Mediating role of factors influencing the adoptability of Electrical Vehicles towards Economic and Environmental Sustainability

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Abstract

Electric vehicles (EVs) are a type of vehicle that uses electricity as its primary source of power instead of traditional gasoline or diesel fuel. They are designed to be more environmentally friendly and efficient compared to conventional vehicles. EVs utilize ansubstitute an internal combustion engine with an electric motor that runs on electricity stored in rechargeable batteries. EVs offer several advantages. They produce zero tailpipe emissions, which means they don't release harmful pollutants that contribute concerning air pollution and climate change. This makes them a cleaner option for transportation. Additionally, EVs are quieter and provide a smoother driving experience compared to traditional vehicles. This research aims to explore how adoption of EV act as catalysts, propelling toward enhanced economic and environmental sustainability in the Indian context.

KEYWORDS: *EV vehicle, Sustainability, Perception*

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 an substitute option for people who areconcerned 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.

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In the near future, especially in the Mangalore region, electric cars EVs will become a more popular innovation in the transportation sector. These vehicles are more sustainable and environmentally beneficial since they use electricity to power them rather than fossil fuels like petrol or diesel. The significance of electric vehicles lies in theirability to cut back on harmful emissions and fight climate change. EVs emit no carbon pollution. because their main source of power is electricity, which means that they don't discharge any of the pollutants like carbon dioxide, nitrogen oxide, or particulates that contribute to air pollution and global warming. This can lower the carbon footprint of the area and significantly enhance the air quality in Mangalore. In terms of sustainability, electric vehicles also provide a number of benefits. They decrease their impact on the environment by charging using renewable energy sources like solar or wind power. This encourages a transition to cleaner energy and lessens reliance on limited supplies of fossil fuels. The adoption of electric vehicles can have a number of beneficial effects in Mangalore. 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, the residents' health may improve. Secondly, the Mangalore area is blessed with a wealth regarding alternative energy sources such as wind powerand solar power. The region could unlock its capacity for renewable energyand establish a sustainable transportation system through the adoption of electric vehicles.A better and more resilient future may be made possible by this combination of clean energy and electric vehicles. Additionally, because electric vehicles are quieter to operate than regular vehicles, using them in Mangalore can help reduce noise pollution. This can improve people's quality of life and make the city a more serene and peaceful place to live, especially in metropolitan areas.

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 aopportunity 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.

Problem Statement

Despite there are several advantages of adapting the EV, India is facing several challenges towards the sales of EV. This demands the identification of factors, influencers, advantages, limitations towards acceptance of EV by Indian customers. Hence this research paper focuses on the study of various factors which influences and limits the adoptability of EV as EVs are major step towards the 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.

Scope of the Study

Coastal Karnataka, an area renowned for its diverse consumer base and the importance of EV 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 a thorough grasp of the relationship between many aspects and the economic sustainability of electric vehicles.

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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 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.

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 in order to comprehend, manage, and improve the nation's economic trajectory. The study of the economic sustainability of electric vehicles (EVs) is important for many reasons, including supporting India's sustainability goals; pressures from serious environmental issues, such as air and water pollution, inequality in economic opportunities, and infrastructure; the need to create jobs and recommend policies to improve workforce employability; the need to identify growth barriers, foster innovation, and promote long-term economic competitiveness; the need to investigate ways to improve energy efficiency, reduce waste, and promote renewable energy sources for sustainable economic development; the need to serve as a guide for plans that are economically viable, socially inclusive, and environmentally responsible; and finally ECS is not solely a national concern but also has global implications in international trade, climate negotiations, and sustainable development commitments.

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,

Environmental friendliness: EVs contribute in the fight opposed to air pollution and the effects of climate change results from their emissions.no tailpipe emissions. By transitioning from traditional (ICE) vehicles to (EVs), we can significantly reduce emissions of greenhouse gases emissions and enhance air quality, both of which will improve public health.

Energy Efficiency: EVs consume a lower amount of energy compared to conventional (ICE) vehicles. Internal combustion engines are only approximately 20% efficient, compared to the normal 80–90% efficiency of electric motors. Due to the vehicle's increased efficiency, less energy is squandered and more of the battery's energy is utilized to power it.

Reduction in Fossil Fuel Dependence: Electric vehicles have the potential to lessen our dependence on non-renewable energy sourcessuch 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.

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Lower Operating Costs: Compared to ICE vehicles, EVs are more affordable to operate. Lower fuel expenses are a result of the fact that electricity is typically less expensive than petrol or diesel. 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.

Tax breaks and incentives: To promote the use of EVs, many governments provide tax breaks and incentives. For buying EVs, these can include tax breaks, rebates, and subsidies in addition to perks like waived or reduced registration fees, toll exemptions, and preferred parking. Due to these advantages, EVs are more accessible and appealing to prospective buyers.

