaning and context of the data collected, and is typically used to explore complex phenomenon that cant be easily quantified. Qualitative analysis often involves collecting data through methods such as interviews, focus groups, observation, and document analysis. Researchers then analyse this data through techniques such as coding, categorizing, and interpreting themes and patterns. It provides rich and detailed insights into the experiences, perspectives, and behaviours of individuals and groups, and is often used to generate hypotheses and develop theories that can be further tested through quantitative research.

CHAPTER: 1

INTRODUCTION

INTRODUCTION OF STUDY

LOGISTICS

Logistics is the management of the flow of goods, information and other resources in a repair cycle between the point of origin and the point of consumption in order to meet the requirements of customers. Logistics is a channel of the supply chain which adds value of time and place utility.

Before the 1950s, no formal concept or theory of logistics existed but the logistical functions were performed in the corporate world without due recognition. The second half of the twentieth century witnessed a phenomenal growth and development in the overall concept and approach towards logistics.

AUTOMOBILE INDUSTRY

The history of the vehicle begins in 1769, with the invention of steam-powered automobiles capable of transporting humans. The first cars powered by internal combustion engines running on fuel petrol were introduced in 1806, leading to the invention of the ubiquitous modern petrol fueled internal combustion engine in 1885. Cars powered by electricity existed briefly around the turn of the twentieth century but faded from popular use until the turn of the twenty-first century, when interest in low and zero-emissions transportation was renewed. As a result, the early history of the automobile can be divided into several eras based on the predominant mode of vehicular propulsion at the time. Later periods were marked by exterior appearance, size, and utilitarian tendencies.

LOGISTICS IN AUTOMOBILE INDUSTRY

The Auto industry cannot function without logistics. The flow of raw materials, components, and completed goods from the point of origin to the site of consumption must be planned, coordinated, and managed. To meet production schedules and consumer demand in the automotive sector, logistics is essential for ensuring that the appropriate components are delivered to the appropriate assembly lines at the appropriate times.

Due to the worldwide character of the industry and the enormous number of suppliers, manufacturers, and distributors involved in the supply chain, the logistics of the automotive sector are extremely complicated. To ensure the efficient flow of goods and commodities, logistics encompasses the coordination of transportation, warehousing, inventory management, and information management.

In recent years, the automobile industry has experienced significant changes due to the rise of electric vehicles, autonomous driving, and the shift towards sustainable and environmentally friendly transportation. As a result, logistics in the automobile industry has had to adapt to new challenges such as the need for new supply chain models, battery management, and the recycling of materials.

Effective logistics management in the automobile industry is crucial for companies to remain competitive, meet customer demand, and optimize costs. It requires a focus on innovation, collaboration, and the use of technology to enhance visibility and efficiency throughout the supply chain.

CHAPTER: 2

LITERATURE REVIEW

Logistics

Bowersox, D.J. and Closs (2000) opines that logistics may be defined as a single minded logic to guide process of planning, allocating and controlling financial and human resources committed to physical distribution, manufacturing, support and purchasing operations.

Automobile

Berry, C.P. (1877) in his book, defined automobile as a self-propelling vehicle or carriage for the transportation of persons or property and whose operation is not confined to a fixed track.

Miguel (2004) indicates performance measurement systems truly applicable in Logistics Management and control. The impact of using performance measurers on management style has been largely neglected. The author sets out to explore this gap using an approach based on Simons' diagnostic versus interactive modes of control. The author aimed at describes the changes in logistics management and control compared with the situation in the rest of the firm. A case study method was undertaken involving a medium sized ceramic tile manufacturer. The results show that a clear interactive use in the logistics area, while in non-logistics department's performance measures is used diagnostically.

Neil and Jim (2001) look at the emerging issues in reverse logistics system. There is a fundamental shift in waste management responsibility from the private waste management industry and local governments towards manufacturers, distributors and retailers. In the recent years the responsibility of manufacturers has been extended to cover the entire life of certain products. The enforcement of environmental legislation becomes more stringent and an increasing number of customers are demanding to take-back of their old products. Companies are beginning to focus on possible distribution channels for the return of their products i.e. Reverse logistics. This paper examine the emerging issues in reverse logistics, in particular the information requirements for reverse logistics within the extended enterprises. A study of end-of-life vehicles (ELVs) illustrates the specific information flow between the key players within the automotive industry. This study addresses the initial development of possible distribution channels, their key operational decisions and supporting information systems for the recycling of end of life products.

According to O'Neil and Shah (2014), logistics plays a crucial role in ensuring that the right parts and materials are delivered to the right place at the right time, which is essential for maintaining a smooth and efficient supply chain. The authors argue that effective logistics management is critical for ensuring that automobile manufacturers are able to meet customer demand, reduce costs, and improve overall operational efficiency.

