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Mediating Role of Factors Influencing the Adaptability of Electrical Vehicles Towards Economic and Environmental Sustainability

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Abstract: **-** Electric Vehicles, also known as EVs, operate using electricity as their main power source rather than relying on gasoline or diesel-like traditional vehicles. These eco-friendly and efficient vehicles replace the internal combustion engine with an electric motor powered by rechargeable batteries. Electric vehicles (EVs) provide numerous benefits. They emit zero tailpipe emissions, reducing harmful pollutants that worsen air pollution and climate change. This makes them a more environmentally friendly choice for transportation. Moreover, EVs operate quietly and offer a more seamless driving experience in comparison to conventional vehicles. This study seeks to investigate the impact of EV adoption as a driving force towards improved economic and environmental sustainability in India.

Keywords*: EV vehicle, Sustainability, Perception.*

1. Introduction

The growing interest in electric vehicles (EVs) reflects a significant shift in consumer attitudes toward sustainable transportation. As the world grapples with climate change, EVs have emerged as a crucial solution in reducing our carbon footprint and transitioning towards a greener future. Their increasing popularity has also spurred numerous automotive companies to invest heavily in research and development, expanding the market with a variety of models to suit different consumers' needs.

Connecting an electrical power supply to an electric car will charge it, such as a wall outlet or a specialized EVs charging point. The vehicle's forward movement is driven by the electrical energy stored in its battery, which powers the electric motor. The distance an EV can cover on a single charge fluctuates based on the specific model and the capacity of its battery. Various kinds of electric vehicles are on the market, including all-electric vehicles (also called battery electric vehicles or BEVs), which run solely on electricity, and plug-in hybrid electric vehicles (PHEVs), which have both a traditional engine in addition to a motor powered by electricity that can receive a charge from an external supply. The electric car range is increasing and charging infrastructure is growing as EV technology develops. Because of this, electric vehicles are a potential and increasingly well-liked substitute option

for people who are concerned about the environment and wish to minimize their environmental impact in terms of carbon emissions, while actively participating in the pursuit of a more eco-friendly future.

In the coming years, particularly in the Mangalore area, electric vehicles (EVs) are poised to gain significant popularity as an innovative mode of transportation. These cars offer a more sustainable and environmentally friendly alternative by relying on electricity instead of fossil fuels such as petrol or diesel. The significance of electric vehicles lies in their ability to minimize detrimental emissions and contribute to the fight against climate change. Electric vehicles (EVs) are environmentally friendly as they do not emit carbon pollution since they run on electricity. This eliminates the release of harmful pollutants like carbon dioxide, nitrogen oxide, and particulates that are known to cause air pollution and contribute to global warming. By using EVs, the carbon footprint of the area can be reduced, leading to a notable enhancement in air quality in Mangalore. Moreover, electric vehicles provide numerous advantages in terms of sustainability as they minimize their environmental footprint by utilizing renewable energy sources such as solar or wind power for charging. This not only encourages the adoption of cleaner energy but also decreases reliance on limited fossil fuel reserves. The implementation of electric vehicles in Mangalore can result in multiple favourable outcomes.

In the first place, it can aid in reducing pollution levels brought on by conventional combustion engines, especially in heavily populated places. Due to improved air quality, the city can also become more verdant and increasingly suitable for living, and the residents' health may improve. Additionally, the Mangalore region is fortunate to have access to various alternative energy sources like wind power and solar power. By embracing electric vehicles, the area could tap into its potential for renewable energy and develop a sustainable transportation infrastructure. This blend of clean energy and electric vehicles could pave the way for a brighter and more sustainable future. Moreover, electric vehicles are known for their quieter operation in comparison to conventional vehicles, thus aiding in the mitigation of noise pollution in Mangalore. This has the capacity to elevate the standard of living for individuals and transform the city into a more serene and peaceful habitat, especially within metropolitan regions.

Against this backdrop, the research paper seeks to delve into the nuanced dynamics of economic sustainability in Indian automobile. By investigating the factors influencing towards purchase of EV and economic sustainability and assessing the impact of adopting to EV, the study aspires to contribute insights that inform strategic decision-making, policy formulation, and industry practices. The overarching goal is to chart an opportunity toward a more economically sustainable future for Indian green energy, ensuring not only the prosperity of individual enterprises but also the resilience and vibrancy of the entire automobile sector.

1.1 Problem Statement

Despite there are several advantages of adopting the EV, India is facing several challenges towards the sales of EVs. This demands the identification of factors, influencers, advantages, and limitations towards the acceptance of EVs by Indian customers. Hence this research paper focuses on the study of various factors which influence and limit the adoptability of EVs as EVs are a major step towards economic and environmental sustainability and it focuses on the variables that the Companies or the Government should identify to make EVs more affordable and accessible, build the necessary infrastructure for charging, and promote their use as a sustainable option for transportation.

1.2 Scope of the study.

Coastal Karnataka, an area renowned for its diverse consumer base and the importance of EVs in the local economy, is the subject of the research paper's demographic analysis. The coastal Karnataka includes Dakshina Kannada. In terms of research technique, the study uses a qualitative approach to provide readers with a thorough grasp of the relationship between many aspects and the economic sustainability of electric vehicles.

