

# A Study on Customer Perception of Electric Vehicle and Its Impact on Traditional Supply Chain in India

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## ABSTRACT

India traditionally has been belligerent to any changes. But with the need to curb environmental emissions it has been identified that there is a need to switch from ICE vehicles to Electric Vehicles. This switch is eminent and a necessity in order to fight the climatic and environmental changes which is affecting all living life whether in land, water or air. It is a fact that with substantial shift in the automobile industry towards Electric Vehicles disruption in the automobile supply Chain is imminent. It is true that for those suppliers who are heavily leveraged and unable to adapt it could spell a disastrous financial troubles ahead. This study is an attempt to identify how production and supply of electric vehicles will impact the traditional supply chain in India and suggest ways and methods to incorporate the changes. An attempt has also been made in this study to identify the perception of individuals regarding Electric Vehicle. Because it is the people's choice which will lead to boon or bane for this segment of automobiles.

**KEYWORDS:** Electric Vehicle, Automobile, Supply Chain

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## 1. INTRODUCTION:

### 1.1. Automobile Industry

#### 1.1.1. Electric Vehicle and its history

The first electric car was manufactured between 1825-1835 in Hungary, Netherlands and U.S. British Inventor Robert Anderson developed the first crude electric carriage but in 1900's. In the second half of 19<sup>th</sup> century French and British investors build the first practical electric cars. In India the first electric vehicle was developed in 1996 by Scooters India Private Ltd which produced a three wheeler electric vehicle name VikramSafa. They sold 400 vehicles which ran on 72 volt lead acid battery. In 1999 Mahindra and Mahindra launched its first electric three wheeler and in 2001 it launched a new company in Coimbatore to make and sell small electric vehicle Bijlee which unfortunately closed down due to low demand of the vehicle. In 2000 BHEL launched its eighteen seater electric bus however these vehicles registered poor consistency. Bajaj Auto Ltd., Pune brought out a prototype electric 3 seater rickshaw in 2001 but since then the product has not been launched in the market. In 2001 REVA collaborated with

American company Amerigon and entered the Electric vehicle sector. Approximately 3200 cars has been sold worldwide with 1500 in India. Subsequently Hero Cylces, Electotherm India, TVS motors, Maruti Suzuki, Totyota and many other companies have started entering Indian market with battery and ancillary hybrid electric vehicle products. However subsequently in the period between 2005 and 2015 the electric vehicle segment in India continuously faced setbacks. Most of traders who traded and sold electric vehicle simply forgot about the vehicles and poor after sales service, no maintenance facilities, poor battery quality all affected the segment adversely.

#### 1.1.2. Present Automobile Industry in India

In the year 2019 India provided with the fifth largest auto market with approximately 3.81 million sales in passenger and commercial vehicle range. India is also the 7<sup>th</sup> largest manufacturer of commercial vehicles and the two wheeler segment dominated the market. Rural market have also supplemented in the growth of the automobile sector. Being of a prominent auto

exporter the growth expectations of automobile industry in India is showing a strong expectation in the future. There have be numerous initiatives by the Government of India and also the Automobile major payers in making India a leader in two-wheeler an four-wheeler market in near future. In the years between 2020 nearly 26.36 million vehicles have been manufactured in India which is showing a exponential growth of 2.36% CAGR between 2016-2020. In passenger car sales small and mid size cars have dominated the market. Two wheelers and passenger cars cumulatively have a sale of over 20.1 million in 2020, with passenger vehicle sale showing a 14.91% increase over last year. Automobile export have registered 4.77 million vehicles in 2020 with highest export of 73.9% in two wheelers followed by passenger vehicle 14.2%, three wheelers 10.5% and commercial vehicles 1.3%.

### 1.1.3. Growth in Electric Vehicle Segment in India

Electric Vehicles in two wheeler segment in India had a growth of 20% reaching to 1.56 units in the year 2020. It is estimated that the electric vehicle segment in the automobile industry will reach Rs. 3.7 lakh crores by the year 2030 i.e. in the next ten years.

This can be estimated due to the increase in FDI in the automobile industry and especially in electric vehicle and electric vehicle component industry. In Feb. 2021 Delhi Government has started process to set up 100 vehicle battery charging points across Delhi and surrounding regions in order to push acceptance of electric vehicles among consumers. Also in Jan 2021 Fiat Chrysler Automobiles announced investment of US\$250 million to expand its product line-up in India to included Electric Vehicles. It is estimated that a cumulative investment of Rs.12.5 trillion will be needed in changing vehicle production and infrastructure required until 2030 to meet the challenging Electric Vehicle target in India. Electric Automotive leader Tesla has announced the setting up of R&D facilities in Bengaluru in Jan 2021 which has been registered under Tesla India Motors and Energy Private Ltd. Kinetic Green and electric vehicles manufacturer has announced the setting up of a manufacturing facility for electric golf carts and a battery swapping unit in Andhra Pradesh.

