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Supply Chain Management In Tata Nexon EV

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ABSTRACT

The automobile industry is one of the most important sectors contributing to the global economy. However, this industry is also a significant contributor to the carbon footprint and air pollution, leading to severe environmental concerns. In recent years, electric vehicles (EVs) have emerged as a potential solution to this problem, as they are powered by electricity and produce zero-emissions. TATA Motors, the Indian multinational automotive manufacturing company, has been an early adopter of EVs in the Indian market. TATA Motors launched its first EV, the Tigor EV, in 2017, which was followed by the launch of the TATA Nexon EV in January 2020. The TATA Nexon EV is a compact SUV that runs entirely on electricity and offers a range of 312 km on a single charge, making it one of the most popular EVs in India. The TATA Nexon EV has gained significant attention in the Indian market, as it offers a sustainable and eco-friendly transportation solution. In addition, the Indian government has been actively promoting EVs to reduce the dependence on fossil fuels and reduce the carbon footprint of the transportation sector. The government has also introduced various incentives and subsidies to promote the adoption of EVs in the country. In this report we are going to highlight the Supply chain and Computer integrated manufacturing of EV's in India with its Challenges and oppurtunities.

KEYWORDS: Electric Vechile (EV), Supply Chain Management (SCM), Computer Integrated Manufacturing (CIM), Battery electric vehicles (BEVs), Plug-in hybrid electric vehicles (PHEVs)

1. INTRODUCTION

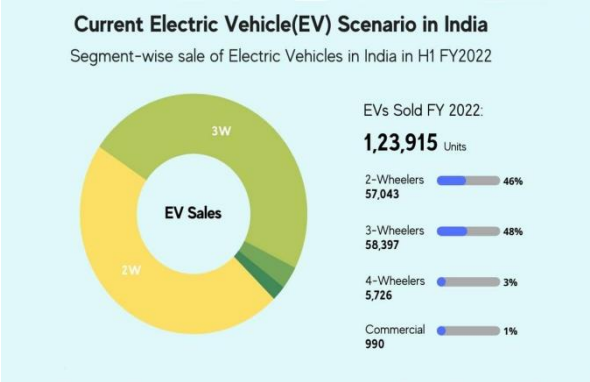
The supply chain of TATA Nexon EV has gained significant attention in recent times, given the increasing demand for electric vehicles (EVs) in India. The TATA Nexon EV is one of the most popular EVs in India, and its supply chain plays a crucial role in ensuring the efficient production and delivery of the vehicle to the market. This report aims to provide an in-depth analysis of the supply chain of TATA Nexon EV, with a particular focus on the Indian market. The report starts with an overview of the global electric vehicle market and the growth of the EV industry in India. This is followed by a discussion of the revenue and sales of electric vehicles in India and the different types of EVs available in the market. The report also provides an overview of supply chain management and computer integrated manufacturing of the EV industry.

2. MARKET SIZE OF ELECTRIC VECHILE

Due to a number of causes, including growing fuel prices, financial incentives from the government, and environmental concerns, the global market for electric vehicles has grown quickly in recent years. According to the BloombergNEF analysis, 58 percent of new

passenger car sales are anticipated to be electric vehicles by 2040.

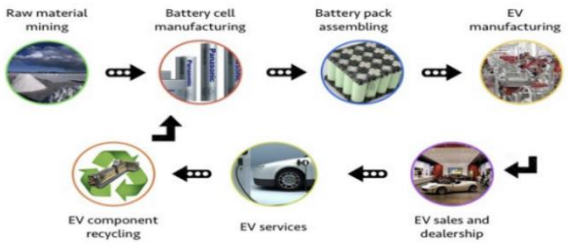
One of the biggest car markets in the world, India, has also experienced an increase in the use of electric vehicles. By 2030, the Indian government wants to sell only electric vehicles, which has spurred a flood of capital into the sector. In India, 3,400 electric vehicles were sold in 2020, up from 1,200 the previous year.