In terms of the expected contributions the scope of practical implications to be derived are to provide actionable insights for Companies, policymakers, and customers to enhance technology adoption, innovate management practices, and improve economic and environmental sustainability in Coastal Karnataka. The theoretical implications are aimed to contribute to the academic literature by expanding the understanding of the interplay

between technology adoption, innovation management, and economic sustainability in the context of EVs. Thus, this study aims to meaningfully contribute to the body of knowledge by concentrating on Coastal Karnataka and utilizing a qualitative research design. It also hopes to provide insightful information for academic and practical stakeholders interested in the development of EVs in the region.

1.3 Need for the study

Several Researchers (e.g., Joshi et al., 2023; Kumar, 2007; Thakur et al., 2022) have stressed the need for an investigation of ECS in India, citing a number of important aspects that affect the nation's growth, prosperity, and general well-being. India presents special potential and challenges in attaining sustainable economic growth because of its size and diversity of population. It is imperative to carry out this kind of research to comprehend, manage, and improve the nation's economic trajectory. The study of the economic viability of electric vehicles (EVs) holds significant importance for various reasons, such as aiding India in achieving its sustainability objectives, addressing pressing environmental concerns like air and water pollution, tackling economic disparities, and enhancing infrastructure. Additionally, it is crucial for job creation, suggesting policies to enhance workforce skills, identifying obstacles to growth, fostering innovation, and boosting long-term economic competitiveness. Furthermore, it is essential to explore methods to enhance energy efficiency, minimize waste, and promote renewable energy sources for sustainable economic progress. This research also serves as a blueprint for economically feasible, socially inclusive, and environmentally responsible strategies, with global implications in international trade, climate discussions, and sustainable development commitments beyond national borders.

1.4 Benefits of EV Vehicles

Electric vehicles (EVs) provide several advantages for both people and the environment. some of the main benefits of electric vehicles are,

1. Environmental friendliness: The adoption of electric vehicles (EVs) plays a crucial role in combating air pollution and mitigating the impacts of climate change due to their zero tailpipe emissions. By shifting away from conventional internal combustion engine (ICE) vehicles to EVs, we can effectively decrease greenhouse gas emissions and enhance air quality, thereby positively impacting public health.
2. Energy Efficiency: Electric vehicles (EVs) use less energy than traditional internal combustion engine (ICE) vehicles. While ICE engines are only about 20% efficient, electric motors typically have an efficiency of 80-90%. This increased efficiency in EVs results in less wasted energy and more effective utilization of the battery's power.
3. Reduction in Fossil Fuel Dependence: Electric vehicles have the potential to lessen our dependence on non-renewable energy sources such as gasoline and diesel. We can reduce our dependency on non-renewable resources and enhance the environmental friendliness of transportation by transitioning to electric vehicles EVs and using electricity generated through the utilization of sustainable energy sources like solar and wind power, which are inherently renewable.
4. Lower Operating Costs: Electric vehicles typically offer a more cost-effective option in terms of operational expenses when compared to conventional internal combustion engine vehicles. This is primarily attributed to the relatively lower cost of electricity in contrast to petrol or diesel, leading to decreased fuel expenditures. Furthermore, due to their simpler design with fewer moving components, electric cars necessitate minimal maintenance. Throughout the vehicle's lifespan, there is no requirement for gearbox servicing, oil changes, or spark plug renewals.
5. Tax breaks and incentives: Different governments provide tax incentives and breaks to promote the use of electric cars. Along with tax breaks, rebates, and subsidies, potential perks for buying electric vehicles could involve waived or decreased registration fees, toll exemptions, and priority parking. These benefits enhance the appeal and accessibility of electric vehicles to prospective customers.
6. Smoother and Quieter Ride: Compared to conventional automobiles, electric vehicles make a lot less noise. EVs operate quietly because of the absence of an ICE, which lowers noise pollution in populated places. Electric motors also offer immediate torque, creating an enjoyable and agile driving encounter.

7. Technical Developments: The automobile sector is seeing technical development due to the popularity of EVs. This entails the creation of more effective batteries, quicker charging infrastructure, and cutting-edge elements like linked car systems and regenerative brakes. Additionally, these developments may benefit other sectors of the economy and advance technology as a whole.

Although electric vehicles offer numerous benefits, it is important to consider certain drawbacks that come with them. These drawbacks consist of limited driving range in comparison to other vehicle types, the environmental consequences of battery production and disposal, and the accessibility and availability of charging stations. Nonetheless, the overall viability and environmental friendliness of electric vehicles are progressively improving due to ongoing developments and investments in these areas.

2. Literature Survey.

Electric Vehicles in an Urban Context: Environmental Benefits and Techno-Economic Barriers, by Adolfo Perujo, Christian Thiel and Françoise Nemry (2011) - According to this study, encouraging extensive EV use won't in and of itself help create a sustainable transportation system. Although this is only one aspect, it can help to lessen the environmental burden brought on by vehicle travel which promotes sustainable growth. The use of individual transportation (such as a personal vehicle) must be decreased in favour of communal public transportation to truly meet the sustainability paradigm [1].

