

A STUDY ON THE TECHNOLOGICAL INNOVATION AND CAPABILITY OF THE AUTOMOBILE INDUSTRY IN CHENNAI.

Submitted in partial fulfillment of the requirements for the award of

Master of Business Administration

By

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Register No.40410091



DEPARTMENT OF MANAGEMENT STUDIES

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY (DEEMED TO BE UNIVERSITY)
Accredited with Grade "A" by NAAC | 12B Status by UGC | Approved by AICTE
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

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DEPARTMENT OF MANAGEMENT STUDIES

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work LOGESH S (40410091) who carried out the project entitled “**A Study on the technological innovation and capability of automobile industry in Chennai**” under my supervision from August 2021 to November 2021.

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Submitted for viva voce held on _____

INTERNAL EXAMINER

EXTERNAL EXAMINE

DECLARATION

I **LOGESH S (40410091)** hereby declare that the Project Report entitled “**A study ononline retail automation in Chennai and their influence on the customer engagement**”done by me under the guidance of **Dr. MATHAN.N** is submitted in partial fulfillment of the requirements for the award of Master of Business Administration degree.

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PLACE: CHENNAI

SIGNATURE OF THE CANDIDATE

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ABSTRACT

The automobile industry is broadly categorized into three segments—commercial vehicles, passenger vehicles and two/three-wheelers. The automobile supply chain is complex, as this includes raw material suppliers, component manufacturers, sub assemblers, final assemblers, different distribution channels, networks and end consumers. The objectives of this article are to find segmental differences in the supply chain performance of the Indian automobile industry and to quantify the impact of supply chain performance on the overall profitability of the firms across the segments. In particular, the application range of automation technology has become more extensive, because automation technology itself has more advantages and cannot be replaced by many other traditional technologies. Thanks to the application of high-precision automation technology, all work can be carried out continuously by established computer programs. In this way, the number of errors caused by human work is actually reduced, and the pass rate of the product can also take this opportunity to be significantly improved. When performing various tasks, workers in the mechanical manufacturing field will actively apply the most suitable automation technology according to their actual conditions, and organically integrate their valuable work experience with brand-new automation technology. This allows all work to be of higher quality in the implementation process.

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CHAPTER – 1

INTRODUCTION

1.1 INTRODUCTION

1.1.1 SUPPLY CHAIN IN AUTOMOBILE INDUSTRY

The automobile industry is one of the most complex and information-intensive sectors. With innumerable companies taking thousands of corridors delivered to complete their manufacturing processes and deliver high- quality products, it's no wonder technology has drastically bettered the industry. Software systems combined with the internet allow manufacturers and distributors to search monstrously complex supplies incessantly. With global logistics networks, companies can transport goods anywhere on the earth. The result is an automobile industry that can produce all features of products using encyclopedically sourced accoutrements for fast assembly and trade to the client. Supply chain operation involves enforcing software systems and operation strategies to strain up every stage of the manufacturing operation, beginning before customer orders and ending with product delivery. Force chain operation software incorporates technology and data collection to develop detailed logistics plans. In confluence with logistics software, colorful operation strategies help reduce recalls and returns, exclude waste and ameliorate profit perimeters.

The automobile and transportation force chain involves all incoming and gregarious accoutrements, services and corridor that pertain to your business operations. This means that the success of your enterprise depends on the trust ability and thickness of automobile manufacturing logistics. Several aspects of automobile and transportation industry SCM (force chain operation) are critical to its success and can be modified to suit your requirements better. These include integrating technology, relating and collecting data and producing detailed logistics plans. It can also involve employing innovative third- party logistics providers that can serve as linchpins in the force chain.

Supply chain operation in the automobile industry can be broken down into three core areas:

- Using technologically able software platforms to collect and organize information and prognosticate and dissect trends.
- Maintaining the loftiest possible norms in all operations, both internally and externally.
- Ensuring all of your variable and fixed costs are justified so your perimeters can be maintained and bettered.

1.1.2 TECHNOLOGY INNOVATION IN SUPPLY CHAIN MANAGEMENT

The automobile industry sat at a crossroads indeed before the health extremity of 2020. Evolving technology, globalization, urbanization and environmental enterprises have gathered to change the part of the auto within our diurnal lives. What's more, the development of both independent vehicles and electric vehicles change force chain stylish practices, fit new players into the industry, and bear updates across the industry to keep pace. Unnaturally, a lot of different mystification pieces need to work together seamlessly in order to produce a finished vehicle. Although COVID may have actually reinvigorated interest in particular vehicle power, it also revealed the fragility of global force chains. OEMs, retailers and element suppliers all need to review stylish practices and develop further sustainable and robust force chain connections in order to accommodate the change proceeding in the industry. The fleetly accelerating electric vehicle (EV) request has a major impact on force chains. In 2019, the global deals of EV units were further than two million. This is anticipated to grow further as some governments propose a ban on dealing diesel, petrol and cold-blooded vehicles.

Internet of Things

The new wave applications and in-vehicle innovations powered by the internet have gone beyond the application of RFID tags that used to regulate routing, inventorying, and loss prevention. Internet of automobile things are deeply embedded within the vehicle, in the logistics & production environments and the after-market service infrastructure. Various supply chain touch points are connected to the internet and work in tandem enabling visibility and information flow through a common enterprise platform. More and more auto companies are introducing technology enabled cars in their range of brands.

Big data

For automakers, big data is expanding the range of information used in decision making. Compared to the past when car manufacturers could only use a handful of experiences or a small pile of information, now they use big data for developing a new model or providing brand-new services. They also can predict the future of the automobile industry related to Mobility, Electrification, Connectivity, and Autonomous (M.E.C.A.).

AI

It's vital for vehicle manufacturers to be able to monitor every stage of a component's journey and know exactly when to expect its arrival at the destination plant. That's why modern supply chains often rely on cutting-edge IoT, block chain, and AI technologies. In particular, vehicle manufacturers can turn to solutions relying on different machine learning algorithms and AI-powered predictive analytics.

Blockchain

Automotive supply chain managers can use blockchain to multiple supply chain problems, like keeping complex databases and monitoring products and services. A far less corruptible and automated alternative to centralized databases is another advantage. In the field of monitoring and testing products and services, a blockchain-based automobile supply chain management system allows for accurate record-keeping and monitoring of provenance as product information is accessible via embedded sensors and RFID tags.

Blockchain may trace the past of a commodity right from its origin to where it is in the present time. Also, this form of exact provenance monitoring can ensure fraud detection in any part of the supply chain.

The car supply chain is a highly dynamic and big field with numerous participants, ranging from parts suppliers, producers to sellers. Delivering real customer value includes a review of existing infrastructure and business processes, as well as solutions that respect protection, confidentiality, and authorization permissions.

Blockchain can prove an ideal solution. Blockchain can be used by automobile manufacturers to protect their brands against counterfeit goods and to build customer-centered business models.

1.1.3 CAPABILITY IN AUTOMOBILE SUPPLY CHAIN

Supply chain associations within the automobile supplier assiduity contribute to manufacturing excellence in numerous ways, including quality, cost, and delivery to their original outfit manufacturers (OEM) and subsystem client base. Concentrated on issues, a competitive force chain capability not only assures the on- time delivery of element material, but also the prosecution of inbound force to insure the payload of quality finished goods at a competitive price while delivering on- target perimeters for the manufacturers.

Moment, in order to negotiate these pretensions, nonstop enhancement in global force chain prosecution has come a core force capability needed by utmost automobile OEM's. Strategies around spare loss and logistics must be stationed to negotiate performance pretensions, numerous of which may be needed to remain in good standing. Executing these strategies requires manufacturers to completely work the eventuality of moment's innovative network- grounded force chain systems and processes.

Moment it's possible to completely engage the knowledge and capabilities of an extended enterprise across their force chain in real time. This evolving network- grounded capability provides the implicit to drive significant advancements in overall loss performance and cost pretensions.