Government regulations, equipment costs, and consumer knowledge are a few of the variables that affect EV revenue and sales in India. The Policy for Adoption and Production of Electric Vehicles (FAME) is one of many programmes and incentives the Indian government has put in place to encourage the usage of electric vehicles. Additionally, the GST (Goods and Services Tax) on EVs reduces the cost of ownership, making them more competitive with consumer automobiles and hybrid vehicles

3. TATA NEXON SUPPLY CHAIN IN INDIA

Supply chain management plays an important role in the automotive industry as it involves the effective coordination of various activities such as raw material sourcing, production, distribution and delivery of goods. Good supply chain management can help EV companies reduce costs, improve quality and increase customer satisfaction. The automotive industry in India is still thriving, facing many challenges such as low payments, high battery costs and power supply interruptions due to the COVID-19 pandemic. However, the government has implemented a number of strategies, such as the manufacturing process of electric vehicles and their components, to encourage local production and reduce dependence on imports.



Supply Chain Flow Chart of EV's

The EV supply chain in India has many stages and many players including raw materials, manufacturers and EV suppliers.Every stage of the supply chain plays an important role in ensuring material and equipment consistency, and any disruption can result in delays or increased costs. Raw Materials provides the basic materials needed for battery manufacture, such as lithium, cobalt, nickel and graphite. These raw materials mainly come from countries such as China, Australia and Chile. Some of these materials also include indigenous materials such as manganese and aluminum from India. Component manufacturers produce products such as batteries, electric motors and electric motors.Key players at this stage of the supply chain include companies such as Exide Industries, Amara Raja and Bharat Forge. Many of these manufacturing companies have entered into joint ventures or partnerships with international companies to gain access to technology and increase their competitiveness.

EV assemblers in India include Indian and foreign companies such as Tata Motors, Mahindra Electric and Hyundai. These companies import components from suppliers and assemble them in India to produce electric vehicles. The Indian government has also announced various incentives and schemes such as Adoption and Production of (Hybrid and) Electric Vehicles (FAME) India in India to promote the use of electric vehicles.Apart from these players, there are shipping and shipping companies involved in delivery as well as regulatory bodies overseeing the industry such as the Ministry of Heavy Industry and Public Enterprises and the Automotive Research Association of India (ARAI).

4. TATA NEXON EV'S SUPPLY CHAIN CHALLENGES AND SOLUTIONS

The supply chain of any complex product like the Tata Nexon EV can face various challenges. Here are some

potential problems that can occur in the supply chain of the Tata Nexon EV:

1. Component Availability and Lead Time:

- Limited Supplier Capacity: The production of specialized components, such as battery packs and electric motors, may be limited due to a limited number of suppliers or their production capacities. This can result in insufficient availability of components to meet the demand for the Tata Nexon EV.

- Long Lead Times: Some components may have long lead times, especially if they are sourced from distant suppliers or require complex manufacturing processes. Delays in component delivery can disrupt the production schedule and delay the availability of the vehicles.

To tackle these challenges:

- Collaborate with Suppliers: Tata Motors can work closely with suppliers to understand their capacity constraints and plan production schedules accordingly. Regular communication and forecasting can help suppliers allocate resources effectively.

- Identify Alternate Suppliers: Identifying and qualifying additional suppliers can provide backup options in case of capacity constraints or delays from primary suppliers. Building a diverse supplier base can enhance flexibility and reduce the risk of component shortages.

- Advanced Planning and Forecasting: Accurate demand forecasting and timely communication of production schedules can help suppliers plan their operations and allocate resources more efficiently.

2. Quality Control and Supplier Reliability:

- Inconsistent Component Quality: The quality of components can vary among suppliers, leading to variations in the performance and reliability of the Tata Nexon EV. Defective or substandard components can cause production delays or result in vehicles that do not meet quality standards.

- Supplier Reliability Issues: Suppliers may face challenges in maintaining consistent production quality, meeting delivery deadlines, or experiencing financial instability. Such issues can disrupt the supply chain and impact the production schedule.

To tackle these challenges:

- Stringent Supplier Selection: Tata Motors can implement robust supplier evaluation processes that assess factors such as manufacturing capabilities, quality management systems, and financial stability. This can ensure that suppliers have the necessary capabilities and resources to consistently deliver high-quality components.