Simple Economics of Electric Vehicle Adoption, by VolodymyrBilotkacha, Mike Mills (2012) - Rising energy costs have rekindled interest in the creation of electric automobiles. Due to the restricted range, lengthy recharge times, and limited required availability in the present infrastructure, many buyers would see an electric vehicle as a subpar alternative to a gasoline-powered vehicle. This article presents the first formal model of electric vehicle adoption. We demonstrate that, depending on the settings of the model's parameters, it is possible for some commuters to buy an electric automobile in addition to a traditional gasoline-powered car. With the aim of analysing the issue of the embracing of electric vehicles, this study will offer a framework model that will be developed in subsequent studies [2].

Electric commercial vehicles: Practical perspectives and future research directions, by Dimitris Margaritis, Afroditi Anagnostopoulou, Alkiviadis Tromaras and Maria Boile (2015) - To eliminate negative externalities and create an effective, sustainable, and ecologically friendly "green" goods transport system, various hurdles must be overcome. Over the recent years, there has been a noticeable rise in efforts for technological innovation and improvements in the transport sector, and the new trend for public bodies, non-profit organizations, and many commercial enterprises supporting fleets of vehicles using renewable sources is sustainable progress. This essay examines the usage of electric commercial vehicles within the context of "green" transportation, offers an analysis of their essential technological features, and highlights the significant operational factors that affect their efficiency. It is an effort to take advantage of obstacles and consider regulatory changes for greater adoption of electric commercial vehicles in regular transportation throughout the EU region [3].

The future of electric vehicles: prospects and impediments by Amela Ajanovic (2015) - Electric vehicles EVs have garnered increasing interest in recent times. However, for a more extensive significant obstacles to market penetration must be removed. The utmost crucial pair are high upfront costs and short driving distances, which are both brought about by the battery, which serves as an EV's worst flaw. The economics of EVs in comparison to conventional cars are a crucial factor in this article's main goal, which is to evaluate the future market possibilities of various types of EVs. The main takeaway from this essay is that EV future prospects will only be promising if battery costs can be reduced through technological advancement and if better storage can result in longer driving distances. However, the electricity for EVs must be produced from sources of renewable energy to reap the full environmental benefits of EVs [4].

Assessing demand by urban consumers for plug-in electric vehicles under future cost and technological scenarios by Rachel Krause, Bradley Lane, Sanya Carley & John D. Graham (2016) - In this study, a survey-based discrete choice method is utilized, involving 961 individuals considering the purchase of new vehicles in major cities across the U.S. The aim is to examine potential shifts changes in consumer inclinations regarding electric vehicle

technology through various advancements in PEV technology. Respondents are asked to select which of four powertrains they are most likely to acquire after being shown a range of price and technological scenarios: a gasoline-powered car, a traditional hybrid, or either a vehicle that runs on battery electricity (BEV) or a hybrid electric vehicle that can be plugged in (PHEV). The conventional hybrid is the preferred option when cars are presented with their current features. A BEV is the most commonly chosen choice, with 44% of respondents declaring intent to buy beneath the breakthrough technology scenario that equalizes all vehicle powertrains with petrol vehicles in terms of cost, driving range, and recharging periods [5].

Quantifying the Societal Benefits of Electric Vehicles, by Ingrid Malmgren (2016) - The additional expense of automobiles stands as one of the various challenges facing the market for electric vehicles. Cost-benefit studies tend to overlook or underappreciate several of the benefits of electric vehicles. These advantages pertain to the environment, grid, air quality, and human health resilience. To identify the wide range of advantages offered by electric vehicles and, where sufficient data is available, to generate estimates to quantify these advantages, VEIC performed a study. Policymakers may make investment and incentive decisions that appropriately reflect the full value of electric vehicles to society by using the worth of these benefits as advice [6].

Mass deployment of sustainable transportation: evaluation of factors that influence electric vehicle adoption, by Ona Egbue, Suzanna Long, V. A. Samaranayake (2017) - The embrace of electric vehicles at a large scale will have a variety of effects and advantages, including the potential to reduce emissions of greenhouse gases substantially. from the transportation industry. Consequently, this technology is anticipated to progressively acquire a larger portion of the market over the upcoming years. This study models the circumstances under which a person, particularly one with an engineering or technical background, is more or less likely to adopt an electric vehicle and analyses the elements that influence the embrace of electric vehicles. The model's findings demonstrate that some variables, such as willingness to pay for new, alluring technology, distance travelled, perceptions of electric vehicles' environmental benefits, and perceptions of their speed, are statistically significant in affecting a person's decision to buy an electric vehicle [7].