Bolumole (2015) note, advances in technology have made it possible to automate many logistics functions, such as inventory management, transportation planning, and route optimization. The authors argue that these technologies can help automobile manufacturers to reduce costs, improve delivery times, and increase overall supply chain efficiency.

The industry is subject to fluctuations in demand and supply, which can lead to inefficiencies and disruptions in logistics operations (O'Neil and Shah, 2014).

The complexity of the supply chain, which can involve multiple tiers of suppliers and distributors, as well as cross-border shipments and customs clearance procedures (Verma and Kumar, 2016).

Wu (2020) explored the impact of sustainability on logistics operations in the European automobile industry. The authors conducted interviews with logistics managers and found that sustainability considerations, such as reducing carbon emissions and promoting social responsibility, were increasingly important for logistics operations. The study also identified several barriers to sustainable logistics, including a lack of awareness, high costs, and regulatory issues.

Zhang (2019) investigated the role of information technology in logistics operations in the Chinese automobile industry. The authors surveyed 234 logistics professionals from different companies in the industry and found that information technology, such as RFID and GPS, could improve supply chain visibility, reduce transportation costs, and enhance logistics efficiency. The study also highlighted the need for companies to adopt integrated logistics management systems to improve logistics operations.

Sarkar and Mohapatra (2018) examined the challenges faced by logistics managers in the Indian automobile industry. The authors conducted interviews with logistics professionals and identified several challenges, including high transportation costs, inadequate infrastructure, and regulatory issues. The study also highlighted the need for collaboration and information sharing among different stakeholders in the industry to improve logistics efficiency.

A study by Choudhary and Sharma (2017) focused on the role of inventory management in the Indian automobile industry. The authors surveyed 105 supply chain professionals from different companies in the industry and found that inventory management practices, such as safety stock levels and inventory turnover, were important factors in improving supply chain performance. The study also highlighted the need for better coordination between different departments within companies to improve inventory management practices.

Jha (2018) examined the challenges faced by logistics service providers (LSPs) in the Indian automobile industry. The authors conducted interviews with LSPs and found that the lack of standardization and infrastructure, as well as the complex regulatory environment, were major challenges for logistics operations in the industry. The study also highlighted the need for collaboration between LSPs and automobile manufacturers to address these challenges and improve logistics efficiency.

Singh and Garg (2019) investigated the impact of logistics practices on supply chain performance in the Indian automobile industry. The authors surveyed 100 supply chain professionals from different companies in the industry and found that logistics practices, such as transportation management and warehousing, had a positive impact on supply chain performance. The study also found that supply chain integration and collaboration were important factors in improving logistics performance.

KPMG (2020) examined the growth prospects of the global automobile industry. The authors analyzed data on vehicle production, sales, and investment trends and found that the industry was facing significant challenges, such as declining demand in key markets and the need to invest in new technologies. The study also identified opportunities for growth, such as the development of electric vehicles and autonomous driving technologies.

McKinsey & Company (2019) investigated the competitive landscape of the global automobile industry. The authors analyzed data on market share, production, and sales of different types of vehicles and found that the industry was highly competitive, with several large multinational players vying for market share. The study also identified opportunities for differentiation and innovation in the industry, such as the development of connected vehicles and mobility services.

Dubey et al. (2019) focused on the technological innovation in the global automobile industry. The authors analyzed data on patent filings related to different types of vehicle technologies and found that innovation was increasingly driven by digital technologies, such as artificial intelligence and the internet of things. The study also identified challenges to innovation, such as the need for new business models and the difficulty of integrating new technologies into existing supply chains.

Hossain and Uddin (2021) examined the environmental impact of the global automobile industry. The authors analyzed data on greenhouse gas emissions from different types of vehicles and found that the industry was a significant contributor to global emissions. The study also identified opportunities for reducing emissions, such as the development of electric and hybrid vehicles, as well as the adoption of sustainable manufacturing practices.

McKenna (2020) focused on the technological advancements in the global automobile industry. The authors analyzed the impact of technological trends, such as electric vehicles, connected cars, and artificial intelligence, on the industry and identified challenges facing companies in adopting these technologies. The study also highlighted the need for collaboration and innovation to address these challenges and drive technological progress in the industry.

Jürgens (2018) investigated the competitive landscape of the global automobile industry. The authors analyzed data on market share, production, and sales of different types of vehicles and found that the industry was highly competitive, with several large multinational companies dominating the market. The study also identified opportunities for innovation and differentiation in the industry, such as the development of electric vehicles and autonomous driving technologies.

Schuh and Aichele (2020) examined the economic impact of the global automobile industry. The authors analyzed data on production, sales, and employment in the industry and found that it accounted for a significant share of global GDP and employment. The study also identified challenges facing the industry, such as changing consumer preferences, technological disruption, and the need for sustainability.

CHAPTER: 3

LOGISTICS ACTIVITIES OF INDIAN AUTOMAKERS

3.1 INTRODUCTION

The Indian automobile industry has seen significant growth over the years, with a strong emphasis on logistics to support its operations. Logistics plays a crucial role in the Indian automobile industry, as it involves the movement of raw materials, components, and finished goods between different locations.