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.

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's important to consider certain drawbacks they entail, including limited driving range in comparison to other types of vehicles, the environmental effects of battery production and disposal, and the accessibility and availability of charging infrastructure. The overall viability and sustainability of electric vehicles are, however, continuously improving due to ongoing developments and investments in these fields.

Literature Review

“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 in order to truly meet the sustainability paradigm.

“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 the required availability is 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 analyze the issue of the embracing of electric vehicles, this study will offer a framework model that will be developed in subsequent studies.

“Electric commercial vehicles: Practical perspectives and future research directions” by DimitrisMargaritis, AfroditiAnagnostopoulou, AlkiviadisTromaras and Maria Boile (2015) - In order 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 organisations, and many commercial enterprises supporting fleets of vehicles using renewable sources is sustainable progress. This essay examines the usage of

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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 a greater adoption of electric commercial vehicles in regular transportation throughout the EU region.

“The future of electric vehicles: prospects and impediments” by AmelaAjanovic (2015) - Electric vehicles EVs have garnered increasinginterest in recent times. However, for a more extensive significant obstacles to market penetration must be removed. The utmost crucial pair arehigh upfront costs and short driving distances, which are both broughtabout 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.

“Assessing demand by urban consumers for plug-in electric vehicles under future cost and technological scenarios” by Rachel Krause, Bradley Lane, SanyaCarley& 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 acrossthe 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 a 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 equalises all vehicle powertrains with petrol vehicles in terms ofcost, driving range, and recharging periods.

“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.

“Mass deployment of sustainable transportation: evaluation of factors that influence electric vehicle adoption” byOnaEgbue, 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 toprogressively 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 a number of variables, such as willingness to pay for new, alluring technology, distance traveled, 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.

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“Policies for Promotion of Electric Vehicles and Factors Influencing Consumers Purchasing Decisions of Low Emission Vehicles” by MatjazKnez ,MatevzObrecht (2017) - In order 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 privatesectors 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 ownershipand fuel efficiency, must be considered while developing promotional plans.

“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 ofwidespread 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.

“An Analysis of the Environmental Impact of Electric Vehicles” by Ashley Schmid (2017) -Electric cars is regarded as potential solution to several present economic and environmentalproblems. Since the 1830s, several innovators have been interested in electric motors, However, fully electric vehicles did not gain widespreaduntil 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 forthe pollutants generated during the energy generation process needed to charge those vehicles. This study assesses the environmental effects pertaining to electric vehicles along with the financial incentives for increased use of this technology.

“Literature review of electric vehicle consumer awareness and outreach activities” by Lingzhi Jin, Peter Slowik (2017) - The focus of this study is to investigatestrategies that yield the best results in educating consumersabout 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 deliberationwith 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.

“Beyond Emissions and Economics: Rethinking the co-benefits of Electric Vehicles EVsand 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 in addition to the obvious ones, such as cost reductions, reduced emissions, and incorporation of renewable energy. Noise reduction and improved performance,

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two benefits that are rarely highlighted, were the second and third most frequently brought up advantages of EVs.

"Key Factors Influencing Consumers' Purchase of Electric Vehicles" by Jui-CheTu and Chun Yang (2019) - The attitudes and behaviours of consumers regarding the acquisition of electric cars are not greatly influenced by their friends, colleagues, or family members' viewpoints. The primary determinantthe fact that the choice and the acquisition of electric cars by customers acts 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.

"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 the duration oftheir 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.

Sustainable Perspective of Electric Vehicles and It's Future Prospects" by PawanMaske, ArvindChel , Pradeep K. Gopal , GeetanjaliKaushik (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 thearticle, 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.

"Consumer adoption intention for electric vehicles: Insights and evidence from Indian sustainable transportation" by Deepak Jaiswal, Vikrant Kaushal , Rishi Kant , Pankaj Kumar Singh (2021) - This study aims to understand and predict consumer interest in embracing of 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 regardingpolicymakers and marketers to promote EVs effectively. Attitude is found to partially mediate the impact of usefulness and ease of use on adoption intention.

"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 organisation should receive funding for the building of a charging infrastructure is the intriguing question. growing similarly.In this report, we offer the government comprehensive legislative recommendations as well as manufacturer strategic options for various scenarios.

"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

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environment. Several issues require attentionto 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.

“Electric vehicles can have only a minor role in reducing transport’s energy and environmental challenges” by Patrick Moriarty (2022) - Numerous governments haveoffered purchase discounts or waived gasoline taxes in an endeavor 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 basedon 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 to come 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.

“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 furnishednumerous 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.