Indian Companies such as Ultraviolette Automotive have also raised substantial investment for manufacturer of electric motorcycle. Toyota Kirloskar Motors, Mahindra and Mahindra, Lithium Urban Technologies, Tata Autocomp Systems have all collaborated with major global players towards electric vehicles, electric components technology and infrastructure.

### 1.1.4. Government Initiatives in Electric Vehicle Segment

Since the year 2008 various initiatives have been introduced by Government of India to promote demand of Electric Vehicles. In the year 2008-09 the Central Government of Indian announced a subsidy of \$80 for those who purchased electric vehicle but this failed to gain momentum as it was very poorly funded and this was shoved in 2012. Then in the year 2015 GOI launched FAME India Initiative under NEMMP(National Electric Mobility Mission) to provide subsidy to manufacturers and buyers of electric and hybrid vehicles.

## 1.2. Supply Chain Model

### 1.2.1. Traditional Supply Chain Model in automobile segment

A traditional supply chain includes the supplier who supplies raw materials or semi finished goods to OEM (Original Equipment Manufacturers). These raw materials or semi finished goods are then manufactured or assembled into final products by the manufacturers and sent to wholesaler or trader who forwards the same to a dealer or retailer and finally the product or good is delivered to customer. In automotive Industry the traditional supply chain model can be bifurcated into 4 tiers. The first Tier consists of pre-assembled modules, Second tier consists of sub-assemblies, third tier consist of components and parts and fourth tier consists of raw material and single parts. The whole system is arranged in a pyramid with the OEM on the tip of pyramid followed in downward direction by 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Tier respectively. The main focus of this system is to focus on processes that are needed to maintain supply to customer's demands, allows maximum usage of inventory held and minimize any wastage or delay. Each member of the automotive supply chain model is connected to other parts of the supply chain by flow of materials, orders, money and information. Thus flexibility and dexterity is considered important in this supply chain.

### 1.2.2. Electric vehicle and supply chain model

Electric Vehicle poses significant challenge to auto suppliers. Adaptability and flexibility will be needed in order to cater to the demand of supplying of parts of an electric vehicle. Auto suppliers of vehicles exhaust systems; fuel systems and transmissions face considerable challenge. Technical knowhow and digitalization will be required by the auto suppliers all tiers. Moreover automotive supply chain has a global nature and has great impact in changing internal combustion engine (*ICE*) of an automobile into electric engine. Auto companies and its ancillaries will have to invest heavily in technologies related to

electric systems and Research and Development will take a major chunk of all resources. Right from sourcing decisions to production tremendous changes has to be incorporated. Key differences between the maker of Electric Vehicles and Internal Combustion engine Vehicles will identify the suppliers who will be at the most risk. The radical difference between the two engines with the Electric vehicles being rather simpler than the traditions ICE engines wherein Electric Vehicle engines require far fewer components than the traditional ICE. Electric Vehicle Engines have single-speed transmission and there is no need for turbo or superchargers and EVs don't require exhaust systems to remove waste gases. In addition as compared to traditional ICE engines EVs have only three moving parts as compared to the traditional cylinder internal-combustion engine in ICE. But alternatively requirements in chassis, body, interior components, lithium-ion battery packs will increase with EV vehicles. Suppliers and makers of battery packs have been outside the auto supplier line but with EVs they will have to be included thus creating new challenges. It is a fact that with substantial shift in the automobile industry towards Electric Vehicles disruption in the automobile supply Chain is imminent. It is true that for those suppliers who are heavily leveraged and unable to adapt it could spell a disastrous financial troubles ahead.

### 1.3. Research Problem

India traditionally has been belligerent to any changes. But with the need to curb environmental emissions it has been identified that there is a need to switch from ICE vehicles to Electric Vehicles. This switch is eminent and a necessity in order to fight the climatic and environmental changes which is affecting all living life whether in land, water or air. But how the traditional auto supply chain model will be affected and what are the ways in which the auto suppliers can overcome this obstacle keeping in toe with the changes. It is also identified that electric vehicle will be successful only if and when it meets the perception of its customers and in order to develop the market a smooth flow in supply chain as well as flow of knowledge is required.