Some key aspects of logistics in the Indian automobile industry are:

Supply Chain Management: To assure the timely delivery of raw materials, components, and finished goods, the Indian automobile industry primarily relies on supply chain management. A network of suppliers, vendors, manufacturers, distributors, and retailers manages the supply chain.

Transportation: In the Indian car industry, transportation is a crucial part of logistics. It involves the transportation of goods between locations, which includes interplant logistics as well as inbound and outbound logistics.

Warehousing: As it involves the storage and control of raw materials, components, and completed items, warehousing is a crucial part of logistics. To support its operations, the Indian automobile industry has a strong warehouse infrastructure.

Inventory Control: In the Indian car industry, inventory control is a crucial component of logistics. In order to maintain ideal levels of inventory at all times, it requires managing the inventory of raw materials, components, and completed goods.

Information Management: Since it involves the use of technology to track and monitor the movement of goods, information management is essential to logistics in the Indian automobile industry. To control inventory levels, track shipments, and keep track of delivery timeframes, software solutions are used.

Logistics activities of leading automakers in India

3.2 MARUTI SUZUKI

Maruti Suzuki, the largest automobile manufacturer in India, has a strong logistics network that spans across the country. Here are some examples of logistics activities of Maruti Suzuki in India:

- **Inbound logistics** :Maruti Suzuki has a robust inbound logistics network that involves the delivery of components and raw materials from its suppliers to its manufacturing facilities. A vendor management system has been put in place by the business to oversee its vendors and guarantee prompt material delivery.
-

- To streamline its incoming logistics operations, it also makes use of cutting-edge technologies like predictive analytics.

- **Outbound logistics** :Maruti Suzuki has a strong outbound logistics network that involves moving finished items from its production facilities to dealerships all around the nation. To manage its dealers and enhance its outbound logistics operations, the company put in place a distribution management system. In order to shorten lead times and increase delivery accuracy, it also makes use of cutting-edge technology including automated material handling systems.

- **Warehousing**: Maruti Suzuki has 29 mother warehouses and over 1,100 dealer locations across India. The company uses advanced technologies like automated warehouses and RFID to manage its inventory and optimize its warehousing operations. It also has a centralized logistics control center that monitors the movement of goods in real-time.

- **Transpotation** : For transporting its products around the nation, Maruti Suzuki uses a fleet of more than 1,000 trucks and more than 3,000 drivers. The business uses cutting-edge technology to streamline its transportation operations and guarantee prompt delivery of goods, including GPS tracking and computerised routing.

- Information management: Maruti Suzuki manages its supply chain operations using cutting-edge technology like predictive analytics and artificial intelligence. To give its suppliers access to real-time information and guarantee prompt material deliveries, the company has established a supplier portal. In order to track the flow of goods in real-time and make wise decisions, it also makes use of a centralised logistics control centre.

3.3 Mahindra & Mahindra

Mahindra & Mahindra, one of the leading automobile manufacturers in India, has a comprehensive logistics strategy that includes inbound logistics, outbound logistics, and inter-plant logistics. Here are some examples of logistics activities of Mahindra & Mahindra in India:

- **Inbound logistics** :Mahindra & Mahindra has a robust inbound logistics network that involves the delivery of components and raw materials from its suppliers to its manufacturing facilities. A vendor management system has been put in place by the business to oversee its vendors and guarantee prompt material delivery. In order to streamline its inbound logistics operations, it also makes use of cutting-edge technologies like RFID and GPS tracking.

- **Outbound Logistics**: Mahindra & Mahindra has a strong outbound logistics network that comprises shipping finished products from its manufacturing facilities to dealerships all throughout the nation. To manage its dealers and enhance its outbound logistics operations, the company put in place a distribution management system. In order to shorten lead times and increase delivery accuracy, it also makes use of cutting-edge technology including automated material handling systems.

- **Inter-Plant Logistics**: Mahindra & Mahindra has an efficient inter-plant logistics system in place for the movement of commodities between its manufacturing facilities. In order to control inter-plant logistics activities and enhance its supply chain, the company put in place a transport management system.

- **Warehousing** : Mahindra & Mahindra has a thorough storage strategy that covers the management of inventory for raw materials, components, and finished items. To efficiently manage its inventory and warehouse operations, the corporation makes use of cutting-edge technologies like RFID and automated warehouses. It also has a central logistical command centre that keeps track of the flow of commodities in real time.

- **Information Management**: Mahindra & Mahindra uses advanced technologies like predictive analytics and artificial intelligence to manage its supply chain operations. The company has implemented a supplier portal to provide real-time information to its suppliers and ensure timely delivery of materials. It also uses a centralized logistics control center to monitor the movement of goods in real-time and make informed decisions.

