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The Impact of Electric Vehicles on Automotive Aftermarket in 4-Wheeler Car Segment

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Abstract

The extensive review and integration of management literature, this study draws on spares parts, battery durability, E-mobility technologies, infrastructure of recharging stations, govt policies and demand for battery electric vehicle, to develop a research framework that establishes the impact of electric vehicles on automotive aftermarket in 4-w segment. It further compares the effect of individual independent variables' direct and indirect on the automotive aftermarket. The framework was tested in a survey applied to 330 to senior executives, middle managers, aftermarket stakeholders (dealers, distributors and technicians), policy makers etc. By considering the direct and indirect impacts the following ranks scored by govt polices, infrastructure of recharging stations, demand for battery electric vehicles, E-mobility technologies, spare parts and battery durability as first, second, third, fourth, fifth and sixth respectively.

The suggestions provided in this paper ensures the benefits to practitioners as follows: significantly increase the profit potentials for automotive aftermarket stakeholders, demand for skilled technicians will elevate globally, consumer preference for battery electric vehicles in 4-w segment will surge, new business avenues for battery recharging stations will spread globally and demand for battery electric vehicles will rise exponentially.

Keywords: automotive aftermarket, electric vehicles, spare parts, conceptual model.

I. INTRODUCTION

Currently, the automotive market is undergoing a massive change from traditional individual mobility which was driven mainly by (IC) internal combustion engines to one that is driven more by sustainable drive systems, such as electric mobility.

1.1. Automotive Aftermarket

Automobile aftermarket stakeholders include three major groups: consumers, dealers and manufacturers. As a rule, manufacturers/producers are businesses that manufacture vehicles and spare parts for their vehicles. Service dealers sell spare parts and perform repairs on vehicles.

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1.2. Electric Vehicles in Automotive Aftermarket

An electric vehicle (EV) is a vehicle that is, either partially or entirely, powered by electricity. Due to their limited number of moving parts, EVs have low maintenance costs and are extremely eco-friendly, since they use only small amounts of fossil fuels (petrol or diesel).

The global revenue for electric vehicles in the four-wheeler segment is projected to reach substantial growth. A core challenge for the automotive aftermarket sector is that maintaining and repairing an EV is significantly easier than an ICE vehicle, as shown in Table 1.1. Conversely, a hybrid vehicle requires more effort to operate.

Table 1.1

Repair and Maintenance of Various Drive Concepts

	ICE	Hybrid	REEV	BEV
Oil change	✓	✓	✓	-
Exchange coolant	✓	✓	✓	-
Exchange spark plug	✓	✓	✓	-
Exchange fuel filter	✓	✓	✓	-
Exchange brake fluid	✓	✓	✓	✓
Check power electronics	-	✓	✓	✓
Additional coolant	-	✓	✓	✓
Brake system	✓	reduced	reduced	reduced
Exhaust system	✓	reduced	reduced	reduced
Clutch	✓	reduced	-	-

Data source: maintenance of ICE vs Electric

To understand further this paper also clearly specifies research objectives for clarity and clear outcomes:

- 1) To understand the implication of spareparts count with respect to ICE & electric vehicles for the aftermarket automotive stakeholders (i.e., automotive manufacturers, distributors, dealers, and technicians).
- 2) To establish the role of battery durability/life for the for the aftermarket automotive stakeholders (i.e., automotive manufacturers, distributors, dealers, and technicians).
- 3) To understand the role of different e mobility technologies/telematics in the electric vehicles.
- 4) To understand the role of battery recharging stations/infrastructure which can be key lever in establishing a range of electric vehicles.
- 5) To understand the major role played by the governments to promote the electric vehicle.
- 6) To establish the role of battery electric vehicles will cater to the market.

II. LITERATURE REVIEW

The Factors influencing the impact on automotive aftermarket in 4-wheeler car due to influx of electric vehicles are categorically reviewed and identified by testing hypothesis.

2.1. Spare Parts (SP)

Achanga et al. (2006) underline in their research that spare parts play a significant role in enhancing the overall equipment effectiveness and operational efficiency of an organization. According to Ganesan (2008), having a properly organised spare parts management system is crucial, as it has a direct impact on various operational aspects, including downtime, operational costs and the engine’s lifespan

2.2. Battery Durability (BD)

Battery durability is an essential factor for electric vehicles (EVs) since it has a direct influence on the vehicle's range, performance, and cost-effectiveness when it comes to electric mobility (Kumar, 2023; Lin & Silfvenius, 2024). Achieving longer battery life spans relies greatly on the selection of electrode materials, electrolytes, and cell designs (Scrosati et al., 2011).

The economic implications of battery life cycles in EVs are important. The decline in battery quality may lead to decreased vehicle range and performance, which could affect consumer satisfaction and the resale value of EVs. Thus, promoting longer battery lifespan and enabling secondary usage can bring economic advantages for both consumers and manufacturers (Nykvist et al., 2015).

