



An Investigation of the Change Management Strategies Used by the Electric Vehicle Manufacturers in China and India.

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Summary:

Electric Vehicle industries are rapidly evolving around the world, with myriad innovations and development in the EV technologies. With the rapid development and market expansion, manufacturers encounter numerous challenges which causes obstacle in the growth.

The study focuses on the change management strategies that are employed by the electric vehicle (EV) manufacturers in China and India. The study is only aimed to investigate the strategies of only China and India, to understand how two prominent countries with largest market performs in the global EV shift. Moreover, the investigation is mainly focused on only the Chinese origin and Indian origin EV manufacturers and not about how foreign manufacturers performs in the China and India. Both countries have set ambitious goals to address the environmental and energy challenges by transitioning to EV by 2030. The investigation also examines the change management strategies, regulatory policies, challenges in adopting technological advancement in EV manufacturing in both countries.

This study aims to provide a comprehensive and comparative analysis of how manufacturers in China and India utilizes the change management strategies in their EV transition. By conducting a thorough review of existing articles and empirical data, this study also uses case study analysis of the EV manufacturers from both China and India, to gather insights of how the EV manufacturers in both countries uses the strategies to mitigate the challenges that they face during the development and market expansion.

Keywords: Change Management strategies, Electric Vehicles, EV transition, qualitative research, Battery Electric Vehicles, China, India.

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List of Abbreviations:

1. CM	-	Change Management
2. EVs	-	Electric Vehicles
3. CO ₂	-	Carbon-di-Oxide
4. BEVs	-	Battery Electric Vehicles
5. PHEVs	-	Plug-in Hybrid Vehicles
6. HEVs	-	Hybrid Electric Vehicles
7. MHEVs	-	Mild Hybrid Vehicles
8. RE-EVs	-	Range Extended Electric Vehicles
9. FCEVs	-	Fuel Cell Electric Vehicles
10. BYD Auto	-	Build Your Dreams Auto
11. RECC	-	Reva Electric Car Company
12. AEVT	-	American Electric Vehicle Technologies
13. SMEV	-	Society of Manufacturers of Electric Vehicle
14. FAME	-	Faster Adoption and Manufacturing of Electric Vehicles
15. M&M	-	Mahindra and Mahindra
16. MEB	-	Modular Electric Drive Matrix

17. CAGR	-	Compound Annual Growth Rate
18. IOTA	-	internet of Things Application
19. GTRI	-	Global Trade Research Initiative
20. M2M	-	Machine-to-Machine
21. NSGM	-	National Smart Grid Mission
22. OEMs	-	Other Equipment Manufacturers
23. SGMW	-	SAIC-GM-Wuling
24. NYSE	-	New York Stock Exchange
25. V2G	-	Vehicle to Grid
26. Faas	-	Fleet as a Service

1 Introduction

Change Management (CM) is processes of preparing and guiding an organisation, individual, and team through transition in the strategies, processes, and technologies. CM is not new to the current market. CM have played a crucial role in many companies to achieve desired goals and outcomes. However, CM can also involve difficulties, such as uncertainty, complexity, and conflict. This study will delve about the strategies that are used by the Electric Vehicle (EV) manufacturers in China and India. It also analyse the current state of the EV industry in both countries, evaluate the effectiveness and outcomes and provide recommendations and suggestion for best practices.

1.1 Evolution of the Change Management:

The change management discipline had emerged in pre - 1990s, implementing change management in an organisation will improvise and helps it to understand, how the systems interacts and reacts. In the pre 1990s, the change management was only used to study, how the humans experiences the change and how they react for the change. Then in 1990s, change management models are applied in the business vernacular. After second era, the change management formalized and codified as a discipline. Now in this fast phased era, the change management discipline is applied in every individual profession and organizations for its development and growth. Figure 01 shows the stages of change management strategy that contribute the company to success.

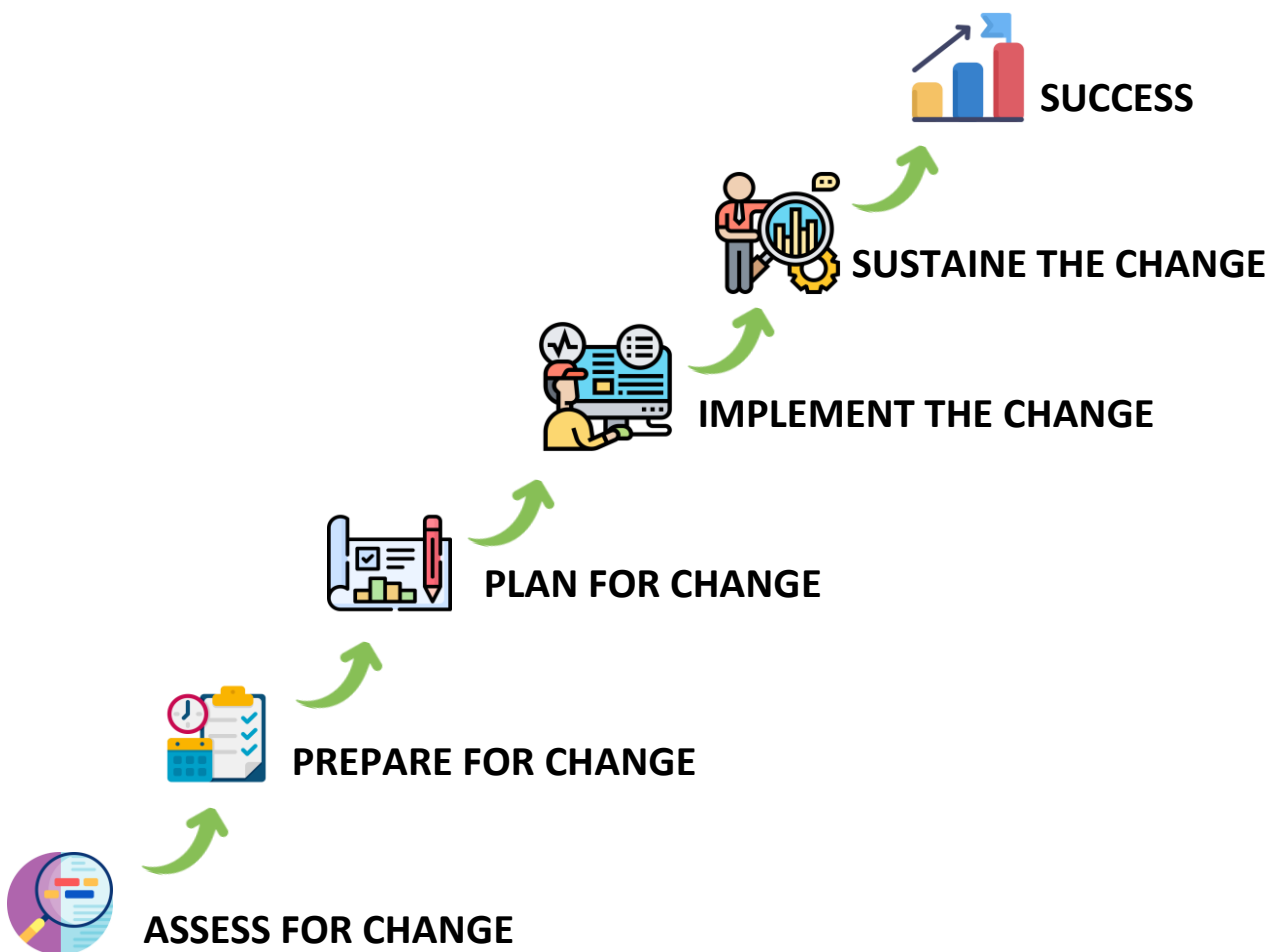


Figure 01: Change Management (Design referred from: depositphotos.com)

1.2 Need for Electric Vehicles:

The transition toward the clean energy had become an imperative in the today's world. An edition published in July 2023 stated that “ the UN secretary general, António Guterres had said that the scientist confirmed, July was on track to be the world's hottest month on record”, he also mentioned that “the era of the Global warning has ended and now it's the era of Global Boiling has arrived” (Ajit Niranjana, 2023). The report by Copernicus Climate Data Store states that July 2023 was the hottest July ever recorded from the year 1940, the temperature recorded are shown in the figure 02. The report by IEA also states that the global carbon dioxide (CO₂) emissions from the use of fossil fuels gradually steadily increased from the year 2000 and in the year 2022 it is recorded to be the all-time high of 36.8 Gigatons which is shown in figure 03 (IEA, 2023). The rise of the global temperature are stocked by the usage of fossil fuels and the spurring violent weather. A report by Our World in Data, depicts that the almost three-quarter of the greenhouse gases are emitted from the energy use only. The total emission from energy use is 73.2 percent of overall greenhouse gas emission, in which the emission from the transports are 16.2 percent which is approximately 8.22 billion tons of CO₂ (Hanna Ritchie, Max Roser and Pablo Rosado, 2020).

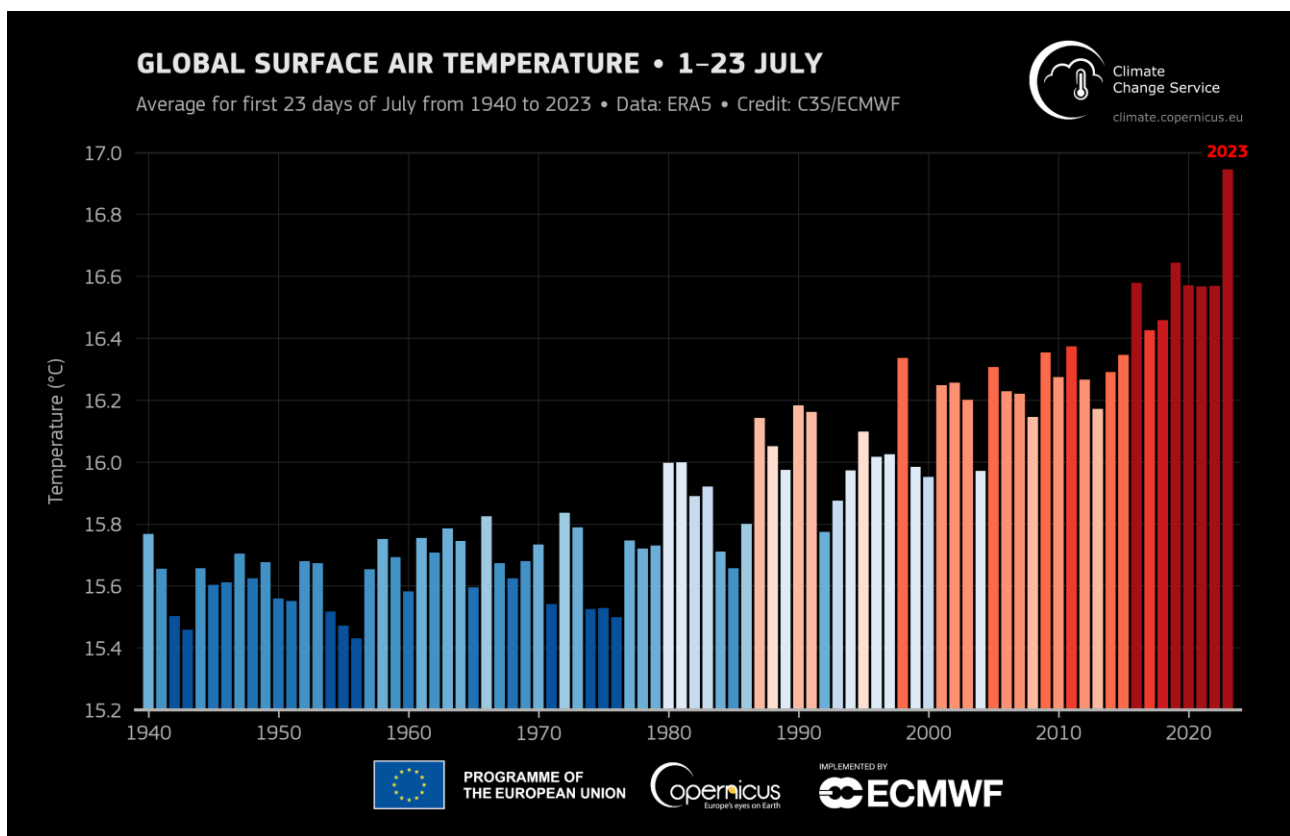


Figure 02: Global Surface Temperature. (Source: climate.copernicus.eu)

