

Use Of Electric Vehicles In Last-Mile Delivery For B2c: A Step Towards Green Supply Chain

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Abstract

The last few years have seen tremendous growth in the E-commerce industry. It has further improved due to COVID -19 pandemic. We are witnessing a change in consumer buying behavior and online shopping has become the new normal. In addition to safety consideration, the convenience factor has also encouraged the need for a much faster, efficient e-commerce operations. The e-commerce and the last-mile delivery operations has recovered from the impact of pandemic. It has bounced back with more positive energy and expected to grow more in the coming time. This has increased the number of vehicles doing last-mile delivery, which will increase fuel consumption resulting into increase in carbon emissions. The use of Electric vehicles for last-mile delivery may contribute towards the implementation of green supply chain logistics practices. Though consumer is still skeptical about purchasing Electric vehicles, because of high initial cost, limited range, and lack of charging infrastructure, this may not be the case with organizations involved with last-mile delivery. The reduction in the overall cost of delivery may turn to be beneficial to them by providing the required competitive edge of cost. Through this paper, the use of electric vehicles for last-mile delivery for different logistics providers will be studied and its benefits will be analyzed. Secondary data and use cases aligned with the objective will be used for this research work.

Keywords: Electric Vehicles, E-commerce, Last-Mile Delivery, Green Supply Chain, Carbon Emission.

Introduction:

Though the E-commerce industry in India was not in a very nascent stage, COVID-19 has come up as an opportunity as well as a challenge for it to tackle and fulfill the country's huge demand. The pandemic has brought up a significant change in the buying behavior of the consumer in terms of online purchase and it has become a new normal for many of us. The last two years have created an enormous demand for faster delivery options, dynamic demand, and hyperlocal shopping. Convenience has become a major factor for customer satisfaction than ever before. The convenience factor has also encouraged the

mandate for faster, more efficient, dependable last-mile operations. The surge in online shopping has increased the number of vehicles on the road doing last mile operations in a significant manner. This has further increased more fuel consumption and carbon emission. (Sharma, 2021)

Amongst all the different sectors impacted by pandemic and the national lockdown, the e-commerce and last-mile delivery recovered very fast and has also shown enough flexibility and resilience. In the coming days also, the last mile deliveries are expected to grow more, which will increase the carbon emission and

pollution if proper measures will not be taken. (Ross, 2021)

For the organizations involved in the last mile delivery operations, in delivery of groceries, food item, home services, retail, e-commerce, and many more similar services, the logistics cost will play an important role to decide its success in the marketplace.

This brings along, a challenge for socially responsible corporates to control the disturbing impressions of logistical activities on the efforts in building a sustainable supply chain.

Organizations are hence looking for opportunities to embrace greener supply chain practices to reduce carbon emission through their activities and minimize the impact on the environment. The use of electric vehicles for last-mile deliveries possibly be one of the feasible options in doing the same. Electric vehicles run on electric motors as compared to internal combustion engines which generate power by burning a mix of fuel and gases.

However, electric mobility is in a very nascent stage in India and its penetration is very less. The major challenges for the adoption of EVs include the high cost of acquisition, lack of charging infrastructure, limited range, and absence of a favorable ecosystem for vehicles and batteries. Though individual consumers hesitate to purchase EVs because of the above-said challenges, the equivalence deviates when it comes to organizations engaged in last-mile deliveries. (Gupta, 2021a)

Last-mile connectivity is facilitated by 2-wheelers and when it comes to EVs, there is no pollution from it. In terms of volume, around 90% of EVs in India are 2W and around 90% of it is contributed by e-commerce organizations

through the use of fleet operators. (Srinivasa, 2021)

Literature Review

The literature review part of this paper examines the concept of last-mile delivery, the use of electric vehicles in last-mile delivery of the e-commerce industry, and its relation to the green supply chain.

Concept of Last-Mile Delivery:

The delivery for last-mile is an important and challenging component for the distribution process.

Due to the rapid expansion in the e-commerce logistics, the challenges of distribution and last-mile delivery for online orders are also increased, and added to the last mile delivery is counted as the highest cost component.