2.3. E Mobility Technologies (EMT)

Enhancements in the efficiency of these components result in optimized power conversion, reduced energy losses, and ultimately lead to a higher overall efficiency of the vehicle (Rathore et al., 2017). Their primary objective is to enhance charging and discharging cycles, safeguard against potential overcharging, and ultimately guarantee the utmost safety and durability of the battery (Tudoroiu, 2021). The landscape of e-mobility is being transformed by the incorporation of autonomous driving and connectivity technologies. This integration allows EVs to communicate with each other and with the infrastructure, resulting in optimised traffic flow and decreased congestion. Autonomous features also contribute to energy-efficient driving, thereby enhancing the efficiency and eco-friendliness of EVs (Ye et al., 2019).

2.4. Infrastructure of Recharging stations (IRS)

For consumers, the accessibility of charging infrastructure is a key factor influencing their decision to purchase electric vehicles (EVs). Consequently, dealerships and service workshops equipped with charging stations are positioned to gain new business prospects while also offering the necessary maintenance and support for EV owners (He et al., 2022).

The number of electric recharging stations, in recent years, the utilization of electric vehicles (EVs) has witnessed a significant increase, primarily driven by environmental and economic concerns. According to the estimations made by Lee and Han (2006), the sales of EVs are expected to grow at an annual rate of over 25% by 2025. The findings of our study on charging infrastructure availability in 2017 are summarized in Table 2.1 and Figure 2.1.

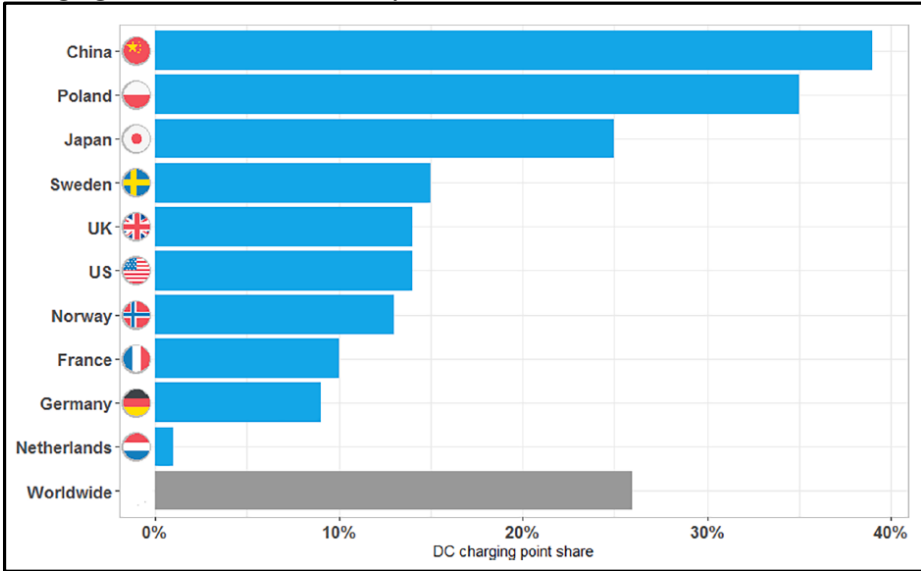
Table 2.1

Charging Infrastructure Availability in 2017

Parameter	China	US	France	Germany	Japan	Netherlands	Norway	Poland	Sweden	UK	World
PEV per charge point	6	17	7	5	7	4	19	4	12	10	7
BEV per DC fast charge point	11	64	59	28	14	46	94	6	20	22	17
ICEV per gasoline station	2200	1600	2900	3000	1900	2000	1400	2900	1500	3400	n/a
CP (DC+AC) per gasoline station	1.94	0.24	1.43	1.68	0.72	8.03	5.24	0.06	1.37	5.45	n/a

Notes: status quo (year 2017) of charging infrastructure availability, CP= charging point. Data source: IEA (2018), EAFO (2017), Eurostat (2017), AFDC (2017), and R&M (2019).

Figure 2.1
Charging Infrastructure Availability in 2017



Data source: IEA (2018), EAFO (2017), Eurostat (2017), AFDC (2017), and R&M (2019)

2.5. Govt Policies

The global outlook on policy instruments for advancing electric mobility is examined in the article titled ‘Policy instruments to promote electric mobility: A global perspective’, authored by Axsen et al. (2017) and published in transport policy. This comprehensive study delves into a range of incentives and subsidies as effective measures in encouraging the adoption of electric vehicles worldwide. Numerous governments offer financial incentives to encourage the adoption of electric vehicles EVs (Martins et al., 2024).

Climate change and the transition to a low-carbon, sustainable future are urgent challenges that must be addressed. The net-zero carbon 2050 target reflects this global consensus. To succeed in this endeavour, governments, businesses, communities and individuals must all work together (United Nations, n.d.).

2.6. Demand for Battery Electric Vehicles (BEV)

Battery electric vehicles (BEVs) represent a specific category of electric vehicles exclusively driven by an electric battery. In contrast to hybrid vehicles that harmonize an internal combustion engine along with an electric motor, BEVs entirely depend on electric energy for their propulsion.