- Supplier Development Programs: Collaboration with suppliers to improve their production processes, quality control systems, and overall reliability can help address quality issues. Sharing best practices, providing training, and conducting regular audits can foster continuous improvement and enhance supplier reliability.

- Supply Chain Visibility: Enhancing visibility into supplier performance and quality metrics can enable proactive identification of potential issues. Early detection of quality concerns allows for timely intervention and corrective actions to maintain product quality.

3. Supply Chain Disruptions:

- Natural Disasters and External Factors: Supply chains can be disrupted by natural disasters, geopolitical tensions, transportation disruptions, or unforeseen events such as pandemics. These disruptions can impact the availability of components, transportation routes, and logistics operations.

- Dependencies on Single Sources: Reliance on a limited number of suppliers or single geographic regions can increase vulnerability to disruptions. If a single supplier or region is affected, the entire supply chain can be impacted.

To tackle these challenges:

- Risk Management Strategies: Tata Motors can develop comprehensive risk management strategies that identify potential disruptions and their impact on the supply chain. This involves conducting risk assessments, developing contingency plans, and diversifying sourcing and logistics options.

- Supplier Collaboration: Building strong relationships with suppliers and establishing open lines of communication can facilitate early identification of potential disruptions. Regular dialogue and information

sharing allow for collaborative problem-solving and contingency planning.

- Geographic Diversification: Identifying alternative sourcing locations and logistics routes can reduce dependence on single regions. Expanding the supplier network and establishing redundant capabilities in different geographic areas can enhance supply chain resilience.

Addressing these supply chain problems requires proactive management, collaboration, and a focus on continuous improvement. By implementing strategies to enhance supplier relationships, improve quality control processes, and mitigate supply chain disruptions, Tata Motors can build a robust and efficient supply chain for the Tata Nexon EV.

5. CIM IN TATA

The phrase "computer integrated manufacturing," or CIM, refers to the complete automation of a manufacturing plant, in which all processes are managed by computers and interconnected by digital data. Manufacturing may become more accurate and efficient by integrating computers. The main advantage of CIM is the capacity to create automated procedures for production. CIM frequently employs closed-loop control strategies based on current sensor data. Flexible manufacturing and design are common names for it. Let's use the Automated Canning Industry as an example.

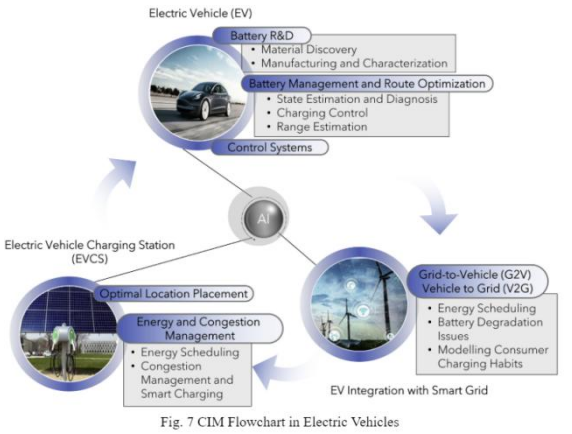


Fig. 7 CIM Flowchart in Electric Vehicles

The production of high-quality automobiles is crucial for both the business and the client. Therefore, the problem is to take the required steps to lower the current cost base while maintaining the marketing advantages of large product offerings. The management of the Tata Plant has adopted a very aggressive strategy to save costs through increased productivity.

At Tata India Limited, the following production systems are listed in order of when computer-integrated manufacturing is employed or is put into operation:

- Product Planning
- Prototype
- Styling
- Engineering design
- Testing
- Mass Production
- Quality Assurance
- Pre-delivery inspection
- Distribution
- Product Marketing

Tata India Ltd. boasts the industry's first fully automated, computer-integrated manufacturing (CIM) system, which covers everything from order processing to vehicle production. This was accomplished by a team of Tata engineers using the most recent computer-controlled automation technologies. The team at the Tata manufacturing facility was led by employees who had major responsibility for the programme. When necessary or at the request of the heavy vehicle factory management, other business roles participated. Tata Manufacturing Plant's most sophisticated and effective manufacturing system is the outcome of a massive, cooperative plant/staff effort including carefully selected, highly skilled manufacturing and systems engineers.