Policies for Promotion of Electric Vehicles and Factors Influencing Consumers Purchasing Decisions of Low Emission Vehicles by Matjaz Knez, Matevz Obrecht (2017) - To better the creation of green products and successful methods that could hasten change over to a sustainable future, several players from both the general public and private sectors are putting a lot of work into identifying consumer behaviour. The research investigates how shifting consumer inclinations towards vehicles powered by alternative fuels are influenced by regulations that support electric cars. The findings suggest that addressing the diverse attitudes towards low-emission vehicles requires distinct strategies for different population groups. The most important elements, such as total expenses associated with ownership and fuel efficiency, must be considered while developing promotional plans [8].

Sustainable Electric Vehicle Transportation by Raymond Kene, Thomas Olwal and Barend J. van Wyk (2017) - This study intends to review the current level of conduct research and engage in the process of development in this field to promote environmentally friendly EV transportation. This study is noteworthy since it succeeds in achieving its main goals. (1) Firstly, the influence of widespread EV. The impact on the distribution network is considered while evaluating integration with the electrical grid (2). Next, it offers energy management techniques to decrease the load demand of plug-in EVs on the electrical grid (3). It offers a comprehensive analysis and clear guidance on sustainable EV charging infrastructure [9].

An Analysis of the Environmental Impact of Electric Vehicles by Ashley Schmid (2017) -Electric Vehicles are potential solutions to several present economic and environmental problems. Since the 1830s, several innovators have been interested in electric motors, However, fully electric vehicles did not gain widespread until 2008, when Tesla Motors introduced the Roadster. Industrialized countries harm the environment because the quantity of greenhouse gas emissions continues to increase. While fully electric automobiles assert to have no emissions at the tailpipe, this fails to account for the pollutants generated during the energy generation process needed to charge those vehicles. This study assesses the environmental effects of electric vehicles along with the financial incentives for increased use of this technology [10].

Literature review of electric vehicle consumer awareness and outreach activities by Lingzhi Jin, and Peter Slowik (2017) - The focus of this study is to investigate strategies that yield the best results in educating consumers about electric vehicles and conducting outreach. It examines the research on the value of customer education and pinpoints shining examples of what successful electric vehicle markets are doing. Based on our analysis, we also five examples that serve as representatives have been supplied for additional deliberation with the purpose of better understanding the essential components of successful all-encompassing consumer awareness initiatives. Although the focus of this work is on how raising awareness and understanding might affect the uptake of electric vehicles, we point out that a wide range of promotion actions (such as financial and non-financial incentives, the establishment of charging infrastructure and the wide range of available vehicle models, efforts to raise awareness and understanding, and others) are essential for growing the market [11].

Beyond Emissions and Economics: Rethinking the co-benefits of Electric Vehicles EVs and Vehicle-To-Grid (V2G) by Lance Noel, Gerardo Zarazua de Rubens, Johannes Kester, and Benjamin K. Sovacool (2018) Utilizing electric vehicles and vehicle-to-grid technology is a pathway to transitioning toward a low-carbon society. These technologies have faced an assortment of hurdles that have hindered their widespread implementation, despite the anticipated benefits of cost savings and carbon reductions. The experts discussed various novel benefits in addition to the obvious ones, such as cost reductions, reduced emissions, and incorporation of renewable energy. Noise reduction and improved performance, two benefits that are rarely highlighted, were the second and third most frequently brought up advantages of EVs [12].

Key Factors Influencing Consumers' Purchase of Electric Vehicles by Jui-CheTu and Chun Yang (2019) - The attitudes and behaviour of consumers regarding the acquisition of electric cars are not greatly influenced by their friends, colleagues, or family members' viewpoints. The primary determinant is the fact that the choice and the acquisition of electric cars by customers act as a point of reference for consumers' decision-making and functions as a theoretical foundation for the creation and crafting of electric vehicles that better meet consumer needs. To draw customers and encourage the sustainable growth of the auto industry, the government and pertinent Manufacturers need to factor in expanding the publicity of EVs and introducing more alluring battery and charging plans [13].

Charging the Future: Challenges and Opportunities for Electric Vehicle Adoption by Henry Lee Alex Clark (2019) -There have been notable strides in progress over the last ten years in electric vehicles (EVs), partially attributed to the declining costs of batteries. But throughout their useful lives, EVs continue to be more expensive than gas-powered cars. This essay examines the future developments required for electric vehicles to become a significant portion of the fleet of passenger vehicles [14].

Sustainable Perspective of Electric Vehicles and Its Future Prospects by Pawan Maske, Arvind Chel, Pradeep K. Gopal, and Geetanjali Kaushik (2021) – This study states that, Pollutants such as carbon monoxide, carbon dioxide, sulfur and nitrogen oxides discharged into the air by fossil fuel-powered vehicles, endangering the environment. This problem may always be solved by using electric or hybrid automobiles, and the market is about to undergo a revolution thanks to the use of renewable energy sources for charging. The paper presents an overview of electric cars used for passenger and cargo transportation worldwide, focusing the world, with a focus on the infrastructure for battery charging. By the conclusion of the article, we get into prospective development areas, governments as well as government incentives, issues faced by electric car manufacturers, and recent trends and advancements in battery technology [15].