The following is a breakdown of the critical force chain capabilities and conditioning that should be in place within an automobile supplier association to misbehave with moment's client contract conditions and to execute perfect force fulfillment:

- Lean manufacturing, replenishment, and logistics practices
- Establishment of replenishment processes, procedures, and policies to assure on-time delivery at the highest level of quality and lowest possible cost throughout the extended supply chain
- Real-time digital communication between suppliers and customers (zero latency preferred)
- Demand analytics around EDI transaction sets 830, 862, 866, as well as any web-based electronic communication
- Real time collaborative communication throughout the supply chain to address potential issues in meeting demand requirements
- Ability to react to weekly schedule variation, reconciling Cums and comparing the demand to capacity
- Ship according to a latest set of transportation routing instructions
- Real-time response to alerts, issues, and exceptions
- Repeatable processes that minimize human intervention including continuous process measurement and reporting
- Identification and measurement of key trending metrics on a weekly or monthly basis, with an emphasis on corrective action planning to address metrics that don't meet goals

1.2 STATEMENT OF THE PROBLEM

Automotive industry is passing through a serious extremity after a veritably long time due to global retardation and Government programs within India. It's seen that after every profitable retardation, machine industry has seen technological as well as procedural changes. Shifting request demand is a crucial challenge in the automotive industry. Lack of force chain visibility similar as supplier, material, and product constraints beget scheduling detrainments, and short-term product changes. Lengthy New Product Development cycles.

Still, it's seen that cost reduction pressure is there to boost unborn demand and hence new technologies similar as Internet of Things (IoT), Big Data, Data Science, artificial intelligence (AI) & machine learning, robotic, and blockchain are coming up at a fast pace to transform the force chain as a whole. A lot of studies have been conducted on this area.

This paper attempts to review how the current supply chain operation practices impacts through Technology innovation in automobile industry. It also helps to understand the unborn trends of Technology innovations in force chain in automobile Industry.

1.3 INDUSTRY PROFILE

The automobile industry in India is the world's fifth largest. India was the world's fifth largest manufacturer of cars and seventh largest manufacturer of marketable vehicles in 2019.

Indian automotive industry (including element manufacturing) is anticipated to reach Rs.16.16-18.18 trillion (US\$251.4-282.8 billion) by 2026. The industry attracted Foreign Direct Investment (FDI) worth US\$25.85 billion between April 2000 and March 2021 account for 5 of the total FDI during the period according to the data released by Department for Promotion of Industry and Internal Trade (DPIIT). The Indian automotive industry is anticipated to reach US\$ 300 billion by 2026.

Two wheelers and passenger vehicles dominate the domestic Indian auto request. Passenger car deals are dominated by small admit-sized cars. Two wheelers and passenger cars reckoned for 80.8 and 12.9 market share, independently, counting for a concerted trade of over 20.1 million vehicles in FY20. Two-wheeler deals stood at units in March 2021, compared with units in March 2020, recording a decline of 35.26.

A recent study conducted by Castrol plant out, utmost of Indian consumers would consider buying an electric vehicle by the time 2022.

A number of knowledge and Communication Technology (ICT) in transport, that comprise the umbrella of Intelligent Transport System (ITS) are being employed for rising property and potency of urban and rural transport. In India, IT is at its emergent stages.

The outlook for the business is incredibly robust with Bharat expected to become third largest automobile manufacturing country once China and USA by 2030. Business specialists believe that Bharat can overtake European automobile producing countries by 2020 and USA by 2035.

Even so, the business can also be facing challenges of accelerating use of greener and cleaner technologies, fuel economical vehicles, affordability and lack of fine road infrastructure within the country.

1.4 COMPANY PROFILE

Established in 1967, Hyundai Motor Company has grown into the Hyundai Motor Group, which was ranked as the world's fifth-largest automaker since 2007 and includes over two dozen auto-related subsidiaries and affiliates.

Hyundai Motor, which exported its first independently-made vehicle, the Pony, in 1976, now exports over one million high-quality vehicles ranging from sedans, SUVs, trucks and buses.

In 2010, Hyundai Motor sold about 3.6 million cars worldwide, up 16.3 percent from 2009.

Hyundai Motor, South Korea's largest automaker, sold 659,565 cars in the Korean domestic market in 2010, reaching a market share of about 45 percent. Outside Korea, the company sold about 2.9 million cars in 2010 in over 186 countries through some 5,300 dealers.

Hyundai's new brand statement is "New Thinking. New Possibilities." This encompasses Hyundai's new brand concept, "Modern Premium," which aims to provide customers with emotional value and experiences beyond expectations through new thinking and new possibilities. The new brand direction also captures the spirit of change at the automaker, which has shown dramatic growth in all areas of business.

Employing over 78,000 people worldwide, Hyundai Motor is implementing a new global policy aimed at localization.

Currently Hyundai Motor has six overseas plants in the U.S., India, China, Turkey, the Czech Republic and Russia. The company will add a seventh plant by 2012, in Brazil. Hyundai Motor today has a combined global production capacity of about 3.91 million units a year (Korea Domestic: 1.86 million / Overseas: 2.05 million).

Hyundai Motor India Limited (HMIL) is a wholly owned subsidiary of Hyundai Motor Company (HMC). HMIL is India's first smart mobility solutions provider and the number one car exporter since inception in India.

It currently has 10 car models across segments SANTRO, GRAND i10 NIOS, all-new i20, AURA, VENUE, Spirited New VERNA, All New CRETA, ELANTRA, New 2020 TUCSON & KONA Electric.

HMIL forms a critical part of HMC's global export hub. It currently exports to around 88 countries across Africa, Middle East, Latin America, Australia, and Asia Pacific.

To support its growth and expansion plans, HMIL currently has 522 dealers and more than 1,298 service points across India. In its commitment to provide customers with cutting-edge global technology, Hyundai has a modern multi-million-dollar R&D facility in Hyderabad. The R&D center endeavors to be a center of excellence in automobile engineering.

TECHNOLOGY IN HUYNDAI SUPPLY CHAIN

The MoU will allow Hyundai Construction Equipment to use KT's 5G communication network and its artificial intelligence (AI) technology to enhance its logistics capabilities. Ten officers were in attendance to evidence the signing of the agreement for smart construction outfit and material administration.

The agreement will enable the combination of the two companies' technologies, with the independent vehicle technology of Hyundai Construction Equipment and the information and communication technologies of KT working together. The objective of the collaboration will be to supply the global market with advanced smart logistics solutions.

Hyundai Construction Equipment was the first company in Korea to develop and launch driverless, independent forklift trucks, and the MoU will help to enhance the remote operation and position of control of these independent forklift trucks. The trucks will also profit from a remote service system, operated by an artificial intelligence voice control result, videotape, and hyped reality (AR).

By carrying work out along a easily planned out and defined route, the threat of plant incidents or accidents is significantly reduced. The ongoing COVID-19 epidemic has also led to a swell in demand for no- contact results within the force chain, with social distancing being put in place in manufactories and workplaces around the world.

KT is continuing to work nearly with the Hyundai Heavy assiduity Group to enhance and upgrade its smart manufactory and smart shipyard business, combining its 5G, big data.

TECHNOLOGY INNOVATION IN HYUNDAI

The age of smart automobiles is approaching apace as motorcars are progressively making full use of electronic technology developments. There are formerly cars out there which can drive themselves, automatically accommodate speed and initiative into the hard shoulder in emergency situations.

Smart Traffic Jam Assist

In stop-and-go traffic, Traffic Jam Assist observes the road ahead with steering help control and automatically maintains a safe distance behind the car in front, accelerating and slowing as traffic allows at a steady speed.

Interactive Voice Recognition

Created with the rearmost IT development and the AVN system, the new technology enables an interactive voice recognition through the speaker or a button that allows the driver to control 'Siri (Apple's voice recognition service)' and the mobile phone with ease.

Night View

The advanced characteristic of the real-time camera display provides the driver with optimized road visibility and enhanced safety for night driving conditions.

Highway Driving Assist

Designed to enhance the driving support system, Highway Driving Assist System integrates longitudinal and side control for the speed range under 150kph and assists driver steering while keeping the vehicle at a safe distance with Advanced Smart Cruise Control (ASCC) for a more effective and safer driving on an expressway.

CHAPTER – 2

LITERATURE REVIEW

2.1 REVIEW OF LITERATURE

Fragapane et al..., (2020) smart- contract design by blockchain and supply chain adaptability offer perception on the setup of I4.0 through the development from flexible and reconfigurable manufacturing systems and lean manufacturing towards production surroundings build by a composition of IoT, big data, electric vehicles, 3D printing, cloud computing, artificial intelligence, and cyber-physical systems.

Oztemel and Gursev (2020) define I4.0 as ‘a methodology to induce a changeover from machine dominant manufacturing to digital manufacturing’.

Raj et al..., (2020) perform across-country analysis of hedges for I4.0 relinquishment. High investment in I4.0 execution, lack of clarity regarding profitable benefit, challenges in value- chain integration, lack of architecture, and lack of digital experience and digital culture have been associated as critical problems for I4.0 adoption.

Radouane et al..., (2019) Growth of a providence and its technological geography are immensely impacted by the state of the auto manufacturing assiduity, which is considered to be one of the most important parts of the manufacturing segments.