3.4 TATA MOTORS

Tata Motors, one of the largest automobile manufacturers in India, has a strong logistics network that supports the movement of its vehicles and spare parts across the country. Here are some examples of Tata Motors' vehicle and spare parts logistics in India:

- **Vehicle Logistics**: Tata Motors has a well-established network for moving finished vehicles to dealerships all throughout the nation from its manufacturing facilities. The company uses cutting-edge technologies, such as GPS tracking and automated routing, to streamline its logistics for trucks and guarantee on-time delivery. Additionally, Tata Motors controls the company's vehicle transportation through its dedicated business, Tata Motors Logistics Solutions.

- **Logistics for spare parts**: Tata Motors has a vast network for logistics for spare parts, which includes managing spare parts inventory and distributing spare parts to dealerships all over the nation. In order to manage its spare parts inventory and streamline its logistics processes, the company uses cutting-edge technologies like RFID and automated warehouses. Tata Motors also operates a dedicated spare parts distribution division, Tata Motors Service, which manages the distribution of spare parts for the company.

- **Warehousing** : Tata Motors manages its inventory of vehicles and replacement components through a network of warehouses and stocking sites spread out across the nation. To manage its inventory and streamline its warehousing operations, the corporation uses cutting-edge technologies like RFID and automated warehouses.

- **Information Management**: To manage its supply chain activities, Tata Motors makes use of cutting-edge technology like predictive analytics and artificial intelligence. To give its suppliers access to real-time

information and guarantee prompt material deliveries, the company has established a supplier portal. In order to track the flow of goods in real-time and make wise decisions, it also makes use of a centralised logistics control centre.

3.5 ASOK LEYLAND

Asok Leyland Motors, one of the largest automobile manufacturers in India, has a strong logistics network that supports the movement of its vehicles and spare parts across the country. Here are some examples of Asok Leyland Motors' vehicle and spare parts logistics in India:

- **Vehicle Logistics**: Ashok Leyland has a well-established network of vehicle logistics that involves shipping finished vehicles from its manufacturing facilities to dealerships and customers all throughout the nation. In order to manage its vehicle logistics operations and improve its supply chain, the company has put in place a transport management system. Inland World Logistics, a business specifically responsible for managing vehicle transportation for Ashok Leyland, is another division that the corporation runs.

- **Spare Parts Logistics**: Ashok Leyland has a vast network for managing spare parts inventory and distributing spare parts to consumers and dealerships all over the nation. To manage its supply of replacement parts and streamline its logistics processes for spare parts, the company has built a warehouse management system. Ashok Leyland also operates a dedicated spare parts distribution division, Ashok Leyland Service Zone, which manages the distribution of spare parts for the company.

- **Warehousing**: To handle its inventory of vehicles and spare parts, Ashok Leyland maintains a network of warehouses and stocking locations all over the nation. To manage its inventory and streamline its warehousing activities, the business has installed an automated warehouse system.

- **Information management**: Ashok Leyland uses cutting-edge technology to control its supply chain activities, including GPS tracking and RFID. The business has put in place a supplier portal to give its suppliers access to real-time data and guarantee prompt material delivery. To track the movement of items in real-time and make wise judgements, it also makes use of a centralised logistics control centre.

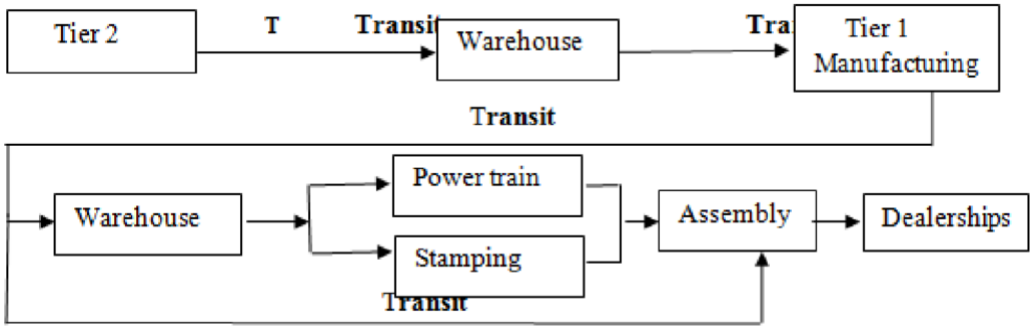
CHAPTER: 4

CHALLENGES AND FUTURE OF LOGISTICS AND SUPPLY CHAIN IN INDIAN AUTOMOBILE INDUSTRY

PROBLEMS AND CHALLENGES IN AUTOMOBILE LOGISTICS AND SUPPLY CHAIN

An accurate definition of a supply chain is a "network of organisation's that are involved in the various processes and activities that produce value in the form of products and services in the hands of the ultimate consumer" . As a result, a supply chain is the culmination of efforts to integrate a network of businesses and coordinate information, material, and financial flows. It's interesting to note that the top two supply chain objectives have changed from lowering operational costs and total inventory levels to concerns of how to improve customer service and speed of product delivery to markets.

