**Title of Research Paper:**

**A Study to know Sustainability Practices of selected Electric Car Companies in India.**

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**Abstract:**

Growing concerns about environmental issues and the need for sustainable transportation have led to the emergence of electric vehicles (EV) around the world. India, one of the world's largest car markets, is also focused on electric cars. The Government of India has launched various policies and initiatives to promote EV adoption, making the Indian EV market highly competitive.

 The purpose of this study is to compare and analyse electric car companies operating in India. The study focuses on three major players in the Indian EV market namely Mahindra Electric and Tata Motors. The study analyses various aspects of these companies, including their pricing strategies, EV portfolio, battery technology, charging infrastructure and overall market share.

 To conduct the study, secondary data is collected from various sources such as company websites, industry reports and market research reports. The data is analysed using a comparative approach to identify the strengths and weaknesses of each company.

 The study provides valuable insights into the performance of each company in the Indian electric vehicle market. The findings will help stakeholders including policy makers, investors and consumers to make informed decisions about EV adoption in India. The purpose of the study is to contribute to the growing knowledge of the electric vehicle market in India and provide a framework for future research in the field.

**Keyword:**

Sustainable transportation, competitive strategies, Govt policies, Indian EV market, Mahindra Electric, Tata Motors

**INTRODUCTION**

India is a developing nation with a large population and expanding economy. As a result of this growth, there has also been a significant increase in the number of vehicles on the road, which has led to issues with pollution, carbon emissions, and traffic congestion. Reasonable transportation is presently vital for the public authority, with electric vehicles at the front. Tata Motors and Mahindra Electric are two of the biggest players in the Indian market for electric vehicles. This paper compares these two companies' contributions to sustainable transportation in India, highlighting their strengths, weaknesses, and research gaps. Sustainable transportation is an important part of lowering carbon emissions and keeping the environment healthier and cleaner. In contrast to conventional vehicles powered by non-renewable energy sources, electric vehicles have emerged as an affordable and easy-to-maintain alternative. The government of India has set a lofty goal of achieving 30 percent electric vehicle adoption by 2030. Notwithstanding, various variables, including significant expenses, a restricted charging foundation, and reach nervousness, have eased back the reception of electric vehicles in India. The Indian government has launched a few initiatives to promote electric vehicles and reduce reliance on gasoline subordinates. India has the potential to become a global leader in electric mobility due to its substantial domestic market and robust manufacturing capabilities. Tata Motors and Mahindra Electric, the two major players in the Indian market for electric vehicles, have invested heavily in environmentally friendly modes of transportation.

**Literature Review**

**Indukala M. P and Bincy M. Mathew (2019** observed that Traveller electric vehicle deals are assessed to arrive at 10 million in 2025, 28 million in 2030, and 56 million by 2040. A conversion of variables, including environmental change, has set out a freedom for electric portability to join the standard market. The likelihood of a fast global temperature rise has necessitated a decrease in the usage of fossil fuels and the emissions connected with them. Renewable energy advancements Wind and solar power generating technologies have dramatically lowered their costs during the previous decade, introducing the potential of clean, low-carbon, and low-cost systems. Rapid urbanization is taking place. Economic progress, particularly in emerging nations, is causing a surge in urbanization as rural residents seek jobs in cities.

**Mohamad .M. et. al.(2018)** explored that The majority of big cities have high levels of air pollution, with vehicle emissions being one of the main culprits. Delhi, the capital of India, has begun to experience smog because to high levels of air pollution. Even more environmentally beneficial are EVs thanks to the usage of recycled and used auto parts. A greater understanding of climate change encourages the development and selling of electric vehicles. A greater awareness of pollution encourages the development and selling of electric vehicles.

According to the study conducted by **Happy Choudhary et. al. (2022**) the Indian vehicle industry is anticipated to move up to third place by 2030. This industry has a larger obligation to contribute significantly to lowering pollution levels and decreasing reliance on imported crude oil. Due to the fact that they are the ones who bring in the clients, marketers should play a crucial role. It is their duty to inform customers of the value of and necessity for green products. Consumers should be informed about environmentally friendly vehicles and their benefits. The government should offer the assistance required to make this happen. By the recent Budget policy measures, the Indian government has already started a number of initiatives in this area.