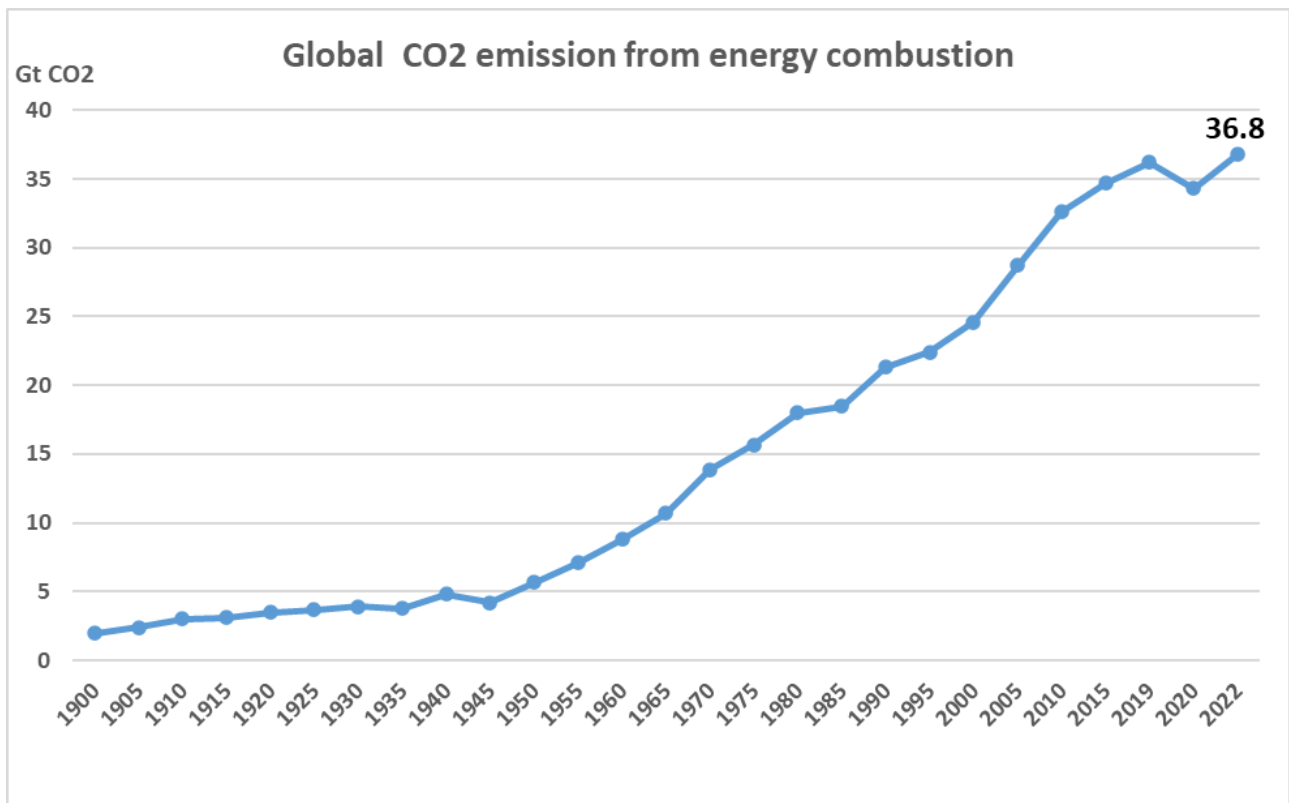


Figure 03: Global CO₂ emission from energy combustion (www.iea.org)

Due to rising of the harmful gases emitted by the usage of the fossil fuels, countries around the world had concerns to mitigate the degradation of the climate and environment. The major CO₂ emitting countries in the globe are the China, United States, European Union, and India. China and India are two prominent countries, which are ambitious to solve the challenges such as the urban air pollution, greenhouse gas emissions and oil dependence. The CO₂ emission of China is 31 percent of the entire world's emissions, and the CO₂ from India is accounted as 7 percent of the globe's emission (The India Express, 2022). To address the issue, China and India are adopting EVs, for creating a sustainable future and to forefront themselves in the global race towards a clean and green future.

1.3 Types of Electric Vehicles:

Many governments had already taken initiative and strategies to mandate the use of EVs in their countries, for example China. China had already implemented ban the motorcycles in Beijing in the year 1985, and mandated people to use only electric scooters (Chi – Jen Yang, 2010). To make the people to switch to the use of clean energy vehicles, government had taken many initiatives to make it possible. Even many manufacturers had made alliance with the government to increase the EV transition by providing diverse model of EV and subsidies and to make people from all the financial level to switch to use electric vehicles. Figure 04 shows the distinct types of EVs and how the EVs are depended on the fuel and electricity for the vehicle operation.

There are different types of electric vehicles (EVs) that use electricity to power their motors which are:

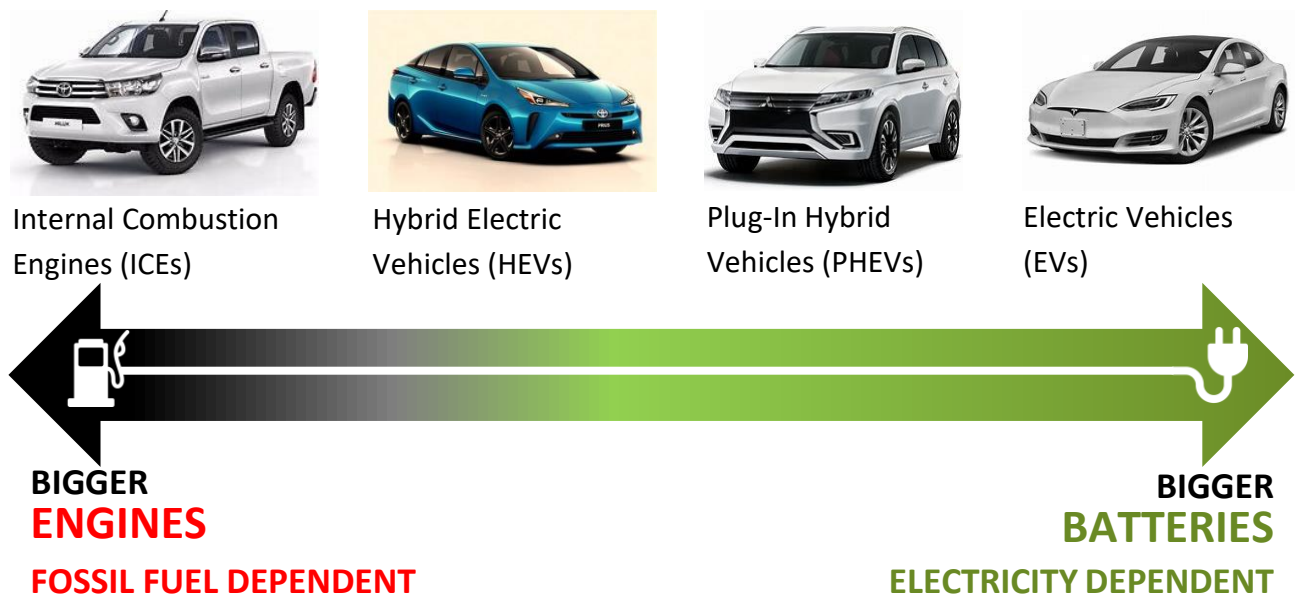


Figure 04: Types of Electric Vehicles (Source: marylandev.org)

Battery Electric Vehicles (BEVs):

These EVs are completely powered by the electricity stored in the batteries. The batteries are needed to be recharged for usage. The batteries can be charged by plugging the charger to the car. For a complete charge the vehicle can run approximately 100 miles to 400 miles depending on the battery size that the car have, and it also rely on the other external factors like the passenger's weight, storage weights, the driving style of the drivers, even the range of an EV can also reduce due to the low air pressure in the wheel, which increases the friction between the tyre and the road. Examples of BEVs are Tesla Model S, Nissan Leaf (RAC,2021).

Plug-in Hybrid Electric Vehicles (PHEVs):

The Plug-in hybrid electric vehicles can run with both engine power and electric motor, or it can run separately. The batteries in the cars can either be charged by relying on the power from the engine or it can even be charged by plugged in to their batteries. Even though, the batteries in the plug-in electric vehicles can be recharged by plugged in, yet still it cannot run completely with the battery power as like the Battery electric vehicles. The primary power for the vehicle comes from its engine. With its battery power, the plug-in hybrid electric vehicle can approximately run no more than 40 miles. Example of PHEVs are Mitsubishi Outlander PHEV, Volvo XC60 Recharge (RAC,2021).

Hybrid Electric Vehicles (HEVs):

These hybrid vehicles are similar to the plug-in hybrid electric vehicles, however the batteries in hybrid car cannot be charged by plug-in charger. The hybrid vehicles combines the petrol or diesel engines with the electric motors and batteries. Moreover, the hybrid vehicles either can run on fuel engines or on electric power, or even on both simultaneously. Hybrid cannot run completely on the electric power stored on the battery, compared with the BEVs the size of the battery in these vehicles are very less, however they mainly rely on the engines for the power to recharge and extend the electric drive rang. Example for HEVs are Toyota Prius, Hyundai Ioniq (RAC,2021).

Mild Hybrid Electric Vehicles (MHEVs):

The Mild Hybrid vehicles are type of hybrid vehicles that combines the internal combustion engine with a small electric motor and battery. Unlike the plug-in hybrid or the full hybrid vehicles, the MHEVs does not have the capability to run only on the electric motor. Alternatively, the electric motor in the MHEVs assists the internal combustion engines to provide an additional power when required by reducing the load on the engine and improves its efficiency. The batteries in the MHEVs are charged by the regenerative breaking and engine power. Example of a MHEVs are Ford Puma, Suzuki Swift (RAC,2021).

Range Extended Electric Vehicles (RE-EVs):

These RE-EVs is also a type of hybrid electric vehicles which combine the electric motor with the internal combustion engine. However, the internal combustion engines does not drive the car, instead the engine acts as a power generator to generate the electricity for the electric motor to run the car. The engine kicks in to generate the electricity when the power in the battery reduces and extends the vehicles drive range. Even though the vehicle is solely runs on the electric power, the production of these category cars are manufactured very minimal by few manufactures. Examples of a RE-EVs are BMW i3, Vauxhall Ampera (RAC,2021).

Fuel Cell Electric Vehicles (FCEVs):

These FCEVs are powered by combustion of Hydrogen(H_2) and Oxygen (O_2). The FCEVs are also considered to be a best alternate to the BEVs, since the fuel combustion in FCEVs emits only water as a byproduct. The fuels used in FCEVs generate electricity through an electrochemical reaction which makes the hydrogen atoms to split into protons (H^+) and electrons (e^-). These separated protons pass thorough the electrolyte layers which generates the electricity to power the electric motor. Example of a FCEVs are Toyota Mirai, Hyundai NEXO (RAC,2021).

1.4 Aim and Objectives:

Aim: To investigate and compare the change management strategies employed by the electric vehicle manufacturers in China and India.

The Objectives of the project are:

1. To Identify the key drivers and the catalysts for the change within electric vehicle manufacturing in China and India.
2. To investigate and analyse the outcomes of the change management strategies implemented by the Chinese electric manufacturers and the Indian electric vehicle manufacturers.
3. To identify the key challenges and obstacles faced by the electric vehicle manufacturers in implementing the change management strategies.
4. To provide an insight and suggest the potential solutions or recommendations for the electric vehicle manufacturers for both China and India to enhance their overall organizational agility.

1.5 Research Questions:

1. What is Change Management, and why is it important?
2. How are change management strategies used by the management and how does it help?
3. Which are the best strategies that are used by the manufacturers?
4. What are the challenges encountered by the manufacturers in implementing the strategies effectively?

2 Literature Review

Article name: Launching Strategy for Electric Vehicles: Lessons from China and Taiwan.

Author: Yang, C.-J, 2017.

This article explores and compares, how the government in China and Taiwan had taken initiatives and strategies to implement electric vehicles in both countries to reduce the carbonization and promote green transportation. The report states that China started to commercialize the electric vehicles from the year 1990. The Chinese government had taken various strategies to stop the people from using gasoline motorcycles which forced the people switch to use electric motorcycles. The strategies taken by the Chinese government are to ban the usage of motorcycles in major cities and in major roads, cutting down the insurance for the motorcycles, and banning the entry of motorcycles to the downtown regions. Although these bans are generally meant for every motorcycle, however the appearance of the electric motorcycle is also appearing like a motorcycle, but the EV motorcycles are not banned. It is the case because, the electric motorcycles are equipped with a paddle which made them to fall in bike category. The article highlights that these policies are made because the policy maker in China believes that the motorcycles are the reason to cause accidents and it disrupts the traffic. The author mentions that; however, the policy made the people to adapt the electric motorcycles usage and it reduced the gasoline motorcycles yet, the policy was an accident rather than policy success. The author states, in case of Taiwan's promotion of electric motorcycle was contrary than the case of China. The Taiwan government had subsidised and promoted the electric motorcycle to the people. The government had provided initiatives like providing subsidies like: To provide tax reduction for the electric scooter manufacturers, subsidies for research and development, promotional activities, charging facilities, and rebates for consumers amounting to nearly half of the scooters retail price. Moreover, these subsidies had made the electric scooters to cost comparatively same price as the gasoline motorcycles. Even by providing these subsidies for the consumers yet still, the government had failed to make people adapt to use electric scooters. The author also mentioned that the retailers had quoted that "for every ten consumers who purchased an electric scooter, ten of them would come back to complain." Moreover, the author also mentioned that the failure of the electric scooters made the retailers to fear of losing their reputation and made them hesitate to recommend it to the customers. Through the author's research he predicts that, the failure of the electric scooter is caused due to the unpredicted errors in technology and weak infrastructure facilities, which he also mentions that even the promising technology may fail to commercialize among the customers if the consumer is unsatisfied.

The author suggests the pioneering companies to use "loss leader strategy" which will make the companies to sell the EVs for lower cost to captivate the customers. He also mentions it is an extremely risky strategy. In concluding the article, the Chinese strategy, does not provide an alternate option for its consumers but forced them to adapt to use EV. Whereas Taiwan provided subsidies and lowered the price of EV, yet it allowed the customers to use gasoline vehicles as well, therefore, the initiative ended as failure. This article by Chi – Jen Yang, was a foundation for this investigation of the change management strategies used by the EV manufacturers in China and India.

