



A Predictive Analysis for Demand Forecasting and Optimizing Electric Vehicle towards Consumer Preferences in TMA EV Company

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ABSTRACT: This study conducts a predictive analysis for demand forecasting and optimization of electric vehicles (EVs) towards consumer preferences within TMA EV Company at Tenkasi region. The objectives encompass identifying cost-effective strategies through demand pattern analysis, understanding consumer preferences via predictive analytics to maximize revenue, predicting consumer behavior concerning EVs, and analyzing consumer preferences to assist in demand forecasting and product development. Data collection relies on structured questionnaires, predominantly comprising closed-ended questions, distributed among EV consumers. Purposive random sampling is employed, with a sample size

of 132 out of a population of 200. The conclusion highlights the significance of predictive analysis in forecasting demand and customizing EVs to consumer preferences, providing vital insights and strategies for automotive industry stakeholders, policymakers, and relevant groups. Through the utilization of sophisticated data analytics, machine learning methods, and consumer behavior analysis, this research enhances decision-making processes and strategic initiatives aimed at promoting the acceptance and advancement of EVs.

Keywords: Predictive analysis, Demand forecasting, Electric vehicles, Consumer preferences, Cost-effective strategies, Revenue maximization, Consumer behavior prediction.

I.INTRODUCTION

This research aims to explore the integration of predictive analysis techniques and business analytics in the context of demand forecasting and pricing optimization for electric vehicles. Examining real-world case studies industry best practices, and theoretical frameworks, the study seeks to elucidate the potential benefits and challenges associated with implementing predictive analytics in the EV industry. The electric vehicle (EV) industry has witnessed unprecedented growth in recent years, driven by concerns over environmental sustainability, advancements in technology, and governmental incentives promoting clean energy alternatives. As a result, companies operating in this sector face the challenge of not only meeting the increasing demand for EVs but also aligning their product offerings with evolving consumer preferences.

TMA Electric Vehicles Company, a prominent player in the EV market, and aims to leverage predictive analytics techniques to forecast demand accurately and optimize EV features according to consumer preferences. By integrating data analytics

into strategic decision-making processes, TMA Electric Vehicles Company can gain a competitive edge by anticipating market trends and tailoring their products to meet consumer expectations effectively. Demand Forecasting is Utilize predictive analytics models to forecast future demand for electric vehicles, considering various factors such as economic indicators, market trends, and consumer behaviour patterns. Consumer Preferences Analysis are Conduct comprehensive analyses to understand consumer preferences regarding EV features, including range, price, performance, design, and additional functionalities. Optimization Strategies Develop optimization strategies to enhance EV offerings based on insights derived from demand forecasting and consumer preferences analysis. This involves identifying areas for improvement and innovation in product design, marketing strategies, and customer experience. Implementation Plan is propose a roadmap for implementing the findings of the study within TMA Electric Vehicles Company, outlining steps for integrating predictive analytics into existing processes, collaborating



across departments, and monitoring performance metrics.

II. OBJECTIVE OF THE STUDY

- 1.To identify cost-effective strategies by analysing demand patterns.
- 2.To understand the consumer preferences based on predictive analytics to maximize revenue.
- 3.To understand and predict consume behaviour related to Electric Vehicles
- 4.To analyse the consumer preferences to purchase electric Vehicle aiding in demand forecasting and product development

III. SCOPE OF THE STUDY

Investigate consumer preferences regarding electric vehicles, including vehicle features, pricing, range, charging infrastructure, and brand perception. Develop optimization strategies for electric vehicle design, pricing, and marketing based on insights gained from demand forecasting and consumer preference analysis. Develop optimization strategies for electric vehicle design, pricing, and marketing based on insights gained from demand forecasting and consumer preference analysis.

IV. LIMITATIONS OF THE STUDY

The study is restricted to a sample size of respondents who consumed on Electric vehicle in Tenkasi region. The study may have a limited scope in terms of the factors considered for demand forecasting and optimization, potentially overlooking important variables that could influence consumer preferences and purchasing decisions. The study relies on assumptions regarding consumer preferences for electric vehicles

V. STATEMENT OF THE PROBLEM

Limited Understanding of Consumer Preferences is a gap, understanding consumer preferences and behavior regarding electric vehicles, including factors such as vehicle features, pricing, range, and charging infrastructure accessibility, which hinders the ability to tailor EV offerings to meet market demand effectively.

VI. REVIEW OF LITERATURE

Zixuan Jia, Jianing Li, Xiao-Ping Zhang, and Ray Zhang(Mar.2023) “REVIEW ON OPTIMIZATION OF FORECASTING AND COORDINATION STRATEGIES FOR ELECTRIC VEHICLE CHARGING”. This paper

reviewed previous research in this area in terms of EV charging forecasting strategies and coordinated EV charging strategies. Zhang et al. to be significant in the broad adoption of EVs in China ZIXUAN Jia, Jianing Li, Xiao-Ping Zhang, and Ray Zhang(Mar.2023) “Review on Optimization of Forecasting and Coordination Strategies for Electric Vehicle Charging”. This paper reviewed previous research in this area in terms of EV charging forecasting strategies and coordinated EV charging strategies.