Tata is facing many business challenges ahead. The company is under pressure to release new models faster. Pressure is mounting to improve quality and reduce costs. Complicating matters further, customer needs and perceptions change rapidly rather than over time. In particular, some areas of product development offer the best opportunities to address these critical challenges. This includes shorter development times for new tools, shorter tool design times, significantly reduced rework requirements, and lower costs.

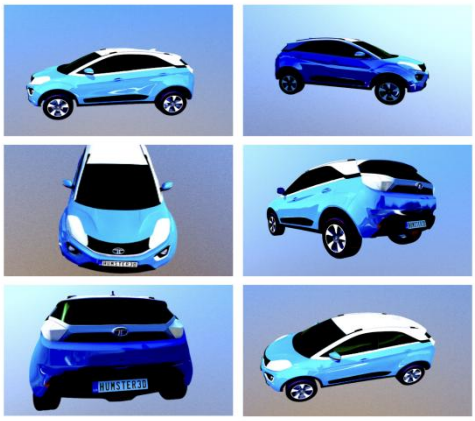
Tata Die Shop uses a variety of standard and advanced processes to design, validate, manufacture and launch products, including NX™ software and Teamcenter®

software from Siemens PLM Software.

The information comes from the Tata Product Design team in NX format. Then additions, trusses, lines, etc. such a dead face is decorated with its NX tools. Data is transferred externally to CAE (Computer Aided Engineering) software to confirm the simulation results.

After the simulation is completed, the parts are moved to the device position based on CAE Rendering and the layout is prepared by dividing the parts using NX 2D Drafting. Then the device structure is built.

Finally, 2D and 3D Rendering, device assembly, testing and production. Although the process is generally similar to that used by other original equipment manufacturers (OEMs), Tata Die Shop has made significant progress in many areas, especially in the preparation and assembly of tooling structures.



Tata used the NX composite design tool to create several molds for the composite design phase. The designer is represented by a template that displays the component parameters. Designers can incorporate new product features to update the template to the current design. Pairs of normal parts are recorded, so changing one part also shows the position of the normal part. This greatly speeds up the design of the device structure.

Tata Die Shop has saved this critical time with the 'cloning concept', which identifies repetitive structures in a design and takes it as a standard building block to create an initial or basic template design. The template structure is used to define control points, create installation entities, define map files for deployment, and more.

Similarly, Tata introduced design standardization in the development of cam units. Instead of modeling each camera individually, the company creates off-the-shelf parts to automatically assemble the camera unit. Companies can save 10 hours per die by using camera units. Depending on your project, the savings can be exponential.

6. CHALLENGES FOR THE INDIAN EV SECTOR

As a new technology, there are major challenges in the way of EV adoption in India :-

1. EV - Luxury Cost

Indians are reputed to measure carefully before making any purchases. Due to this, Indian buyers favour diesel vehicles despite the higher pollution levels and price differential. Because the government has provided numerous incentives to all parties involved, including businesses, merchants, and buyers, it may be quite practical.

On the other hand, the cost of all battery capacity, particularly lithium-ion battery technology, which is still underdeveloped in our industry, makes the price of the electric car look poor. India has to build up its capacity for battery manufacture because it currently lacks the necessary resources.

2. Electricity Emergency

India is dependent on coal since power plants generate around 70% of the nation's electricity. Up until October 2021, India's reliance on electricity is constrained by a lack of coal supplies. As a result, the government places a high priority on the production of clean and sustainable electricity.

Even in India, where the bulk of people still reside in rural regions, electric vehicles have grown prohibitively expensive. In 52 different cities, there are more than 65 all-electric vehicles.

The current demand cannot be satisfied despite the construction of 27 charging stations and 30 battery transfer stations.

3. Vehicle Prices

The expensive price of electric vehicles is the second significant issue, which is making the Indian people hesitate before making a purchase.