Consumer adoption intention for electric vehicles: Insights and evidence from Indian sustainable transportation by Deepak Jaiswal, Vikrant Kaushal, Rishi Kant, and Pankaj Kumar Singh (2021) - This study aims to understand and predict consumer interest in embracing electric vehicles. EVs in a developing sustainable transportation market. It explores the roles of EV attitude, financial incentives, and factors like perceived utility, ease of use, and danger. Results highlight these as key predictors of EV adoption intention, with financial incentives moderating their impact. The research provides valuable perspectives regarding policymakers and marketers to promote EVs effectively. Attitude is found to partially mediate the impact of usefulness and ease of use on adoption intention [16].

Promoting electric vehicle adoption: Who should invest in charging infrastructure? by Rajeev Ranjan Kumar, Abhishek Chakraborty, Prasenjit Mandal (2021) - To diminish the transportation sector's carbon footprint, governments and policymakers are turning to electric mobility as an important endeavour. But the embracing of electric cars EVs is sluggish, largely because there aren't enough reliable charging stations. Which organization should receive funding for the building of a charging infrastructure is an intriguing question. growing similarly. In this report, we offer the government comprehensive legislative recommendations as well as manufacturer strategic options for various scenarios [17].

Utilization of Electric Vehicles for Vehicle-to-Grid Services: Progress and Perspectives by Sai Sudharshan Ravi and Muhammad Aziz (2022) - Electric vehicles EVs are being developed as a potential means of achieving this challenging objective of fostering better modes of transportation and a cleaner environment. Several issues require attention to be solved due to the outcome of the EV-based mobility sector and economy. The problems range from increasing power production to meet the anticipated surge in consumption to creating an infrastructure large enough to handle the increased demand for electricity triggered by the market penetration of EVs.This paper tries to outline certain aspects of the potential auxiliary service opportunities of such a system while also examining the potential drawbacks, consequences, and possibilities for V2G technology to penetrate new markets [18].

Electric vehicles can have only a minor role in reducing transport's energy and environmental challenges by Patrick Moriarty (2022) - Numerous governments have offered purchase discounts or waived gasoline taxes in an endeavour aimed at promoting the widespread use of (EVs). The main conclusions of this article are that, at least for some countries, the benefits of EVs have been overestimated in terms of their energy savings and climate mitigation benefits differ based on things like annual mileage per car, the kind of fuel used for power, the dimensions of the vehicle, and even the local environment. The majority of these tasks lack the required amount of time. Power production comes from non-carbon sources because the escalation in both frequency and intensity of occurrences indicates the pronounced presence of significant climate change. Catastrophic events. Significant reductions in road vehicle travel are required to efficiently and rapidly address all of the environmental concerns that road vehicles face [19].

Advancements and Future Prospects of Electric Vehicle Technologies: A Comprehensive Review by M. S. Hossain, Laveet Kumar, Mamdouh El Haj Assad and Reza Alayi (2022) - This research has furnished numerous sobering insights on specific events, like the rise in EV demand worldwide, the demand for power and batteries, the technological advancements of EVs, energy storage technologies, and charging methods. It also provides information about the upcoming EV generation and its scientific progress, including wireless power transfer. Since there haven't been any integrative evaluations that evaluated EVs' global demand and development concurrently and collectively, this review gained a unique perspective stemming from the creation of the smart city concept by EV implementation. This research finishes with the rationale for politicians and investors to consider electric mobility [20].

2.1 Research Gap and Research Objectives.

Research Gap: The review of the literature shows that the research topic is not been carried out in coastal Karnataka. However, People have adjusted and adopted fuel vehicles in all regions or industries, making it difficult to apply new economic theories that promote sustainability as observed in the research literature. Resistance to change, whether from economic actors or policymakers, can hinder the exploration and application of innovative economic approaches.

To fill the research gaps the data has been collected to understand the Technology adoption, barriers to adoption, advantages considered and the concern towards economic sustainability.

Research Objectives:

- To recognize the socio-economic factors that have an impact on the adoption of EVs.
- To determine the significance of relationship/association between the factors, and the adaptability of EV vehicles.

- To make suggestions to the policymakers of automobiles in India, so that the support provided to the customers may be state-of-the-art in terms of facilities.

2.2 Research Methodology

The Sampling Design:

The study utilizes a qualitative methodology, lacking an archive or index containing a sample frame of all consumer participants. Despite the finite population, non-probability sampling methods will be employed to gather data from the target user group. The data collection process involves convenience sampling.

The focus of the study revolves around individuals who own vehicles in the coastal region of Karnataka, specifically in the Dakshina Kannada district. A group of one hundred participants were chosen to collect the required data. To gather the necessary information, a survey was conducted using a 5-point Likert scale. The analysis involved the utilization of several statistical techniques including reliability testing, Chi-square analysis, correlation assessment, multivariate regression analysis, and independent sample t-test.

To reach the respondents, a convenience sampling technique through online survey applications as well as hardcopy-based questionnaires has been employed.

Hypothesis:

H1: The advantages of EVs do not correlate with their adaptability.