Muhamma adnan khan , shazia saqib , tahir alyas , anees ur rehman, yousaf saeed , asem zeb, mahdi zareei and ehab mahmoud mohamed(june2020) “EFFECTIVE DEMAND FORECASTING MODEL USING BUSINESS INTELLIGENCE EMPOWERED WITH MACHINE LEARNING” Business intelligence plays a pivotal role in an inevitable decision support system that enables the enterprise to perform analysis on data and throughout the process of business. Machine learning predicts the forecasting of future demands of the enterprises. Demand forecasting is one of the main decision-making tasks of enterprise. For demand forecasting first raw sales data is collected from the market, then according to data, the future sale/product demands are forecasted.

Fanchao Liao, Eric Molin & Bert van Wee (2017) “CONSUMER PREFERENCES FOR ELECTRIC VEHICLES: A LITERATURE REVIEW”. A review of preferences for EV attributes EV preference studies generally include the financial, technical, infrastructure and policy attributes for vehicle alternatives. In addition they include ASC in the utility function, capturing the joint effect of all the attributes of an alternative which are not included in the choice experiment. Financial attributes refer to various types of monetary costs of vehicle purchase and use: Purchase price is included in all the reviewed studies. Many studies used pivoted design for this attribute: price levels are customised and pivoted around the price of a reference vehicle stated by each respondent. Purchase price was found to have a negative and highly significant influence on the EV utility in all studies. In most of the studies this is explored as a linear relationship, with rare exceptions. Technical attributes describe the technical characteristics of the vehicle itself a relatively short driving range is considered to be one of the biggest barriers to the widespread adoption of EV. The most common operationalisation is driving range with a full battery. Infrastructure attributes focus on the



availability of the charging infrastructure. Most studies explore the interaction between individual-related variables and preference parameters separately without controlling for the correlation between different categories of individual-related variables. The effect of individual-specific variables on EV preference remains an open question. Psychological variables are the exception and have a proven stable effect, shown by several studies. For socio-economic and demographic variables, the impact is unclear and sensitive to small changes in model specification. The direction of the effect is also ambiguous since existing evidence is contradictory. Other variables are only included in a few studies, therefore their effects are as yet inconclusive. In most cases, the correlation between all these variables has not been controlled for to avoid self-selection bias. More research is definitely necessary to clarify these currently fuzzy

relationships and other methods are needed to add more rigour and confidence to the results.

VII. RESEARCH METHODOLOGY

DATA COLLECTION METHODS

Data Source:

Data collection primarily relies on using questionnaires to gather primary data directly from participants. This involves distributing structured surveys to collect responses, ensuring clarity and relevance of question

Sampling Techniques:

Purposive random sampling was the method of sample that was EV Consumer for the survey

Population:

The population of the study is 200.

Sampling Size:

The sample size of the respondents is 132.

VIII. DATA ANALYSIS AND INTERPRETATION

DEMOGRAPHIC PROFILE OF RESPONDENTS - PERCENTAGE ANALYSIS

Descriptive statistics	Particulars	No. of respondents	Percentage
Gender	Male	70	53.0
	Female	62	47.0
	TOTAL	132	100.0
Age	Below 20 years	22	16.7
	21- 30 years	83	62.9
	31 - 40 years	20	15.2
	Above 40 years	7	5.3
	TOTAL	132	100.0
Educational qualification	School level	16	12.1
	Diploma	25	18.9
	UG/PG	86	65.2
	Others	5	3.8
	TOTAL	132	100.0
Marital status	Married	59	44.7
	Unmarried	73	55.3
	TOTAL	132	100.0
Monthly income	Below Rs.20000	29	22.0
	Rs.20000-Rs.40000	56	42.4
	Rs.40001 - Rs.60000	38	28.8
	Above Rs.60000	9	6.8
	Total	132	100.0

Interpretation:

53% of the respondents are male, while 47% are female. This suggests a relatively balanced gender distribution in the sample. The majority of respondents (62.9%) fall within the age range of 21-30 years. The highest proportion of respondents (65.2%) have completed undergraduate or postgraduate education, indicating a well-educated sample. The sample is almost evenly split between married (44.7%) and unmarried (55.3%) respondents. The largest portion of respondents (42.4%) have a monthly income ranging from Rs. 20,000 to Rs. 40,000.



Consumer preference in purchasing electric vehicles

H₀₂: There is no association between demographic profile and consumer preference in purchasing electric vehicles.