In India, the cost of an electric vehicle is three times that of a fuel vehicle. Customers find it simpler to select a gasoline-powered vehicle over an electric one due to these price differences.

4. Fewer Miles

The inability of an EV to transport users to their destinations is one of its drawbacks. However, unlike conventional vehicles, which can be recycled at petrol stations, electric vehicles lack the requisite processes. Additionally, it takes an hour to charge a car to 80% of its capacity, which necessitates a lengthy wait. Due to this drawback, the majority of Indians dislike waiting while having to pay for a car.

5. Service Center Absent

At some time, every car needs maintenance. EV servicing costs, however, are not yet known or even predicted, unlike those for traditional vehicles. Customers may experience increased difficulties as a result of the country's ongoing infrastructure service deficiencies.

6. lack of qualified personnel

Because the EV business in this nation and state currently lacks trained personnel, EV technology is still being developed.

What would you do if you were driving and your automobile suddenly broke down in the middle of the road? Will you call anyone? You require some qualified experts to address your issue and guide you to the next location. It wants engineers to be more adept at digital platforms than manual ones, among other things. Customers find it inconvenient because the majority of mechanics are currently unaware of their success.

7. Unhappy with Government Policy

In India, the government first lacks the consumer's level of clarity. In contrast to other governments, it does not have definite norms and regulations. Even if they had no plans to entice customers with lower taxes or other incentives, this ultimately left manufacturers unsure on how to proceed with the production of electric vehicles. However, after observing Indians' adoption of EVs, the government took action akin to the FAME policy, which was announced in April 2019, by spending Rs 1000 to boost EV demand. As Express journeys demonstrated, Delhi government would soon be abolished as well. Road tax and registration fees have been announced. In addition, new car subsidies are provided.

In addition, the government (Ministry of Road Transport and Highways) has declared that the sale of electric two- and three-wheelers without batteries is now permitted.

8. Supply-chain Problems

The supply of electric vehicles is a problem in the industry as much as the demand for them. The majority of the expense of electric cars—nearly two-thirds—is borne by the industry's reliance on the importation of batteries and electrical components from other nations. Furthermore, there is no design that will guarantee the reliability and security of battery-related items.

Additionally, there is no clear structure for any obligation relating to damaged or returned batteries, which can be quite expensive and necessitate a well-managed supply chain.

In addition, a number of issues, such as demand-supply imbalances, unprofitable volume restrictions, etc., raise the cost of producing EVs, which ultimately requires planning to overcome.

9. A lack of power outlets

The absence of charging facilities in India is a significant issue. The overall number of charging stations established in India is 970, which is fewer than the rising number of electric vehicles, according to the Ministry of Heavy Industry (DH) and the Ministry of Electric Vehicle Development. Additionally, it is challenging for

electric vehicles to travel very far due to the lack of a charging station on the route, which is cumbersome. As a result, we cannot schedule lengthy trips in electric cars.

7. TRENDS AND SOLUTIONS

Industry experts believe that by fusing the physical and digital worlds through the creation of a digital twin between the product and manufacturing phases, the challenges associated with the production of electric vehicles may be resolved. The future factory concept relies on the digital twin of the production machinery and procedures to boost efficiency. These digital twins gather information about physical performance from workplaces and items. It is decided to switch everything off for further optimisation when data from linked smart devices in the field and factory is gathered, evaluated, and integrated into products.

Throughout the product and service life, this digital twin publication has numerous interrelated digital sequences in the engineering disciplines of mechanical, electrical, and software goods.By facilitating continuous improvement in design, manufacturing, and operations, data analytics, the cloud, and the Internet of Things (IoT) enable closed-loop engineering processes. With the help of this ideal digital twin, businesses can organize and carry out production procedures for new designs and various vehicle models, all while lowering battery costs and coordinating them throughout the distribution facility.

8. INVESTMENT OPPORTUNITIES IN THE INDIAN EV SECTOR

The popularity of electric vehicles in India has led to investments in a variety of sectors that support them. Investments in electric vehicles are worth billions of dollars due to changes in global mobility trends. The greatest market is EV production, where all manufacturing expenses and capital expenditures will be turned into EVs, with sales expected to reach INR 1,239,800 ($177 billion) in the eight years between FY2022 and FY2030.