H2: The future of Electric vehicles is not linked to any influencing factors, nor does it depend on the benefits, advantages, or disadvantages of electrical vehicles.

H3: The mean ranking for the factor that could potentially impact the adoption of electric vehicles in Mangalore (as determined by the Friedmans test) does not exhibit any notable disparity.

H 4: The mean ranking for The Potential economic benefit of electric vehicle adoption in Mangalore shows no notable variance.

Reliability Test:

The reliability of data collected through Likert's Five Point Scale is evaluated using Cronbach's Alpha reliability coefficient. This coefficient ranges from 0 to 1, with a value of 0.7 or above typically deemed reliable in academic research. A reliability coefficient exceeding 0.7 indicates that the collected data is dependable and suitable for subsequent analysis. In this particular study, Cronbach's Alpha reliability coefficient was determined to be 0.97 based on respondents' answers to all questions in the Likert scale, confirming the reliability of the collected data.

3. Results and Discussions.

Table 1. Simple Percentage Analysis.

Sl. No	Personal Factors	Frequency	Percentage
1	**Age**		
	Below 20 years	6	6.0
	21-30 years	86	86.0
	31-40 years	3	3.0
	Above 40 years	5	5.0
	Total	**100**	**100.0**
2	**Occupation**		
	Student	44	44.0
	Employee	50	50.0
	Business	1	1.0
	Other	5	5.0
	Total	**100**	**100.0**

From the above table, it is evident that the majority of the respondents belong to the age group 21-30 years (86%) with the occupation's employee (50%) followed by student representatives (44%). All the respondents are aware of electric vehicles.

3.1 Correlation Analysis.

Table 2. H1: There is no correlation between the factors related to advantages of the Electric vehicles.

Correlations						
		Potential benefit of electric vehicle adoption in the Mangalore region	Potential disadvantage of electric vehicle adoption in the Mangalore region	Potential disadvantage of electric vehicles in terms of sustainability	Potential economic benefit of electric vehicle adoption in Mangalore	The main advantage of electric vehicles in terms of sustainability
Potential benefit of electric vehicle adoption in the Mangalore region	Pearson Correlation	1	-.054	.075	**.388****	**.419****
	Sig. (2-tailed)		.593	.458	**.000**	**.000**
Potential disadvantage of electric vehicle adoption in the Mangalore region	Pearson Correlation		1	**.338****	.058	.072
	Sig. (2-tailed)			**.001**	.568	.474
Potential disadvantage of electric vehicles in terms of sustainability	Pearson Correlation			1	**.453****	**.508****
	Sig. (2-tailed)				**.000**	**.000**
Potential economic benefit of electric vehicle adoption in Mangalore	Pearson Correlation				1	**.636****
	Sig. (2-tailed)					**.000**
The main advantage of electric vehicles in terms of sustainability	Pearson Correlation					1
	Sig. (2-tailed)					
	N					100

**. Correlation is significant at the 0.01 level (2-tailed).

From the correlation analysis, it is concluded that

- There is a significant positive correlation between the potential benefits of electric vehicle adoption in the Mangalore region and the potential economic benefits of electric vehicle adoption in the same area (r=0.388, p<0.01). Additionally, there is a strong correlation between the potential benefits of electric vehicle adoption in the Mangalore region and the main advantage of electric vehicles in terms of sustainability (r=0.419, p<0.01) at a 1% level of significance. The p values being less than 0.01 indicate that these factors move in the same direction. This means that as the perception of the potential benefits of electric vehicle adoption in the Mangalore region improves, so does the perception of the potential economic benefits of electric vehicle adoption in the area, as well as the main advantage of electric vehicles in terms of sustainability.
- A significant positive correlation was found between the potential disadvantage of electric vehicle adoption in the Mangalore region and the potential disadvantage of electric vehicles in terms of sustainability (r=0.338, p<0.01) at a 1% level of significance. The results indicate that as the perception of potential disadvantage of electric vehicle adoption in the Mangalore region improves, the potential disadvantage of electric vehicles in terms of sustainability also improves significantly.
- A strong positive correlation was found between the potential disadvantage of electric vehicles in terms of sustainability and the potential economic benefit of electric vehicle adoption in Mangalore (r=0.453, p<0.01). Additionally, there was a significant correlation between the potential disadvantage of electric vehicles in terms of sustainability and the main advantage of electric vehicles in terms of sustainability (r=0.508, p<0.01) at the 1% level of significance. The results suggest that an improvement in the perception of the potential disadvantage of electric vehicles in terms of sustainability leads to a better perception of the potential economic benefit of electric vehicle adoption in Mangalore, as well as a significant improvement in the perception of the main advantage of electric vehicles in terms of sustainability.
- There is a significant positive correlation (r=0.636, p<0.01) between the potential economic benefit of adopting electric vehicles in Mangalore and the main advantage of electric vehicles in terms of sustainability. This implies that as the perception of the potential economic benefit of electric vehicle adoption in Mangalore improves, there is a significant improvement in the perception of the main advantage of electric vehicles in terms of sustainability.