“Last-mile delivery corresponds to the last leg in the distribution process, whereby the consignment is delivered from the last distribution point, either a warehouse or a distribution center, to the recipient, either at the recipient’s home or at a collection point”. (Archetti & Bertazzi, 2021)

Last-mile delivery is the final-end of the distribution process where they meet the end-user or receiver. Hence it refers to the physical delivery of the product or orders to the customer or receipt at the final destination.

The last-mile delivery is an important component of last-mile logistics which comprises five components as shown in fig 1. (Olsson et al., 2019)

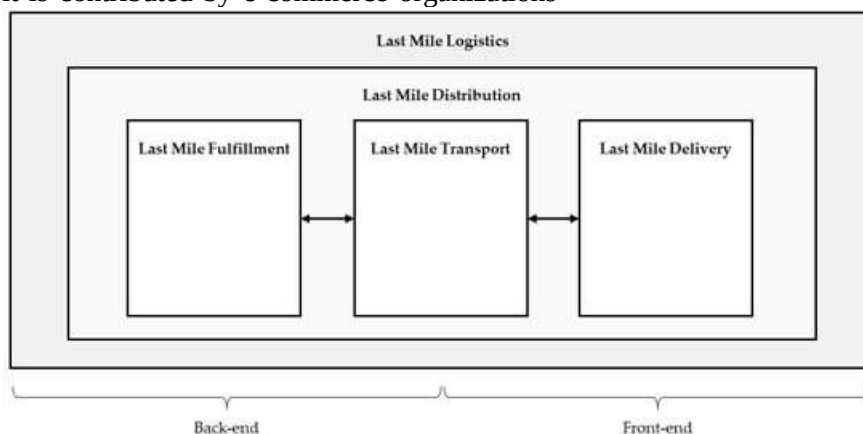


Fig. 1. The overall framework is composed of five components. (Adopted from Olsson et al., 2019)

The Use Of Electric Vehicles In Last-Mile Delivery:

The necessity for improvement and advancement in last-mile delivery to reduce the overall cost of distribution and also to reduce the emissions causing the pollution in last-mile delivery, has enforced the vendors or companies to experiment and evaluate various alternatives.

In the pursuit of this, electric vehicles have emerged as an innovative technology that reduces local emissions which helps in reducing the emissions of fumes and noises in the distribution process in the e-commerce industry. (Ehrler et al., 2021)

The supply chain of e-commerce i.e B2C industry is different than the traditional retail supply chain. For this, the coordination of smaller deliveries to the households in the city or district is an important aspect.

In the traditional retail or grocery supply chain, expenses of the last mile are mostly covered by the customer themselves whereas in the e-commerce industry the last mile expenses remain with the vendors which results in a higher cost of the distribution process. With the cost of the last mile, the emissions caused by the last-mile delivery are also challenged to the vendors for improving the overall distribution structure and adopting alternative logistic solutions to remain profitable.

The literature suggests that one solution for this challenge is the use of electric vehicles in the last mile delivery. Considering the recent developments in the business environment, the use of electric vehicles will create an impact on the optimization of emissions and also increase the economic and technical benefits in last-mile logistics. The international trend of sustainable development is also an important driver for the use of sustainable logistics alternatives. The pressure of zero or low emission in the last mile logistics in the distribution will foster the further utilization of electric vehicles in the last mile delivery.

(Ehrler et al., 2021)

The use of a conventional vehicle in last-mile delivery hurts four categories as follows:

Negative impact on Environment: Includes the excessive use of non-renewable resources, air and noise pollution, various kinds of waste involved in transportation.

Negative impact on society: Includes degradation of standard of life due to impact on public health because of pollution, traffic accidents.

Negative impact on economics: The inefficiencies in resolving transportation issues created an economic burden on all stakeholders and also negative social and environmental impacts.

Negative impact on Operations: This includes the various congestions and obstructions in the traffic to the other users of road transportation in urban areas.