Research Gap

The review of literature shows that the research topic is not been carried out in coastal Karnataka. However, People have adjusted and adopted to fuel vehicles in all the 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 EV

To determine the significance of relationship/association between the factors, and the adoptability of EV vehicles.

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

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The Research Methodology

The Sampling Design

This research paper is based on qualitative *approach.* There is no *archive* or *an index* with a *sample frame* of all the consumers who are the data providers in this research despite the fact that the population is finite; thus, *non-probability sampling* will be used to collect data from the target user group. C*onvenience sampling* has been used to collect the data.

The target sample chosen in this research are vehicle owners in coastal Karnataka that includes Dakshina Kannada district.100 samples have been chosen for the data collection. Questionnaire using 5-point Likert scale has be used to collect the data. Statistical techniques like reliability test, Chi square test, Correlation analysis, Multivariate regression analysis, Independent sample t test were employed.

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

Hypothesis

H1: There is no association between the advantages of EV and adoptability

H2: There is no association between the future of Electric vehicles and influencing factors, benefits advantages and disadvantage of electrical vehicles

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)

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

Reliability Test

Cronbach's Alpha reliability coefficient is used to find out how far the data collected by using Likert's Five Point Scale are reliable. The reliability coefficient ranges from 0 to 1.A reliability coefficient of 0.7 or greater is generally said to be reliable in literature. When the reliability coefficient is 0.7 or greater than it is concluded that the data collected by the researcher is reliable and can be used for further analysis. Cronbach's Alpha reliability coefficient is calculated for the respondents response for all the questions in Likerts scale and it was found to be 0.97 and hence, the data collected by the researcher is reliable.

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**

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

Correlation Analysis

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 the Mangalore	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 the Mangalore	Pearson Correlation				1	**.636****
	Sig. (2-tailed)					**.000**
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).

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From the correlation analysis it is concluded that

There exists a strong positive correlation between Potential benefit of electric vehicle adoption in the Mangalore region and Potential economic benefit of electric vehicle adoption in the Mangalore ($r=0.388$, $p<0.01$) , Potential benefit of electric vehicle adoption in the Mangalore region and Main advantage of electric vehicles in terms of sustainability ($r=0.419$, $p<0.01$) at 1% level of significance as p values are less than 0.01 which leads to the conclusion that each of the factors move in the same direction that is as perception on Potential benefit of electric vehicle adoption in the Mangalore region improves perception on Potential economic benefit of electric vehicle adoption in the Mangalore and Main advantage of electric vehicles in terms of sustainability also improves significantly

There exists a strong positive correlation between Potential disadvantage of electric vehicle adoption in the Mangalore region and Potential disadvantage of electric vehicles in terms of sustainability($r=0.338$, $p<0.01$) at 1% level of significance as p value is less than 0.01 which leads to the conclusion that the factors move in the same direction that is as perception on Potential disadvantage of electric vehicle adoption in the Mangalore regionimproves Potential disadvantage of electric vehicles in terms of sustainabilityimproves significantly

There exists a strong positive correlation between Potential disadvantage of electric vehicles in terms of sustainabilityand Potential economic benefit of electric vehicle adoption in the Mangalore ($r=0.453$, $p<0.01$) , Potential disadvantage of electric vehicles in terms of sustainabilityand Main advantage of electric vehicles in terms of sustainability ($r=0.508$, $p<0.01$) at 1% level of significance as p values are less than 0.01 which leads to the conclusion that as perception on Potential disadvantage of electric vehicles in terms of sustainability improves perception on Potential economic benefit of electric vehicle adoption in the Mangalore and Main advantage of electric vehicles in terms of sustainability improves significantly

There exists a strong positive correlation between Potential economic benefit of electric vehicle adoption in the Mangaloreand Main advantage of electric vehicles in terms of sustainability ($r=0.636$ $p<0.01$) at 1% level of significance as p value is less than 0.01 which leads to the conclusion that as perception on potential for economic benefit of electric vehicle adoption in the Mangalore improves the perception on Main advantage of electric vehicles in terms of sustainability improves significantly

H2: There is no association between the future of Electric vehicles and influencing factors, benefits advantages and disadvantage 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
Potential barrier to electric vehicle	Pearson Correlation	.036

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adoption in the Mangalore region	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**
Potential solution to address the challenge of limited range in Mangalore	Pearson Correlation	.111
	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 significant positive correlation between Potential solution to address limited charging infrastructure in the Mangalore region, Potential solution to address limited availability of electric vehicles in the Mangalore, Potential economic benefit of electric vehicle adoption in the Mangalore, 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.