Tang and Veelenturf (2019) Concentrated on the logistics issues in the I4.0 period and linked cumulative manufacturing, advanced robotics, artificial intelligence, independent vehicles, blockchain, drones, Internet-of- Things (IoT) as major technologies to execute I4.0. Some operations of operations exploration, industrial engineering, and control methodologies to OM problems in the I4.0 environment have been shown for shop bottom control.

Khan and Wisner, (2019) Synchronization between all the members of the supply chain plays a vital part in meeting stakeholders' demand, achieving client satisfaction, and making a positive impact on the terrain as well as on society.

SIAM, (2019) the automobile assiduity has evolved into a matrix of product parts and production categories. The performance of the assiduity is estimated through both categories and partitions of OEMs.

Oliveira et al..., (2018) the industry has a multi-fold donation covering foremost change in product processes and the progression of technological innovation and operation.

Veeramani and Nagraj, (2018) the Indian automobile industry is an important element in the Indian frugality and ranked 7th across the world in terms of volume of output.

Katiyar et al..., (2018) Supply chain performance has been broadly delved both theoretically and empirically. The abstract base of supply chain performance and related architectures has been the base a lot of experimenters.

Mittal et al..., (2018) under- line the part of leadership and functional capabilities needed for I4.0 relinquishment. They develop a maturity model of transition to I4.0 connecting production and logistics operation processes with IoT and mastermind-architectures.

Mujkić et al..., (2018) Effective SCM leads to the sustainability of the supply chain and supply chain optimization. Sustainability is a critical aspect of the supply chain and in turn, to the overall business. Effective supply chains are imperative for on- time high- quality delivery. An establishment's interest in profitable sustainability is driven by profit maximization. The enterprises have considered profitable pointers affiliated to cost reduction and profit growth as their long- term decision- making objectives.

Vázquez et al..., (2016) the automobile supply chain (ASC) is a lengthy and entangled chain, the effectiveness of which depends upon the combined capability of the chain rather of the capabilities of many players in the league.

Vázquez et al..., (2016) Studies have also shown that enhancement in distribution effectiveness, reduction in cycle time, reduction of operating cost, effective client demand and stock operation, working capital management, quality operation and client satisfaction lower supply chain threat.

Bhattacharya et al..., (2014) The case of Indian ASC is further characterized with low technological capability, a large number of automobile assemblers, low delivery and distribution dependability, lower capacity of automobile ancillary enterprises, poor rear logistics and lack of collaboration among the partners along the supply chain.

Pero and Lamberti, (2013) it has been proved that the interface between the supply chain and marketing function plays a critical function in the new product development stage.

Berk et al..., (2013) the supply chain design in the automobile sector is determined by the market parts, the league mates and the original outfit manufacturers (OEMs), which in turn, affect the modeling and performance of the individual supply chain.

Rasiah (2011) still, significantly unlike these countries the Indian auto assiduity consists of regional enterprises with indigenous design and development capability, well established global brands and has marketing presence in the Indian as well as other arising markets.

Uchikawa, (2011) the performance of the Indian automobile assiduity is dependent upon the smooth integration of individual categories like the global automobile assiduity. The application in the automobile assiduity consists of multiple categories, for illustration, raw material suppliers, auto- element manufacturers, sub assemblers, and final assemblers.

Ellinger et al..., (2011) the financial performance of the companies is dependent upon the supply chain design borrowed. Research has shown a positive relationship between financial performance in terms of working capital, profit, and operating costs of the company with supply chain operation (SCM) capability. Assiduity famed companies with qualified SCM have better financial performance.

Liao et al..., (2010) the industry continually strives to explore ways to accelerate supply chain performance taking into account the technological aspects and complications in its factors in addition to challenges being faced in product cost, quality and lifecycle, time to deal , timely delivery, client services, pricing issues, supplier collaboration, diversification of products and environmental issues. In the global market atmosphere, the relationship between supply operation, supply adaptability and supply chain performance has been studied and was proved to be a positive relationship which leads to better supply chain performance.

[FICCI], (2010) Hyundai, the South Korean company, has surfaced as the biggest exporter of the country, by exporting further than cars annually from India (Federation of Indian Chambers of Commerce and Industry).

KPMG AutoSurvey, (2010) The Indian OEMs substantially feed to the domestic market in which two/ three-wheelers and small passenger cars are major contributors to the assiduity. Low- cost manpower, friendly manufactured policy, drop in perpendicular integration, concentrate towards lean manufacturing and increased participation in the global production network helped in the growth of the assiduity and contributed towards adding export.

Olugu et al..., (2010) in the present demanding terrain, automakers can distinguish themselves from their challengers by a superior supply chain. The current trend in the automobile assiduity suggests the need for companies to review their supply chain strategies, layouts, and operations. The company's upstream measures of the forward supply chain are being looked upon to assure supplier commitment and downstream measures are shouldered by the manufacturer to assure clients satisfaction. An effective and effective global supply chain is an essential for automobile manufacturers and their suppliers.

Nair, (2009) From the start of 2000 numerous MNC automobile enterprises similar as Hyundai Motors, Nissan, Toyota, Volkswagen, and Suzuki have set up production establishments in India to serve Indian domestic as well as overseas markets. By 2010 this redounded in India arising as a mecca for the production of passenger cars. For illustration, automobile exports to the UK have grown by over 8 times from\$ 52 million in 2006-07 to\$ 481 million in 2009-10. By 2009 India (0.23 m) surpassed China (0.16 m) as Asia's fourth-largest exporter of cars after Japan (1.77 m), Korea (1.12 m), and Thailand (0.26 m).

Wang et al..., (2006) Virtual integration using the IT- enabled system needs to be an integral part of the ASC to guaranty synchronization across the chain.

Saad and Patel, (2006) Utmost of these performance measurement tools are used from the establishment's perspective rather than assiduity perspective and suffered from the limitation of drive towards supply chain performance measure blocking at the establishment's boundary.

Nelson (2004) points out that technological capability development consists of much further than a reproduction of the manufactured technologies and institutions of advanced economies.

Hahn et al..., (2000) hence, the supply chain of the automobile assiduity becomes complex passing through the categories before it reaches the end clients from distributors.

Stank, and Arango, (1999) in recent times, experimenters have accepted an evaluation of different functional aspects and supply chains. It has been formerly linked that cooperative integration between marketing and logistics functions impacts firm performance relative to challengers.

CHAPTER – 3

METHODOLOGY

3.1 RESEARCH METHODOLOGY

Research methodology is needed for the purpose of framing the research process and designs tools that are to be used for the project purpose. More specifically, it's about systematically designing a study to ensure valid and reliable results that address the research aims and objectives. Our research methodology helps to find, how the technology innovation and capability of automobile industry in Chennai. This time research methodology is framed for the purpose of analyzing and assessing the technology innovation and capability of automobile industry in Chennai.

3.2 NEED, SCOPE, AND OBJECTIVES

NEED FOR THE STUDY

This study was based on, how the technology plays a vital role in capability and performance of the automobile industry SCM, For this concept of technology innovation supply chain management in automobile industry **HYUNDAI MOTOR INDIA.LTD** was takes as an example, Because of their biggest contribution to smart tech by successfully implementing and pursuing advanced technology innovation in several ways by understanding the customers future needs for feasible and safe driving.

SCOPE OF THE STUDY

- To study analyzes, how technology innovation is implemented in supply chain management in the automobile industry in Chennai.
- To study analyzes the importance of technology and capability in automobile supply chain management.
- To study asses the efficiency of technology in automobile supply chain Management.

OBJECTIVES OF THE STUDY

- To study the technological innovation effects on supply chain management in automobile industry.
- To study the challenging factors in implementing the supply chain technology innovation in organization.

3.3 LIMITATIONS OF THE STUDY

- The sample size is small.
- The study time duration less.
- The demographical variables effect on the depending variables are not satisfied.
- The data is collected on the online forms than hands on guide.

3.4 POPULATION, SAMPLING AND QUESTIONNAIRE SURVEY

Sampling is a vital strategy in a statistical analysis, which comprises a selection of a few portions of a potential population to assess or learn something from the population at a cheaper cost. Simple random sampling (SRS), popularly known as “random sampling”, includes the selection of sample at arbitrary from the sampling frame utilizing either random number tables or an internet arbitrary number generator. The questionnaire comprises close-ended and open-ended questions with multiple choice options. The survey questionnaire is designed online, hosted in google drive and shared in a google form. Link to the google form is shared on professional platforms such as LinkedIn and construction professionals’ forums, as well as direct emails sent to managers. A total of 100 responses were received. The survey questionnaire was structured under the following subheadings of demography, project status due to e-commerce effectiveness, flexibilities and other comments.