Article name: Electric Vehicle in China: BYD Strategies and Government Subsidies

Author: Masiero, G. *et al*, 2016.

This article depicts about the future vision of the Chinese government and the strategies that are been used in increasing the usage of Electric Vehicles in local and national with combining with the EV manufacturers in China. The reviewed paper also highlights that the Chinese government had taken these initiatives to reduce the greenhouse gases and to find an alternate clean energy and to reduce consumption of fossil fuels and imports. This article provides the valuable insight about the partnership made between the leading electric vehicle manufacturer BYD Company Limited in China with the government. The government had also implemented strategies like providing incentives to the manufacturers and industries to improvise and strengthen the commitment to encourage the electric vehicle development. The paper also addresses the obstacle faced by the EV manufacturers such as, the infrastructure, battery production and manufacturing costs. The researchers had also mentioned the Chinese government had created framework in establishing standards and regulations known as Access Regulation for New Energy Vehicle Manufacturers and Production to develop the battery industries. Through multi-level perspective strategy by the Chinese government had increased the job vacancies across the country, reduces the urban pollution, and reduce the dependency on the oil imports. This article was also a foundation for the further research in the field of the change management strategies used in the current EV market.

Article name: An Overview of Change Management within Manufacturing Environment.

Author: Hasan, S.M. and Shah. S, 2013.

This article explores about the various change management strategies and methodologies that can be used by a manufacturing company for new product development (NPD). It also explores the practices like simulation and concurrent designs. The article highlights the flaws of the conventional approach that companies uses for the NPD, it also highlights that the conventional approach is a time-consuming approach as well as a costly approach. The paper argues that using the Change Management (CM) strategies in a company will mitigate the challenges and it enhances the functions of the supply chain and underpins the development of the new development product at its early stage. The article also delves into various other change management techniques that integrated the NPD within the supply chain. The highlighted CM techniques in the article are TROPICS test model, Kotter's "eight step" change model, Doppelts "wheel of change" model, Business Process Modelling (BPM) and Business Process Simulation (BPS) model. The author suggests that manufacturing companies that uses conventional approaches for the new product development in the current competitive market can be an iterative process. Moreover, the authors stated, 'learning is not just focused entirely on the process followed for the development, but also towards their customers knowledge.' He also suggested that, in the current changing environment integrating new features like change management, time to market and new technology in the new product development can lead to a better performance within the supply chain.

Article name: Transition to Electric Mobility in India: Barriers Exploration and Pathways to Powertrain Shift through MCDM Approach.

Author: Ashok, B. *et al*, 2022.

The article illustrates and highlights the key challenges that are faced in the India towards the EV transition analysing through best worst method. The article identified the barriers through Multi Criteria Decision Making (MCDM) approach, such identified barriers are economical barriers , inconsistent batteries used in EVs, infrastructural difficulties, societal challenges, Environmental challenges, Technological difficulties, consumer behaviours on electric vehicles, practical challenges in implementing EVs for mass transportations and challenges in government supports. The article uses various methodologies to analyse the data's, such methods are ANOVA, Q-method, MCDM, PROMETHEE approach and Criteria Wise Alternative Best to Worst methods, which are used to accumulate the data, solve complex decisions, evaluate multi-criterial statistics, and evaluate the opinions from the expertise to identify the positive and negative attributes of the electric vehicles. The article also provides recommendation to mitigating the barriers and challenges that are identified in the article, with providing a clear comparison and highlights the advantages of the alternate solutions that are recommended.

Article name: Electric Vehicle Manufacturers' Perception of the Market Potential for Demand-Side Flexibility Using Electric Vehicles in United Kingdom.

Author: Earl, J. and Fell, M.J, 2019.

This article explores the perception of an EV manufacturers about the EV transition in current market of United Kingdom(UK) and implementing demand side flexibility strategy in UK. The authors had conducted interviews with 11 EV manufacturers in UK and analysed their perspective about the current EV market and the importance of the demand side flexibility. The article also explores the common barriers that are faced by the electric vehicle manufacturers in UK. The author had highlighted the advantages of using demand side flexibility for energy usage and about the smart charging the EVs. Additionally, about how implementing demand side flexibility will reduce the cost on energy for the UK government. Through the interviewing with EV manufacturers, the authors explored that the most EV manufacturers in UK are currently focused on domestic market and comparatively less focused on the commercial EV market. The authors analysis on the interview also explored that the EV manufacturers are not currently concerned about the customers demand factors about the EV rather they are focused on research and developing the technologies. Furthermore, the manufacturers mentioned that implementing the demand side flexibility strategy at the current EV market will be complicated and hard to navigate. However, the manufacturers mentioned, that the customers will accept it unless the benefit is more and financially its compelling and since the EV market is currently developing the need of demand side flexibility will be helpful in future. The author also had noted concerns of the manufacturers through the interviews, such like the demand side flexibility should be customer led and not mandatory, and the manufacturers revealed that the benefit for a manufacturer is by providing lower total cost ownership for customer.

Article name: A Study on an Automobile Revolution and Future of Electric Cars in India.

Author: Pandey, A., Saini, P. and Manocha, S, 2020.

This article explores about the importance of battery electric vehicles and plug in hybrid electric vehicles in India. It also highlights the challenges that are faced during the EV transitions, different overview about the implementation of EVs, its limits, key techniques, and solutions to overcome the issues. The authors discussed that the importance of electric vehicle and the current state of EVs in India. The author argues that “the India is heading towards a terrible future” and the bills are expected to increase drastically in future. The author suggest BEVs, and PHEVs could be an optimal solution to reduce the pollutants and the expenses on the fuel imports. The authors had examined and researched about the suitability and mobility of an electric vehicle through conducting questionnaires with the daily EV users. Additionally, the author also used secondary data resources like existing research papers for a valid conclusion. The article provides a conceptual discussion about remedies to tackle the obstacle of EV. Some of analysed solutions are to improve the facilities for public charging stations, to reduce cost of the EVs. The author also suggest considering “Demand and Supply strategy” to reduce the cost of the EVs. The author had also highlighted some of the initiatives taken by the government to improve the EV among the people, such initiatives are developing standards for Electric Vehicles and Power Supplies (EVSE), National Mission Plan for Electric Mobility (NEMMP) and Faster Adoption and Manufacturing of Electric Vehicles (FAME).

3 Methodology

This research uses qualitative research methodology, which provide a comprehensive understanding of change management strategies that are used by the electric vehicle (EV) manufacturers in China and India. The methodology flow chart in figure 05, depicts the process workflow of this report.

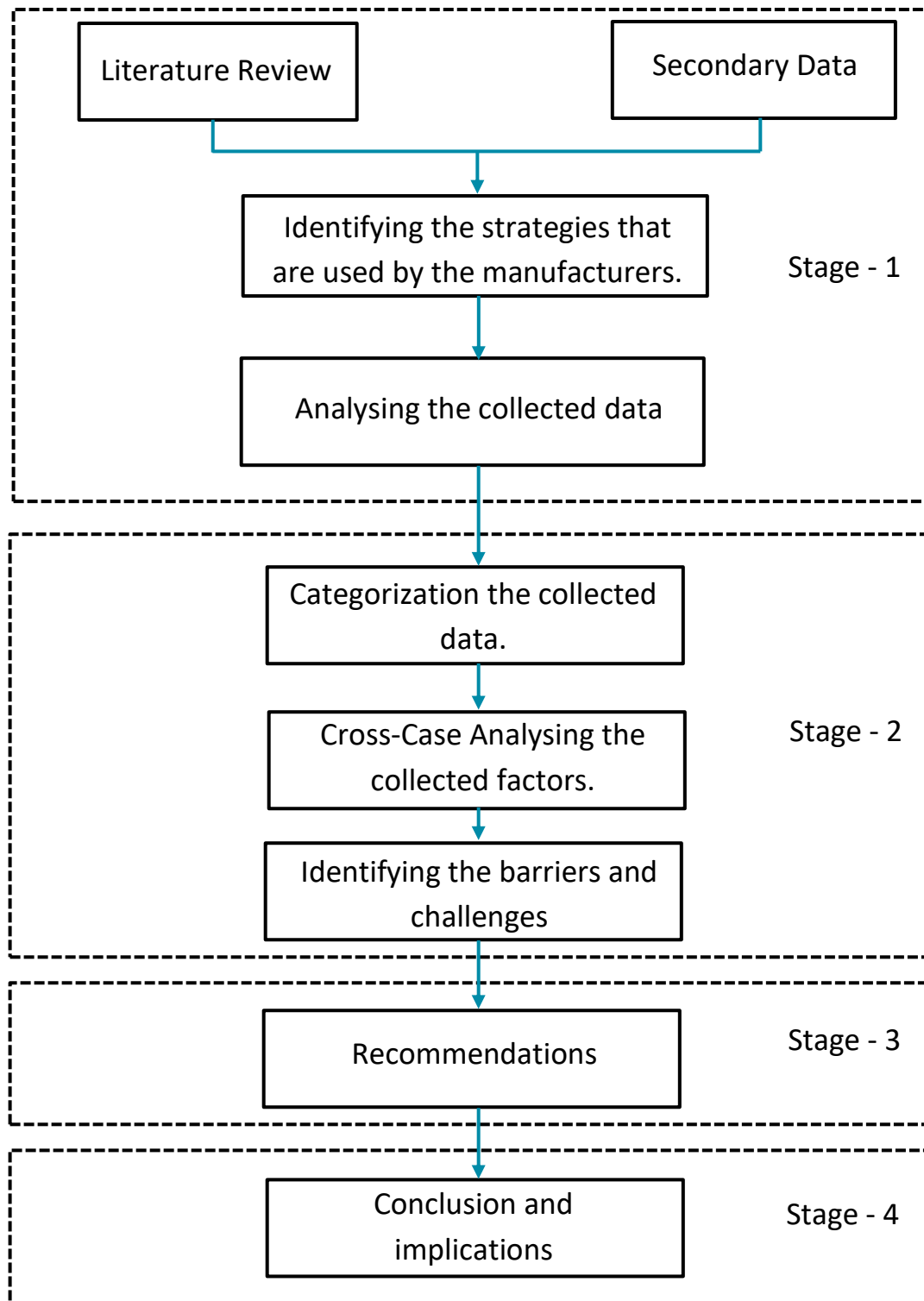


Figure 05: Methodology Flow Chart

This study employs qualitative research method, which explores the various strategies of both countries manufacturers and compares with both country EV manufacturers. The study has been performed in four stages as shown in figure 05. The Stage – 1 identifies and analysis the data collected from literatures and secondary data sources, Secondly, Stage – 2 categorizes and cross analysis the collected data and identifies the strategies and challenges. Stage – 3 provides recommendation for the identified barriers, and Finally Stage – 4 concludes the overall investigation.

3.1 Dissertation Structure:

This dissertation consists of six chapters. The first chapter is the Introduction, narrates about necessity of the change management and the motive of this investigation, it also familiarise the reports aim and the objectives. Followed by the first chapter, the chapter two is the literature reviews of the already published articles and research works. The articles reviewed in this report are acquainted with the research topic. The chapter three is about the methodologies that were used for this research and how the collected data will benefit this research work, discusses about the strategies used by the Chinese EV manufacturers, also includes with real time examples and case study analysis. It also discusses the change management strategies which are used by the Indian EV manufacturers with including real time example. The chapter four provide the result of the investigation by discusses the outcomes of this investigation, comparing the strategies and identifying the common bases of the strategies of both manufacturers and the challenges faced by the EV manufacturers. The chapter five discusses the reason and need for the CM strategies, benefits, and outcomes of the investigation and also investigation limitations. and Finally, Chapter six, concludes the overview of the report.

3.2 Literature Review and Data Collection:

The Data for this investigation are collected through the existing published articles, and with the available secondary data resources. The literature review (Chapter 2) are collected from a very specific publishers like Science Direct, Elsevier and ResearchGate. The data collected from the literature where very beneficial for this study. It provided a base foundation of how research should be conducted and what methodologies can be used for collecting an authentic data. The secondary data resources are sites, blogs, EV manufacturers official feeds and news feeds, which are collected from reputed enterprises and journalists. The secondary data resources are, International Energy Agency (IEA), Our World in Data, Copernicus Climate Data Store, Society of Manufacturers and Electric Vehicle (SMEV), China Passenger Car Association (CPCA), British Broad Cast (BBC), Financial Express, Economic Times, Times of India, IBEF, Autocar and other established societies and communities. These secondary data were also beneficial for this investigation and the data were cross verified and validated the accuracy of the data.

3.3 Change Management Theory Model:

The Change management theory is a framework, of an approach to transitioning people, understanding process, resources and managing the process of organizational change to achieve better outcomes. It provides strategies, models, principles to guide the organization for making right decision, it also minimises the disruptions and the resistance in transitions. The change is caused by internal and external factors in an organization. When an organization identifies a new trend, the organization tries to adapt to the new trend, hence the change occurs in the organisation. There are various change management models that are employed in organization to achieve the goals. The Figure 01 provides an overview of the change management model. There are varieties of CM models and strategies used around the world by industries and organizations. Some of the CM and models are:

3.3.1 Lewin's change management model

This model consists of three stages – unfreeze, change, and refreeze. This model helps to identify the need for change, implement new technologies and processes and stabilize the change to ensure they become the new norm with the organization.

3.3.2 The McKinsey 7-S model

This model analyses how effectiveness can be achieved in an organization through the seven interconnected elements of an organization, which are Strategy, Structure, Systems, Style, Staff, Skills, and Shared Values.