**Satyendra Pratab Singh (2021)** found that Mandya, 100 kilometres from Bangalore, has been found to have lithium stores, an intriguing metal expected for the assembling of electric vehicle batteries. This will be a major headway in homegrown EV battery fabrication. Researchers from India's Nuclear Energy Bonus assessed lithium stores to be 14,100 tons on a little land parcel reviewed in the Southern Karnataka state. Chile is supposed to hold as much as 8 million tons of lithium stores, while Australia has distinguished 2.8 million tons.

**Pritam Keshavdas Gujarathi and Varsha Shah (2018)** found that Contrary to other nations, the United States has a very high car-to-person ratio, higher population density, and higher emissions. With 1.726 billion mt of CO2 emissions, India comes in third. According to, the top 10 emitting nations are responsible for almost two-thirds of global CO2 emissions. So, it is vital to concentrate on EV technology, which can produce no emissions for sustainable transportation. Also, a sharp rise in the number of personal vehicles has been seen because of urbanization and the decentralization of municipal areas.

**Rujuta O. Kambli (2022)** opened it for some on-road applications, EVs have a significant amount of potential to replace ICEVs. The use of EVs can decrease reliance on oil, increase driving comfort, improve surrounding air quality, and decrease ozone-depleting chemical emissions. The jolt of cars fits in with more extended zap and decarbonization patterns and collaborates with other advancements in portability, such as computerization, metropolitan micro versatility, and portability-as-a-service options. With EVs capable of assisting power-framework arranging and activities in various ways, the legal incorporation of EVs into power frameworks opens up a number of opportunities for synergistic advancement of electromobility and electric power frameworks.

**Anil Khurana et. al.(2019)** It was found that the over exceptionally old vehicle business is ready for change. Individual versatility propensities should change because of rising non-renewable energy source costs and the extreme ecological impacts of their outflows. The business, which has been driven by gas powered motors, is steadily changing to electric vehicles (EVs). Electric engines push the vehicles, and the power supply is kept up with by a compact energy stockpiling unit or battery-powered battery. These vehicles use less energy, create less ozone-depleting substances (GHG), and produce less commotion.

**Sonali Goel (2021)** stated that as the EV market evolves, the primary focus should be on actual EV adoption rather than intervention. It is also critical to consider the gap between purpose and actual behavior. The current study's key research gap is consumer awareness and abilities for assessing and comparing the financial benefit and costs of EVs. Future customer education studies may have an impact on how effectively politicians and marketing professionals grasp the financial benefits and costs of EVs.

According to **Menonjyoti Kalita & Golam Imran Hussain (2021),** On a global basis, the market for electric vehicles (EVs) is rapidly developing. The market is developing as the Ministry of Heavy Industries and Public Enterprises initiated the FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) project in 2015. By 2026, the market for EV batteries in India is anticipated to develop at a CAGR of 30%, reaching US$ 520 million in 2018. 4.75 GWh of additional MWh were added in total in 2018, and 28.0 GWh are anticipated to be added by 2026.

**Rumi Aijaz (2022)** found that because of the multiple challenges caused by the use of petroleum products, such as their swift exhaustion, growing energy costs, the natural effect of engine cars, and concerns about environmental change, India felt the necessity to transition to electric transportation. According to projections, India's transportation industry will be responsible for around 375 million tonnes of direct CO2 emissions in 2022, accounting for nearly 10% of the country's total GHG outflows.

**Statement of the problem**

India's transportation business has an impact on the climate and general well-being due to high levels of contamination and waste from fossil fuels. Adopting cost-effective transportation options is critical to resolving these difficulties. However, putting acceptable transportation concepts into action necessitates tremendous conjecture, and organizations should design new ways to enable decent transportation practices. As a result, the purpose of this investigation is to look at Goodbye Engines and Mahindra Electric's strategies for improving sustainable versatility in India, as well as their commitment to attaining economic development objectives.

**Objective**

The ideal of this exploration is to give a relative analysis of Tata Motors and Mahindra Electric on sustainable transportation in India.

The study aims to :

 1.Anatomize the sustainability practices adopted by both companies in promoting sustainable transportation in India.

2. Assess the impact of these practices on the terrain and public health.

3. Identify the challenges faced by both companies in promoting sustainable transportation practices.

**Research Methodology**

* Qualitative research methodology will be used in this study. The data will be collected from the following secondary sources like Academic article, Government publications, Company websites, and Industry reports.
* •The data collected from the sources will be analysed using content analysis, which involves identifying themes and patterns in the data.
* •The analysis of the data was conducted using a comparative approach, focusing on key sustainability metrics of both Tata Motors and Mahindra Electric such as electric vehicle production, charging infrastructure, research and development, and policy advocacy.