(Slabinac, 2015)

The literature reveals that the vendors or companies have put more emphasis on the two pillars of sustainability more i.e. economic sustainability and relatively less emphasis on environmental sustainability and social sustainability. The consideration of social and environmental sustainability in the supply chain process remains limited. Hence, the necessity of research having a focus on social and environmental sustainability is the need of an hour. (Olsson et al., 2019)

Objectives:

To understand the benefits and challenges of use of Electric Vehicles in the last-mile delivery.

To understand the adaptation of Electric Vehicles for the last-mile delivery by various organizations.

To understand the cost-benefit analysis for the use of Electric Vehicles in last-mile delivery.

Research Methodology

The paper adopts the descriptive research design for understanding the use and switching to electric vehicles in the last mile delivery. Considering the nature of the research topic, researchers have used secondary data from peer-reviewed journals, blogs, and news articles. The researcher has used company websites and blogs to adopt the representative cases to describe the challenges and benefits to the companies for switching to electric vehicles in the last mile delivery for the e-commerce industry.

Switching To Electric Vehicles In The Last-Mile Delivery: A Move Towards Green Supply Chain Initiative

With the necessity to move ahead with the sustainable development trend, the vendors and companies are switching to electric vehicles

instead of the conventional one for the last-mile delivery. This switch to an alternative solution has various benefits for the vendors in the distribution process and overall impact on society.

The important benefit of use of electric vehicles is reduction in local emissions such as PM or NOx which results in a reduction in transportation footprint.

With the advantage of less air pollution, electric vehicles also reduce the negative impact on the environment. (Iwan et al., 2021)

The use of electric vehicles as an alternative to fuel-intensive vehicles helps the vendors in addressing the issue of pollution, use of non-renewable resources. (Sharma, 2021)

Electric vehicles not only contribute to the environmental and social aspects of sustainability for the vendor or companies but also in the economic sustainability and other business benefits.

The minimum fuel consumption is the important benefit of the use of EVs in last-mile delivery. Compared to the other types of vehicles, EVs minimize fuel consumption significantly.

Another benefit of the use of EVs is cost-efficient logistics. The fuel consumption and the overall cost of logistics have a direct relation to each other. EVs reduced operational costs with lesser fuel consumption. According to (Sharma, 2021), traditional delivery vehicles cost 3.3 times higher than EVs. Also, it reduces the huge monetary investment.

The EVs are also user-friendly and easy to maintain as compared to the conventional delivery vehicles. EVs are low maintenance vehicle similar to other electronic gadgets. Also, it has less number of auto parts compared to the conventional one.

The limited travel radius requirement for the vehicles in last-mile delivery reduces range anxiety. For the last mile delivery, the travel distance and route are pre-defined and most of the time it is in slots. The vehicle is supposed to come back to the source location within 2-3 hours and can get recharged for the next trip of order delivery. This reduces the range anxiety and may not get affected by the lack of infrastructure ecosystem. The source location can have its own recharging station for the vehicles.

Good Business Practices Applied for Sustainable Last - Mile Delivery Operations

Nevertheless, EVs are there for a long time now, recently it has won the substantial attention of the organizations involved in the last-mile delivery due to their efficacy and sustainability. Though the use of EVs may prove itself good for different types of delivery business, it is most suited to last-mile delivery operations as it has a fixed and limited radius to move, for ex- milk, groceries, food delivery, home service deliveries, retail delivery, e-commerce, etc. The advantages of the implementation of EVs can be further enhanced by optimizing the delivery route and daily dispatches supported by artificial intelligence, to drive lesser kilometers, and also improving last-mile visibility for the businesses.

Few of the present business cases can be studied to understand the use of the EVs for last-mile delivery operations. These business models may encourage other similar businesses to evaluate the benefits of it and motivate them to switch to EVs for a better and greener tomorrow.

Big Basket

The organizations engaged in delivery services, like BigBasket will be a support for the evolving electric bike start-up environment in the country. BigBasket has deployed electric vehicles in their approx. 5k stores to deliver their services to customers within a limited range of 10-12 km. They have developed charging stations within the stores to charge the vehicles. A delivery person's bike covers approx. 60-80 km in a day compared to around 20km for a normal user. This saves on fuel which covers up the higher upfront vehicle cost compared to a conventional bike. Normally, a 2-wheeler carries orders for a two-hour delivery slot, then comes back to the store and recharges the battery. This falls very well within the battery range to cover around 80 km. The great advantage to BigBasket is a drop in cost per order by approx. 30-40%.