The development of strong charging infrastructure and advancements in battery technology, together with growing customer preference for environmentally friendly transportation, is contributing to the growth in BEV usage (Burra, 2024; Qadir et al., 2024). BEVs are anticipated to have a significant influence on transportation in the future (Liu et al., 2024). They will be a crucial component in initiatives to reduce dependency on fossil fuels and lessen the effects of vehicles on the environment. The size of the India’s electric market size is illustrated in Figure 2.2.

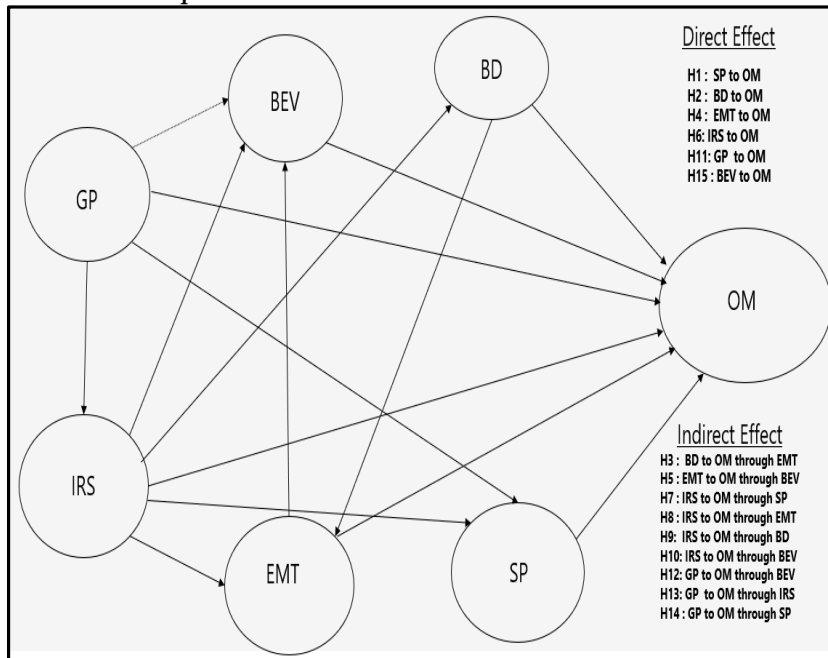
Figure 2.2
Indian Electric Vehicle Market



Data source: Mordor intelligence.

By considering the above detailed literature review, the following detailed conceptual framework with mediations are shown below in Figure 2.3.

Figure 2.3
Detailed Conceptual Framework with Mediations



III. RESEARCH METHODOLOGY

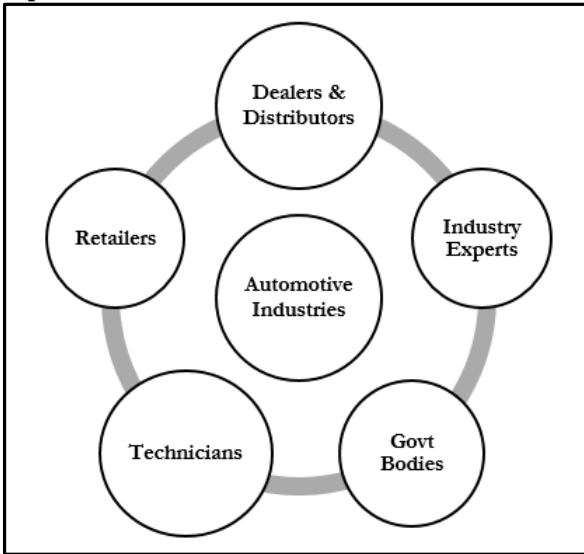
The detailed review of literature was conducted to arrive on the independent and their sub variables. In this paper, we have synthesized the online secondary sources that provide comprehensive information about this topic. A primary data collection method involves gathering data from first-hand sources, which was done when the survey instrument was ready for distribution in the second stage of the study. As the qualified respondents are very rare and available at EV manufacturing and its stakeholders’ segments hence convenient sampling method has been used by considering LinkedIn

and the researcher's corporate connections. The researcher cleaned the data, tested data reliability, validity and test for sampling bias ensured no sampling bias, no reliability issues and no validity issues before issuing the data for model building and testing the hypotheses.

Using LinkedIn and corporate email addresses, we personally contacted each of the 330 respondents.

Figure 3.1

Illustrates the Study Population that Included Job Levels of Automotive Industry (Senior, Middle Management Hierarchies), Dealers and Distributors of Aftermarket, Industry experts, Government Bodies and Technicians.



Demographic analysis has been shown through pie charts (Figure 3.2 to 3.4).