Figure below schematically depicts a typical automotive supply chain which comprises of a network of small supply chains.



The estimated 20,000 components and 1,000 sub-assemblies or modules that make up the average vehicle can be used to estimate the complexity of the automotive supply chain. The Tier 1, 2 and Tier 3 suppliers and manufacturers, together with numerous assembly plants and dealerships, are all part of the automotive supply chain. The wide range of features and customizations that customers want add to the high level of reaction required from automotive supply chains. In the automotive business, the standard order lead time is 4-6 weeks, and supply chain management (SCM) practices implementation and design quality and conformity are positively correlated.

Table below shows trends in the car sector that have an impact on the supply chain. A supply chain needs to be customised based on the unique specifications of the product being made, according to Fisher [25]. This is especially true for the intricate automotive sector, where an automaker must manage a network made up of

numerous supplier chains. For the Indian car sector to maximise competitive advantage in a developing market, supply chain practices and business strategy must be perfectly aligned . The effectiveness of existing supply chains is severely hampered by macroeconomic cycles of expansion, recession, and recovery, particularly in the automotive sector due to its extensive interconnections with other industries.

Table . Trends Impacting SCM

Demand-Side Trends	Supply-Side Trends
Uneven Growth	Differentiated Outsourcing
Fragmentation	Low-Cost-Country Sourcing
Accelerated Volatility	Risk Management
Importance of After market	Transparency / Accountability

Compared to 10-11% in Europe and 9% in the USA, Indian business spends a high 14% of its GDP on logistics, and roughly 22% of total sales, or over USD billion, are related to inventories in supply chains. The cost of logistics is still high because of a number of issues, such as a lack of significant, integrated third-party logistics (3PL) companies that use cutting-edge technologies and an inadequate infrastructure. This suggests that there is plenty of room for Indian automakers to improve their supply chains and boost their competitiveness . Instead of between whole supply chains, including first tier component suppliers, the main competition between automakers in India is at the level of the assemblers.

4.1 Integration

Automakers have been observed to put more of their attention on improving the overall supply chain's efficiency than on enhancing certain functional areas as a result of the industry's fierce competition.

Due to a significantly smaller client base than, say, the FMCG sector, supply chain entities in the automotive industry use collaborative forecast practices extensively and with great visibility . Supply chain practices are now integrated with the product creation procedure. For instance, Toyota's product development process is tightly related to its production system. This framework's core components also include regular, close cross-functional interactions that can be both official and informal, as well as close mentorship by superiors to their subordinates. The automotive supply chain must be adaptable in the modern environment of erratic demand and shifting consumer preferences. Numerous issues, including as the instability of the global economy, the identification and adaptation of emerging markets, growing competitive rivalries and consumer preferences, etc., have a negative impact on the ability to implement flexible practices . 'Lean' and 'agile' practices would enable auto supply systems to tackle such problems, and a structure for a 'Leagile' supply chain has been proposed , which highlights the important issue of dynamically positioning the 'decoupling points'.

4.2 Supply Chain Challenges

Visibility, cost containment, risk management, rising consumer demands, and globalisation are the top five global supply chain concerns . It is interesting to note that, internationally, automotive supply chains fall behind other supply chains (such as retail, pharmaceutical, etc.) in these five metrics, highlighting the need for and potential for significant improvements to make them more efficient and responsive. The increase in demand over the past ten years has placed sudden pressure on the country's existing auto and auto component manufacturers, who have little integration, to quickly adopt international standards and practices and introduce or rev up supply chain processes, creating challenges in technological preparation and transition management almost dynamically without affecting the brand image.

Automotive supply chains must deal with idiosyncrasies in the Indian setting that are very different from those in Western nations. Favouritism for small cars and two-wheelers, a lack of customer visibility, particularly in rural markets, packaging challenges due to linguistic and cultural diversity, quality issues due to resource limitations, a large number of fragmented suppliers that impede effective collaborations, complex tariffs and duties, a lack of infrastructure (off-highway transit is challenging), and a multilevel distribution system that affects product prices are some of the significant factors. The management of inbound logistics, product and part proliferation, and end-to-end supply chain integration present the greatest challenges . The auto component industry, a major contributor to export and growth, is beset with frequent changes in costs of raw materials, customer demand for product quality, timely deliveries and sourcing of raw materials . Multinational companies entering India face unique challenges cultural diversities, pricing-income disparities and sourcing.

4.3 OEM-Supplier Synergy

Increased pressures on Tier-1 suppliers are related to performance expectations, lack of strategic collaboration and lack of information . The major aspect of the ‘OEM-auto component along with concerns about location, cost, and module design capabilities, manufacturers' connectivity pertains to issues with responsibility for design and quality. It is clear that 'on-site' suppliers significantly aid in improving overall supply chain efficiency through cost-effectiveness and part standardisation . OEM outsourcing has also led to suppliers taking on more duties in the design and development of assemblies and subassemblies, demanding extensive technological innovation. Global suppliers in particular confront difficulties with logistics, local content and quality, supplier innovation, dependability, and cost .