3.5 PERCENTAGE ANALYSIS

Percentage analysis is the method to represent raw streams of data as a percentage (a part in 100 - percent) for better understanding of collected data. A percent change analysis shows how two items changed as a percentage from one period to another period. Used on a balance sheet, a percent change analysis shows how a balance sheet account changes from year to year, or quarter to quarter. The balance sheet accounts are assets, liabilities, and stockholders' equity. Percentage Statement Analysis is an analysis which highlights important relationships in the percentage statements.

Percentage Statement analysis embraces the methods used in assessing and interpreting the results of past performance and current percentage position as they relate to factors of interest in investment decisions. It is an important means of assessing past performance and in forecasting and planning future performance.

Percentages are often used to express a proportionate part of a total. If 50% of the total number of students, long before the existence of the decimal system, computations were often made in fractions. The term "percent" is derived from the Latin per centum, meaning "hundred" or "by the hundred". The Percentage increase and decrease. Due to inconsistent usage, it is not always clear from the context what a percentage.

Percentage is used to understand and interpret data. The nth percentage of a set of data is the value at which n percent of the data is below it. In everyday life, percentage are used to understand values such as test scores, health indicators, and other measurements. For example, an 18-year-old male who is six and a half feet tall is in the 99th percentage for his height. This means that of all the 18-year-old males, 99 percent have a height that is equal to or less than six and a half feet. An 18-year-old male who is only five and a half feet tall, on the other hand, is in the 16th percentage for his height, meaning only 16 percent of males his age is the same height or shorter.

The original variation between the actual value and the calculated value extracted in the form of percentage is termed to be the percentage error. This tool is used to measure whether the data collection is progressing in the right direction and is mostly used by corporate companies and statistic experts. If taken the context of academic career, the

percentage error formula is very crucial for the students pursuing their degrees in the discipline of economics and science. While conducting a study or calculations from the figures provided in a database, various errors could occur.

Majorly the percentage error formula is used to determine how accurate the calculated value is by keeping in mind the actual value. I mentioned in a very rough language, it is the variation of the gap between the calculated value and the genuine value expressed in the form of a percentage. Commonly, the extent of the percentage error is expressed in the positive denominations, although having a negative percent error is not a wrong approach. Relying on the sign of the percentage error measure, it could be analyzed whether the calculated value is being paced below or higher to the actual value. The tool of percentage error formula is one of the most reliable and accurate tools in calculating the relative error by keeping the original measure as the basis.

3.6 STATISTICAL ANALYSIS

Statistical analysis is the science of collecting, exploring and presenting large amounts of data to discover underlying patterns and trends. Statistics are applied every day in research, industry and government to become more scientific about decisions that need to be made.

Importance

Statistical analysis is a study, a science of collecting, organizing, exploring, interpreting, and presenting data and uncovering patterns and trends. Many businesses rely on statistical analysis and it is becoming more and more important. One of the main reasons is that statistical data is used to predict future trends and to minimize risks.

DESCRIPTIVE ANALYSIS

The descriptive statistic is used to describe the basic features of information and shows or summarizes data in a rational way. Descriptive statistics is a study of quantitatively describing. This type of statistics draws in all of the data from a certain population or a sample of it. Descriptive statistics can include numbers, charts, tables, graphs, or other data visualization types to present raw data. However, descriptive statistics do not allow

making conclusions. We cannot get conclusions and generalize that extend beyond the data at hand. With descriptive statistics, you can simply describe what is and what the data present.

INFERENTIAL TYPE

This type of statistical analysis is used to study the relationships between variables within a sample, and we can make conclusions, generalizations or predictions about a bigger population. In other words, the sample accurately represents the population.

Moreover, inference statistics allows businesses and other organizations to test a hypothesis and come up with conclusions about the data. One of the key reasons for the existing of inferential statistics is because it is usually too hard to study an entire population of people or objects.

3.7 RESEARCH TESTS

ANOVA

ANOVA in SPSS is used as the test of means for two or more populations. ANOVA in SPSS must have a dependent variable which should be metric (measured using an interval or ratio scale). ANOVA in SPSS must also have one or more independent variables, which should be categorical in nature.

CHI-SQUARE

The Chi-Square Test of Independence determines whether there is an association between categorical variables, whether the variables are independent or related. It is a nonparametric test. This test is also known as Chi-Square Test of Association.

CORRELATION

Correlation analysis in research is a statistical method used to measure the strength of the linear relationship between two variables and compute their association. Simply put correlation analysis calculates the level of change in one variable due to the change in the other.

3.8 RESEARCH DESIGN

From the objective we have studied the automation of online retail industry. To analyze this different data, have to be collected from various retail industries such as in what way the automation plays a vital role in their industry and what are the barriers to implement this concept also been discussed.

3.9 HYPOTHESIS TESTING

- **H0:** There is no relationship between performance and technology.
H1: There is a relationship between performance and technology.

- **H0:** There is no relationship between performance and employee competency.
H1: There is a relationship between performance and employee competency.

- **H0:** There is no relationship between performance and flexibility.
H1: There is a relationship between performance and flexibility.

CHAPTER – 4

DATA ANALYSIS AND INTERPERTATIONS

4.1 PERCENTAGE ANALYSIS

S.NO	PARTICULARS	NO OF RESPONSES	PERCENTAGE
1	Male	54	54.00%
2	Female	46	46.00%
Total		100	100%

TABLE 4.1.1 representing Gender of the respondents

INTERPRETATION:

Out of 100 respondent's male respondents are 54.00 percentage and female respondents are 46.00 percentage

S.NO	PARTICULARS	NO OF RESPONSES	PERCENTAGE
1	27-35	46	46.00%
2	36-44	40	40.00%
3	45-55	14	14.00%
Total		100	100%

TABLE 4.1.2 representing Age group of the respondents

INTERPRETATION:

Out of 100 respondents, 46.00 percentage of the respondents are aged between 27-35, 40.00 percentage of the respondents are aged between 36-44, and 14.00 percentage of respondents are aged between 45-55.

S.NO	PARTICULARS	NO OF RESPONSES	PERCENTAGE
1	Doctorate	34	34.00%
2	Post-Graduate	42	42.00%
3	Under-Graduate	24	24.00%
Total		100	100%

TABLE 4.1.3 Representing Educational qualification of the respondents

INTERPRETATION:

Out of 100 respondents, 34.00 percentage of respondents belong to Doctorate, 42.00 of the respondents belong to post-Graduate and the remaining 24.00 percentage of the respondents are Under-Graduate.

S.NO	PARTICULARS	NO OF RESPONSES	PERCENTAGE
1	employee	70	70.00%
2	Self-employed	30	30.00%
Total		100	100%

TABLE 4.1.4 Representing Occupation of the respondents

INTERPRETATION:

Out of 100 respondents, 70.00 percentage of the respondents were employee, and 30.00 percentage of the respondents were self-employed.

S.NO	PARTICULARS	NO OF RESPONSES	PERCENTAGE
1	Below 20K	23	23.00%
2	20K – 30K	17	17.00%
3	30K – 40K	23	23.00%
4	40K – 50K	18	18.00%
5	Above 50K	19	19.00%
Total		100	100%

TABLE 4.1.5 representing income of the respondents

INTERPRETATION:

Out of 100 respondents, 23.00 percentage of the respondents comes under the category of income Below 20K, 17.00 percentage of the respondents comes under the category of income between 20K – 30K, 23.00 percentage of the respondents comes under the category of income between 30K – 40K, 18.00 percentage of the respondents comes under the category of income 40K – 50K and 19.00 percentage of the respondent comes under the category of income above 50K.

4.2 STATISTICAL ANALYSIS

4.2.1 CORRELATION

PERFORMANCE AND TECHNOLOGY

HYPOTHESIS TESTING:

H0: There is no relationship between performance and technology.

H1: There is a relationship between performance and technology.

Correlation				
			Performance	Technology
Spearman's rho	Performance	Correlation Coefficient	1.000	.702**
		Sig. (2-tailed)	.	.000
		N	100	100
	Technology	Correlation Coefficient	.702**	1.000
		Sig. (2-tailed)	.000	.
		N	500	500
**. Correlation is significant at the 0.00 level (2-tailed).				

Table 4.2.1.1 representing the correlation between Performance and Technology.

INTERPRETATION:

From the table, it is interpreted that the significance value is 0.00 which is less than 0.05 and less than the critical value 1, so the null hypothesis rejected, and alternative hypothesis got accepted. Thus, there is a relationship between performance and technology.