Table 3. H2: There is no association between the future of Electric vehicles and influencing factors, benefits advantages and disadvantages of electrical vehicles.

		The future of Electric vehicles in Mangalore
The significance of electric vehicles in future when compared to these days	Pearson Correlation	.058
	Sig. (2-tailed)	.568
The factor that could influence the adoption of electric vehicles in Mangalore	Pearson Correlation	.124
	Sig. (2-tailed)	.220
Potential benefit of electric vehicle adoption in the Mangalore region	Pearson Correlation	.122
	Sig. (2-tailed)	.228
A potential barrier to electric vehicle adoption in the Mangalore region	Pearson Correlation	.036
	Sig. (2-tailed)	.723
	N	100
Potential solution to address limited charging infrastructure in the Mangalore region	Pearson Correlation	**.253***
	Sig. (2-tailed)	**.011**
Potential solution to address limited availability of electric vehicles in the Mangalore	Pearson Correlation	**.206***
	Sig. (2-tailed)	**.039**
	Pearson Correlation	.111

Potential solution to address the challenge of limited range in Mangalore	Sig. (2-tailed)	.273
Potential disadvantage of electric vehicle adoption in the Mangalore region	Pearson Correlation	.084
	Sig. (2-tailed)	.407
Potential economic benefit of electric vehicle adoption in the Mangalore	Pearson Correlation	**.520****
	Sig. (2-tailed)	**.000**
Main advantage of electric vehicles in terms of sustainability	Pearson Correlation	**.373****
	Sig. (2-tailed)	**.000**
Factors that is most likely to influence the sustainability of electric vehicles in Mangalore	Pearson Correlation	**.385****
	Sig. (2-tailed)	**.000**
Potential disadvantage of electric vehicles in terms of sustainability	Pearson Correlation	**.305****
	Sig. (2-tailed)	**.002**
Potential strategy to promote electric vehicles in Mangalore	Pearson Correlation	**.390****
	Sig. (2-tailed)	**.000**
	N	**100**

There is a significant positive correlation between the Potential solution to address limited charging infrastructure in the Mangalore region, the Potential solution to address limited availability of electric vehicles in Mangalore, Potential economic benefit of electric vehicle adoption in Mangalore, the main advantage of electric vehicles in terms of sustainability, Factors that is most likely to influence the sustainability of electric vehicles in Mangalore, Potential disadvantage of electric vehicles in terms of sustainability and Potential strategy to promote electric vehicles in Mangalore and future of electric vehicles in Mangalore.

3.2 Multiple Regression Analysis.

The impact of various factors such as influential factors, advantages, disadvantages, benefits, and potential strategies to promote electric vehicles on the future of electric vehicles in Mangalore. An analysis was conducted through a multiple linear regression model to investigate the influence of specific factors on a dependent variable utilizing a regression equation. The dependent variable under consideration is the future of electric vehicles in Mangalore.

The influential factors, advantages, disadvantages, benefits, and potential strategies to promote electric vehicles are considered as the independent variables. It is postulated that the future of electric vehicles in Mangalore is influenced by these selected independent variables, such as influential factors, advantages, disadvantages, benefits, and potential strategies to promote electric vehicles.

While testing the multiple linear regression models, the null hypothesis is that “Selected independent variables such as influential factors, advantages, disadvantages, benefits, potential strategies to promote electric vehicles have no impact on the future of electric vehicles in Mangalore ”

There are 100 respondents from the specified region included in this multiple regression model. The analysis began by examining all potential variables identified from correlation analysis, such as influential factors, advantages, disadvantages, benefits, and potential strategies to promote electric vehicles, as independent variables. The assumptions of linearity and homoscedasticity were confirmed through a scatter plot of standardized residuals plotted against predicted values for the multiple regression model. The results of the regression analysis are presented in the table below. No outliers were detected in the case-wise diagnostics using the Cook's distance formula. All standardized residual values fell within ± 3 standard deviations. The assumptions of multicollinearity were also assessed using Variance Inflation Factor (VIF) values, and none of the variables exhibited

multicollinearity issues. Therefore, we retained all independent variables with VIF values less than five, indicating that the assumptions of multicollinearity were satisfied. The multiple regression models outlined in the table below elucidate the subsequent findings.

The table shows the Impact of influential factors, advantages, disadvantages, benefits, and potential strategies to promote electric vehicles in future of electric vehicles in Mangalore.

Table 4: Multiple Regression Analysis result.