3.3.3 Kotter's change management theory

This theory emphasizes to creates a sense of urgency, building a guiding coalition and fostering a vision for the transition and garner support from key stakeholders.

3.3.4 ADKAR change management theory

This theory focuses on individual change, awareness, desire, and reinforcement. This theory can be used facilitate employee readiness, and support for the EV transition.

3.3.5 Nudge theory

This theory uses a positive reinforcement and indirect suggestion to influence decision making. This theory can be used to encourage the consumers and employees to adopt electric vehicles for sustainability.

3.3.6 Brigges transition model

This model emphasizes managing the psychological and emotional aspects of change, this model can help the employees and stakeholders cope with the emotional transition that comes with embracing new technologies and practices.

3.3.7 Kübler-Ross change management framework

This model help to understand grief stages. This model can be used to anticipate and address the emotional responses of employees and stakeholders.

3.3.8 The Satir change management model.

This model focuses on improving communication and building a supportive environment during a change. This model can be employed to enhance communication channel and foster a positive atmosphere for change.

These CM models may not be directly used on every situation, whilst the manufacturers will tailor and combine these approaches to their own requirement and for the needs based on the challenges faced. Although these are the best-known CM models strategies that were employed, however due to the rapid transformation of the global market the manufacturers had also equipped various strategies for the better change in the firms. Since the countries around the world are trying to promote the cleaner ecosystem with adopting the EVs. However, the transition towards the electrified future has myriad of complexities where the EV manufacturers faces a diverse of challenges from the rapid evolution of technologies, changing market dynamics, regulatory and requirements. In this constant transforming market, the implementation of change management in an electric vehicle manufacturing plays a pivotal role that underpins the success. The change management theory encompasses the strategic planning, supply chain optimizations, embracing innovations, cost effective, risk mitigation, structured approach with collaborating the stakeholders, and ensuring long-term viability.

3.4 Chinese EV Manufacturers Strategies:

China had shown a tremendous development in its electric vehicles in the recent years. Chinese government had aimed make the country a carbon neutrality by the year 2060 (Matt McGrath,2020). At the early 20s, China was not able to compete with the internal combustion engine innovations with the foreign manufacturers, however in the recent years the situation is completely lopsided (Jennifer Conrad, 2022). Since China is the major emitter of greenhouse gases, the government had passed various schemes to make its people to adapt to use the electric vehicles. The government had planned to change at least 40 percent of its population to use electric vehicles by the year 2030, and by the year 2040 the Chinese government is aiming to reach 77 percent of the population to adapt EV . These transition plan of making China electrified is allied with the EV brands in China. The table 01 and figure 06 shows the popular Chinese EV brands and the market segment of the popular Chinese EV brands..

Table 01: Chinese EV Manufacturers (thechinaproject.com).

S. No	Brand Name
1	BYD Auto
2	SAIC Motors
3	Geely
4	GAC Groups
5	Chery Automobile
6	Changan Automobile
7	Li Auto
8	Great Wall Motor
9	NIO Inc
10	XPeng Motors
11	Leap Motor
12	Hozon Auto

MARKET SEGMENTATION

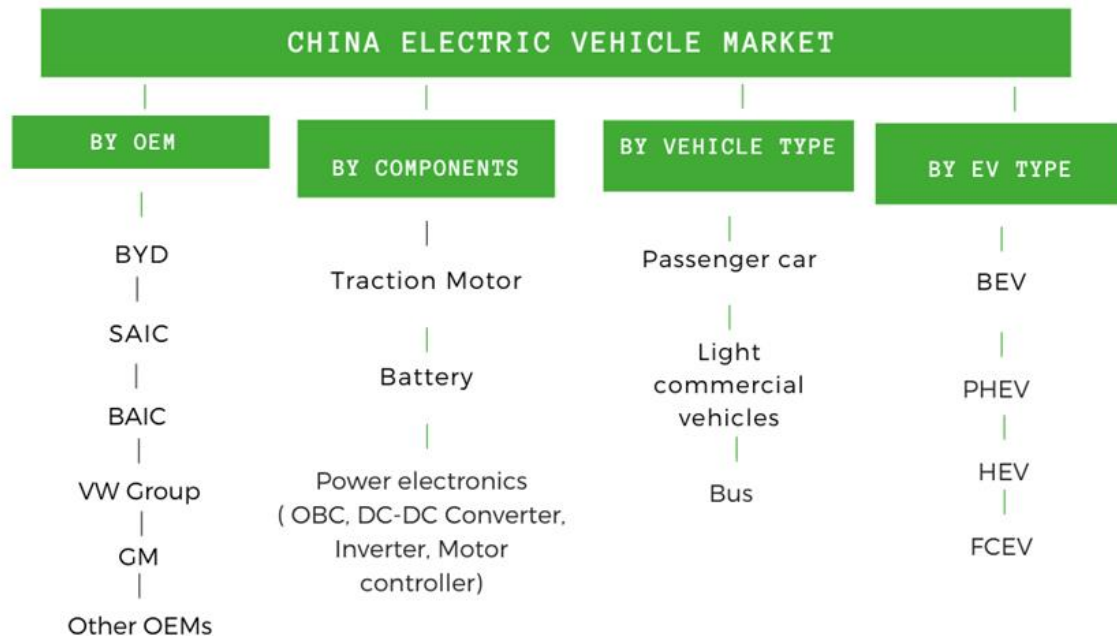


Figure 06: EV Market Segmentation in China (Source: mobilityforseights.com)

The Chinese EV manufacturers had shown an exponential development in the electric mobility revolution. In the realm of electric mobility, the Chinese manufacturers have emerged as a dynamic and influential player with its innovative strategies from creating groundbreaking advancements in technologies to pioneering business models, their multifaced strategies reflects a commitment to revolutionizing transportation and sustainability and driving change to mass adoption of electric vehicles. Namely BYD Auto are known to be the Tesla's only real challenger (Barry Van Wyk, 2023). These strategies which are used by the Chinese EV manufacturers showcases ingenuity and ambition in shaping the future of mobility on worldwide scale. Some of the strategies are.

3.4.1 Collaboration and partnerships:

Partnership and collaboration have become an integral component of the strategies employed by the Chinese electric vehicle manufacturers. It helps them to leverage complementary expertise, resources, and market reach to accelerate their growth.

- Collaborating with companies, will enhance the technological capability of the manufacture, and helps them to mitigate the risk factors.
- It also helps the manufacturer to expand its market globally, which expands its customer base and access to new markets with the partner company.

- It increases the manufacturers capabilities to develop robust features such like charging stations, battery swapping stations, vehicle design aesthetics improvements and EV ecosystem. BYD had made a collaboration with the Power Grid Corp for constructing charging facilities and vehicle maintenance (Liu, J., and Meng., Z,2017).

Moreover, the EV manufacturers of China also collaborate with the Chinese government for providing subsidies for the electric vehicles, tax benefits and expands its market reach and production capacity. For example: BYD Auto, had made a co-operative agreement with Dalian's municipal government of China, to deliver 1,200 electric buses (BYD, 2023).

3.4.2 Technological Innovations:

The EV manufactures of China had kept the technological advancement and innovation as a prominent to carter the needs of its local and global customers. Manufacturers also exposes its technological innovation to attract the markets and customer base.

- BYD had showcased its latest EV Yang Wang U9, where this car can jump into the air while standing still from the ground with using its all four wheels at same time and this car can also drive with a wheel missing (Greg Potts, 2023).
- Companies also showcase its technologies to create a rivalry with its competitive manufacturers by providing similar features at competitive prices, which to attract the customer away from their rivals which increases the market share. For example: NIO Inc had showcased it ET7 EV a competitor to Tesla's Model S EV, the EV had launched at price equivalent around £51,000, with EV capable of providing range of 621 miles which is around 1000 kilometres of range (Tom Harrison, 2021).

3.4.3 Continuous improvement culture:

Continuous improvement approach is adopted by many EV manufacturers in China, which helps the manufacturers to enhance their ongoing and future products with collecting feedback from its customers.

- Through this strategy, the manufacturers can identify the areas that requires more focus and improvements. Moreover, through the feedbacks, manufacturers can study the customers preferences and identify the required needs.
- To stay on top of the market, manufacturers also does benchmark their own products and themselves with industry leaders to identify the flaws and identify the best practices required for continuous improvements.
- This approach also helps the manufacturer to stay on the trend of the market. Since the EV industry is evolving rapidly, this approach enables the manufacturers to adapt quickly to the changes in market.

3.4.4 360-degree Strategy:

In the current EV market, China is seen to be a pioneer in developing innovative features in EV's. This strategy is developed by the Chinese EV manufacturer to achieve electric vehicle targets. Moreover, this strategy helps the EV manufacturer to encompass various aspects which allows them to manage production, supply chain, attain up-to-date information.

- This 360-degree strategy allows the manufacturer to monitor the inventory levels, optimize procurements, and manage and control the entire supply chain effectively (Yves Helen, 2023).
- This strategy incorporates all aspects of the electrification factors, like from raw material sourcing, distribution and sale & marketing the EV.
- One such example of EV manufacturer using 360-degree strategy is BYD Auto (Zander Henry, 2018). BYD Auto produces its own EV components like batteries, power electronics, motors, and other key components for its EV.

3.4.5 Green Manufacturing and Sustainability:

Chinese government had kept its ambition to attain carbon neutrality by the year 2060 (Matt Mcgrath 2020). Therefore, to achieve the carbon neutrality EV manufacturers of China have been focusing on green manufacturing and sustainability in the EV's and EV component manufacturing through constructing Gigafactories. For example,

- BYD Auto, uses Blade Batteries which has longer lifespan and it is completely recyclable.
- BYD Auto, also uses a technique called "Lightweighting," also known as "Structural Battery." Where the batteries of the EV are integrated with the vehicle body to recues the material usage simultaneously reducing the carbon footprint. BYD placed its batteries in the car's frame which increased the car structural safety, and also it increased the car's torsional stiffness. (Ivan, 2022)

3.5 Indian EV Manufacturers Strategies:

Over the years, India has witnessed a dynamic evolution in the electric vehicles, the EVs in India had transitioned from early experiments and sporadic initiatives to a concerted push towards mainstream adoption. As India grapples with mounting complexities in energy security, environment degradation, sustainable urbanizations, EVs have emerged as a compelling solution that aligns with India's vision for a cleaner and sustainable future. The history of electric vehicles in India dates back in 19th century. The first electric vehicle in India is "Lovebird" with range of 60 kilometres, manufactured by Eddy Current Controls. However, due to the cars limitation and other flaws made the car a failure. Followed by Lovebird, In the year 1996, Scooter's India PVT Ltd, had launched India's first ever three-wheeler named "Vikram Safa", however, even the Vikram Safa was not successful either. The reason for Vikram Safa's failure was its poor range, the vehicle used a lead-acid battery which ran out after every 41,250 kilometre (Sudarshan, 2021). The first ever successful EV car in India was the REVA, launched by The Reva Electric Car Company (RECC) in the year 2001. RECC aimed to provide an affordable compact electric car to the India market, to make the car successful, RECC had made coloration with Maini Group and American Electric Vehicle Technologies (AEVT Inc.) of the United States of America (USA). Moreover, RECC joined up with several automotive exports like Curtis Instruments, Inc of USA for the electric motors, the battery was developed from Prestolite Batteries and customized in India by Tudor India Limited. The charger for REVA was previously developed by Modular Power Systems of USA, later RECC manufactured its own charger. Later RECC was acquired by Mahindra and Mahindra and renamed as Mahindra Reva Electric Vehicles in 2010. (Sudarshan, 2021). Followed by the success of REVA, the Indian government had begun to focus more on improving the EVs by taking initiatives like providing subsidies, tax incentives and encouraging EV pilot projects. Som of the major Indian EV manufacturers are mentioned in the table 02 and table 03.

Table 02: Indian EV manufacturers.

S. No	Brand Name
1	Tata Motors
2	Ola Electric
3	Ather Energy
4	Mahindra Electric
5	Revolt Motors
6	Ultraviolet Automotives

Table 03: Indian EV manufacturers.