BigBasket works on an asset-light model, where the business doesn't own the capital asset. BigBasket doesn't own the vehicles, hence its responsibility is to persuade the logistics partner to shift to EV for shared benefits. Along with the operational cost benefits, providing the charging infrastructure in the storage facility by BigBasket can be an encouragement for the logistics partner.

The benefit of Electric vehicles is creating demand for different types of business models. For example, an electric bike manufacturer Euler Motors is offering “mobility as a service” as a logistic provider. The various organization engaged in last-mile delivery, e.g. BigBasket, Blue Dart, Ecom Express, Udaan are their clients for this parallel business model. Hyderabad-based Eto Motors which manufacturers three-wheelers also has a logistics arm. This business model provides confidence to the clients, who are still hesitating to use electric vehicles because of the lack of the ecosystem. The greatest barrier to manufacturing EVs is regarding the uncertainty of demand. This two-in-one business model helps manufacturers tackle the issue of demand. Today we may see full-fledged logistics companies with fleets of EVs. We may also see a few aggregators who don’t own vehicles but are promoting EVs through their business models and shifting to it. They provide the service through third-party drivers registered with them and slowly are shifting to the electric vehicle movement. The success of the business model differs at different places and in different companies. BigBasket has partnered with other logistics service provider, like Zypp Electric for the same.

Though individual customers must be waiting for the higher subsidies and lower battery costs, the advantage of lesser operating costs itself is a dividend for the e-commerce and organizations involved in last-mile deliveries and they will take initiatives for the adoption of EVs. (Chakrabarty, 2021)

VegEase

VegEase is a “born in pandemic” start-up delivering vegetables and fruits with the help of new-age technology, blended with the traditional grocery purchasing pattern.

VegEase provides the customer an opportunity to book a grocery cart, typically carrying 70-80 SKUs as per their convenient time slot, and then wait for the cart to arrive at their doorstep to handpick the items themselves. To reduce the carbon footprint for its logistics operations and to reduce the cost for the same, it has started deploying electric vehicles in its last-mile delivery. It has partnered with electric vehicle manufacturer OBA for its 3-wheeler eVikas in a long-term leasing model.

(Express Drives Desk, 2021)

Zypp Electric

Zypp Electric is headquartered in Gurugram and is on a roadmap to make all last-mile deliveries electric. It is a tech delivery EV logistics start-up that has built last-mile delivery services to assist businesses from different sectors. The organization has identified the opportunity to electrify the last-mile delivery operations for the sustainability demands of rising India.

It provides its services to a variety of enterprises, starting from large e-commerce, e-grocery stores, small Kirana stores, restaurants, and many which require last-mile delivery options. They provide tech-enabled services for their last-mile deliveries with the use of electric vehicles along with service timings, IoT-enabled battery swapping infrastructure, etc. All the vehicles at Zypp are equipped with IoT-enabled technology for real-time tracking of the vehicle and delivery executive to maximise the efficiency. It is said there, “moving vehicles make money, standing ones don’t.” The Zypp swapping stations are installed at key locations. (Krishna, 2021)

Apart from providing services to clients, it also helps their delivery riders in purchasing an electric 2-Wheeler at zero interest which assist them to earn more and generate higher profits. Zypp Electric is operational in Delhi, Gurgaon, Ghaziabad, Noida, Faridabad, Mumbai, Pune, Bengaluru and Hyderabad.

(Livemint, 2021)

Cost Comparison

Electric Vehicles will become economical than conventional ICE vehicles over the life cycle. The overall cost of ownership of the vehicle will be further reduced with a reduction in battery prices. One of the downsides for EVs today is, it is priced higher than their counter ICE vehicles. Though only the purchasing cost doesn’t represent the total cost of ownership for the consumer. The EVs stand quite economical in terms of operational costs when compared to ICE vehicles. This means with a few years of operations, the total cost of conventional will be much more than EVs.