### 1.4. Objectives of Study

The objectives of this study

- To study the impact of electric Vehicles on the traditional auto supply chain model in India.
- To understand customer's perception with respect to Electric Vehicles

### 1.5. Hypothesis

H1: Electric Vehicle will have positive impact on traditional auto supply chain model

H0: Electric Vehicle will have negative impact on traditional auto supply chain model.

H2: Customers have a positive perception toward Electric Vehicle

H0: Customers have a negative perception towards Electric Vehicle

### 1.6. Limitations of Study

This study is based on primary data collected through circulation of questionnaire via google form and secondary data which is collected through various newspaper articles, research papers, government publications, government bodies, automobile industry publication.

The primary data was obtained to understand the people's perception on electric vehicle majority of the findings is based on secondary database.

### 1.7. Flow of the paper

This study starts with introducing the concept of Electric Vehicle and Supply Chain in the automobile industry. Further it elaborates how the electric vehicle will impact the traditional supply chain of auto suppliers. Objective of the study is formed and Research problem is identified. Hypothesis is formed to substantiate the study. Limitations are identified and put forth.

After introduction a brief literature review is done on any past or existing study/research conducted in this area. Literature review is followed by research methodology wherein the method of research for this study has been explained in detailed. After research methodology data is analyzed and interpretation is derived on the basis of various analyses, findings on the basis of data interpretation are put forth in the paper. On the findings conclusions are drawn and suitable observations are made.

## 2. LITERATURE REVIEW

2.1. According to the findings of NITI AYOJ and Rocky Mountain Institutes on 'Valuing society First: An assessment of the potential for Feebate policy in India' a carefully designed feebate market based policy which combines rebates to reward energy efficient or environmentally friendly investments or practices is necessary in order to promote clean mobility and prosperous economy via electric vehicles. India's growing automotive sector is conducive to support this initiative. The major step in this area will be to promote technical design, development and research. Setting up a highly professional body in order to develop this initiative is highly conducive.



2.2. In the research paper ‘Sustainable supply chain management in automotive Industry: a process oriented review’ by S. Maryam Masoumi, NimaKazemi and SalwaHanim Abdul-Rashid in MDPI, 19<sup>TH</sup> July 2019, it has been identified that feebate policy involving rebates and rewards to companies adopting market-based environmentally friendly investments and practices should be adopted whereas simultaneously adopting stricter practices and penalizing inefficient and environmentally harmful ones will promote environment conscious and sustainable organizations.

### 3. RESEARCH METHODOLOGY

The study was conducted first by identifying the issues related to challenges faced by traditional supply chain for automobile industry in India with the advent of Electric Vehicle. It was identified that in spite of the fact that government has started the initiative of introducing Electric Vehicle the adoption of requisite technology by auto and auto ancillary industries required lot of efforts thereby impacting the traditional supply chain.

#### 3.1. Type of research conducted for this study

Descriptive research was conducted as this research is based on previously published research and reports and it analyses the changes occurring due to change in time period and macro factors effecting the automobile industries.

#### 3.2. Research methodologies utilized

For this study the researcher has adopted both primary and secondary data and analyzed the information of the data to arrive at conclusion. Secondary database acquired through online and offline sources, newspaper articles, research paper, statistics of Government and Private bodies was sourced and studied for identifying the changing patterns. Primary data base was collected through structured questionnaire to identify customer perception with regards to electric Vehicle since automobile industry is completely customer oriented any impact on customer’s perception changes the demand thereby the supply.

For collection of primary data, non-probability sampling technique was utilized wherein judgmental sampling method was used to collect data.

#### 3.3. Analysis method

Analysis of data was done by using simple statistical tools. Data is represented in graphical as well as tabular form. Interpretation of data was arrived using various statistical tools. Findings of the study is based on the interpretation

## 4. ANALYSIS AND FINDINGS

### 4.1. Traditional Indian Auto-Parts Industry and Supply Chain System.

The traditional Indian Automotive ancillary industry is renowned worldwide for quality and productivity and is a significant contributor in the global automotive supply chain. It supplies high value and critical components globally. The rapid growth in domestic automotive market has also supplemented to the growth for auto components industry in India. India is acknowledged globally as small car manufacturing hub and auto component suppliers. With the support of government which has allowed 100% foreign equity investment the auto component industries is expected to grow steadily and strongly.