S. No	Brand Name
7	TVS Motors Company
8	Hero Electric
9	Okinawa Autotech International Private Limited
10	Ampere Electric
11	Ashok Leyland
12	Bajaj Auto Limited

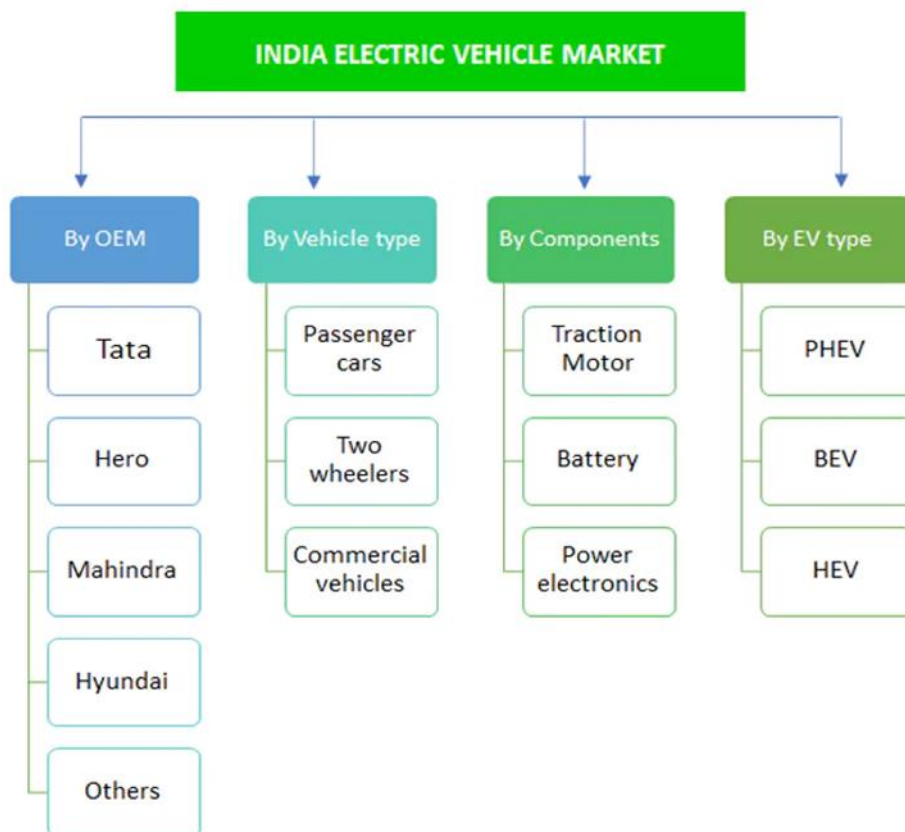


Figure 07: EV Market Segmentation of India (Source: mobilityforsights.com)

Electric Vehicles in India are gradually started to gain popular among the customers. As evidence of rising demand, the EV manufacturers in India have announced a significant increase in production, the entire EV ecosystem in India seems to have gained momentum by its new strategies and initiatives taken to make people to adopt EVs. Some of the strategies that are used the manufacturers are.

3.5.1 Government Policy Alignment:

The EV transition in India in recent year have evolved drastically, EV manufacturers in India have aligned their strategies with the government policies, regulation, and incentives for quicker EV adoption. EV manufacturers and government had launched a portal called “e-AMRIT,” which is mainly focused to create awareness to the people about the electric mobility. The portal showcases the policies, subsidies, opportunities, the list EV manufacturers of India and the types of EV that are available in the market. Moreover, the portal provide all the information’s related to electric vehicles and helps eliminate the myths of EV adoptions (India.gov.in, 2021).

To develop the EV infrastructures like the charging station, EV facilities and promoting EV for faster adoption, Society of Manufacturers of Electric Vehicle (SMEV) had aligning with the government of India and proposed a scheme called “Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India” (FAME India) through which the required facilities and initiatives for EV will be established (SMEV,2023). The FAME is proposed with two phases. “Phase 1” - focuses on technological development, demand generation, pilot project and charging infrastructure. “Phase 2” – promotes faster adoption of EV, provides incentives and subsidies, and focused on proliferation of EV by reducing the upfront costs. The government had accomplished the Phase 1 in 2019, and currently the Phase 2 is aimed to be completed by 2024 (Fame2.heavyindustries.gov.in, 2022).

3.5.2 Strategic Alliances:

India had aimed to convert more than 30 percent of people to switch to electric vehicles by 2030. To ramp up the adoption of electric vehicles the EV manufacturers are making alliances with foreign EV manufacturers to access the modern technologies to improve the quality of the products and to improve the products range. Though this strategic alliances with the foreign manufacturers, will reduce the costs by sharing the resources and expertise, and helps the manufacturers to mitigate the risks associated with technology and market uncertainties. Some of the alliances made by the Indian EV manufacturers are,

- Mahindra and Mahindra (M&M) Ltd of India had made a strategic alliance with Volkswagen (VW) Groups to supply the Modular Electric Drive Matrix (MEB) electric components of VW groups to the Mahindra’s new built electric platform vehicles (Volkswagen, 2022).
- Tata AutoComp had made a tie up with United States of America based EV charging Infrastructure company “Tellus Power Green” to supply both DC and AC Fast Chargers for the all category EV’s in India such as, Two Wheelers, Three Wheelers, Commercial Vehicles and Passenger Vehicles (Tata Autocomp, 2020).
- Ola Electric, a separate entity of Ola mobility services formed in 2017, aiming to revolutionize the electric mobility in market in India and globally. Ola Electric had made alliances with more than 20 EV original Equipment Manufacturers (OEM’s), including Bosch and Samsung, to come up with providing sustainable EV at affordable price and also planned to build the charging infrastructure, software platforms and battery swapping station for electric mobility (Salman, 2020).

3.5.3 Startup Eco system engagement:

Startups always foster innovation and accelerate the development of the industry. They always develop new technologies, products, and solutions for challenges with incorporating cutting-edge technological features. As India is actively enhancing its EV facilities and EV startup manufacturers, it is expected that by 2030 the Compound Annual Growth Rate (CAGR) of India EV industry will expand 36%. (IBEF, 2022), more than 550 startups are working on developing various aspects of EV features, such like energy infrastructures, battery management systems, innovation, and R&D for creating sustainable mobility (World Resource Institute India, 2022). For example,

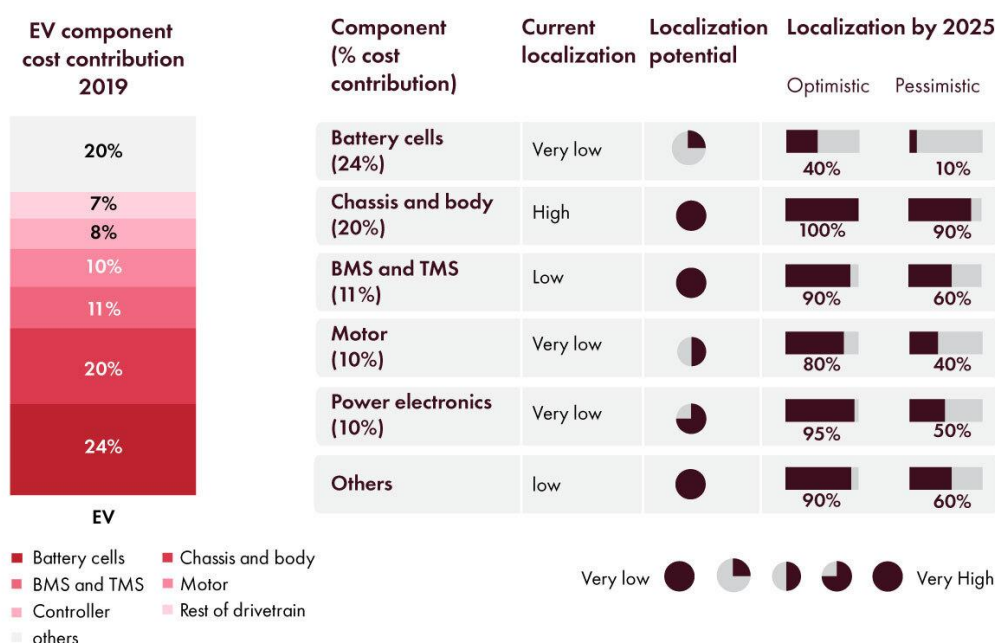
- Ultraviolette Automotive is Indian startup founded in 2016, which is specialized in electric mobility has created its most power-dense batteries in the world. Moreover, the company had filed 7 international patents on its battery system alone, where the battery alone comes with its own processors, memory, and GPS module (Autocar, 2019).
- Ather Energy is another leading EV startup in India founded in 2013, is an EV two-wheeler manufacturer which is known for pioneer innovations. The company had so far published a whopping 151 patent worldwide, in which 90 percent of its patent, which is 136 patents are activity utilized. Some of its patents covers aspects such as battery management systems, vehicle control unit, thermal management system and user interface (UI) (Deepak Syal, 2023).

3.5.4 Supply Chain Localization:

Localizing the supply chain can be beneficial for the growth of EV manufacturers. It associated with saving the expenses and import taxes of the components and materials. It also mitigates the risks factors such as logistic challenges, political conflicts, and the dependence on the foreign suppliers. Localizing supply chain provide the manufacturer strategic independence to have more control over their production process and enables them to claim the benefits of governments initiative FAME (PWC, 2022).

- Tata Motors a leading EV manufacturer in India had started to integrate its group companies to create ecosystem and localize the manufacturing the EV components like EV batteries, components and charging facilities. Tata motos had integrated its six group industries such are, Tata Autocomp, Tata Power, Tata Mototsfinance, Tata Chemicals, Tata Consultant Services and Croma. Moreover, the EV and Corporate Strategy President of Tata Motors, “Shailesh Chandra” stated that “Our localised content has helped us to price our vehicles at close to automatic CUVs, which could not be done by the peers due to high import duties they have to pay” (Financial Express Bureau, 2020).
- Hero Electric is one among the two-wheeler EV manufacturer in India, had started to build its own facility for production of its own batteries, products, and EV components with integrating internet of Things Application (IOTA) as focal point for state-of-the-art technology manufacturing (Hero Electric, 2022).

India is all set for the EV localization drive



Sources: EV Manufacturing Sophistication Model, Secondary research, PGA Labs Analysis

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Figure08: EV components localization in India (Source: pgalabs.in)

3.5.5 Consumer Awareness and Educational Campaigns:

EV campaigns about EV plays a pivotal role in India. As the country accelerates its transition to greener mobility solution, these campaigns plays a predominant importance. Through this campaigns manufacturer disseminate the accurate and true information about the EV's and acts as a bridge between the technological advancements and the consumer understanding. Moreover, through the campaigns EV manufacturers the promotes EV adoption by dispelling the myths and concerns related to EV's like range, charging infrastructure, performance, lifespan, and efficiency about.

- Tata Motors had launched campaign called "Nexon EV Charging Stories." Which focuses on promoting the benefits of EV adoption in India by conveying the hassle-free long drive experience, and to local drives or weekend trips. The Head-sales, Marketing and Customer Care, EV Business Unit Tata Motors, Mr. Ramesh Dorairajan, stated that "We are not only offering aspirational and accessible electric vehicles, but also creating a holistic e-mobility ecosystem that addresses the barriers of EV adoption" (Market Screener, 2021).
- Ola Electric had also launched campaign and community called "Future is Electric and Customer Day Campaign." Where this campaign enables Ola to showcase its glimpses of its upcoming EV. It also allows the customer to schedule a visit the Ola Electric manufacturing plant across the country, test drive the EV's and register a product in Ola's EV. This campaign is focused on attracting the customers to adopt EV. (Ola Electric, 2023)

3.6 Challenges Faced by the EV Manufacturers:

China and India are the two prominent countries with largest market for EV's in the world, even though both countries are developing rapidly in EV market, yet both countries faces unique challenges in the EV industry. Here are some of the challenges, which acts as a barrier for EV manufacturers in India and China to implement strategies effectively:

3.6.1 Challenges Faced by the EV manufacturers in India:

Limited Resources:

Though EV manufacturers in India are initiating inhouse EV component manufacturing, still they are depended on China for the raw materials. India has limited availability of the raw material resources to satisfy the demand of lithium-ion batteries manufacturing, majority of its resources are imported from China. According to the report of "Global Trade Research Initiative" (GTRI) about 70 percent of the raw material for manufacturing EV components are imported from China and a few other countries (Times of India, 2023). Due to the importing resources and with limited resources in India, the cost for raw material for manufacturing batteries will be so high.

Lack of Facilities:

Despite India had kept its goal of achieving a 30 percent adoption rate of EVs among its population by 2030, however still the EV manufacturers country faces challenges due to lacks facilities and infrastructure for EV mobility. As per the report by Society of Manufacturing Electric Vehicles (SMEV) India, there are only 1800 charging station where established in March 2021 (Sameer Aggarwal, 2021) and according to the E-Amrit web portal of India, there are only 934 active public charging station available (e-amrit.niti.gov.in). However, according to the report of Confederation of India Industry (CII), approximately 1.32 million charging stations are required by the year 2030, to meet the demand India needs to install approximately 400,000 EV chargers annually (Economic Times Energy Worlds, 2023). Moreover, due to the increase usage of EVs, India would need to generate 100 Terawatt-hour (TWh) of electricity to meet the demand (Sameer Aggarwal, 2021).

Driving Environment Challenges:

Indian road are prone for chaotic traffic patterns and its intercity road infrastructure are unpredictable about the nature of traffic behaviour. Due to the various hinderance caused by the two-wheelers, rickshaws, animals, pedestrians, and the vulnerable traffic behaviour on the road, makes it as hurdle for implementing the self-driving cars and makes it difficult for the deep learning technology to handle (Srinivas Chitturi, 2021). India also lacks high speed internet connectivity technology for an efficient machine-to-machine communication. High speed internet connectivity is playing a pivotal role for autonomous driving technology, although the telecom providers such as Airtel, Jio are already providing the Machine-to-Machine (M2M) communication solutions, still it is not accessible in all places (Srinivas Chitturi, 2021).

Customer Adoption Challenges:

Indian EV manufacturers face a notable strategy challenge in encouraging the customer to adopt EVs. While the benefits of EVs are vast, still the customers are not engaging to join the transition to EVs. One of the key challenges due to the higher upfront costs. Compared with the engine vehicles, the higher upfront cost of an EV in the price sensitive market make the customer to hesitate to adopt to EV. Moreover, Indian customer also have concerns about the limited charging infrastructure, range anxiety, and power outages. India still faces power outages and voltage fluctuations. However, the National Smart Grid Mission (NSGM) India had taken initiatives to improve the networks (PIB.gov.in, 2022), still the grid implementation is not fully accomplished in all the parts of the country.