H_{02a}: There is no association between gender and consumer preference in purchasing electric vehicles.

Association between gender and consumer preference in purchasing electric vehicles

Gender * Consumer preference in purchasing electric vehicles										
Gender		Type of electric vehicle brand using					Total	P- value	Sig.	S/NS
		Eagle	Zees	Vespa	Spark	Envy				
	Male	18	15	9	17	11	70			
Female	5	11	33	11	2	62				
Total	23	26	42	28	13	132				

(Source: Computer data)

Interpretation:

The above table indicates that there is significant association between gender and consumer preference in purchasing electric vehicles. As the significant value is less than 0.05 it shows that there is a significant relationship between gender and consumer preference in purchasing electric vehicles. **Hence the null hypothesis is rejected.**

H_{02b}: There is no association between age and consumer preference in purchasing electric vehicles

Association between age and consumer preference in purchasing electric vehicles

Age group * Consumer preference in purchasing electric vehicles										
Age group		Type of electric vehicle brand using					Total	P- value	Sig.	S/NS
		Eagle	Zees	Vespa	Spark	Envy				
Below 20 years	5	5	2	8	2	22	17.294	.139	NS	
21-30 years	10	15	33	17	8	83				
31-40 years	6	3	6	2	3	20				
Above 40 years	2	3	1	1	0	7				
Total	23	26	42	28	13	132				

(Source: Computer data)

Interpretation:

The above table indicates that there is no significant association between age and consumer preference in purchasing electric vehicles. As the significant value is more than 0.05 it shows that there is no significant relationship between age and consumer preference in purchasing electric vehicles. **Hence the null hypothesis is accepted.**

H_{02c}: There is no association between educational qualification and consumer preference in purchasing electric vehicles.

Association between educational qualification and consumer preference in purchasing electric vehicles

Educational Qualification * Consumer preference in purchasing electric vehicles										
Educational Qualification		Type of electric vehicle brand using					Total	P- value	Sig.	S/NS
		Eagle	Zees	Vespa	Spark	Envy				
School level	4	3	2	5	2	16	10.798	.546	NS	
Diploma	2	9	7	5	2	25				
UG/PG	16	13	32	17	8	86				
Other	1	1	1	1	1	5				



Total	23	26	42	28	13	132			
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(Source: Computer data)

Interpretation:

The above table indicates that there is no significant association between educational qualification and consumer preference in purchasing electric vehicles. As the significant value is more than 0.05 it shows that there is no significant relationship between educational qualification and consumer preference in purchasing electric vehicles. **Hence the null hypothesis is accepted.**

H_{02d}: There is no association between monthly income and consumer preference in purchasing electric vehicles

Association between monthly income and consumer preference in purchasing electric vehicles

Monthly Income * Consumer preference in purchasing electric vehicles										
		Type of electric vehicle brand using					Total	P-value	Sig.	S/NS
		Eagle	Zees	Vespa	Spark	Envy				
Monthly Income	Below Rs.20000	4	5	11	6	3	29	9.688	.643	NS
	Rs.20000- Rs.40000	12	15	13	11	5	56			
	Rs.40001 - Rs.60000	5	6	13	9	5	38			
	Above Rs.60000	2	0	5	2	0	9			
Total		23	26	42	28	13	132			

Interpretation:

The above table indicates that there is no significant association between monthly income and consumer preference in purchasing electric vehicles. As the significant value is more than 0.05 it shows that there is no significant relationship between monthly income and consumer preference in purchasing electric vehicles.

Hence the null hypothesis is accepted.

Linear Regression

H₀₃: There is no significant impact on the factor purchasing of electric vehicle to some extra money to for its comfort and luxury towards monthly income

Factor purchasing of electric vehicle to some extra money to for its comfort and luxury towards monthly income (Model Summary)

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.093 ^a	.009	.001	.50157

a. Predictors: (Constant), Monthly Income

Factor purchasing of electric vehicle to some extra money to for its comfort and luxury towards monthly income(Coefficients)

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.388	.120		11.546	.000
	Monthly Income	.054	.051	.093	1.069	.287

a. Dependent Variable: Did you buy electric vehicle to some extra money to for its comfort and luxury?



Factor purchasing of electric vehicle to some extra money to for its comfort and luxury towards monthly income (ANOVA)

ANOVA ^b						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.288	1	.288	1.143	.287 ^a
	Residual	32.705	130	.252		
	Total	32.992	131			
a. Predictors: (Constant), Monthly Income						
b. Dependent Variable: Did you buy electric vehicle to some extra money to for its comfort and luxury?						