The following graph (fig. 2) shows the reduction in the price of batteries from 2013 to 2019 for the battery pack and battery cell. As

per the analysis and forecasting done by DataLabs by Inc42, by 2025 the price of the

battery will reach US\$96 per KWh will play a major role in reducing the cost of EVs.

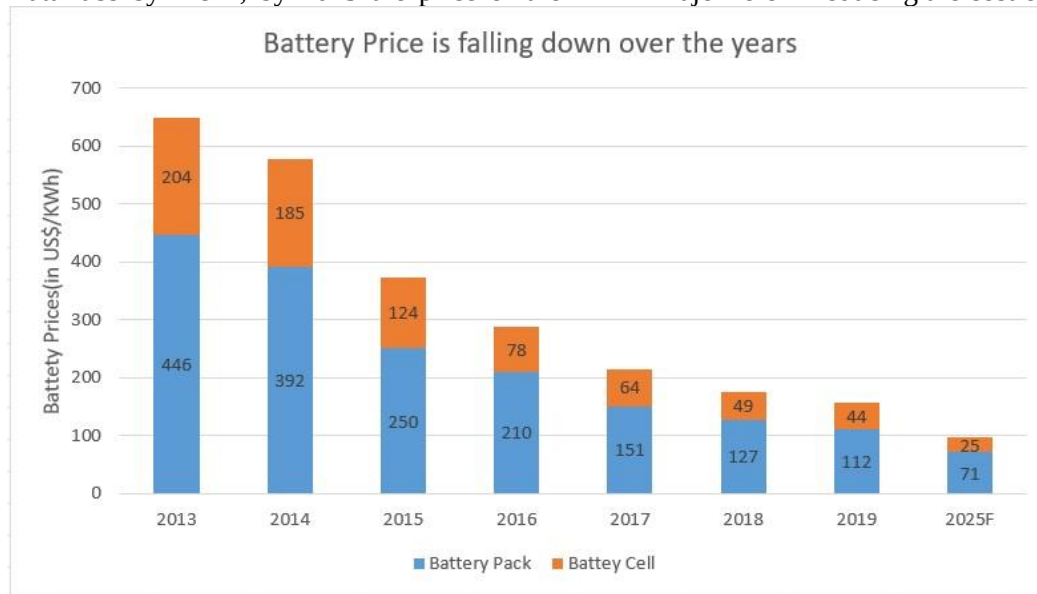


Fig 2: Reduction in Battery Price over the years

Source: Adopted from DataLabs

Two-Wheelers:

The two-wheeler EV market in India is dominantly ruled by manufacturers like Ather, Hero Motocorp, Bajaj AutoRevolt, and Okinawa. A comparative analysis of Ather 340

and Honda Activa 5G conveys that the operational cost of the electric 2W can be 4 times lesser than a conventional vehicle after 5 years of operation (fig 3). For the last mile delivery operations, 2W EVs is a much-preferred mode of transportation because of their low cost of operations.