Limited OEM's and Manufacturers:

India is having a steady growth in EV industry and adoption, yet India still lacks the original equipment manufacturers (OEMs) and EV manufacturers. According to the e-AMRIT portal of Indian government, so far there are only 380 electric vehicle manufacturers are approved by FAME-II in India (e-AMRIT). In which majority of the EV manufacturers are Three-wheeler manufacturers. There are totally 81 three-wheeler manufacturers, 39 two-wheeler manufacturers and 19 four-wheeler manufacturers, in which many manufacturers are still under development and testing (e-AMRIT) and there are only 40-50 other equipment manufacturers (OEMs) for EV components, and many OEMs are still in the testing phase and estimating to launch in few years (Dr. Irfan Khan, 2022).

3.6.2 Challenges faced by the EV manufacturers in China:

Competitive Environment:

The EV market in China is highly competitive due to the rapid growth of the EV industries. There are numerous EV manufacturers holding higher market share which leads the EV market in China to intense competition which causes pressure on the other EV manufacturers to develop EVs in differentiate from the others to maintain profitable in the EV realm. The BYD holds 27.9 percent of the EV market shares in China for almost two quarters of 2022, even the top selling EV models in China are assembled by the BYD's five assembly lines such as Song, Qin Plus, Han, Dolphin, and Tang. However, SAIC-GM-Wuling (SGMW) outperforms the BYD EV selling 161,579 Wuling Hongguang Mini EV microcar in months between from January and May 2022. BYD's highest sold EV's are 127,304 units from its Song assembly line. Followed by the BYD and SGMW, even other manufacturers like GAC, NIO and many more EV manufacturers causes a huge competitive environment in EV realm of China (Rhian Hunt, 2023).

Supply Chain Disruptions:

Still the EV manufacturer in China faces supply chain challenges in both domestic and international markets. One of the primary challenges faced by the manufacturers are the lack of stable and high-quality supply of essential components like the batteries, electronic chips, and electric power trains. CEO of Jidu Automobile recently has stated that “Sometimes the cost of a sample is close to dozens of times the cost of mass productions” (Guo Shaodan, 2022). Chinese EV manufacturers still faces chip shortage due to the “CHIP and Science Act” which restricted the export of chips to China caused disruption in the semiconductor supply and led to insufficient production (Yi Wu, 2023).

Global Expansion:

The EV manufacturers are actively expanding their market globally for expanding global market shares. BYD Auto also termed as Tesla of China, is expanding its EV sales globally rapidly. However, still there are many Chinese EV manufacturers still faces challenges in the global expansion process due to the poor cost differences, lack of international experiences, lacks establishing trust among the customers on Chinese EV brands and logistic issues. The Europe CEO of Zeekr, a Chinese brand owned by Geely, stated that due the logistics expenses, sales taxes, import duties, and satisfying European certification makes the EV price to pile up and making it a challenge to sell the car cheaper in Europe. Added by MG motors, one of the bestselling Chinese made brand in Europe, stated that importing cars from China to European distribution sites is take a long lead time and causing huge challenge for the company (Victoria Waldersee, 2023).

Infrastructure challenges:

As China is leading its was in expanding its EV market across China and global markets, the demand for charging stations and OEMs also need to be developed to satisfy the demand (Chris Busch, 2023). Many pioneer EV companies had developed and implemented solution for the EV charging and infrastructural issues, still there are lack of charging station in rural areas of China, which causes fear for many drivers about the battery charge (Montway, 2023). Even many drivers hesitates to adopt EV due to the long charging time of EV's and feels it is not dependable as engine vehicles. Due to the longer charging duration, it causes many drivers to wait in queue for charging EV.

Subsidy Withdrawal Concerns:

China had taken initiatives of providing subsidies to EV, for boosting the EV adoption among people and to level the price difference between the engine vehicles in the early stage of EV adoption in the year 2010. China had initially planned to stop to subsidies for EV in 2020, however due to the pandemic (COVID-19), to maintain the economic stability the Chinese government was gradually reducing the subsidies for EV by 10 to 30 percent annually and stopped the subsidies at the end of 2022. Due to the drop of subsidy caused the prices of EV to increase in China, making the EV sales slower (Jiang Mengnan, 2023). The leading EV manufacturer of China BYD, had started to increase its price from 2,000 Yuan (USD 290) to 6,000 (USD 872) in 2023 across all of its EV models (Phoebe O'Hara, 2023).

3.7 Case Study:

3.7.1 An Analysis on BYD Auto Strategies, China:

BYD Auto is established in China by the year 1995. By the year 2003, BYD Autos entered into the automobile industry (BYD Auto, 2022). BYD stands for “Build Your Dreams.” The aim of BYD Autos was to become number 1 EV manufacturer in China, and BYD Auto had become as number 1 EV manufacturer in China in the year 2015. After acquiring the number 1 position in China, BYD Autos had also targeted to become as the number 1 EV manufacturer in the world by the year 2025. BYD had established four main industries, which are automobile, electronics, new energy, and rail transits. BYD develops new energy sources as an alternate to the fossil fuels, and non-renewable energy resources to develop eco-friendly and clean energy vehicles as a replacement of the traditional vehicles. In fact, BYD had developed the EV to address the environmental degradation by controlling the emissions to help the humanity to achieve ‘the green dream’ (Crystal Gore and Noemi Gavino-Lopez, 2019). Moreover, with its innovative technologies in the EV’s and with BYD’s strategic plans, BYD had started to dominate the global EV market.

BYD Auto is a pioneer in manufacturing rechargeable batteries, the batteries BYD manufactures has a wide variety of applications including, electric vehicles, consumer electronics and energy storages. With the concerns of emissions and responsibility of conserving environment, BYD manufacturers and uses Lithium Iron Phosphate (LiFePO₄) batteries in its EV’s. These batteries are environmentally friendly, when compared with other EV batteries. These LiFePO₄ batteries has longer lifespan, can be completely recyclable and it doesn’t contain toxic chemical material like Lead and Cadmium (EcoFlow, 2023). Unlike the other EV manufacturers, BYD uses a form of “Vertical Integration Strategy” to tackle the excess spending on developing or purchasing the technologies from other firms. The vertical integration has two forms which are Forward Integration and Backward Integration. BYD Auto uses “Backward Integration Strategies,” where the company starts to acquire or merges with other company which supplies its products or services. With implementing this strategy, BYD Auto had increased its work efficiency and reduced the cost spendings by taking ownership and mastered the core technology in battery manufacturing, it also integrated raw material and it can manufacture its vehicle parts completely in-house, including the microchips and other components for the EV manufacturing (Masiero, G. *et al*, 2016).

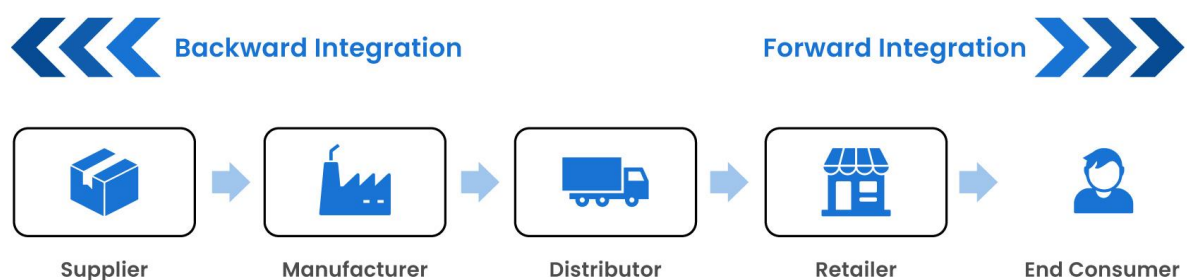


Figure 09: Forms of Vertical Integration Strategy (Source: dealroom.net).

BYD also follows strategies like,

- 7+4 full market EV Strategy,
- collaboration with other foreign firms,
- developed a global design centre.

The “7+4 full market strategy” was established by BYD Auto in the year 2015. The “7” in the strategy represents the seven fields of transportation and the “4” represents the off-road vehicles for special applications. The seven transportation fields are, The Electric Buses, Electric Taxis, Logistic Vehicles, Private Vehicles used for Commercial Market, Electric Motor Coaches, Construction Vehicles and Waste Management Vehicles. The four special application vehicles are, Mining Operations, Marine ports, Warehouse and Logistics and Airports (BYD, 2022).

BYD also foreign technology companies to develop its technologies and to expand its market to the global market. BYD had strategically collaborated with “NUVVE” and a joint venture company “LEVO Mobility, LLC,” capital investors “Stone peak Partners LP” and “Evolve Transition Infrastructure LP.” The NUVVE and LEVO are a “San Diego” based companies which are specialized for the transportation and Vehicle to Grid (V2G) capabilities. BYD had made this collaboration to integrate the Levo mobilities technology to offer a fully financed medium and heavy-duty BYD commercial EV’s and combining with NUVVE’s technology will allow Levo to provide Fleet as a Service (Faas) solution to help shift to electric vehicles quickly, with no upfront costs and full financing options (Scooter Doll, 2021).

BYD Auto had also established a “Global Design Centre” at its global headquarters located in Shenzhen, China (BYD Auto, 2023). BYD Auto believes establishing this centre will create an open communicative and creative work environment, which improve its future designs of EVs in the market (BYD Auto, 2023). Through launching the global design centre, BYD will work with more than 600 designing professionals and designers from over 10 various countries around the world, which includes Germany, Italy, Spain, and Switzerland. BYD had created the global design centre with state-of-the-art equipment, like entire set of world-class new systems, new processes, new standards for design from creative divergence, digital design, and clay model production to virtual reality (VR) evaluation, ergonomic validation, as well as quality control and validation (BYD Auto, 2023).

In Conclusion, BYD Auto from establishment in China to its current status of global leader in the electric vehicle (EV) industry, showcases a remarkable commitment of how BYD had structured itself with the innovation, sustainability and strategically planning its growth. This analyses about how BYD Autos, had navigated the strategies and market analysis it used to achieve its goal to become global number 1 EV manufacturer.

3.7.2 A study on NIO Inc Strategies and Challenges, China:

NIO Inc is one among the leading EV manufacturer in China. The NIO Inc is also represented as “Tesla of China” and “Tesla killer” (Robin Brant, 2021). NIO Inc, is a startup company, established in China in the year 2014. During its launch, the company was invested by various other firms like, Tencent, Lenovo, TPG, Sequoia and Temasek (Logomyway). NIO Inc is second EV manufacturer which is listed on the New York Stock Exchange (NYSE) after Tesla, on 12th September 2018. NIO is specialized in designing and developing premium smart electric vehicles. It offers innovative solution for electric powertrains, batteries, autonomous driving, and digital technology. NIO Inc had so far filed more than three hundred patents until 2021, these patents are field on features like communication systems, safety features, lighting, HVAC systems, distribution, and electric power conversion (Dipak Shenvi, 2021). The NIO Inc’s guiding philosophy is “Blue Sky Coming” which describes the to create sustainable environment with brighter and positive future, the philosophy is also conveyed in the logo as well (Nio, 2023). NIO Inc stands apparat from other electric vehicle manufactures through its combination of innovation approaches, strategies, and distinctive brand identity. NIO sets itself apart from other EV manufacturers through its strategies which are:

- User Operation and Engagement
- Outsourcing
- Battery Swapping Technology
- Integrating Driving Innovation
- One click for power.

NIO Inc is user operation and engagement-based company. Compared with other traditional manufacturers, NIO Inc maintains a long-lasting and continuous user touchpoint with is direct sales and services. To create a brand loyalty and a good user satisfaction for its customers, NIO Inc had created its own ecosystem with including NIO application, NIO House, the Worry-Free service, and NIO Life. Moreover, to increase the user experience, NIO Inc had integrated an artificial intelligence (AI) technology called “NOMI,” in its car to provide a closest engagement with the driver and passenger. NIO Inc had also made this AI more interactive with its second-generation “NOMI Mate 2.0” through gimmicking the human action like eye blinking. This AI adjusts the user’s driving preferences like adjusting the steering position and seats according to the user by detecting the user and also through voice commands (logomyway,2023).

Since, NIO Inc is a startup company founded in 2014, and founded by its investors, it is difficult to establish its own original equipment manufacturer (OEMs) and factory for manufacturing. Therefore, NIO Inc outsources its vehicle manufacturing to its partner, Jianghuai Automobile Co. Ltd (JAC motors) (Gustavo Henrique Ruffo, 2021). The batteries of the NIO Inc EV’s are outsourced to Contemporary Amperex Technologies Co. Ltd of China. Moreover, NIO Inc is only responsible for development and engineering the EV’s, supply chain management, manufacturing techniques, quality management and assurance. JAC motors are in responsible for the vehicle assembly and operation management. To mitigate the growing demand of NIO Inc EV’s, NIO Inc had increased its existing joint manufacturing arrangement with JAC to May 2024, in which JAC will continue to manufacture the NIO Inc EV’s with increasing its production capability to 240,000 units (NIO, 2021).

Nio had successfully established the battery swap system in a mass scale in China. The battery swapping system was not new to the EV market. Many companies like Tesla and Better place (Israeli startup) had tried to establish this system for the EV's, whilst they ended up this initiative with a failure. However, NIO Inc had now established more than 1313 battery swapping station across China, and it also planned to construct one thousand more battery swapping station this year (2023) with aiming to provide its customer to have at least one battery swap station within 3 kilometres of their home(Nora Manthey, 2023). These battery swap stations are capable of swapping batteries 408 time a day, and it is estimated to take approximately three to five minutes for swapping batteries.

