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Probability of Purchase of Electric Cars by the Indian Consumers

Dr. Archi Mathur

Associate Professor, Faculty of Management Studies, National Law University, Jodhpur

Abstract:
This paper highlights upon the fact that whether India is ready for the electric car category of vehicles or not? It is also interesting to note that despite people favoring the idea of an electric car, not many are even considering it as an option of purchase. They might think of considering it if it satisfies their choice criteria.
This study highlights upon two things:
a. What is the future of electric cars in India?
b. Whether there is any relation between future of electric cars and consideration of purchase of electric cars by the consumer?

Keywords: Future of Electric Cars, Chi Square Test, Consideration of Purchase

Introduction:

With the Government providing income tax benefits to the consumers on purchase of electric cars, yet, the Indian consumers are not inclined towards the purchase of these cars. They are not sure about the long term performance of these cars in the market. As the average purchase of any car is not that frequent for Indian consumers, they are very cautious about purchasing it. Indian customers are more into savings and investments as compared to spending too frequently.
Therefore, a survey was conducted to see that whether the Indian customers are risk takers or not when it comes to purchasing an electric car.

Research Methodology:

a. Data Collection: A questionnaire was prepared and the data was collected by administering the questionnaire on the selected sample by posting a link on the social media platform or whats app or through e mails.

b. Sample Size:

The sample size of the survey is around 213 respondents. Out of these 213 respondents, 101 respondents were females and 112 respondents were males. The sample unit consists of respondents ranging from housewives, entrepreneurs (male and female), salaried working males and females, female and male students (from the Universities as they are the future prospects), practicing professional males and females, retired people (male and female). Demographic (age, sex, income and occupation) basis of segmentation is used for this survey.

Tools/Techniques used for Data Analysis:

For testing the hypothesis, Chi Square Test will be performed. Chi Square Test is used as a statistical tool to analyse and interpret the data so collected. This test is helps us to study the relationship between two categorical variables. The two categorical variables included in this study are consideration of electric car for next purchase (no, never; maybe, if it satisfies my choice factors and yes, definitely) and future of electric cars in India (poor, below average, average, good and excellent). Through the Chi Square Test, the researcher tries to determine whether the difference between the observed values and the expected values is statistically significant.

To undertake this test, firstly framing of hypothesis is done. Null hypothesis and alternate hypothesis is accordingly framed.

Hypothesis:

Set 1:

Null Hypothesis (H_0): The future of Electric cars in India is not good.

Alternate Hypothesis (H_1): The future of Electric cars in India is good.

Set 2:

Null Hypothesis (H_0): There is no relation between future of electric cars and consideration of purchase of electric cars by the consumer.

Alternate Hypothesis (H_1): There is a relation between future of electric cars and consideration of purchase of electric cars by the consumer.

The significance level will be taken as 0.05 i.e. $\alpha = 0.05$

This indicates that there is a 5% risk of concluding that there exists an association between the variables taken when there is actually no association.