	Future of electric vehicles in Mangalore (Y_1)			**Collinearity Statistic- VIF**
	Unstandardized Coefficient (Beta)	***t*-value**	***p*-value**	
(Constant)	.283	3.253	.001	
Potential solution to address limited charging infrastructure	.036	.196	.845	2.154
Potential solution to address limited availability of electric vehicles	-.122	-.696	.488	2.007
Potential economic benefit of electric vehicle adoption	.486	3.475	.001**	2.045
The main advantage of electric vehicles in terms of sustainability	.055	.346	.730	2.094
Potential disadvantage of electric vehicles in terms of sustainability	.095	.603	.548	1.818
Potential strategy to promote electric vehicles	.101	.655	.514	1.953
Adjusted R^2	67.1%			
F-value	6.165		0.000	

Dependent Variable: Future of electric vehicles in Mangalore

Impact of influential factors, advantages, disadvantages, benefits, potential strategies to promote electric vehicles on future of electric vehicles in Mangalore

The model indicates that 67.1% of the variation in the future of electric vehicles in Mangalore is explained by the selected variables, while 32.9% is determined by other factors not considered. The statistical analysis shows that only the potential economic benefit of electric vehicle adoption is statistically significant at a 1% significance level. An increase of one unit in this variable would result in a 0.486 increase in the future of electric vehicles in Mangalore, holding other variables constant. Therefore, among the factors related to electric vehicles, the potential economic benefit of electric vehicle adoption has a significant impact on their future in Mangalore.

Table 5. H2: H3: There is no significant difference in the mean ranking for the factor that could influence the adoption of electric vehicles in Mangalore (Friedmans test).

The factor that could influence the adoption of electric vehicles in Mangalore - **Ranks**	Mean Rank	Rank	
Cost of electric vehicles	2.59	2	Friedman's Test value = 19.067
Charging infrastructure availability	2.22	4	d.f=3
Driving range of the vehicle	2.38	3	p value = 0.000 < 0.01
High fuel prices	2.82	1	

The Chi square value calculated is 19.067. The significance value for 3 degrees of freedom is 0.000, which is less than 0.01. Therefore, we can conclude that there is a significant difference in the mean ranking between the variables. According to the table, it is evident that "High fuel prices" with a mean rank of 2.82 is a crucial factor influencing the adoption of electric vehicles in Mangalore. Additionally, "Cost of electric vehicles" with a mean rank of 2.59 has a significant impact on the adoption of electric vehicles in Mangalore. Following this, "Driving range of the vehicle" with a mean rank of 2.38 also has a notable influence on the adoption of electric vehicles in Mangalore. Since the asymptotic significance is less than 0.01 (1% level of significance), the hypothesis is rejected, and the hypothesis that there is a significant difference in the mean ranking from the respondents on the factors influencing the adoption of electric vehicles in Mangalore is supported.

Table 6. H 4: There is no significant difference in the mean ranking for The Potential economic benefit of electric vehicle adoption in Mangalore.

Potential economic benefit of electric vehicle adoption in the Mangalore - Ranks	Mean Rank	Rank	
Job creation in the electric vehicle industry	2.94	4	Friedman's Test value = 14.504
Reduced Fuel Import Dependence	3.29	1	d.f=4
Revenue generation through public charging stations	2.98	3	
Reduced Maintenance and Operating Costs	2.77	5	p value = 0.000 < 0.01
Local Industry Development	3.03	2	

The Chi square value obtained is 14.504. The significance value for 4 degrees of freedom is 0.000, which is less than 0.01. Therefore, we can conclude that there is a significant difference in the mean ranking between the variables. Analysing the table above, we can infer that "Reduced Fuel Import Dependence" with a mean rank of 3.29 is a highly important factor in relation to the potential economic benefit of electric vehicle adoption in Mangalore. Additionally, "Local Industry Development" with a mean rank of 3.03 has a significant impact on the potential economic benefit, followed by "Revenue generation through public charging stations" with a mean rank of 2.98. These factors greatly influence the potential economic benefit of electric vehicle adoption in Mangalore. Since the asymptotic significance (sig.) is less than 0.01 (1% level of significance), we reject the hypothesis and

support the hypothesis that there is a significant difference in the mean ranking from the respondents regarding the potential economic benefit of electric vehicle adoption in Mangalore.

4. Conclusions.

- In conclusion, the research has shed light on the significant potential of electric vehicles (EVs) in contributing to economic and environmental sustainability, particularly in the context of Coastal Karnataka and the broader Indian automobile sector. The study has highlighted the advantages of EVs, such as reduced air and noise pollution, potential revenue generation through public charging stations, and the utilization of renewable energy sources. Additionally, the research has identified key factors influencing the adaptability of EVs, including cost, driving range, and technological advancements. The findings emphasize the need for strategic decision-making, policy formulation, and industry practices to address the challenges and capitalize on the opportunities presented by EV adoption. Furthermore, the study has provided actionable insights for companies, policymakers, and customers to enhance technology adoption, innovate management practices, and improve economic and environmental sustainability in the region.
- The theoretical implications contribute to the academic literature by expanding the understanding of the interplay between technology adoption, innovation management, and economic sustainability in the context of EVs. Moving forward, stakeholders must consider the identified factors and their association with the adaptability of EVs, as well as prioritize the development of infrastructure for charging and promote the use of EVs as a sustainable transportation option. By addressing these factors and leveraging the potential economic benefits of EV adoption, the automobile sector in India can progress towards a more economically sustainable and environmentally friendly future." This conclusion integrates the key findings and implications of the research, emphasizing the significance of EVs in the context of economic and environmental sustainability while providing actionable insights for stakeholders.

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