Figure 3.2

Respondents' Profile in their Demography: Age on the Graph%

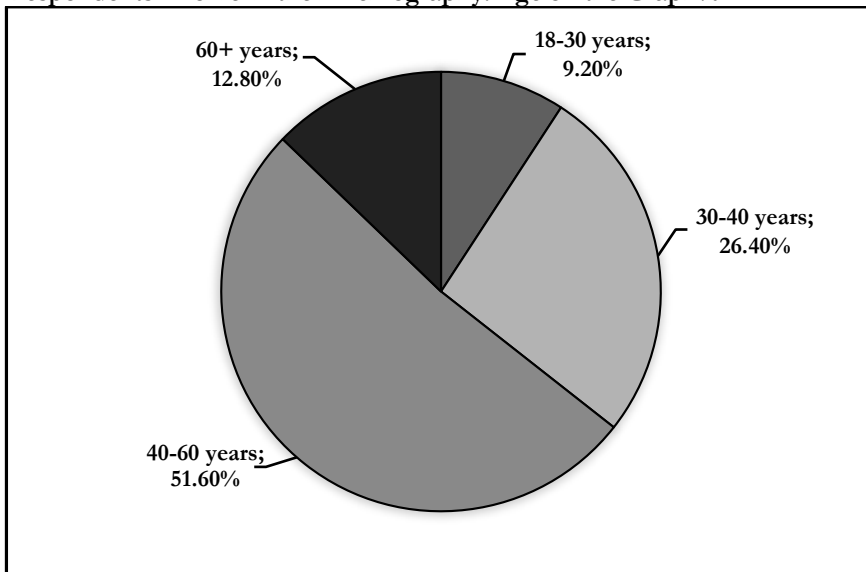


Figure 3.3
Respondents Profile in their Demographic: Occupations

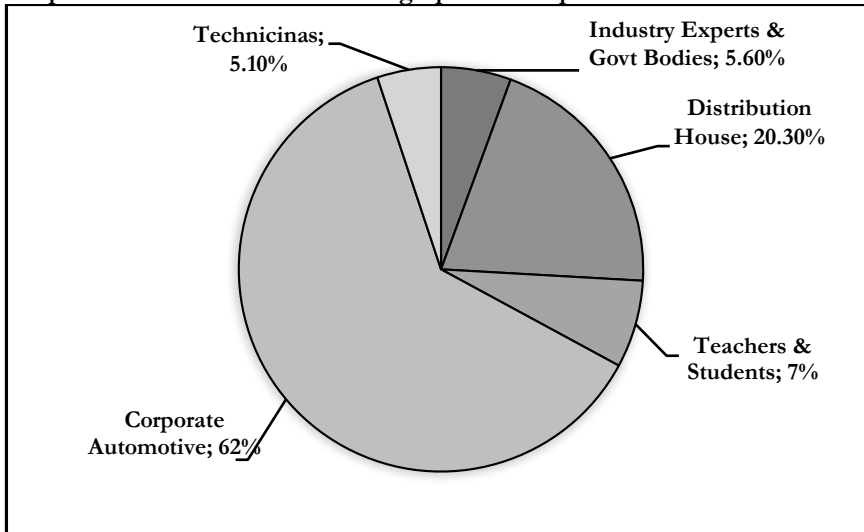
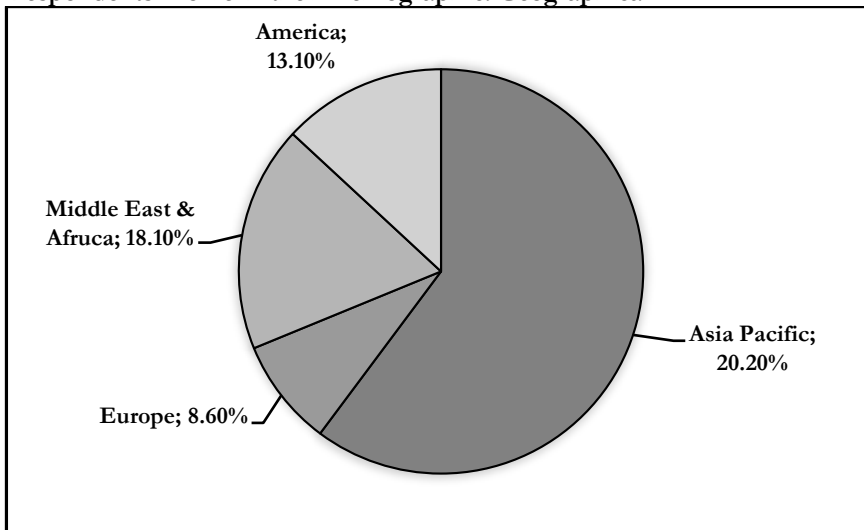


Figure 3.4
Respondents Profile in their Demographic: Geographical



Based on this model, the 15 relationships are separately complemented to the 15 operational hypotheses, of which six were direct and nine indirect. The statistical tool using Adanco (advanced analysis of composites) 2.0.1 was conducted for 15 hypothesis testing models, to arrive at path coefficients, beta values, t-values, and p-values indicated whether the hypotheses were accepted or rejected.

IV. RESULTS AND DISCUSSIONS

4.1. Data Analysis

We tested 15 hypotheses and analysed our measurement and structural models using the structural modelling program Adanco 2.0.1. This required a thorough statistical analysis, which included:

- 1) Construct validity and reliability: evaluating cross-loading, discriminant, and convergent validity.