PEERFORMANCE AND EMPLOYEE COMPENTENCY

HYPOTHESIS TESTING:

H0: There is no relationship between performance and employee competency.

H1: There is a relationship between performance and employee competency.

Correlation				
			Performance	Employee competency
Spearman's rho	Performance	Correlation Coefficient	1.000	.502**
		Sig. (2-tailed)	.	.001
		N	100	100
	Employee competency	Correlation Coefficient	.502**	1.000
		Sig. (2-tailed)	.001	.
		N	100	100
	**. Correlation is significant at the 0.01 level (2-tailed).			

Table 4.2.1.2 representing the correlation between Performance and Employee competency.

INTERPRETATION:

From the table, it is interpreted that the significance value is 0.01 which is less than 0.05 and less than the critical value 1, so the null hypothesis rejected and alternative hypothesis got accepted. Thus, there is a relationship between performance and employee competency.

PERFORMANCE AND FLEXIBILITY

HYPOTHESIS TESTING:

H0: There is no relationship between technological performance and flexibility.

H1: There is a relationship between technological performance and flexibility.

Correlation				
			Performance	Flexibility
Spearman's rho	Performance	Correlation Coefficient	1.000	.802**
		Sig. (2-tailed)	.	.001
		N	100	100
	Flexibility	Correlation Coefficient	.802**	1.000
		Sig. (2-tailed)	.001	.
		N	100	100
**. Correlation is significant at the 0.01 level (2-tailed).				

Table 4.2.3. Representing the correlation between Performance and Flexibility.

INTERPRETATION:

From the table, it is interpreted that the significance value is 0.01 which is less than 0.05 and less than the critical value 1, so the null hypothesis rejected and alternative hypothesis got accepted. Thus, there is a relationship between performance and flexibility.

4.2.2 CHI SQUARE

PERFORMANCE AND TECHNOLOGY

HYPOTHESIS TESTING:

H0: There is no association between performance and technology.

H1: There is an association between performance and technology.

		Chi-square and df	Fishers Exact Test	Total
	Performance	Pearson	Sig 2 sided	
Technology	Strongly agree	6.0 & 4.8	.001	94
	Agree	6.0 & 4.8	.001	6
Total				100

Table 4.2.2.1 representing the correlation between Performance and Technology.

INTERPRETATION:

From the table, It is interpreted that the significance value is 0.001, which was less than 0.5, So the null hypothesis rejected and alternative hypothesis got accepted with the chi square value 6.0 and 4.8. Thus, there is an association between performance and technology.

PERFORMANCE AND EMPLOYEE COMPETENCY

HYPOTHESIS TESTING:

H0: There is no association between performance and employee competency.

H1: There is an association between performance and employee competency.

		Chi-square and df	Fishers Exact Test	Total
	Performance	Pearson	Sig 2 sided	
Employee competency	Strongly agree	7.5 & 6.5	.001	91
	Agree	7.5 & 6.5	.001	9
Total				100

Table 4.2.2.2 representing the correlation between Performance and Employee competency.

INTERPRETATION:

From the table, it is interpreted that the significance value is 0.001, which was less than 0.5. So, the null hypothesis rejected, and alternative hypothesis got accepted with the chi square value 7.5 and 6.5. Thus, there is an association between performance and employee competency.

PERFORMANCE AND FLEXIBILITY

HYPOTHESIS TESTING:

H0: There is no association between purchase performance and flexibility.

H1: There is an association between purchase performance and flexibility.

		Chi-square and df	Fishers Exact Test	Total
	Performance	Pearson	Sig 2 sided	
Flexibility	Strongly agree	5.0 & 5.5	.001	90
	Agree	5.0 & 5.5	.001	10
Total				100

Table 4.2.2.3 representing the correlation between Performance and Flexibility

INTERPRETATION:

From the table, it is interpreted that the significance value is 0.001, which was less than 0.5. So, the null hypothesis rejected, and alternative hypothesis got accepted with the chi square value 5.0 and 5.5. Thus, there is an association between purchase decision and customer satisfaction.

4.2.3 ANOVA

HYPOTHESIS TESTING

HO: There is no relationship between the dependent variable (Performance) and independent variable (Technology, Employee competency, Flexibility)

H1: There is relationship between the dependent variable (Performance) and independent variable (Technology, Employee competency, Flexibility)

Performance		Sum of Squares	df	Mean Square	F	Sig.
Technology	Between Groups	1.783	8	.594	5.312	.001
	Within Groups	55.505	92	.112		
	Total	57.288	100			
Employee competency	Between Groups	1.739	10	.580	5.108	.002
	Within Groups	56.283	90	.113		
	Total	58.022	100			
Flexibility	Between Groups	1.703	9	.568	4.935	.002
	Within Groups	57.049	91	.115		
	Total	58.752	100			

INTERPRETATION:

Above table states that, there is a relationship between dependent variable and independent variable because of the strong F value, which was greater than the significance value Technology $5.312 > 0.001$, Employee competency $5.108 > 0.002$, Flexibility $4.935 > 0.002$ So, the null hypothesis rejected and alternative hypothesis got accepted.

CHAPTER – 5

RESULTS AND DISCUSSION

5.1 FINDINGS

- Out of 100 respondent's male respondents are (54%) and female respondents are (46%).
- Out of 100 respondents, (46%) of the respondents are aged between 27-35, (40%) of the respondents are aged between 36-44, and (14%) of respondents are aged between 45-55.
- Out of 100 respondents, (34%) of respondents belong to Doctorate, (42%) of the respondents belong to post-graduate and the remaining (24%) of the respondents are under-graduate.
- Out of 100 respondents, (70%) of the respondents were self-employee, and (30%) of the respondents were self-employed.
- Out of 100 respondents, (23%) of the respondents comes under the category of income Below 20K, (17%) of the respondents comes under the category of income between 20K – 30K, (23%) of the respondents comes under the category of income between 30K – 40K, (18%) of the respondents comes under the category of income 40K – 50K and (19%) of the respondent comes under the category of income above 50K.
- Out of 100 respondents, Majority (54%) of respondents agreed that the company has a network of IT systems highly integrated with key suppliers, Majority (54%) of respondents agreed that the company shares information in real time through IT with key suppliers, Majority (36%) of respondents agreed that the company works to have a better alignment of IT with key suppliers, Majority (36%) of respondents agreed that the company shares demand forecasts and production planning with suppliers, Majority (30%) of respondents agreed that the company can add, modify and remove IT components easily and without causing negative effects on performance.

- Out of 100 respondents, Majority (45%) of respondents agreed that the employees have an adequate knowledge of the different functions of the SC, Majority (42%) of respondents agreed that the employees communicate effectively with the different parts of the SC, Majority (54%) of respondents agreed that the employees are trained and continuously trained to perform the functions of the SC, Majority (36%) of respondents agreed that the employees work as a team constantly to implement inter-organizational projects, Majority (42%) of respondents agreed that the employees identify ways to improve efficiency and effectiveness in the face of environmental changes.
- Out of 100 respondents, Majority (45%) of respondents agreed that in relation to competitors, we have processes that can adjust to changes in volume and mix of products quickly, Majority (42%) of respondents agreed that in relation to competitors, the company develops and markets new products more quickly and effectively, Majority (45%) of respondents agreed that the company can ensure the availability of material against changes, Majority (42%) of respondents agreed that the company can adapt to delivery schedules and meet customer requirements, Majority (42%) of respondents agreed that the company can implement structural changes in the organization effectively.
- Out of 100 respondents, Majority (45%) of respondents agreed that the company can modify its products quickly to meet customer requirements, Majority (33%) of respondents agreed that the company responds quickly to changes in market demand, Majority (45%) of respondents agreed that the company complies with the delivery dates and quantities promised consistently, Majority (36%) of respondents agreed that the company provides a high level of service to its key customers, Majority (42%) of the respondents agreed that the company considers the management of the SC as vital in the activities of the business.

5.2 SUGGESTIONS

- Automobile industries should enhance further knowledge on trending technology innovation in supply chain management and to borrow the compatible ways of implementing/ practicing the futuristic supply chain in their manufacturing establishment.
- Each and every automobile assiduity should accommodate technologies which increase the capability of the supply chain management.
- The management should train their workers to work with up-to- date technology so that they're used effectively and reduce time holdups.
- In the age of big data, advanced data analytics informs varied opinions throughout the lifecycle of a vehicle. Data gathered from vehicles enables prophetic conservation, informs directors about their lines, and cautions concerned authorities in case of accidents. Also, client automotive data finds operations in driving deals, optimizing supply chains, and enhancing product design for newer vehicles.
- Blockchain finds multiple operations in the automotive assiduity. These include sharing vehicle data over a secure network for connectivity and shared mobility results similar as lift- hailing, urban transportation, and deliveries.
- 3D printing helps the automotive assiduity in three primary ways. Initially, it enables quick prototyping with 3D printed models that accelerate the design and testing phases of production.