The market for electric car batteries will expand as demand for electric vehicles rises. Battery companies will need to improve their production capacity to keep up with this rising demand, which would necessitate an enormous $17 billion investment in EVs if developed in communities.

A $3.2 billion investment will be made in the EV charging sector in order to fulfil the aim of 30% EV penetration by 2030.

Finally, with a stronger foundation and everything in place, India may benefit from a cleaner, greener means of transportation. As a result, it is never too late to embrace the benefits and challenges presented by EVs in India.

9. RESULTS

The Indian market for electric vehicles has been steadily expanding due to the government's emphasis on lowering greenhouse gas emissions and promoting the usage of electric vehicles. In 2020, sales of electric vehicles in India rose by 20%, bringing the country's overall electric vehicle sales to 156,000 units. The two main categories of electric vehicles in India are battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs).

The Indian electric vehicle supply chain includes extraction of raw materials, production of components, assembly of vehicles, and distribution. The CIM Model for Charging Electric Vehicles is a common format for data communication between electric vehicles and charging infrastructure, making it easier for owners to locate and utilize charging stations. India's market for electric vehicles is expanding and there is potential for electric car producers to increase their market share.

10. DISCUSSION

The study's findings have shed important light on the TATA Nexon EV supply chain in India. The study's main findings are as follows:

India's market for electric vehicles is expanding quickly as more and more people choose them for their affordability and environmental friendliness.

In recent years, electric car sales and income in India have grown dramatically, with TATA Nexon EV one of the key participants in the sector.

Battery electric cars (BEVs), hybrid electric vehicles (HEVs), and plug-in hybrid electric vehicles (PHEVs) are among the various types of electric vehicles that are available in India.

In India, the supply chain for electric vehicles goes through a number of steps, including component production, battery assembly, vehicle assembly and its distribution.

The CIM model of electric vehicle charging allows compatibility across various charging systems and offers a standardised process for recharging and discharging electric vehicles.

The study's conclusions have a number of effects on TATA Nexon EV's supply chain and the Indian electric vehicle market as a whole. First off, it emphasises the necessity for electric car producers to spend money on building a strong supply chain that can effectively meet India's rising demand for electric vehicles.

Second, the study emphasises how crucial it is to use a standardised way to charging electric vehicles, like the CIM model, in order to guarantee compatibility and interoperability between various charging systems.

The report also clarifies the obstacles and difficulties faced by electric automobiles in India. The absence of suitable charging infrastructure in India is one of the main obstacles to the adoption of electric vehicles, which makes buyers concerned about range.

Additionally, as they are still seen as a luxury good, electric vehicles' high price is a significant barrier to their widespread acceptance in India. The insufficient supply of raw minerals like lithium and cobalt needed to make electric vehicles is another major problem.

Despite these difficulties, India's future for electric vehicles is bright given the government's ambitious goals to advance electric transportation there. By 2030, the government wants 30% of all vehicles sold in India to be electric, which is likely to open up a lot of chances for companies like TATA Motors that make electric cars.

11. CONCLUSION

In summary, this study presents an overview of the Indian market for electric vehicles, an analysis of its revenue and sales, an overview of the country's electric vehicle supply chain, and an analysis of the CIM model of electric vehicle charging. According to the survey, India's market for electric vehicles is expanding quickly, with rising income and sales. In India, there are many different steps and important stakeholders in the supply chain for electric vehicles. In addition, the charging and discharging system for electric vehicles can use the CIM model of electric vehicle charging successfully.

However, the report also emphasized a number of difficulties and constraints faced by electric vehicles in India, including a lack of infrastructure for charging, expensive batteries, and low customer awareness. The report suggests that in order to overcome these obstacles, electric car producers and politicians collaborate in order to invest in charging infrastructure, cut the price of batteries, and increase public awareness of the advantages of electric vehicles.

In conclusion, the future of electric vehicles in India appears bright, but major work and funding are still required to properly tap into this developing market's potential.

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Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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