- 2) Dealing with inter-construct correlations and multicollinearity.
- 3) Structural modelling: evaluating theories, citing previous research, and providing t-values and loading estimates for each construct determinant.

Strong dependability was proven by our research, which is in line with the reliable multivariate approach of structural equation modelling (SEM) (MacCallum & Austin, 2000). The demand for battery electric vehicles, government policies, e-mobility technologies, spare parts, battery durability, and infrastructure for charging stations all have rho values higher than 0.8. Furthermore, Cronbach’s alpha (α), Jöreskog’s rho (ρ_c), and Dijkstra–Henseler’s rho (ρ_A) all fell within acceptable bounds, confirming the validity of our results.

4.2. Construct Reliability

An assessment tool’s validity is its ability to measure what it claims to measure (Hair et al., 2011). In order to assess validity, there are several methods. This paper considers three methods: convergent validity, discriminant validity, and cross-validation of scale.

A parameter of convergent validity indicates the degree to which two measures are actually related despite being theoretically unrelated (Campbell & Fiske, 1959).

Table 4.1

Construct Validity

Construct	Dijkstra-Hanseler’s rho (ρ_A)	Jöreskog’s rho (ρ_c)	Cronbach’s alpha (α)
Spare Parts	0.6886	0.8597	0.6759
Battery Durability	0.6838	0.8512	0.6557
E Mobility Technologies	0.6855	0.8292	0.6893
Infrastructure of Recharging Stations	0.7523	0.8151	0.7004
Government Policies	0.8521	0.8874	0.8413
Battery Electric Vehicles	0.8070	0.8654	0.7926
Automotive after Market	0.8287	0.8722	0.8236

Dijkstra-Hanseler’s rho (ρ_A):
 Three constructs above 0.8= excellent,
 One construct above 0.7= very good,
 Three construct above 0.6= good.

Jöreskog’s rho (ρ_c):
 All constructs above 0.8= good excellent

Cronbach’s alpha (α):
 Two constructs above 0.8= good excellent,
 Two constructs above 0.7= medium,
 Three constructs above 0.6= minimum threshold.

Notes: the model has *passed* the test of construct reliability.

4.3. Discriminant Validity

An important parameter of discriminant validity is the level of relationship between constructs that are theoretically unrelated (Campbell & Fiske, 1959). As generated by Adanco 2.0.1, Table 4.2 shows the average variance extracted along the main diagonal, along with the squared correlations across constructs. Discriminant validity exists within model.

Insert Table 4.2 here.

4.4. Scale Validity

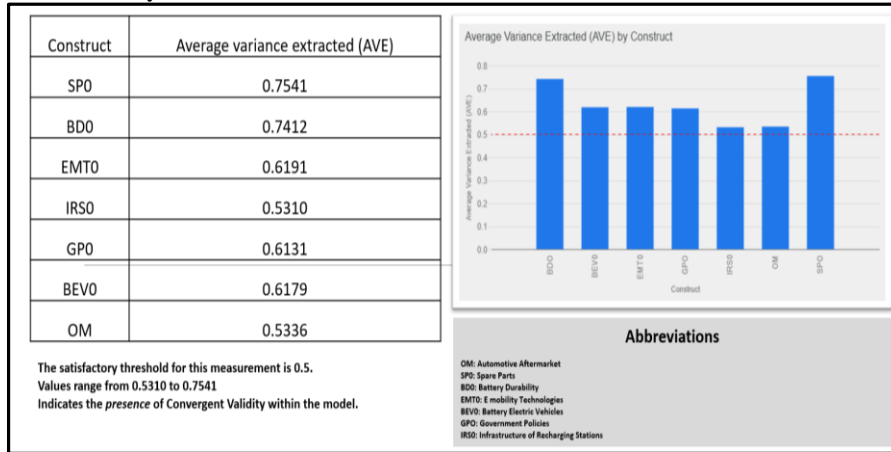
The satisfactory threshold for this measurement is 0.5. Values range from 0.5310 to 0.7541. Indicates the presence of convergent validity within the model as per the mentioned below Table 4.3.

Table 4.2
Discriminant Validity

Construct	SPO	BDO	EMTO	IRSO	GPO	BEVO	OM
SPO	0.7541						
BDO	0.1075	0.7412					
EMTO	0.0259	0.1176	0.6191				
IRSO	0.1119	0.0936	0.1591	0.5310			
GPO	0.1274	0.1137	0.0942	0.3973	0.6131		
BEVO	0.0689	0.0924	0.1322	0.3869	0.3500	0.6179	
OM	0.1285	0.0854	0.1545	0.3956	0.4271	0.4721	0.5336

Notes: squared correlations, AVE in the diagonal.

Table 4.3
Scale Validity



Similarly, the model has also cleared, without reasonable doubt:

- 1) Validation through cross loadings.
- 2) Indicator Multicollinearity.
- 3) Inter-construct correlations.

4.5. Structural Model

This paper describes the model’s external and endogenous constructs as well as their connections. Models assume exogenous constructs are provided by external sources. In this paper endogenous construct is automotive aftermarket and other 6 are exogeneous variables. The empirical research is based on path coefficients and tested on Adanco 2.0 as illustrated in Figure 4.1.