- In the automotive assiduity, IoT enables secure communication between vehicles as well as vehicles and architecture elements. The technology improves road safety, solves traffic jam, and reduces pollution and energy expenditure with better line management. Startups and arising companies develop advanced seeing technologies to gather further data about the vehicle as well as allow the vehicle to understand its surroundings. The technology also automates payments for power and expenses.

5.3 CONCLUSION

This research study based on technology innovation in the automobile industry that are highlights for the effective capability in supply chain management. The adoption of technology innovation in automobile industry has some of barriers but than most of the respondents responding positively the overall technology innovation and capability of the automobile industry is with the satisfactory level. Moreover, the COVID-19 pandemic-the unprecedented challenge for manufacturing industry- has clearly shown and highlighted the importance of technology and cloud manufacturing, proactive scheduling and SC mapping. Firms with established technologies for manufacturing visibility and digital control were able to react to disruptions more flexible and responsive. The three-stage segmental analysis of the Indian automobile industry has brought out some unique features in SCM of the respective segments. Not only that, compared with the previous production technology, the application of this new technology can minimize the probability of work error, so that the overall quality of production work can be significantly improved. Automobile companies can also occupy a higher market share in a complex market environment and strengthen their competitiveness.

This analysis established the segmental difference in ASC performance and the impact of ASC performance on profitability across the segments. The SCPIs of the segments have established that the impact of distribution inefficiency is more for the two/three-wheelers and commercial vehicles segments compared to the passenger vehicles. Hence the firms in these segments should invest in automated distribution focusing on reduced cost.

This article contributes towards finding key segmental supply chain performance features of the Indian automobile industry, which can help firms in the respective segments to enhance their supply chain performance. The article also aids to building a panel data fixed effect regression model by integrating supply chain performance indicators with the profitability of the firms across the automobile industry segments. Thereby, it aims to assess the significance of the impact of supply chain performance on profitability. This model can facilitate firms to identify the vital supply chain aspects that need to be improved to enhance profitability.

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- <https://assets.kpmg/content/dam/kpmg/pdf/2015/08/ACMA.pdf>
- <https://www.aiag.org/supply-chain-management>

A STUDY ON THE TECHNOLOGICAL INNOVATION AND CAPABILITY OF THE AUTOMOBILE INDUSTRY IN CHENNAI

* Required

1. GENDER *

Mark only one oval.

- ☐ MALE
☐ FEMALE

2. AGE *

Mark only one oval.

- ☐ 27-35
☐ 36-44
☐ 45-55

3. EDUCATIONAL QUALIFICATION *

Mark only one oval.

- ☐ UNDER GRADUATE
☐ POST GRADUATE
☐ DOCTORATE

4. OCCUPATION *

Mark only one oval.

- ☐ EMPLOYEE
- ☐ SELF-EMPLOYED

5. MONTHLY INCOME *

Mark only one oval.

- ☐ BELOW 20K
- ☐ 20K-30K
- ☐ 30K-40K
- ☐ 40K-50K
- ☐ ABOVE 50K

6. TECHNOLOGY *

Mark only one oval per row.

	STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE
The company has a network of IT systems highly integrated with key suppliers	☐	☐	☐	☐	☐
The company shares information in real time through IT with key suppliers	☐	☐	☐	☐	☐
The company works to have a better alignment of IT with key suppliers	☐	☐	☐	☐	☐
The company shares demand forecasts and production planning with suppliers	☐	☐	☐	☐	☐
The company can add, modify and remove IT components easily and without causing negative effects on performance	☐	☐	☐	☐	☐

7. EMPLOYEE COMPETENCY *

Mark only one oval per row.

	STRONGLY AGREE	AGREE	NETURAL	DISAGREE	STRONGLY DISAGREE
The employees have an adequate knowledge of the different functions of the SC	☐	☐	☐	☐	☐
The employees communicate effectively with the different parts of the SC	☐	☐	☐	☐	☐
The employees are trained and continuously trained to perform the functions of the SC	☐	☐	☐	☐	☐
Employees work as a team constantly to implement inter-organizational projects	☐	☐	☐	☐	☐
Employees identify ways to improve efficiency and effectiveness in the face of environmental changes	☐	☐	☐	☐	☐

8. FLEXIBILITY **Mark only one oval per row.*

	STRONGLY AGREE	AGREE	NETURAL	DISAGREE	STRONGLY DISAGREE
In relation to competitors, we have processes that can adjust to changes in volume and mix of products quickly	☐	☐	☐	☐	☐
In relation to competitors, the company develops and markets new products more quickly and effectively	☐	☐	☐	☐	☐
The company can ensure the availability of material against changes	☐	☐	☐	☐	☐
The company can adapt to delivery schedules and meet customer requirements	☐	☐	☐	☐	☐
The company can implement structural changes in the organization effectively	☐	☐	☐	☐	☐

9. PERFORMANCE *

Mark only one oval per row.

	STRONGLY AGREE	AGREE	NETURAL	DISAGREE	STRONGLY DISAGREE
The company can modify its products quickly to meet customer requirements	☐	☐	☐	☐	☐
The company responds quickly to changes in market demand	☐	☐	☐	☐	☐
The company complies with the delivery dates and quantities promised consistently	☐	☐	☐	☐	☐
The company provides a high level of service to its key customers	☐	☐	☐	☐	☐
The company considers the management of the SC as vital in the activities of the business	☐	☐	☐	☐	☐

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A STUDY ON TECHNOLOGICAL INNOVATION AND CAPABILITY OF THE AUTOMOBILE INDUSTRY IN CHENNAI.

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ABSTRACT

The automobile industry is broadly categorized into three segments—commercial vehicles, passenger vehicles and two/three-wheelers. The automobile supply chain is complex, as this includes raw material suppliers, component manufacturers, sub assemblers, final assemblers, different distribution channels, networks and end consumers. The objectives of this article are to find segmental differences in the supply chain performance of the Indian automobile industry and to quantify the impact of supply chain performance on the overall profitability of the firms across the segments. In particular, the application range of automation technology has become more extensive, because automation technology itself has more advantages and cannot be replaced by many other traditional technologies. Thanks to the application of high-precision automation technology, all work can be carried out continuously by established computer programs. In this way, the number of errors caused by human work is actually reduced, and the rate of the product can also take this opportunity to be significantly improved. When performing various tasks, workers in the mechanical manufacturing field will actively apply the most suitable automation technology according to their actual conditions, and organically integrate their valuable work experience with brand-new automation technology. This allows all work to be of higher quality in the implementation process.

INTRODUCTION

SUPPLY CHAIN IN AUTOMOBILE INDUSTRY

The automobile industry is one of the most complex and information-intensive sectors. With innumerable companies taking thousands of corridors delivered to complete their manufacturing processes and deliver high-quality products, it's no wonder technology has drastically bettered the industry. Software systems combined with the internet allow manufacturers and distributors to search monstrously complex supplies instantly. With global logistics networks, companies can transport goods anywhere on the earth. The result is an automobile industry that can produce all features of products using encyclopedically sourced accoutrements for fast assembly and trade to the client. Supply chain operation involves enforcing software systems and operation strategies to strain up every stage of the manufacturing operation, beginning before customer orders and ending with product delivery. Force chain operation software incorporates technology and data collection to develop detailed logistics plans. In confluence with logistics software, colorful operation strategies help reduce recalls and returns, exclude waste and ameliorate profit perimeters.

The automobile and transportation force chain involves all incoming and gregarious accoutrements, services and corridor that pertain to your business operations. This means that the success of your enterprise depends on the trust ability and thickness of automobile manufacturing logistics. Several aspects of automobile and transportation industry SCM (force chain operation) are critical to its success and can be modified to suit your requirements better. These include integrating technology, relating and collecting data and producing detailed logistics plans. It can also involve employing innovative third-party logistics providers that can serve as linchpins in the force chain.

Supply chain operation in the automobile industry can be broken down into three core areas:

Using technologically able software platforms to collect and organize information and prognosticate and dissect trends.