**Comparative Analysis Of Tata Motors and Mahindra & Mahindra**

To conduct a relative investigation of Tata Motors and Mahindra and Mahindra we will evaluate them on the following parameters:

1. **Infrastructure for Charging:** A comprehensive charging infrastructure is essential for the widespread deployment of electric cars. Tata Motors has collaborated with a number of organizations to establish charging stations around the country. In addition, the firm has created a mobile charging van to provide charging services in outlying locations. Mahindra Electric has established its own charging infrastructure, dubbed 'Charge Grid,' which has over 300 charge stations spread across India.
2. **Battery Technology:** For their electric vehicles, both companies use lithium-ion batteries. But, Mahindra & Mahindra's subsidiary, Mahindra Electric, has upgraded its battery technology, allowing it to give superior battery performance and a longer range.
3. **EV Portfolio:** Tata Motors and Mahindra both provide a diverse selection of electric cars in a variety of sectors. The Nexon EV, Tigor EV, and Tiago EV are part of Tata Motors' portfolio, while Mahindra’s portfolio includes the e-Verito, e-KUV100, e2o Plus, and XUV400.
4. **Price:** Due to the high cost of batteries, electric cars are more expensive than conventional automobiles. Electric vehicles from Tata Motors and Mahindra are reasonably priced. The Tata Nexon EV has a starting price of Rs. 13.99 lakh, while the Mahindra XUV400 has a starting price of Rs. 15.99lakh.
5. **Government Incentives:** The Indian government provides numerous incentives for electric car adoption, such as tax breaks and subsidies. These subsidies benefitted both Tata Motors and Mahindra, lowering the cost of electric automobiles for customers.
6. **Research and Development:** Both Tata Motors and Mahindra have dedicated R&D teams focused on increasing battery technology, range, and performance. Tata Motors has collaborated with the Indian Space Research Organization (ISRO) to produce indigenous lithium-ion batteries, while Mahindra Electric has created a new motor and drivetrain system for its electric cars.
7. **Market Proportion:** In the Indian EV market, Mahindra and Tata Motors have differing market shares. According to Team-BHP, Mahindra had a 0.6% market share in the Indian EV industry in 2021-22, while Tata Motors had an 85%market share.
8. **Sustainability Strategies:** Tata Motors, India's largest carmaker, is a publicly traded corporation. M&M Limited (M&M) is an Indian multinational automobile manufacturer located in Mumbai, Maharashtra. For decades, both corporations have been committed to long-term sustainability policies. Let's look at some of the efforts that these businesses are launching. Environmental Initiatives - Tata Motors has used renewable energy sources such as solar electricity to minimize its carbon footprint and boost the efficiency of its manufacturing facilities since 2013. It also heats water with a waste heat recovery system, which cuts fuel use by 10%. M&M has installed solar panels at its sites around India to reduce downtime due to power outages during peak periods, lower energy costs, and boost production.
9. **Performance:** The Nexon EV is fueled by a 30.2 kWh lithium-particle battery that can go up to 312 km on a solitary charge. The vehicle heads out from zero to one hundred kilometers each hour in 9.9 seconds and has a maximum velocity of 120 kilometers each hour. Interestingly, the XUV400 is fueled by a 34.5 kWh lithium-particle battery that can go up to 375 miles on a solitary charge. The auto makes a trip from zero to one hundred kilometers each hour in 8.3 seconds and has a maximum velocity of 150 kilometers each hour.
10. **Future Plans:** Tata Motors has stated that it intends to launch many new electric car models in the next years, including the Altroz EV, HBX EV, and Sierra EV. Mahindra & Mahindra has also announced plans to launch new electric vehicle models, including the eXUV300 and Atom.
11. **Recyclable Materials:** Both firms use recyclable materials in the manufacture of their electric automobiles. For example, Tata Motors used recycled PET bottles to manufacture seat textiles in its electric cars, while Mahindra & Mahindra used recycled plastic for part of its electric vehicle components.
12. **Carbon footprint:** Tata Motors and Mahindra & Mahindra have been attempting to reduce the carbon impact of their electric vehicles. They have been implementing initiatives to cut emissions from their manufacturing operations as well as using more energy-efficient components.
13. **Partnerships for Sustainability:** Tata Motors and Mahindra & Mahindra have formed alliances with a variety of groups to promote sustainability in the electric vehicle business. Tata Motors, for example, has collaborated with the Indian government's Department of Science and Technology to develop and market electric vehicles in the country. To encourage sustainable business practices, Mahindra & Mahindra has joined the Confederation of Indian Industry.
14. **Sustainable Mobility Solutions:** In addition to electric automobiles, both firms have been researching sustainable transportation solutions. Tata Motors, for example, has been working on hydrogen fuel cell technology, while Mahindra & Mahindra has been investing in shared mobility solutions.
15. **Green Manufacturing:** Both Tata Motors and Mahindra & Mahindra have been working to improve the sustainability of their production processes. They have put in place measures such as employing renewable energy, lowering water consumption, and reducing waste.