With its component suppliers, Maruti Suzuki was among the first in India to adopt the Vendor Managed Inventory (VMI) model, which has significantly reduced the amount of inventory retained and expedited planning and transportation schedules. Tata Motors through its ‘One Part One Vendor’ system aims at substantially reducing number of vendors. The trend is basically to enhance supplier-side integration by reducing the number of suppliers and having separate sub verticals such as electrical, body frame, engine etc. with some manufacturers creating a different vendor base for each model of automobile [48]. Compatibility is a major criterion for supplier selection in the Indian context [49]. Global OEMs and component manufacturers prefer stable JIT suppliers, located in geographic proximity and those who have established JIT material supply and automated material supply [50]. Although many suppliers in India match up to world industry standards, there is a need to develop the lower–tier suppliers to ensure global competitiveness.

4.4 Leveraging Technology and Visibility

According to a survey of leading auto manufacturers in India, technology is frequently viewed as a supply chain enabler that lowers inventory levels and stocking, reduces lead times, and fosters collaboration with suppliers and dealers [51]. In the majority of businesses, IT managers report a "lack of alignment" between business objectives and IT implementation plans. Even though Indian Tier-1 companies are highly aware of productivity-enhancing

tools like data analytics, ERP, RFID, etc., usage of these tools is still low [33], particularly among Tier 2 suppliers because of obstacles like overcoming cultural, financial, organisational, and technological barriers [45].[31]. PACE (Performance at Customer Elation), a set of technical initiatives by Mahindra & Mahindra in SCM and CRM and Bajaj Auto's 'my SAP' Enterprise portal, Ashok Leyland with SCM Project 'Oscars' [10]) are all aimed at improving service levels, e-payment and clearance facilities and enhancing visibility leading to better coordination and reducing non – core activities, vendor base rationalization etc. at all echelons of the supply chain.

4.5 Performance Measurement and Quality

For Indian automotive supply chains, which may be driven to cut costs and in the process make "sub-optimal" supply chain decisions in times of economic instability and declining demand, establishing practical, reliable benchmarking and performance standards is essential.[54]. To remain competitive in a fast-moving market like the automotive industry, supply chains must be regularly and comprehensively evaluated [55]. There is a definite need for doing much more in this area, according to a rapid scan approach used to evaluate the best practices among suppliers and clients of 20 European automakers [56] and Tier 1 and 2 suppliers' adopting best practices to enhance "business systems engineering" and create a seamless supply chain [58]. A SAP-LAP case study [59] makes the case for the need for vendor performance measurement based on supply chain effectiveness criteria as well as for improved visibility throughout the entire supply chain. It also makes the case for the need to concentrate on second and third tier suppliers as they are the main cause of quality issues.

FUTURE OF INDIAN AUTOMOBILE LOGISTICS AND SUPPLY CHAIN

The constraints and complexities associated with present logistics and SCM practices are a sign that the Indian automobile sector is about to enter a highly competitive era. To preserve and improve their competitive edge, industries must therefore recognise the major present trends that they are expected to encounter in the future and dynamically modify their respective supply chains.

This section lists several methods for overcoming obstacles, forecasts future developments in the automotive supply chain, and compares them to current logistics and SCM procedures. The three key issues that Indian automotive supply chains will need to address in the short to medium term are visibility and innovation, collaboration and supply networks, and the changing role of managers and leaders. The future trends and changes that are anticipated to have an impact on the Indian automotive supply chains in the near future are outlined in a possible framework.

4.6 Strategies for overcoming challenges

Some of the lessons learned from the Indian automobile industry's transformation phase include:

- Application of cutting-edge supply chain principles in emerging markets and underdeveloped economies.
- The significance and benefits of developing cooperative relationships with suppliers.
- The participation of all parties involved in the change and transformation process.

A creative strategy is required to address the issues the Indian automotive sector is now facing, as described earlier in this article. According to some, "splintering" a complicated supply chain has benefits such as lowering complexity, improving visibility, and effectively using lean methodologies, which leads to agility to meet changing business dynamics. According to a study with a futuristic viewpoint, a supply chain should be "instrumented, interconnected, and intelligent" in order to be "smarter" and "more effective."

As a result, the Indian automobile industry must take proactive measures to overcome obstacles and improve competitiveness. The following list of suggestions provides an overview of some of them :-

- **The global picture**: By applying a global view to supplier management, manufacturing, sales, and other areas, concentrate on expanding and retaining international markets, particularly in the small car, LCV, and auto component sectors.
- **Product development procedures and supply chain management**: This calls for implementing "Leagile" practices in automotive supply chains, which entails dynamically moving the decoupling point and altering the fundamental architecture of the vehicle based on the product platform and the modular organisation of subsystems. Modern imperatives include improving service levels, customer relationships, and talent development in order to match demand (diversity) of cars with assemblies/components supply.