(Source: Computer data)

Interpretation:

The above table depicts the regression model showing the factor purchasing of electric vehicle to some extra money to for its comfort and luxury towards monthly income. The multiple regression co-efficient R² is found to be .009 indicating 9 percent of the loyalty predicted by the factors and monthly income. The results confirm that the model is insignificant. The t values of the factors are insignificant towards monthly income.

Correlation

H₀₄: There is no significant relationship between the factors that influence in buying an electric vehicle
Relationship between the factors that influence in buying an electric vehicle (Correlations)

Correlations						
		Price	Range	Charging infrastructure availability	Brand reputation	Technology features
Price	Pearson Correlation	1	.748**	.766**	.755**	.746**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	132	132	132	132	132
Range	Pearson Correlation	.748**	1	.719**	.792**	.729**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	132	132	132	132	132
Charging infrastructure availability	Pearson Correlation	.766**	.719**	1	.794**	.847**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	132	132	132	132	132
Brand reputation	Pearson Correlation	.755**	.792**	.794**	1	.843**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	132	132	132	132	132
Technology features	Pearson Correlation	.746**	.729**	.847**	.843**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	132	132	132	132	132

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

(Source: Computer data)

Interpretation:

The correlation table shows that there is a high correlation between the factors that influence in buying an electric vehicle. The highest correlation is .847 between technology features and charging infrastructure



availability and the lowest correlation is .719 between range and charging infrastructure availability. All the factors are positively skewed.

Hence, it is positive correlation.

IX. FINDINGS SUGGESTIONS AND CONCLUSION

The present chapter presents the findings from the analyses of the study, relevant suggestions and the conclusion pertaining to the objectives of the study.

FINDINGS OF THE STUDY:

Majority (53.0%) of the respondents are male. Majority (62.9%) of the respondents are in the age group of 21-30 years. Majority (65.2%) of the respondents are having UG/PG qualification. Majority (55.3%) of the respondents are unmarried. Majority (42.4%) of the respondent's monthly income is between Rs.20000-Rs.40000. Majority (46.2%) of the respondents owning electric vehicles between 6 months to one year. Majority (31.8%) of the respondents using Vespa brand. Majority (62.1%) of the respondents use public charging stations. Majority (45.5%) of the respondents drive 50-100 km in a day. Majority (44.7%) of the respondents use electric vehicle for transportation several times in a week. Majority (55.3%) of the respondents neither agree nor disagree that the cost to charge an electric vehicle is much less than the fuel cost for a petrol or diesel vehicle. Majority (50.0%) of the respondents neither agree nor disagree that electric vehicle cost about the same to buy as petrol or diesel vehicles. Most (80.3%) of the respondents are using electric vehicle for short distance. Majority (50.8%) of the respondents won't buy electric vehicle to some extra money for its comfort and luxury. Majority (64.4%) of the respondents have agreed that environmental issues a factor for purchasing any vehicle. Majority (64.4%) of the respondents disagree that maintenance of electric vehicles has been high. Majority (55.3%) of the respondents likely to purchase electric vehicle in the next 2 years.

Majority (26.3 %) of the respondents chosen availability of charging infrastructure as the factor that influence decision to use electric vehicle.

The difference between factor that influence when buying an electric vehicle vs gender of respondents is insignificant. The difference between factor that influence when buying an electric vehicle vs age of respondents is insignificant. The difference between factor that influence when buying an electric

vehicle versus the educational qualification of respondents is significant viz price, range and charging infrastructure availability. The difference between factor that influence when buying an electric vehicle versus the monthly income of respondents is significant viz price, brand reputation and technology features.

There is a significant relationship between gender and consumer preference in purchasing electric vehicles. Hence the null hypothesis is rejected. There is no significant relationship between age and consumer preference in purchasing electric vehicles. Hence the null hypothesis is accepted. There is no significant relationship between educational qualification and consumer preference in purchasing electric vehicles. Hence the null hypothesis is accepted. There is no significant relationship between monthly income and consumer preference in purchasing electric vehicles. Hence the null hypothesis is accepted.

The F values of the factors are insignificant towards monthly income.

All the factors are positively skewed. Hence, it is positive correlation.

SUGGESTIONS:

- More charging stations can be opened so as that people will opt for EV rather than petroleum products.
- EV's are suitable for a short distance travel. People should use the EV's as like other vehicles in the future.
- Embrace a mindset of constant enhancement by continuously fine-tuning predictive models and optimization strategies through feedback, incorporating new data, and staying attuned to the evolving trends in the electric vehicle market and consumer preferences.

CONCLUSION

In conclusion, the use of predictive analysis to forecast demand and tailor electric vehicles (EVs) to consumer preferences provides important insights and strategies for key players in the automotive industry, policymakers, and other relevant groups. By utilizing sophisticated data analytics, machine learning methods, and consumer behavior analysis, this research enhances decision-



making processes and strategic efforts aimed at promoting the acceptance and enhancement of EVs.

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