The traditional auto ancillary components consist of Engine Parts which includes pistons and piston rings, engine valves, full injection systems, carburetors, cooling systems, power train components and other parts. Transmission and steering including gears, wheels, steering systems, axels and clutches. Suspension and braking parts brake and brake assemblies, brake lining, shock absorbers, leaf springs. Equipment and headlights, halogen bulbs, wiper motors, dashboard instruments and other panel instruments. Electrical parts including starter parts, spark plugs, electric ignition systems, flywheel magnetos, Other components which consists of sheet metal parts, body chassis, fan belts, pressure die casting, hydraulic pneumatic instruments etc.

Traditionally the India auto-component industry consists of approx. 6400 large and small companies. The large companies contribute to 66% of total auto-component production with main focus on high valued precision engineering products. Engine parts, transmission and steering parts together account for 50% of the production. At the helm of the supply chain are the Original Equipment Manufacturers. Supplying parts to the OMEs are the Original Equipment Supplier under Tier 1. Supporting the OES tier 1 (sub –assemblies) are the Generic manufacturers. The OEMs supply vehicle and vehicle parts to dealers. These dealers consist of OEMs franchise dealers and multi brand dealers. The OEMs also supply to independent parts dealers this leads to better after sales service coverage. Simultaneously the OES tier 1 as well as Generic manufacturers also supply parts to OEMs franchise dealers and multi brand dealers. The Independent parts dealers also supply to multi-brand dealers and also directly to small garages and other small players.

## 4.2. Customer Perception of Electric Vehicles.

A survey was conducted via questionnaire in order to access customer's perception regarding electric vehicles. On the basis of data collected from 50 individuals who owned electric vehicles either two wheeler or four wheelers the following findings were inferred

### 4.2.1. Perception with respect to Main Benefit /Advantage of electric vehicle

100% of the respondents agreed that that main benefit /advantage of electric vehicle was that they were environment friendly due to their zero emissions characteristics. However, 70% of the respondents considered Electric vehicles were much quieter than other vehicles and the cost to charge an electric vehicle is much less than the fuel costs for a petrol or diesel vehicle.

### 4.2.2. Major Disadvantage of electric vehicles

90% of the respondents agreed that the major disadvantages of electric vehicles are that they were more expensive than gas/fuel powered automobile, electric cars have a shorter range than gas-powered cars, recharging the battery takes time, it can sometimes be difficult to find a charging station and that there aren't as many model options.

*\*10% of the respondents did not respond to this question.*

### 4.2.3. Desirable Characteristics and traits in electric vehicles

100% of the respondents agreed that the most preferred characteristics in electric vehicles include better aesthetics, driving performance, lower maintenance and servicing costs, easy recharging and more accessible charging stations. 80% of the respondents also supported environmental benefits and safeguarding features in the vehicles, 40% of the respondents also supported that the electric vehicles should have a good second hand pricing which will also be an added feature and boost purchase of electric vehicles.

## 5. CONCLUSION

Electric Vehicles has brought about a challenge for auto-component industry. Electric Vehicle have increased demand for new parts and components thus increasing challenges and risk for auto-component suppliers and manufacturers. Shortage of critical components have also been reported in the industry. Digitization and electrification of automobiles have considerably changed the supply chain and manufacturing systems in the automobile industry.

Modern electric vehicles have seen a demand for semiconductors, microchips, sensors, batteries, and numerous other electronic components that provide

technological advantages. There is also requirement of thousands of tiny digital parts which form part of Electric Vehicle.

Supply of batteries one of the major component of electric Vehicle will require more stringent standards in order to reach the global standards.

Another requirement will be demand for Electric Vehicle charging infrastructure which will lead to a rise in a parallel supply chain for the components required to fulfil this demand.

It is expected that in the coming years the automobile industry will be entering into the phase of electric vehicles. Huge investments will be required to update technological development in this area .Traditional automobile and auto parts manufactures of the various Tiers of supply will have to take drastic decision regarding investment and R&D. With the scope of demand for electric vehicle increasing the traditional auto makers will have to explore new areas. There will be a need to discard the existing technologies and adopted new technologies and operational parameters. Auto and auto-parts dealers and suppliers will also be simultaneously affected. They will have to face challenge of supplying and selling both electric and traditional vehicles and its parts. Auto service will have to be revamped as electric vehicle will require more skilled workforce and technicians. Moreover electric vehicle have lower maintenance cost as compared to traditional It is also expected that the margins and future revenue generated by electric vehicles will be lower than the traditional vehicles since the production cost of electric vehicle is higher than the traditional vehicles.

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