- **Government intervention:** Governmental interventions, such as a favourable tax regime, enhancing R&D capabilities especially related to hybrid car technologies and fuel-cell development and infrastructure are necessary to enhance the sector's competitive edge.

- **Supplier networks**: There is a need to galvanise the supplier networks, especially in the SME sector to adopt global technologies and practices. Sub-contracting should be based not only on cost but on capabilities of design, innovation and engineering. Auto makers and major suppliers should rationalise supplier base, formulate selection criteria, build in sustainability through enhanced collaboration and trust such as Ford's 'Aligned Business Framework (ABF)', a strategic supplier initiative.

4.7 Future trends and practices

This section seeks to discuss some key global trends – modularity, green supply chains, reverse logistics, 'Build-to-Order' Supply Chains (BTO-SC) and vehicle service networks, which are likely to impact the functioning of Indian automotive supply chains.

Future major drivers for the auto industry will be the "green revolution" and "mobility revolution" (both personal and public transportation), which in India will lead to the growth of rural markets, feeder services between transportation modes, and a demand for mass mobility vehicles, necessitating a realignment of current supply chain objectives. A complex system is divided into a number of smaller, discrete, scalable, interchangeable, reusable, and self-contained functional components or modules that can be created and developed individually before being seamlessly put together to form the full system.

In order to satisfy stringent and evolving consumer needs, the BTO-SC paradigm, which has been effectively applied in the German automobile sector [19], may be usefully applied in the Indian context. The BTO-SC's performance depends on a solid IT foundation, strong coordination and integration with suppliers, as well as an effective production and scheduling process . Vehicle service strategy is becoming more and more of a topic of attention in this period of heightened competition and slowing economic growth, expanding a service network, utilising technology as a facilitator, and improving skill sets to guarantee that more consumers utilise OEM authorised service facilities instead than unorganised sector workshops, which is the trend in India. This necessitates the development and application of a completely new supply chain paradigm.

4.8 Visibility and Innovation

Having a successful technology strategy is crucial for achieving corporate objectives in the automotive industry. The creation of parts appropriate for regional conditions, the adoption of cutting-edge technologies, and manufacturing innovation would guarantee that Indian businesses achieve competitive advantage. Technology adoption, particularly in the SME-based car component business, has been mostly "unbalanced," and IT investments should not just follow fashion or serve as a showcase but should instead strengthen competitive advantage [35]. Building innovation hubs with major companies will promote domestic car component production. Bosch Ltd., a worldwide company that manufactures car parts, has created two manufacturing sites in India specifically for exports and a world-class technical facility there.

In the large complex, global automotive supply chains, use of 'Big Data' concepts and resulting data analytics will contribute significantly in reducing in-transit inventory, safety stocks and stock-outs by better analysis of transit times, bottlenecks at ports and shipment routings. New markets must be opened up through innovations, as those for the Tata Nano's Ultra Low Cost Car (ULCC) category and the Small Commercial Vehicles (SCV) industry, which can significantly expand India's export market. Technological innovations like "Additive Manufacturing" — the use of 3D printers — are certain to fundamentally alter the structure and operations of supply chain organisations, and Indian businesses would need to build the capacity to use these technologies. Initiatives like MIT's Global SCALE (Supply Chain and Logistics Excellence) Network, which are global centres for research and education, show how crucial this feature is.

4.9 Collaboration and Supply Networks

The connection between an assembler and a supplier is drastically altering. In order to ensure quality and delivery, suppliers are first given more responsibility for product design and development, and then assemblers are concentrating on fewer suppliers, strengthening their practices of integration and collaboration with them. Because of this, it is essential to encourage supply chain best practices, current technology use, and innovation among SME-focused providers. A "holistic integration of all suppliers to combine resources as well as increase flexibility and adaptability of the value creation process" is what the term "Supply Networks," which is being developed in the intricate automobile supply chains, refers to. Strategic sourcing, which attempts to find and choose suppliers for a long-term partnership, raises the bar for supply chain cooperation significantly. In the Indian automotive sector, this calls for radical changes in the present system of focal organizations handling interaction with suppliers to ensure Flexibility and Agility in the supply chain. A comparison between Indian and Brazilian auto industries (both with similar growth trajectories in emerging markets) highlights the concept of 'follow design' and 'follow sourcing' being practiced in Brazil's automotive industry and suggests the increasing importance of global supply networks - specially of the auto component industry as relates to design, supplier selection and contract allocation. Collaboration and trust-building are going to be the mainstays for development of the Indian auto manufacturing sector in the future. These trends call for a focused Supply Management Orientation (SMO) and establishing performance metrics for both suppliers and buyers including issues such as long-term relationships, supplier involvement in product development, trust and collaboration, quality criterion, cost control and information sharing. The latter is an emerging trend which calls for 'super-specialists' in the industry who could, based on their core competencies, become a sub-system supplier to the entire industry , thus reducing need for heavy investments. This requires a new era of collaboration and trust between present-day competitors, which would also simplify current supply chain complexities.