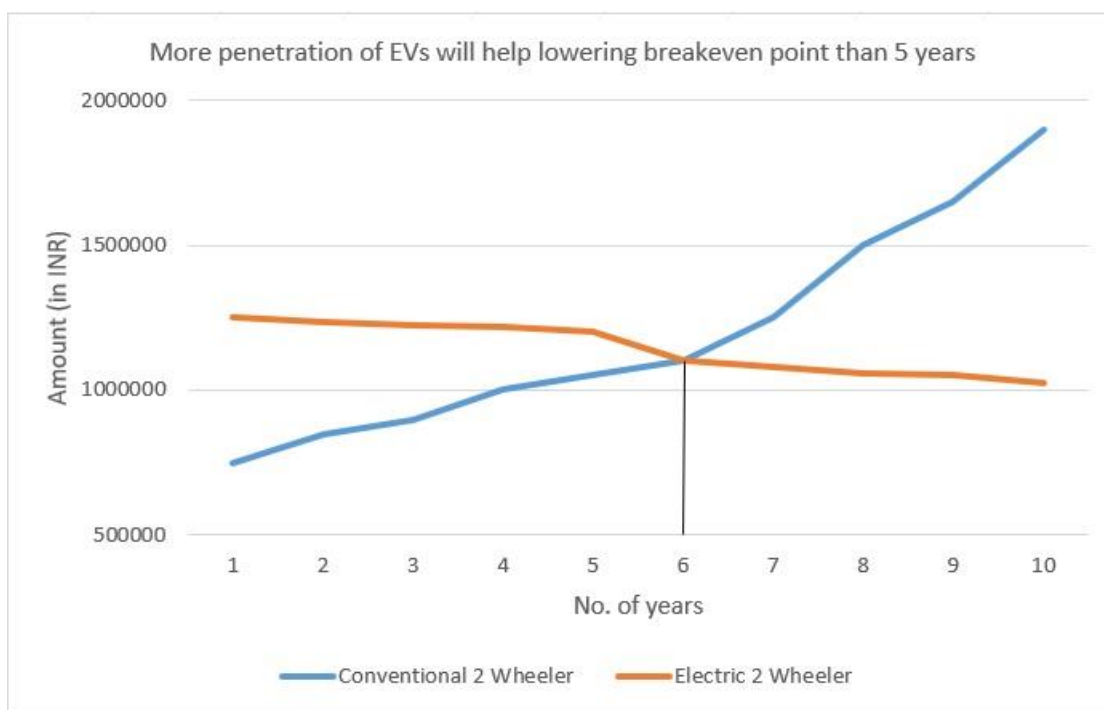


Fig 3: Cost Comparison of Electric 2-Wheeler with Conventional 2-Wheeler

Source: Adopted from DataLabs

Redefining The Micro-Mobility Using Electric Three-Wheelers

In India, any electric 3-wheeler is priced much below any other type of electric vehicle. The lower cost of running is attracting businesses

towards the electric 3W. By doing a comparative analysis of Piaggio Ape Elektrik and Mahindra Alfa DX, we can conclude that the breakeven point can be achieved in just two years of operation (fig 4). This can be achieved in tier 1 cities but for Tier 2 & Tier 3 cities, it

may take a little more because of the gap in the availability of the infrastructure.

The operational cost of an electric 3W is 3.3 times lower than a conventional 3W. This has been concluded by doing a study of both the vehicles for 25,000 km. (Mandal, 2020)