TECHNOLOGY INNOVATION IN SUPPLY CHAIN

The automobile industry sat at a crossroads indeed before the health extremity of 2020. Evolving technology, globalization, urbanization and environmental enterprises have gathered to change the part of the auto within our diurnal lives. What's more, the development of both independent vehicles and electric vehicles change force chain stylish practices, fit new players into the industry, and bear updates across the industry to keep pace. Unnaturally, a lot of different mystification pieces need to work together seamlessly in order to produce a finished vehicle. Although COVID may have actually reinvigorated interest in particular vehicle power, it also revealed the fragility of global force chains. OEMs, retailers and element suppliers all need to review stylish practices and develop further sustainable and robust force chain connections in order to accommodate the change proceeding in the industry. The fleetly accelerating electric vehicle (EV) request has a major impact on force chains. In 2019, the global deals of EV units were further than two million. This is anticipated to grow further as some governments propose a ban on dealing diesel, petrol and cold-blooded vehicles.

Internet of Things

The new wave applications and in-vehicle innovations powered by the internet have gone beyond the application of RFID tags that used to regulate routing, inventorying, and loss prevention. Internet of automobile things are deeply embedded within the vehicle, in the logistics & production environments and the after-market service infrastructure. Various supply chain touch points are connected to the internet and work in tandem enabling visibility and information flow through a common enterprise platform. More and more auto companies are introducing technology enabled cars in their range of brands.

Big data

For automakers, big data is expanding the range of information used in decision making. Compared to the past when car manufacturers could only use a handful of experiences or a small pile of information, now they use big data for developing a new model or providing brand-new services. They also can predict the future of the automobile industry related to Mobility, Electrification, Connectivity, and Autonomous (M.E.C.A.).

AI

It's vital for vehicle manufacturers to be able to monitor every stage of a component's journey and know exactly when to expect its arrival at the destination plant. That's why modern supply chains often rely on cutting-edge IoT, block chain, and AI technologies. In particular, vehicle manufacturers can turn to solutions relying on different machine learning algorithms and AI-powered predictive analytic.

Blockchain

Automotive supply chain managers can use blockchain to multiple supply chain problems, like keeping complex databases and monitoring products and services. A far less corruptible and automated alternative to centralized databases is another advantage. In the field of monitoring and testing products and services, a blockchain-based automobile supply chain management system allows for accurate record-keeping and monitoring of provenance as product information is accessible via embedded sensors and RFID tags. Blockchain may trace the past of a commodity right from its origin to where it is in the present time. Also, this form of exact provenance monitoring can ensure fraud detection in any part of the supply chain. The car supply chain is a highly dynamic and big field with numerous participants, ranging from parts suppliers, producers to sellers. Delivering real customer value includes a review of existing infrastructure and business processes, as well as solutions that respect protection, confidentiality, and authorization permissions. Blockchain can prove an ideal solution. Blockchain can be used by automobile manufacturers to protect their brands against counterfeit goods and to build customer-centered business models.

OBJECTIVES OF THE STUDY

- To study the technological innovation effects on supply chainmanagement in automobile industry.
- To study the challenging factors in implementing the supply chaintechnology innovation in organization.

REVIEW OF LITERATURE

Fragapane et al..., (2020) smart- contract design by blockchain and supply chain adaptability offer perception on the setup of I4.0 through the development from flexible and reconfigurable manufacturing systems and lean manufacturing towards production surroundings build by a composition of IoT, big data, electric vehicles, 3D printing, cloudcomputing, artificial intelligence, and cyber-physical systems.

Oztemel and Gursev (2020) define I4.0 as ‘a methodology to induce a changeover from machine dominant manufacturing to digital manufacturing’.

Raj et al..., (2020) perform across-country analysis of hedges for I4.0 relinquishment. High investment in I4.0 execution, lack of clarity regarding profitable benefit, challenges in value- chain integration, lack of architecture, and lack of digital experience and digital culture have been associated as critical problems for I4.0 adoption.

Radouane et al..., (2019) Growth of a providence and its technological geography are immensely impacted by the state of the auto manufacturing assiduity, which is considered to be one of the most important parts of the manufacturing segments.

Tang and Veelenturf (2019) Concentrated on the logistics issues in the I4.0 period and linked cumulative manufacturing, advanced robotics, artificial intelligence, independent vehicles, blockchain, drones, Internet-of- Things (IoT) as major technologies to execute I4.0. Some operations of operations exploration, industrial engineering, and control methodologies to OM problems in the I4.0 environment have been shown for shop bottom control

Khan and Wisner, (2019) Synchronization between all the members of the supply chain plays a vital part in meeting stakeholders' demand, achieving client satisfaction, and making a positive impact on the terrain as well as on society.

SIAM, (2019) the automobile assiduity has evolved into a matrix of product parts and production categories. The performance of the assiduity is estimated through bothcategories and partitions of OEMs.

Oliveira et al..., (2018) the industry has a multi-fold donation covering foremost change in product processes and the progression of technological innovation and operation.

Veeramani and Nagraj, (2018) the Indian automobile industry is an important element inthe Indian frugality and ranked 7th across the world in terms of volume of output.

Katiyar et al..., (2018) Supply chain performance has been broadly delved both theoretically and empirically. The abstract base of supply chain performance and relatedarchitectures has been the base a lot of experimenters.

Mittal et al..., (2018) under- line the part of leadership and functional capabilities neededfor I4.0 relinquishment. They develop a maturity model of transition to I4.0 connecting production and logistics operation processes with IoT and mastermind-architectures.

Mujkić et al..., (2018) Effective SCM leads to the sustainability of the supply chain and supply chain optimization. Sustainability is a critical aspect of the supply chain and in turn,to the overall business. Effective supply chains are imperative for on- time high- quality delivery. An establishment's interest in profitable sustainability is driven by profit maximization. The enterprises have considered profitable pointers affiliated to cost reduction and profit growth as their long- term decision- making objectives.

Vázquez et al..., (2016) the automobile supply chain (ASC) is a lengthy and entangled chain, the effectiveness of which depends upon the combined capability of the chain rather of the capabilities of many players in the league.

Vázquez et al..., (2016) Studies have also shown that enhancement in distribution effectiveness, reduction in cycle time, reduction of operating cost, effective client demand and stock operation, working capital management, quality operation and client satisfaction lower supply chain threat.

Bhattacharya et al..., (2014) The case of Indian ASC is further characterized with low technological capability, a large number of automobile assemblers, low delivery and distribution dependability, lower capacity of automobile ancillary enterprises, poor rear logistics and lack of collaboration among the partners along the supply chain.

Pero and Lamberti, (2013) it has been proved that the interface between the supply chain and marketing function plays a critical function in the new product development stage.

Berk et al..., (2013) the supply chain design in the automobile sector is determined by the market parts, the league mates and the original outfit manufacturers (OEMs), which in turn, affect the modeling and performance of the individual supply chain.

Rasiah (2011) still, significantly unlike these countries the Indian auto assiduity consists of regional enterprises with indigenous design and development capability, well established global brands and has marketing presence in the Indian as well as other arising markets.

Uchikawa, (2011) the performance of the Indian automobile assiduity is dependent upon the smooth integration of individual categories like the global automobile assiduity. The application in the automobile assiduity consists of multiple categories, for illustration, raw material suppliers, auto- element manufacturers, sub assemblers, and final assemblers.

Ellinger et al..., (2011) the financial performance of the companies is dependent upon the supply chain design borrowed. Research has shown a positive relationship between financial performance in terms of working capital, profit, and operating costs of the company with supply chain operation (SCM) capability. Assiduity famed companies with qualified SCM have better financial performance.

NEED FOR THE STUDY

This study was based on, how the technology plays a vital role in capability and performance of the automobile industry SCM, For this concept of technology innovation supply chain management in automobile industry **HYUNDAI MOTOR INDIA.LTD** was taken as an example, Because of their biggest contribution to smart tech by successfully implementing and pursuing advanced technology innovation in several ways by understanding the customers future needs for feasible and safe driving

RESEARCH METHODOLOGY

Research methodology is needed for the purpose of framing the research process and designs tools that are to be used for the project purpose. More specifically, it's about systematically designing a study to ensure valid and reliable results that address the research aims and objectives. Our research methodology helps to find, how the technology innovation and capability of automobile industry in Chennai. This time research methodology is framed for the purpose of analyzing and assessing the technology innovation and capability of automobile industry in Chennai.

RESEARCH TESTS

ANOVA in SPSS is used as the test of means for two or more populations. ANOVA in SPSS must have a dependent variable which should be metric (measured using an interval or ratio scale). ANOVA in SPSS must also have one or more independent variables, which should be categorical in nature.

CHI-SQUARE

The Chi-Square Test of Independence determines whether there is an association between categorical variables, whether the variables are independent or related. It is a nonparametric test. This test is also known as Chi-Square Test of Association.