4.10 Evolving Role of Managers and Leaders

The changing leadership position of managers, one of the key components of SCM, requires more research and consideration. It has been observed that managers of the automotive supply chain play a less strategic role than those of other supply chains . Therefore, a review of the sector is required to widen the duty of supply chain managers to comprehensively cover risk management, end-to-end visibility functions, product design, and customer management. As a result, they will be held more responsible in terms of supply chain effectiveness as opposed to silo-like operating. Additionally, there is an urgent need for auto supply chain managers, particularly among top leadership, to foster a culture of change management in their company with a focus on the necessity of fostering cooperation and trust at both ends of the supply chain.

According to a study on the significant impact of leadership on the performance of car firms, particularly GM and Toyota, "growth and profit should be mutually inclusive." As a result of management ambition and product complexity, Toyota's deterioration in quality standards saw an increase in faults from 1.01 to 117 per 100 vehicles in 2009–10. Lessons from Toyota's supply chain issues can be attributed to managerial decisions rather than manufacturing system flaws, and, – reduction in relationships with suppliers, highly centralised decision making and poor synergy.

CHAPTER: 5

FINDINGS AND SUGGESTIONS

5.1 FINDINGS

- **Growing demand for vehicles and spare parts** : There is a growing demand for vehicles and its spare parts in the country and logistics activities need to be improved to meet those needs.

- **Government initiatives :** The Indian government has started policies to promote and support logistics and supply chain activities in the automobile sector.

- **Adoption of new technologies**: The Indian auto sector is benefitin greatly from the adoption of new technologies like blockchain, AI, and the Internet of Things.

5.2 SUGGESTIONS

Some suggestions for logistics in the Indian automobile industry:

- **Infrastructure Development**: The Indian government should keep putting its attention towards infrastructure development to enhance logistics. Building improved roads, highways, and bridges as well as making improvements to rail, air, and marine transportation are all part of this.

- **Collaboration and coordination**: The logistics network's numerous players, including automakers, suppliers, logistics providers, and governmental organisations, need to work together and coordinate their efforts more effectively. Establishing communication channels, standardising procedures, and exchanging data can all help with this.

- **Adoption of new technologies**: The Indian auto sector might benefit greatly from the adoption of new technologies like blockchain, AI, and the Internet of Things. In order to track goods in real-time, reduce delays, and increase visibility, RFID tags and sensors can be used.

- **Growing capacity**: The logistics industry need both skill development and growing capacity. This entails educating and training logistics staff members as well as funding the creation of new technology.

- **Green Logistics**: The Indian auto sector ought to concentrate on green logistics, which involves lowering carbon emissions and fostering environmentally friendly behaviours. By purchasing fuel-efficient automobiles, turning to renewable energy sources, and cutting back on trash, this can be accomplished.

- **Reverse Logistics**: Reverse logistics is an area that requires attention in the Indian automobile sector. This includes managing the reverse flow of products, such as parts and materials, from customers to manufacturers. An effective reverse logistics system can reduce costs, improve customer satisfaction, and promote sustainability.

CHAPTER: 6

CONCLUSION

In conclusion, the Indian automobile sector has a long way to go before it can meet the developed nations' supply chain standards, but there is enormous potential for logistics and supply chain integration at the national level. In the report, some future auto industry trends that call for considerable adjustments to supply chain procedures in the automotive supply chains are outlined. Additionally, the industry requires outside assistance in the form of favourable government legislation, policies, and the creation of infrastructure. To meet future, stricter regulations, the industry must concentrate on developing green technologies like hybrid cars, low-emission vehicles, and fuel-efficient engines. It also needs to control costs throughout the automotive value chain, increase investments in R&D, particularly in the sector that makes auto components, and increase scale so that exports can grow.

The GDP of India will increase greatly if the automobile industry in that nation experiences sustained expansion. But for this to happen, all parties involved—the government, OEMs, suppliers, and others—must be committed and determined. Automakers must prioritise strengthening their individual supply chain practises with a focus on aligning these with the dynamic, changing business environment because external agencies and circumstances are beyond their control. Additionally, there is a need for ongoing academic research into this significant sector of the economy in order to develop a comprehensive theoretical framework that makes sense and to specify the dimensional goals that practitioners should pursue in their ongoing effort to improve competitiveness.

To remain competitive, the automotive industry needs to continue to invest in logistics infrastructure and technologies, as well as to focus on sustainable practices and reduce carbon emissions. By implementing these strategies, the global automotive sector can enhance its logistics operations, reduce costs, and improve customer satisfaction.

CHAPTER: 7

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