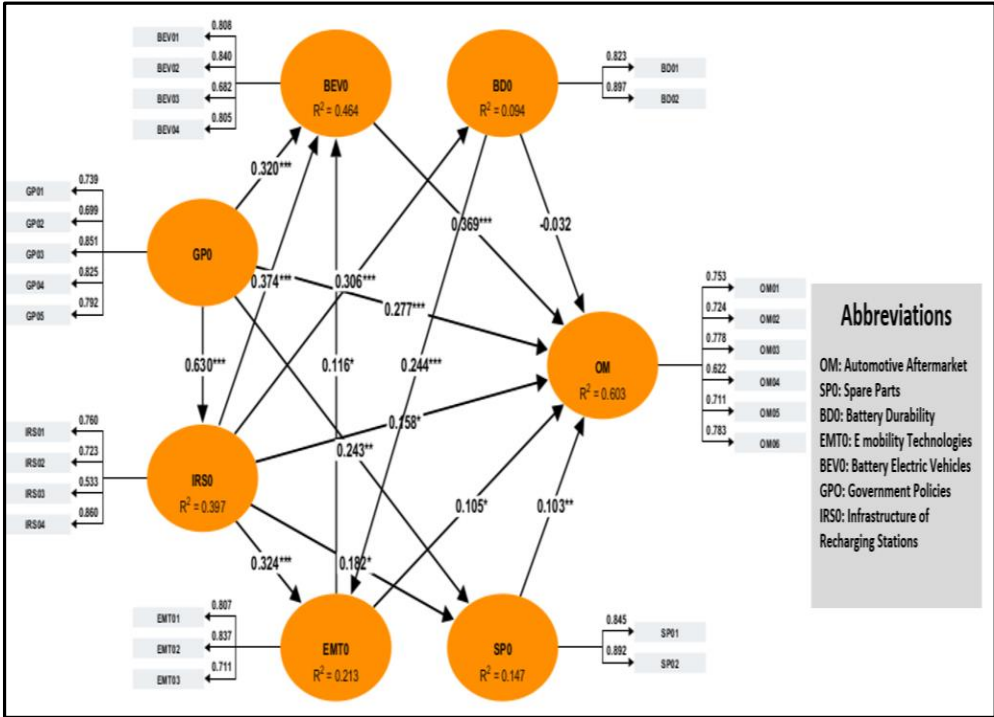
Insert Figure 4.1 here.

An R² value of 0.6063 for the dependent variable reflects that 60.6% of the variance in this latent variable is explained by the contributing factors included as antecedents in this model. This number is considered comparatively high for a partial least-squares regression model (Henseler & Fassott, 2010).

4.5. Summary of the Analyses of all Hypotheses

Fifteen cause-and-effect linkages were constructed and analysed using the structural equation model. Tests between the independent and dependent variables revealed that six of these 15 correlations were direct and nine were indirect. The dependent variable, OM, was found to be significantly impacted by each of the direct and indirect associations. The correlations are summarized in Tables 4.4 and 4.5.

Figure 4.1
Structural Model



Abbreviations

- OM: Automotive Aftermarket
- SPO: Spare Parts
- BDO: Battery Durability
- EMTO: E mobility Technologies
- BEVO: Battery Electric Vehicles
- GPO: Government Policies
- IRSO: Infrastructure of Recharging Stations

Table 4.4
Inference of Direct Effects

Hypothesis	Effect	B coefficient (B Value)	t-value	Significance	Accepted?
1	SPO→OM	0.1034	2.7673	1%	YES
2	BDO→OM	-0.0317	-0.6339	Not Significance	No
4	EMTO→OM	0.1051	2.0211	5% Significance	YES
6	IRSO→OM	0.1578	2.0615	5% Significance	YES
11	GPO→OM	0.2771	4.2472	1% Significance	YES
15	BEVO→OM	0.3693	5.2619	1% Significance	YES

The hypotheses tested in this study provide insights into the factors influencing the impact on the adoption of the 4-w segment of electric vehicles in the automotive aftermarket automotive aftermarket (OM). Out of 15 hypothesized paths, six direct relationships are shown here refer table 4.4, with their statistical outcomes The results and their interpretations are presented below:

H₁ (SPO→OM): spare parts availability has a positive and statistically significant impact on the aftermarket, confirmed at a 1% significance level. This indicates that higher levels of SPO are associated with improved OM. These findings are consistent with prior studies (e.g., Achanga et al., 2006) that reported a positive influencing the impact of spare parts availability on automotive aftermarket performance.

H₂ (BDO→OM): battery durability showed no significant influence, suggesting it may not directly shape aftermarket dynamics. This suggests that BDO does not directly significantly impact OM in the current context, contrasting with some previous research (e.g., Kumar, 2023; Lin & Silfvenius, 2024) that suggested battery durability

could affect aftermarket demand however in our research finding battery durability in indirectly affecting.