NIO is known for its creative innovative features, which its incorporate in the EV's. NIO Inc had also integrated features like NIO Pilot and advanced drive assistance systems (ADAS), to offer its users driving experience and minimize the accidents. The NIO Pilot features, Adaptive Cruise Control, Self-Automatic Parking Assist with Fusion, Lane Keeping Assist, Cross Traffic Alert-Rear, Cross Traffic Alert-Brake, Dynamic HMI on IC and Automatic Lane Simulation and Automatic High Beam(NIO, 2020). NIO Inc is the first ever to EV manufacturer to strategically collaborated with Intel to install the level 4 autonomous driving technology Mobileye EyeQ4 system in the EV for further enhancement of the safety and capability of the EV (NIO, 2020).

NIO Inc Power Mobile is brand new charging feature, which acts like a power bank for EV's. Power Mobile is a valet charging system which can be accessed through the NIO application or on - call service available for 24/7. The van comes to the spot and charges the vehicle on the customers requested location. A 10-minute charge through the power mobile, can provide the EV approximately 100-kilometre range.



Figure 10: NIO Inc Power Mobile feature (Source: NIO.com)

Challenges:

Though NIO Inc EV's are equipped with state-of-the-art innovation and features, however it is still a startup company which is still improving in the beta version and its operating system and technologies are still under improvement. Some of the challenges faced by NIO Inc are,

- In 2019, NIO had to recall its electric SUV due to a problem in its battery pack which induced a short-circuit caused fire in the EV. NIO had to recall nearly 5000 units of its EV. With having meticulous investigation along with the industrial experts NIO , found that the reason for the fire is due to friction created between the wire and the wiring harness (Sean O'Kane, 2019).
- Even with the self-driving technology equipped with Intel's Mobileye EyeQ4 had caused fatality in the year 2021. The driver had enabled the NIO's NIO pilot mode while driving, however due to the incapability of the system to manage the static obstacles made the vehicle to collided violently with a highway maintenance vehicle in China (Dan Mihalascu, 2021).
- Since the Chinese EV market is consists of vast manufacturers from various countries, NIO faces a huge competition in securing the customer preferences and the market. BYD Autos and Tesla are the huge market giants offering high-end battery electric vehicles (BEVs), compared with the NIO vehicles, Tesla's Model 3 is comparatively less expensive. Both BYD Auto and Tesla are outperforming the other manufacturers in China, in 2023 BYD Auto had sold 923,343 units of its EV and Tesla had sold 219,893 units of its EV in China, which made NIO Inc to secure 10th position in the Chinese market with 43,854 units of EV sold (CPCA, 2023).

On conclusion, NIO Inc has shown a consistent development in its EV technologies and features which made it to be dubbed as a Tesla Killer and Tesla of China. Though the company had developed state-of-the-art features, still due to some technical lag and the huge competitive market pressure, NIO is still under developing stage with its technologies. To mitigate the challenges, NIO Inc is taking initiatives and arrangements to meet the market demands and capture its EV market share by collaborating with tech companies.

3.7.3 Case Study Analysis on TATA Motors Limited, India:

In this modern age, concerns for the planets health and sustainability has never been this cautious before, the transportation in this moder era had undergone a significant transformation. In this global shift towards creating greener environment, Tata Motor had also rooted an embarking journey in creating clean energy transport. This case study explores about the early stages of Tata Motors, challenges that Tata Motors faced and delves into the strategies of Tata Motors used to evolve itself as India's leading automobile manufacturer in EV.

Tata Motors was established in the year 1945. The company had made collaboration with Daimler-Benz of Germany and launched its first commercial vehicle in the year 1954. Later, Tata Motors separated and launched its first car Tata Siera in the year 1991. Later Tata motors launched its first fully indigenious car Tata indica in the year 1998. Initially when India launched many auto analysers criticised the car, later its performance with excellent fuel economy, powerful engine and with successful marketing strategy of Tata, Indica became a successful car for Tata Motors. In the year 2008, Tata Motors had a launched it dream project vehicle Tata Nano the worlds least expensive car. Tata Nano was developed to satisfy all the class people dream of owning a car, therefore the car was prices as 1.2 lakh rupees. However, the car had faced controversies and it was failure to Tata Motors. They have tried improved its features and released an updated version of Nano called Tata Nano Gen X, even then the car was not a success. The Tata Nano failed to attract the customer, because of the marking strategy that Tata Motors used. The car was advertised as a world's cheapest car, which created a bad opinion in customers that who will drive the cheapest car in the world (Devashish Shrivastava,2021). Later in 2008, Tata motors had acquired foreign luxury brands Jaguar, Land Rover from Ford Motors and also acquired South Korean commercial manufacturer Daewoo. Tata acquired Jaguar, Land Rover, and Daewoo expand its global market and also improve the design and quality of Tata Motor Vehicles. After acquisition of foreign brands, Tata Motors introduced its next car Tata Tiago, which gained positive reception from the customers. The car was entry-level hatchback came with more modern features and design, subsequently the later lineups of Tata motors was a success.



Figure 11: Tata Nexon before and after transformation pictures. Picture 1: Petrol/Deisel engine car, Picture 2: Transformed Electric Vehicle (Source: wheelsofroad.blogspot.com, wheels97.com).

Due to the increase concerns about the environment degradation and climate change, Tata Motors entered into the EV realm with a success car in the year 2017. Tata was well aware of the necessity to develop an affordable electric vehicle for the price-sensitive people. Therefore, Tata had strategically planned, instead of investing are spending to build a separate EV plant, Tata Motors decided to alter existing successful models Tata Tigor and outfit it with batter pack and introduce it as EV. Later, Tata had also transformed its subcompact crossover SUV Tata Nexon which is launched in 2020. Initially Tata Motors was manufacturing eight cars in a day later it gradually gained attention of people and the demand for the car had increased. Tata now manufacturers more than one hundred Tata Nexon EV's today making it as affordable car for the upper-middle class and kept the price of car not much more than the top variant of the Nexon gasoline version (Zee News, 2022). Followed by the success of Tata Tigor EV and Nexon EV, Tata had started transforming its other existing petrol/diesel engine car into EV's. In the future Tata Motors had also planned to launch ten more new EV model in 2026. The transformed Tata Motors vehicles were Tata Tigor, Tata Tiago, and Tata Nexon. Even after the foreign EV manufacturers launched their own EV's in India, yet Tata Motors hold more than 72 percent of the Indian EV market share and remains as the leading EV manufacturer in India (Business Standards, 2023).

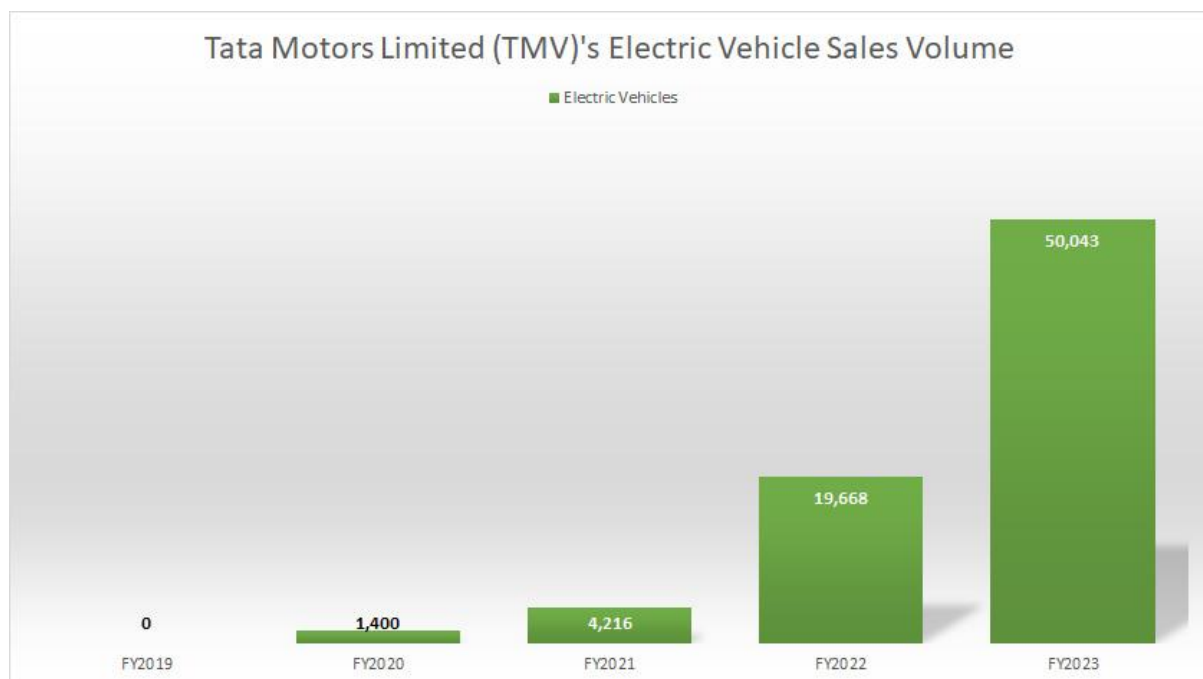


Figure 12: Tata Motors EV Sales Chart (Source: stockdividendsscreener.com)

In this retrospect, it came to know that the trajectory of Tata Motos exemplifies how Tata Motors had strategically structured itself to become a leading EV manufacturer in India. With the case of Tata Nano, even the success of a manufacturer also depends on, how the manufacturer markets its products. Though Tata Nano had other flaws in its features, the major reason for its failure was the marketing strategy. Instead of branding the car as cheapest car in the world, Tata motors could have marketed the car as the world's affordable car to attain people's attention (Etauto, 2015). In the EV realm, Tata had saved a huge investment by its strategy of transforming its existing vehicles as EV, instead of constructing new EV plant for manufacturing EV's.

3.7.4 Case Study Analysis on Mahindra E2O, India:

This case study is about of how Mahindra made its E2O electric vehicle successful.



Figure 13: Mahindra E2O EV (carbuyer.co.uk).

In the year 2013, Mahindra Reva Electric Vehicles launches a its first car after acquiring the Reva Electric Car Company (RECC). The first car of Mahindra Reva was E2O, which is also known as Reva NXR. Mahindra had launched the E2O electric car at price ranging from 6.5 lakh rupees to 8.5 lakh rupees based on the cities in India. The car had created a huge hype before its launch in the Indian market with its new innovative features. The cars came with lithium-ion battery, were the range were expected to be one hundred kilometres and the max speed the car can drive is 80 KMPH – 140 Kilometre Per Hour (KMPH). The E2O's highlighting features are it came with the advanced regenerative braking system where the energy produced during the braking will get back into the battery while the vehicle brake, the E2O came with a special ABS body panel where the colour was impregnated on body panels and not painted, the car has incorporated a with a unique patented technology found by Mahindra called REVIVE technology. Where the customer can make call to the call centre for backup if the vehicle runs on a low power. Additionally, the E2O also equipped other features like remotely can operate and control air conditioner, SMS alerts if in case of burglary attempt, diagnostic checking and lock or unlock the car. The car also had a feature called Sun2Car, where the car can be recharged with solar panels as well.

Even with these myriad features equipped in the Mahindra's E2O, it still had a weakness. The main weakness of the car was, its compact. The car can accommodate only four people if they can adjust in, the car had only three doors, where two where for the passengers to get in and the hatchback door for accommodating luggage. Moreover, the car had very poor exterior body strength, if the car had delt with any damages, the maximum effect will be delt by the passenger. The car also lacked safety features like Anti-lock Braking System (ABS), airbags. Also, Mahindra was facing a huge competition on the EV market, as the other manufacturers were also introducing their own EV's the main rivalry to E2O was, Hyundai i10 electric. The Hyundai i10 electric had more sophisticated features, it came with much larger battery than E2O's. The i10 consists of a 16 Kilo Watt Hour (kWh) lithium-polymer battery capable of providing 160-kilometre range. The car came with a 49-kWh electric motor to deliver max speed of 130 kmph (StudyMoose, 2021).

Though the E2O had huge competitors and drawbacks, yet the E2O was a successor to Mahindra Reva Electric Vehicles Company. It is because of the Mahindra's Marketing Mix Strategy. Mahindra had announced it moto as "Earth's Favourite Electric Car Company," though the car was compact and lacking leg room, Mahindra highlighted the cars major positive features to conceal the weakness, Mahindra also had set upped 250 charging points in various cities with ninety-five charging points in Delhi and one hundred in Bengaluru. Even though Hyundai i10 electric had bigger battery than E2O, the lithium polymer battery used in i10 electric may have shorter lifetime compared with lithium-ion battery used in E2O. To attract the customers in favour of Mahindra, Mahindra had also provided a service called Mahindra First Choice Wheels (MFCW), where the customers can exchange their old cars through XMART exchange program of Mahindra. The company also expected Delhi will be the E2O biggest market as Delhi was providing subsidy for EV's. Delhi was providing 29 percent subsidy of EV's, which reduced the price of E2O was 6.5 lakhs, and in other cities like Mumbai, Bengaluru, Pune, Hyderabad the price of E2O was around 7.5 lakh rupees(StudyMoose, 2021). Even the car was also launched in twenty-six countries worldwide with name of G-Wiz instead of E2O. Notably in United Kingdom, G-Wiz was a bestselling car of all time at the that time, later the recode was broke by Nissan's LEAF in 2016.