**Challenges Faced by the Indian EV Market**

* Besides its growth potential, the Indian EV market faces several challenges. The absence of enough infrastructure for charging is one of the main problems.. The Association of Electric Vehicle Manufacturers (SMEV) reports that there are over 70,000 charging stations in India, while there are only about 1,800 public electric vehicle charging stations. This lack of charging infrastructure makes it difficult for consumers to buy EVs in bulk.
* Another challenge facing the Indian EV market is the lack of consumer awareness. While some consumers are aware of the benefits of electric vehicles, many are new to the technology and skeptical of its performance and reliability.
* Finally, the high price of EVs is a barrier to adoption in India. Electric vehicles are currently more expensive than gasoline vehicles, making them unaffordable for many consumers. One reason for the high price is the high cost of the battery, which is a significant portion of the cost of an electric vehicle.

**Opportunities for companies in the Indian EV market**

* Irrespective of the hurdles, the Indian EV market presents considerable opportunity for enterprises willing to invest in the field. The Indian government has implemented several policies and initiatives to encourage EV adoption, including tax breaks, subsidies, and public charging infrastructure projects. These measures are likely to increase demand for EVs and provide possibilities for companies active in the field.
* Another opportunity for companies in the Indian EV market is the growing demand for electric two-wheelers. According to the SMEV, electric two-wheelers account for more than 95% of all EV sales in India. This provides a chance for companies to manufacture and market affordable, high-quality electric two-wheelers that match the expectations of Indian consumers.

**Research Gap**

Notwithstanding the endeavours of Tata Motors and Mahindra Electric, the reception of electric vehicles in India has been slow. Some of the factors that are holding back the widespread adoption of electric vehicles are the high initial cost, the limited charging infrastructure, and range anxiety. There is a requirement for additional examination of battery innovation, charging framework, and purchaser conduct to distinguish compelling answers for these difficulties.

There is a plethora of information on electric vehicles and sustainable mobility accessible, with several studies focusing on the economic, technological, and environmental consequences of electric vehicles. However, there is a scarcity of research comparing the sustainable mobility activities of various enterprises in the electric vehicle market, notably in India.

This study aims to fill a knowledge vacuum and provide insights into Mahindra Electric and Tata Motors' sustainability efforts.

**Conclusion**

In conclusion, the study on sustainability practices of selected electric car companies in India revealed that most of the businesses have adopted various sustainable strategies to lessen their environmental impact. Using renewable energy sources, lowering emissions, and encouraging energy efficiency are a few of these actions. After comparing Tata Motors and Mahindra and Mahindra, it is clear that both businesses have made substantial contributions to sustainable business practices in India's electric vehicle market.

Many electric car models, including the Tata Nexon EV and Tigor EV, have been introduced by Tata Motors, which has been actively involved in the development and promotion of electric vehicles. Also, the corporation has set up a nationwide network of charging stations and has incorporated other sustainability efforts into its business practices, such as the utilization of renewable energy sources and waste minimization.

With its electric models like the eKUV100 and eVerito, Mahindra and Mahindra, on the other hand, has also been a significant player in the Indian electric car market. The business also uses sustainable business practices in its operations, including the utilization of waste management, renewable energy sources, and water conservation.

Overall, Mahindra & Mahindra and Tata Motors are dedicated to sustainable business practices in India's electric vehicle market and are making considerable efforts to lower their carbon footprint and advance a more sustainable future. Both businesses will need to continue their efforts to maintain their top positions in the sector, while there is still room for advancement and innovation in this field.

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