Electric Three Wheelers Are More Profitable than Conventional Vehicles

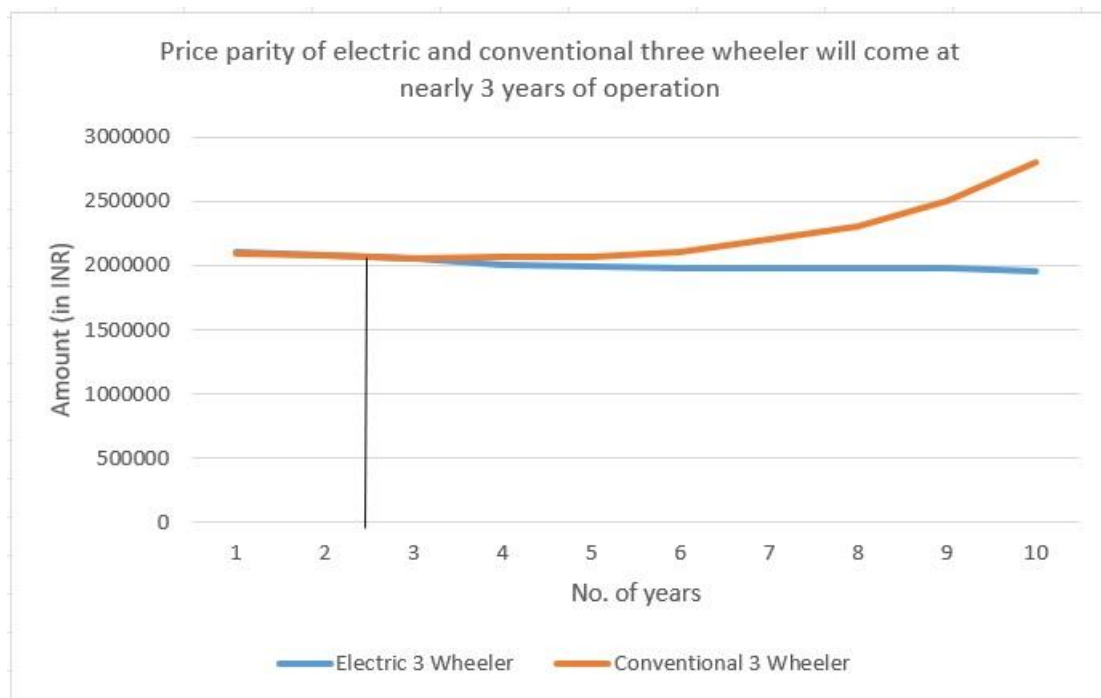


Fig 4: Cost Comparison of Electric 3-Wheeler with Conventional 3-Wheeler

Source: Adopted from DataLabs

The start-ups working in the field of last-mile delivery operations have contributed a lot towards the rise of the usage of electric two and three-wheelers in India. Stimulated by the safety preferences and lockdown restrictions, a lot of people have shifted to online shopping, which has increased the requirement of home deliveries. Though the range anxiety is a major concern for prospective consumers of EVs consumers, it may not be the same for delivery purposes because of predefined and limited routes designed for a limited radius and hence make it simpler to charge the vehicle.

Discussion

Inadvertently, the pandemic has fast-tracked the adoption of electric vehicles. People have realized the importance of the environment and

sustainability and at the same time are gaining advantages of reduction of the cost of operations. The e-commerce, last-mile delivery, hyperlocal delivery businesses have understood the benefits and are adopting EVs quickly. They also are partnering with players of mobility to accommodate the demand-supply gap.

Organizations need to have a long-term vision to adopt EVs. The sentiment of the central and the state governments look quite positive for the implementation of EVs. New policies, potential start-up culture may gain from the available and upcoming market opportunities. Various e-commerce organizations have already announced their intention to transition to a comprehensive electric fleet to get the advantage of its benefits and at the same time earn goodwill for becoming a green organization.

As per the report by World Economic Forum, due to ongoing safety concerns among

consumers, e-commerce will see enormous growth in the coming years. It will increase the number of vehicles on road and this will surely make electric vehicles the preferred choice for commercial uses considering the lesser total cost of ownership (TCO) and operating cost. The continuous increase in the fuel cost is also encouraging the businesses to evaluate the option of EVs. The economic benefits of the adoption of EVs, in the long run, will compensate for the high initial cost of acquisition.

Savings on fuel and operating costs will lead to passing the benefits like reduction in the retail prices of products as the logistics cost contribute a lot to the cost structure. With the record rise in demand for home deliveries, EVs will be the choice for last-mile deliveries. Though the acquisition cost is higher at this point, it is supposed to come down with advancements in technology and a reduction in the battery cost. The government and industry are working together to increase the demand by educating consumers, bursting myths, and positioning EVs. The shift towards electric mobility looks unavoidable. The creation of a robust affordable, accessible, and reliable ecosystem will drive the stakeholders towards a smooth transition towards EVs.

Organizations engaged in supply chain last-mile delivery solutions are welcoming the move for greener logistics practices to reduce the carbon footprint and to minimize the impact of their business on the environment. (Sharma, 2021)

Most of the electric 2W and 3W have a mileage of around 120-150 km in one charge and can last up to 12 hours. The maintenance requirement of these vehicles is comparatively lesser than the conventional vehicles. A study done by automotive researchers says that electric vehicles are at least 30% cheaper than conventional ones. Apart from the benefits of the reduction in operating cost and total cost of ownership, the shift towards electric vehicles is necessary for the fast depletion of fossil fuels, increase in the cost of energy, the negative effect of conventional ICE vehicles on the environment. (Gupta, 2021b)

From the sense of economy, the need of the hour is to create an EV-friendly infrastructure that could lead the country to large-scale adoption.

The ecosystem and efforts by major players provide a sense of favourable environment

getting created towards major transformation in the mobility sector. The businesses which has incorporated EVs into their system will soon be able to endorse it and may motivate other similar businesses to adopt the same.

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