Overall, with the case study, it can be concluded that the right strategy, equipping with the features that are required to satisfy the customers' requirements can make a car sale successful even if the car had a huge competitive market. With its success in the first EV, Mahindra had now planned to introduce more EV models in Indian market as well as in the global markets. Mahindra had strategically planned to create a new e-SUV models and as well as transform its existing successor SUV vehicles (Auto Car, 2023).

4 Results:

This study presents the findings of the qualitative investigation of the change management strategies employed by the electric vehicle manufacturers in China and India. The study is solely conducted with relying on the secondary data resources, including industrial reports, company websites, articles, news articles and other relevant documents, to analyse the various strategies that are implemented by the EV manufacturers in response to the dynamic EV industry landscape. Through this investigation of the collected secondary data, several prominent themes emerged, revealing the change management strategies utilized by the Chinese and Indian EV manufacturers.

4.1 Comparison of Strategies of Chinese and Indian EV Manufacturers:

Both the Chinese and Indian EV manufacturers use distinct strategies to mitigate the challenges faced in their respective markets, even both countries' manufacturers tackle the challenges with similar methods. This comparison will explore both manufacturer's strategies to reveal the differences and similarities in their approach. Some of the differentiated change management strategies of both manufacturers are highlighted below.

4.1.1 Chinese EV Manufacturers:

- 360-degree manufacturing strategy, Chinese EV transitions have stated its EV transition way ahead than India, therefore as a global EV leader, China starts to set its footprint in various types of transports as next stage of evolving in EV industry.
- Green Manufacturing, as largest CO₂ emitter in the world, Chinese EV manufacturers use this green manufacturing strategy to reduce the usage of earth material and eliminate the carbon footprint.
- Continuous improvement culture, as Chinese manufacturers have already established EV in major cities and people are adopting to EV's, Chinese manufacturers try to improve the quality of its EV further through getting feedbacks from its customers.
- Battery Swapping Stations, the battery swapping is efficient and quick process of recharging an EV. It roughly takes barely take not more than five to ten minutes. This battery swapping technology is promising solution, which makes the EV to get charged quicker like the engine cars fuelling.

4.1.2 India EV Manufacturers:

- Government policy alignment, the manufacturers try to align with the government policies to leverage a supportive framework, which will become favourable for the manufacturers for getting tax benefits, subsidies, incentives, and regulation which will facilitate its growth in the EV realm.
- Startup ecosystem, as a rapidly growing country in EV industry, startup industries enhance the EV technologies, economic growth, and the EV transitions among the people from all regions of India to contribute to the country's overall development.
- Consumer awareness and educational campaigns, there are still people in India having anxieties about the EVs' performances and range, to eliminate the false beliefs about the EVs, manufacturers try to conduct campaigns to create an awareness about the positives of the EVs to the public and to dispel the myths.
- EV conversion, since the India market is highly competitive, creating a new EV manufacturing plant, investing in R&D, and designing new vehicles will take time and makes it hard to establish the brand in the market. However, converting an existing internal combustion engine vehicle to EV will only require less investment, and it will be a quicker method to establish the EV in the competitive market as the vehicle model has good reach and customer preference in the market.

4.2 Common Themes:

Some of the common change management strategies used by both the manufacturers are mentioned below.

- Collaboration and strategic alliances, both countries' manufacturers try to collaborate with the local or foreign manufacturers, nevertheless a developed manufacturer or a developing manufacturer, both try to collaborate to enhance its capabilities to create more sophisticated EV products.
- Supply chain localization, localizing the supply chain will benefit both people and manufacturers by reducing the cost of the EV and the EV components. Therefore, manufacturers in both countries are concentrating to localize the supply chain to eliminate the cost burden.
- Technological innovation, both India and Chinese manufacturers are actively investing in the technological development of various aspects in the EV technologies within their industry. Both countries' manufacturers still focus on developing and enhancing the battery technology, power efficiency, charging infrastructures, EV components to address the concerns about the EV.

4.3 Challenges Faced:

4.3.1 Chinese EV Manufacturers:

Chinese EV manufacturers encounters a spectrum of challenges like, global expansion, competitive dynamics, intricate supply chains, and the gradual reduction of subsidies. These challenges are often characteristic of a mature EV market where manufacturers aim to establish a strong global presence. However, even still the Chinese EV manufacturers faces struggles in implementing its strategies in rural parts of China.

4.3.2 Indian EV Manufacturers:

Indian EV manufacturers grapple with a set of distinctive challenges stemming from limited resources, inadequate infrastructure, complex driving environments, customer adoption hurdles, and a relatively small number of original equipment manufacturers (OEMs) and manufacturers. These challenges, intrinsic to a developing EV industry, arise at the initial stages of market development as India works to establish a robust electric vehicle sector. Although the EV industries are at development stages, yet there are manufacturers have already stated to expand market globally.

4.4 Recommendation:

Here are some suggestion/recommendations that can help the EV manufacturers for more sustainable development:

4.4.1 For Indian EV manufacturers:

1. The manufacturers have already made a partnership with the Indian government for creating a favourable policy to attain 30 percent EVs goal by 2030, yet the policies and incentives are inadequate for increasing the growth of EVs. Still people in various region of India believes the EV are only a luxury vehicle.
2. Though charging infrastructure are developing at faster rate across India, still there are concerns lies in grid. Still many areas in India encounters power cuts, voltage fluctuations due to power scarcity. Therefore, the smart grid implementation need to be fastened.
3. Comparing with the case of Taiwan's EV transition plans (ref: Yang, C.-J, 2017), India seems also to implement same strategy as like Taiwan, which led Taiwan to fail in the implementation of EV's, however India manufacturers should align with the government to bring stringent EV adoption rules for improving the EV mobility like China.

4. Indian EV manufacturer should also need to diversify their EV in various fields of transports as well. Currently India holds more EV manufacturer in three-wheelers and two-wheelers, and there are only few four-wheeler manufacturers and electric heavy vehicle manufacturers with proper EV fleets.

4.4.2 For Chinese EV manufacturers:

1. Chinese EV manufacturers are now actively focusing on its global expansion across the global market and majorly focusing on the European market, for effective market adoption, the manufacturers who have started the global expansions like NIO Inc, XPeng Motors and other manufactures can focus more on creating trust in the customer with their EVs.
2. Though the Chinese EV are pioneering in the EV technologies still there are issues with the overall quality and performance with EVs. Therefore, EV manufacturers should conduct more analyse on the issues to resolve them.
3. Like SAIC-GM-Wuling (SGMW), other EV manufacturers could also develop their affordable EV's for quicker market expansion (ref: Rhian Hunt, 2023).

5 Discussion:

The main catalyst for the manufacturers to implement change and promoting faster EV transition due to the rising environmental degradation, caused by the industrial revolution caused by the human activities which emits harmful greenhouse gases (GHG) in the atmosphere. Such kind of concentrations like Carbon dioxide, methane, and nitrous oxides are now higher at any point in the last 800,000 years (EPA, 2023). These abundant presence of harmful gases in the atmosphere had resulted in the rise in the average global temperature. At the preliminary stages of the global warming many nature activists, and scientist had given calls in the early 2000s, to engage and take prevention activities to stop the disruptive events occurrence like melting ices and sea level rising (Galafassi, D. *et al.*, 2018). These rise in greenhouse gases also causes impacts to the human health by disrupting the air quality and water quality. It also cause a change in the climate cycles, also affecting the animal species migration and reproduction, causing change in life cycle event of plants and other organisms (EPA, 2022). In top three major emitting GHG country around world, China ranks as number one, second is United States of America and third is India. These three counties alone contribute 42.6 percent total emission of GHG around the globe (Friedrich, J. *et al.*, 2023). Therefore, rather than predicting the climate change and how it will occur, intending to find an alternate solution for reducing the emission will be predominant (Schwartz, P. and Randall, D., 2003). These concerns induced the countries to switch to use of EVs as it is completely operating on clean energies and supports in creating sustainable future.

The research mainly focuses on China and India because China had started its EV transition way ahead of India, and at current EV realm China resembles as a pioneer in EV technology and actively adopting to clean energy in the global shift. Though, India is at its development stage of the EV's, yet the adoption of EV and EV market are rapidly increasing when compared with other EV markets. To support the EV transitions and to increase the phase of EV adoption, the manufacturers employs strategies to support the EV mobility and to expand the market shares. Since both Chinese and India are the two prominent markets which encounter rapid changes and evolution and frequently changing preference of customers, to capture this diverse and dynamic market many foreign EV manufacturers tries to capture its market, which simultaneously increases the competitiveness in the market. To sustain in the market, EV manufacturers had to study the market changes and adapt to the changes. For quicker market adaption and expanding the market share, Change management strategies plays a pivotal role for the manufacturers. Therefore, comparing the pioneering country's EV manufacturers strategies (China) and rapid developing country's EV manufacturers strategies (India), had provide valuable insights like how the EV manufacturer are adopting to the market dynamics, how to implement changes for adapting in the market and how effectively the strategies are used to tackle the challenges faced.

Benefits of Implementing change management strategies:

- Implementing change management strategies can help the EV manufacturer to cope up with the rapid and complex changes in the market.
- It also helps the manufacturer to acquire technologies, adapt to regulation, government policy benefits and consumer preferences.

- By integrating change management strategies, can enable the EV manufacturer to improve the operational efficiency, product quality, innovation, and competitiveness in the EV realm.
- It also helps the EV manufacturers to achieve their sustainable and social responsibility objective.

5.1 Limitations:

The first limitation of this study is it lack numerical data which resulted in unable to quantitative research method. The second hindrance is, since the strategies are oriented with organisations development and confidential to expose the key strategies and future initiatives, due to these constraints, this article was solely investigated with the secondary data and secondary data resources. Third constraint, due to the limited availability of literatures on change management strategies specifically focusing on the EV manufacturers, secondary data resource like company websites, news feeds, blogs and other reputed data sources where used.

6 Conclusion

In conclusion, this investigation had delved into the various change management strategies which are employed by both China and Indian electric vehicle manufacturers, where both countries are the fastest growing market for EV in the world. This dissertation has adopted a qualitative research method which compares and contrast the change management strategies of the EV manufacturers and revealed the dynamic nature of the burgeoning industries. The study is performed with using secondary data from various sources. The investigation also contains case study analysis of four leading EV manufacturers: BYD Auto and NIO Inc from China and Tata Motors and Mahindra from India. This dissertation also examines, how these EV manufacturers have implemented change management strategies in terms of their vision, goals, processes, and resources and how these strategies have influenced their operational efficacy, product quality, innovation, competitiveness, sustainability, and social responsibilities.

The main findings of the dissertation are:

- The EV manufacturers in China and India have adopted different change management strategy depending on the size, market dynamics, and competitiveness. BYD auto from China and Tata motors from India had leveraged their existing capabilities and resources in the conventional automotive industry to transition to EV production. While NIO Inc from China and Mahindra from India had focused on developing new capabilities and resources for EV production.
- The EV manufacturers in China and India have faced various challenges and opportunities in implementing change management strategies like, prohibitive cost and risk of EV production, lack of facilities, raw material shortages, supply chain challenges and inadequate charging stations. Notability the EV manufacturers in China faces subsidy policies to support EV adoption.
- The EV manufacturers in China had emerged as a global leader in EV production and EV technological inventions and brand recognition. Though, the manufacturers in India are evolving rapidly with the EV technologies and innovations, yet they still lag behind the Chinese EV manufacturers in terms of the EV varieties and innovations.

While both countries EV manufacturers has their own distinct barriers and opportunities, both manufacturers shares same aim and tries to foster the innovation, promoting sustainability, and driving the widespread adoption of the EVs.

Through meticulous exploration and investigation, this report illustrate the employed change management strategies of both countries manufacturers, case study analysis, identifies the barriers and strategies that are used by the manufacturers to tackle them in the current constantly changing market. This dissertation had suggested some recommendation for the future development of the EV industry in both countries. The future of the EV industry in China and India looks promising, and it will be interesting to see how the industry evolves in the coming years.

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Student Self-reflection on performance

Describe how you have used AT LEAST ONE of the following sources of information to improve this piece of work:

- 1.) (PREFERRED) Feedback from previous assignment(s). This can be from the same module or from a previous module or previous year of study (e.g., comments from 1st year lab formal reports should be used to help improve your 2nd year lab formal reports).
- 2.) The marking criteria or rubric provided for this assignment.
- 3.) The Department Technical Writing Handbook for Students.

The department technical writing handbook for the thesis was valuable for me. It helped me to structure the report according to the department's standard. The insights I received from my professor was extremely useful and I learned a lot from the feedback. The module, Engineering Project Management module taught by my professor Dr. Iran Patel, gave me useful ideas, and taught me how to properly frame and write master report with proper citation.

Are there any aspects of this work that you would specifically like the marker to comment/or advise on? For example: "I wasn't sure if my figure formatting looked professional and would appreciate feedback on this aspect"

Appendix A – Plagiarism Statement:

I certify that the work submitted is my own and that any material derived or quoted from the published or unpublished work of other persons has been duly acknowledged.

Student Full Name : Vidur Varshan Manoharan

Student Registration Number : 229035814

Signed : M. Vidur Varshan

Date : 25/08/2023

By signing that I agree to abide by the University Regulations at registration, I have acknowledged my understanding of the regulations relating to examination offences, plagiarism, and collusion. Work that is handed in without this section being signed will receive no mark until you have signed it.