- H₄** (EMTO→OM): e-mobility technologies are significant at the 5% level, indicating moderate but relevant influence, confirming the hypothesis. This aligns with prior literature (e.g., Rathore et al., 2017) emphasizing the role of emerging e-mobility technologies in enhancing automotive aftermarket services and operations.
- H₆** (IRSO→OM): infrastructure of recharging stations has a statistically significant and positive relationship with OM, supporting its foundational role. These findings support previous studies (e.g., He et al., 2022) highlighting that strong charging infrastructure encourages the growth of the automotive aftermarket for electric vehicles.
- H₁₁** (GPO→OM): government policies exert a strong and highly significant influence, emphasizing the regulatory environment's importance. This result corroborates earlier research (e.g., Martins et al., 2024) showing that supportive government policies significantly boost the development of automotive aftermarkets, especially in the EV sector.
- H₁₅** (BEVO→OM): battery electric vehicle adoption has the strongest impact with high statistical significance, underscoring its transformative effect. This aligns with prior studies (e.g., Burra et al., 2024; Liu et al., 2024; and Qadir et al., 2024) demonstrating that the increasing adoption of BEVs drives significant growth in aftermarket services and components.

Each accepted hypothesis meets conventional thresholds of significance (1% or 5%) except battery durability, strengthening the model's empirical robustness. Overall, the results indicate that SPO, EMTO, IRSO, GPO, and BEVO significantly contribute to OM, whereas BDO does not. These findings largely confirm previous literature, reinforcing the theoretical framework of the study and highlighting the importance of emerging technologies, government support, and infrastructure in shaping the automotive aftermarket.

Table 4.5

Inference of Indirect Effects

Hypothesis	Relationship	β value	z/t-value	Significance	Type of Mediation
3	BD→EMT→OM	0.02561	1.7766	0.10>p>0.05 (10%)	Partial
5	EMT→BEV→OM	0.04291	1.9636	0.05>p>0.01 (5%)	Partial
7	IRS→SP→OM	0.01877	1.81465	0.10>p>0.05 (10%)	Partial
8	IRS→EMT→OM	0.03408	1.8283	0.10>p>0.05 (10%)	Partial
9	IRS→BD→OM	-0.0096	-0.6283	p>0.10 (Not significant)	Not Mediating
10	IRS→BEV→OM	0.138	54.98	p<0.01 (1% Significance)	Partial
12	GP→BEV→OM	0.11823	3.5764	p<0.01 (1% Significance)	Partial
13	GP→IRS→OM	0.0994	2.0432	0.05>p>0.01 (5% Significance)	Partial
14	GP→SP→OM	0.025	2.0906	0.05>p>0.01 (5% Significance)	Partial

Above Table 4.5 represents the nine indirect relationships among constructs, analyzed using mediation testing to understand how intermediate variables influence the automotive aftermarket (OM).

- H₃** (BD→EMT→OM): battery durability impacts the aftermarket fully through e-mobility technologies, though the result is marginally significant (10% level), suggesting a nuanced influence chain.
- H₅** (EMT→BEV→OM): e-mobility technologies partially mediate the effect on aftermarket via BEV adoption, significant at the 5% level, reinforcing their transitional role.
- H₇, H₈** (IRS as mediator): infrastructure plays a partial mediation role between spare parts/e-mobility and OM, with marginal significance (10% level), implying infrastructural readiness supports but doesn't dominate aftermarket influence.
- H₉** (IRS→BD→OM): No significant relationship here, indicating battery durability does not mediate the effect of infrastructure on the aftermarket.
- H₁₀** (IRS→BEV→OM) and **H₁₂** (GP→BEV→OM): both show strong partial mediation, statistically significant at the 1% level, underscoring the critical path through which infrastructure and government policy influence market transformation via BEV uptake.
- H₁₃** (GP→IRS→OM) and **H₁₄** (GP→SP→OM): government policy exerts partial influence through infrastructure and spare parts, both significant at the 5% level, highlighting policy's structural and operational reach.

In summary, several indirect paths especially via BEV and infrastructure play a pivotal mediating role, offering strategic insights for policymakers and industry players aiming to navigate or drive change in the aftermarket ecosystem.

4.6. Recommendations for Various Stakeholders

To enable the EV Transition, a strategic roadmap of key recommendations for stakeholders across the Electric Vehicle ecosystem to foster growth and support the aftermarket. The core market driver is the rising demand and consumer preference for 4-wheel battery electric vehicles is accelerating, creating urgency and opportunity across the entire value chain.

Following strategic recommendations for key stakeholders:

- 1) Government and policymakers.
 - Why: to enable EV transition and support OEM's and new aftermarket business models.
 - a) Enforce net-zero policies in corporate supply chain.
 - b) Incentivise retrofitting schemes like CVRAS.
 - c) Create policies to encourage entrepreneurs in EV support services.
- 2) Aftermarket stakeholders.
 - Why: to tap into global opportunities for EV battery recharging stations
 - a) Adopt and aggressively promote recharging station infrastructure.
 - b) Collaborate with manufacturers for a robust service network.
- 3) OEMs and EV manufacturers.
 - Why: rising consumer preference for 4-w battery electric vehicles.
 - a) Develop dedicated battery electric vehicle aftermarket segment.
 - b) Support wide adoption of battery recharging infrastructure.
- 4) Technical training institutes.
 - Why: EV's requires specialised skills in software, hardware and system integration.