CORRELATION

Correlation analysis in research is a statistical method used to measure the strength of the linear relationship between two variables and compute their association. Simply put correlation analysis calculates the level of change in one variable due to the change in the other.

RESEARCH DESIGN

From the objective we have studied the automation of online retail industry. To analyze this different data, have to be collected from various retail industries such as in what way the automation plays a vital role in their industry and what are the barriers to implement this concept also been discussed.

DATA ANALYSIS AND INTERPERTATIONS

Representing Gender of the respondents

S.NO	PARTICULARS	NO OF RESPONSES	PERCENTAGE
1	Male	54	54.00%
2	Female	46	46.00%
Total		100	100%

Representing Age group of the respondents

S.NO	PARTICULARS	NO OF RESPONSES	PERCENTAGE
1	27-35	46	46.00%
2	36-44	40	40.00%
3	45-55	14	14.00%
Total		100	100%

Representing Educational qualification of the respondents

S.NO	PARTICULARS	NO OF RESPONSES	PERCENTAGE
1	Doctorate	34	34.00%
2	Post-Graduate	42	42.00%
3	Under-Graduate	24	24.00%
Total		100	100%

Representing Occupation of the respondents

S.NO	PARTICULARS	NO OF RESPONSES	PERCENTAGE
1	employee	70	70.00%
2	Self-employed	30	30.00%
Total		100	100%

Representing income of the respondents

S.NO	PARTICULARS	NO OF RESPONSES	PERCENTAGE
1	Below 20K	23	23.00%
2	20K – 30K	17	17.00%
3	30K – 40K	23	23.00%
4	40K – 50K	18	18.00%
5	Above 50K	19	19.00%
Total		100	100%

STATISTICAL ANALYSIS

CORRELATION

Representing the correlation between Performance and Technology.

Correlation				
			Performance	Technology
Spearman's rho	Performance	Correlation Coefficient	1.000	.702**
		Sig. (2-tailed)	.	.000
		N	100	100
	Technology	Correlation Coefficient	.702**	1.000
		Sig. (2-tailed)	.000	.
		N	500	500
**. Correlation is significant at the 0.00 level (2-tailed).				

Representing the correlation between Performance and Employee competency

Correlation				
			Performance	Employee competency
Spearman's rho	Performance	Correlation Coefficient	1.000	.502**
		Sig. (2-tailed)	.	.001
		N	100	100
	Employee competency	Correlation Coefficient	.502**	1.000
		Sig. (2-tailed)	.001	.
		N	100	100
**. Correlation is significant at the 0.01 level (2-tailed).				

Representing the correlation between Performance and Flexibility

Correlation				
			Performance	Flexibility
Spearman's rho	Performance	Correlation Coefficient	1.000	.802**
		Sig. (2-tailed)	.	.001
		N	100	100
	Flexibility	Correlation Coefficient	.802**	1.000
		Sig. (2-tailed)	.001	.
		N	100	100
**. Correlation is significant at the 0.01 level (2-tailed).				

CHI SQUARE

Representing the correlation between Performance and Technology.

		Chi-square and df	Fishers Exact Test	Total
	Performance	Pearson	Sig 2 sided	
Technology	Strongly agree	6.0 & 4.8	.001	94
	Agree	6.0 & 4.8	.001	6
Total				100

Representing the correlation between Performance and Employee competency.

		Chi-square and df	Fishers Exact Test	Total
	Performance	Pearson	Sig 2 sided	
Employee competency	Strongly agree	7.5 & 6.5	.001	91
	Agree	7.5 & 6.5	.001	9
Total				100

Representing the correlation between Performance and Flexibility

		Chi-square and df	Fishers Exact Test	Total
	Performance	Pearson	Sig 2 sided	
Flexibility	Strongly agree	5.0 & 5.5	.001	90
	Agree	5.0 & 5.5	.001	10
Total				100

ANOVA

Performance		Sum of Squares	df	Mean Square	F	Sig.
Technology	Between Groups	1.783	8	.594	5.312	.001
	Within Groups	55.505	92	.112		
	Total	57.288	100			
Employee competency	Between Groups	1.739	10	.580	5.108	.002
	Within Groups	56.283	90	.113		
	Total	58.022	100			
Flexibility	Between Groups	1.703	9	.568	4.935	.002
	Within Groups	57.049	91	.115		
	Total	58.752	100			

CONCLUSION

This research study based on technology innovation in the automobile industry that are highlights for the effective capability in supply chain management. The adoption of technology innovation in automobile industry has some of barriers but than most of the respondents responding positively the overall technology innovation and capability of the automobile industry is with the satisfactory level. Moreover, the COVID-19 pandemic-the unprecedented challenge for manufacturing industry- has clearly shown and highlighted the importance of technology and cloud manufacturing, proactive scheduling and SC mapping. Firms with established technologies for manufacturing visibility and digital control were able to react to disruptions more flexible and responsive. The three-stage segmental analysis of the Indian automobile industry has brought out some unique features in SCM of the respective segments. Not only that, compared with the previous production technology, the application of this new technology can minimize the probability of work error, so that the overall quality of production work can be significantly improved. Automobile companies can also occupy a higher market share in a complex market environment and strengthen their competitiveness.

This analysis established the segmental difference in ASC performance and the impact of ASC performance on profitability across the segments. The SCPIs of the segments have established that the impact of distribution inefficiency is more for the two/three-wheelers and commercial vehicles segments compared to the passenger vehicles. Hence the firms in these segments should invest in automated distribution focusing on reduced cost. This article contributes towards finding key segmental supply chain performance features of the Indian automobile industry, which can help firms in the respective segments to enhance their supply chain performance. The article also aids to building a panel data fixed effect regression model by integrating supply chain performance indicators with the profitability of the firms across the automobile industry segments. Thereby, it aims to assess the significance of the impact of supply chain performance on profitability. This model can facilitate firms to identify the vital supply chain aspects that need to be improved to enhance profitability.

FINDINGS

- Out of 100 respondent's male respondents are (54%) and female respondents are (46%).
- Out of 100 respondents, (46%) of the respondents are aged between 27-35, (40%) of the respondents are aged between 36-44, and (14%) of the respondents are aged between 45-55.
- Out of 100 respondents, (34%) of respondents belong to Doctorate, (42%) of the respondents belong to post-graduate and the remaining (24%) of the respondents are under-graduate.
- Out of 100 respondents, (70%) of the respondents were self-employee, and (30%) of the respondents were self-employed.
- Out of 100 respondents, (23%) of the respondents comes under the category of income Below 20K, (17%) of the respondents comes under the category of income between 20K – 30K, (23%) of the respondents comes under the category of income between 30K – 40K, (18%) of the respondents comes under the category of income 40K – 50K and (19%) of the respondent comes under the category of income above 50K.
- Out of 100 respondents, Majority (54%) of respondents agreed that the company has a network of IT systems highly integrated with key suppliers, Majority (54%) of respondents agreed that the company shares information in real time through IT with key suppliers, Majority (36%) of respondents agreed that the company works to have a better alignment of IT with key suppliers, Majority (36%) of respondents agreed that the company shares demand forecasts and production planning with suppliers, Majority (30%) of respondents agreed that the company can add, modify and remove IT components easily and without causing negative effects on performance.
- Out of 100 respondents, Majority (45%) of respondents agreed that the employees have an adequate knowledge of the different functions of the SC, Majority (42%) of respondents agreed that the employees communicate effectively with the different parts of the SC, Majority (54%) of respondents agreed that the employees are trained and continuously trained to perform the functions of the SC, Majority (36%) of respondents agreed that the employees work as a team constantly to implement inter-organizational projects, Majority (42%) of respondents agreed that the employees identify ways to improve efficiency and effectiveness in the face of environmental changes.
- Out of 100 respondents, Majority (45%) of respondents agreed that in relation to competitors, we have processes that can adjust to changes in volume and mix of products quickly, Majority (42%) of respondents agreed that in relation to competitors, the company develops and markets new products more quickly and effectively, Majority (45%) of respondents agreed that the company can ensure the availability of material against changes, Majority (42%) of respondents agreed that the company can adapt to delivery schedules and meet customer requirements, Majority (42%) of respondents agreed that the company can implement structural changes in the organization effectively.
- Out of 100 respondents, Majority (45%) of respondents agreed that the company can modify its products quickly to meet customer requirements, Majority (33%) of respondents agreed that the company responds quickly to changes in market demand, Majority (45%) of respondents agreed that the company complies with the delivery dates and quantities promised consistently, Majority (36%) of respondents agreed that the company provides a high level of

service to its key customers, Majority (42%) of the respondents agreed that the company considers the management of the SC as vital in the activities of the business.

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