Multiple Regression Analysis

The impact of various factors such as influential factors, advantages, disadvantages, benefits, potential strategies to promote electric vehicles on the future of electric vehicles in Mangalore. A multiple linear

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regression model was carried out to examine the impact of the selected factors on a dependent variable using regression equation. The dependent variable is future of electric vehicles in Mangalore

The independent variables are the influential factors, advantages, disadvantages, benefits, potential strategies to promote electric vehicles. It is hypothesized that "Selected independent variables such as influential factors, advantages, disadvantages, benefits, potential strategies to promote electric vehicles *have an impact on the*future of electric vehicles in Mangalore ".

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 selected region which were considered for this multiple regression model. We started the analysis by considering all the possible variables identified from correlation analysis such as influential factors, advantages, disadvantages, benefits, potential strategies to promote electric vehicles as independent variables . The assumptions of linearity and homoscedasticity were verified by scatter plot of standardized residuals over predicted values for the multiple regression model and the results of regression analysis is given in Table below. There were no outliers identified in the case-wise diagnostics using cooks distance formula. All the standardized residual values were within ± 3 standard deviations. The assumptions of multicollinearity were also observed using Variance inflation factor (VIF) values none of the variables faced with multicollinearity issues, Hence we retained all the independent variables which had the VIF values less than five, concluding that the assumptions of multicollinearity are met. The multiple regression models given in below Table explains the following results.

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

	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
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	

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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 predicts the dependent variable and the coefficient of determination, Adjusted R^2indicates 67.1% variation in future of electric vehicles in Mangalore is only explained by the selected variables, whereas, 32.9% variation is determined by other factors which are not considered . influential factors, advantages, disadvantages, benefits, potential strategies to promote electric vehicles could statistically predict their future of electric vehicles in Mangalore , $F(6,93)=6.165$, $p<0.01$. Only one variable Potential economic benefit of electric vehicle adoption (p= 001) is statistically significant at 1% significance level It is observed that there is positive slope coefficients for the independent variable Potential economic benefit of electric vehicle adoption . If the Potential economic benefit of electric vehicle adoption increase by one unit on an average future of electric vehicles in Mangalore would increase by 0.486 keeping other variables constant. Hence among the selected factors related to the electric vehicles Potential economic benefit of electric vehicle adoption has an impact on the future of electric vehicles in Mangalore

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 d.f=3 p value = 0.000 < 0.01
Charging infrastructure availability	2.22	4	
Driving range of the vehicle	2.38	3	
High fuel prices	2.82	1	

The calculated Chi square value is19.067.The significance value for 3 degrees of freedom is 0.000 which is less than 0.01. Hence we infer that there is significant difference in the mean ranking between the variables. From the above table it is inferred that compared with other indicators as far asThe factor that could influence the adoption of electric vehicles in Mangaloreis concerned "High fuel prices " with mean rank 2.82 is a very important factor as far asThe factor that could influence the adoption of electric vehicles in Mangaloreis concerned. "Cost of electric vehicles" with mean rank 2.59 is having a significant impact on The factor that could influence the adoption of electric vehicles in Mangalore followed by " Driving range of the vehicle" (2.38) are having significant impact on the factor that could influence the adoption of electric vehicles in Mangalore. Since asymptotic significance (sig.) is less than 0.01 (1% level of significance), the hypothesis is rejected and the hypothesis that There is significant difference in the mean ranking from the respondents on The factor that could influence the adoption of electric vehicles in Mangalore is supported.

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

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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 d.f=4 p value = 0.000 < 0.01
Reduced Fuel Import Dependence	3.29	1	
Revenue generation through public charging stations	2.98	3	
Reduced Maintenance and Operating Costs	2.77	5	
Local Industry Development	3.03	2	

The calculated Chi square value is14.504 .The significance value for 4 degrees of freedom is 0.000 which is less than 0.01. Hence we infer that there is significant difference in the mean ranking between the variables. From the above table it is inferred that compared with other indicators as far asThe factor that could influence the adoption of electric vehicles in Mangaloreis concerned "Reduced Fuel Import Dependence" with mean rank 3.29 is a very important factor as far asPotential economic benefit of electric vehicle adoption in the Mangaloreis concerned. "Local Industry Development" with mean rank 3.03 is having a significant impact on Potential economic benefit of electric vehicle adoption in the Mangalorefollowed by "Revenue generation through public charging stations" (2.98) are having significant impact on thePotential economic benefit of electric vehicle adoption in the Mangalore. Since asymptotic significance (sig.) is less than 0.01 (1% level of significance), the hypothesis is rejected and the hypothesis that There is significant difference in the mean ranking from the respondents on Potential economic benefit of electric vehicle adoption in the Mangalore is supported.

Conclusion

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 adoptability 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, it is imperative for stakeholders to consider the identified factors and their association with the adoptability of EVs, as well as to 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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