- a) Invest in rigorous training programs for EV servicing skills.
- b) Prepare workforce for advanced E mobility technologies.
- 5) EV parts suppliers and warehouses.

Why: efficient inventory and supply chain are essential for the EV aftermarket.

 - a) Improve warehouse management for EV spare parts.
 - b) Focus on inventory control, demand forecasting and system integration.
- 6) Automotive battery manufacturers.

Why: battery durability (cost, life, efficiency) is the key to EV adoption.

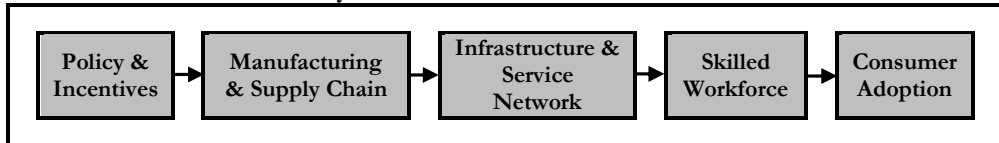
 - a) Promote Aftermarket battery business at competitive prices.
 - b) Maintain high quality standards to drive volume and trust.

4.7. The Interconnected EV Ecosystem

Successful EV adoption relies on a collaborative flow between all stakeholders from policy creation to consumer support. The simplified diagram illustrates critical path as mentioned in the Figure 4.2.

Figure 4.2

The Interconnected EV Ecosystem



4.8. Key Benefits for Enabling Seamless EV adoption in Automotive Aftermarket Transformation

Basis on rigorous data analysis and hypothesis testing (with 99 percent confidence level), the following six outcomes' areas were identified as critical and ranked accordingly for navigating the aftermarket transformation driven by the rise of electric vehicles 4-w segment.

- 1) Ranked 1: simplified implementation process: development of clear polices and framework in collaboration with government bodies to ease aftermarket adoption.
- 2) Ranked 2: enhanced customer engagement: awareness programs across all aftermarket touchpoints to reduce and inform customers on EV components and services.
- 3) Ranked 3: effective challenge mitigation: development of EV -specific part lines and tools to help stakeholders align with emerging usage and service patterns.
- 4) Ranked 4: introduction of new services: promotion of recharging stations and retrofitting solutions by aftermarket players to expand service capabilities.
- 5) Ranked 5: workforce upskilling: specialised training for technicians and mechanics in EV systems, especially battery electric vehicle (BEV) technologies.
- 6) Ranked 6: increased profit potential: higher earnings projected for manufacturers and stakeholders (e.g., distributors, retailers) by adopting the above initiatives.

V. CONCLUSION

This paper presents significant elements that can be expanded upon. Spare parts, battery durability, e-mobility technologies, infrastructure for charging stations, government policies, and battery electric vehicles were the six independent variables that were the focus of the study. The effect of each variable on the adoption of the 4-w segment of electric vehicles in the automotive aftermarket was examined. The six advantages of the adoption—new services, customer engagement, profit potential, resource intensity, strategy to reduce obstacles, and robust implementation—were used to determine the dependent variable.

Veterans in academics and technology from throughout the globe provided the original data. Adanco 2.1.1 was used to statistically analyse the data. The structural model developed in this paper showed that the previously indicated independent factors accounted for 64.1% of the variance in the impact of electric vehicles on the automotive aftermarket 4-w category (see Figure 4.1). Taking into account both direct and indirect effects, our in-depth analysis of EV adoption factors shows a clear hierarchy of the influences. Government policies take the lead and show how important they are. Closely behind are the demand for battery electric vehicles (third) and the infrastructure of charging stations (second), both of which are essential for boosting adoption. Fourth place goes to e-mobility technologies, which have a less direct impact on uptake. Lastly, spare parts and battery durability rank fifth and sixth, respectively; these factors are less significant for initial adoption but crucial for long-term ownership.

The battery durability has no direct impact on the adoption of the 4-w segment of electric vehicles in the automotive aftermarket and at the same time it has significant impact through the mediation of E mobility technologies. This finding contradicting the findings of the (Kumar, 2023; Lin & Silfvenius, 2024). It is advised that these two studies are conducted at different context hence the findings are contradicting.

5.1. Limitations and Scope for Future Research

This study highlights important areas where more study can improve our comprehension of EV adoption and its aftermarket. We found that the current insights were shaped by demographic and regional characteristics, such as the age group of working professionals and the preponderance of Indian respondents. It would be more thorough to broaden future studies to encompass a range of age groups and geographical locations, especially the younger demographic. Similarly, addressing underappreciated but important advancements can be achieved by expanding the literary canon beyond English and embracing current, tech-focused research. Finally, even though our sample included useful information from a few different parts of the world, a wider geographic distribution will increase the findings' generalizability.

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