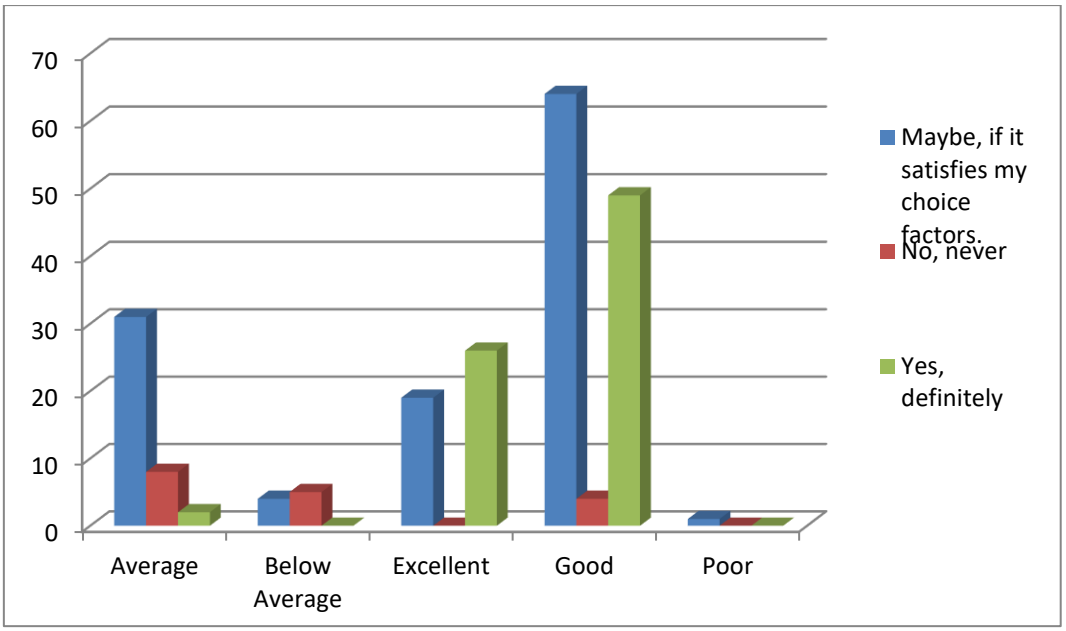
Once the hypothesis is framed, tabulation of the data will be done.

Table of Observed Values:

Observed value is the actual number of observations in a sample that belongs to a category.

Future of Electric Cars	Purchase of Electric Car by the Consumer			Grand Total
	Maybe, if it satisfies my choice factors	No, never	Yes, definitely	
Average	31	8	2	41
Below Average	4	5	0	9
Excellent	19	0	26	45
Good	64	4	49	117
Poor	1	0	0	1
Grand Total	119	17	77	213

Table 1



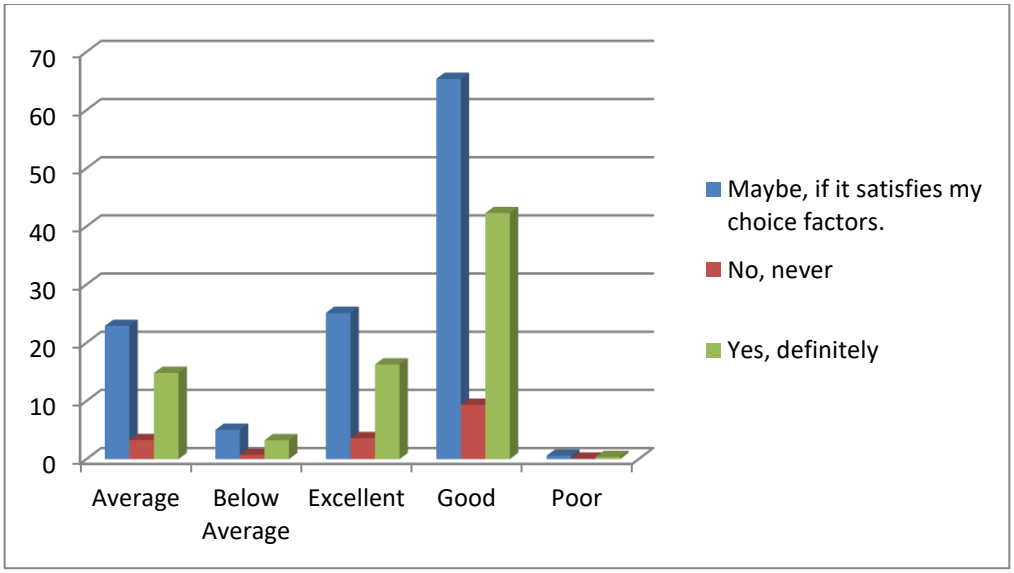
Graph 1 Table of Expected Values:

The expected value is the frequency that would be expected in a cell if the variables are independent.

Expected Value: Row Total * Coloumn Total / Grand Total

Future of Electric Cars	Purchase of Electric Car by the Consumer		
	Maybe, if it satisfies my choice factors	No, never	Yes, definitely
Average	22.9	3.27	14.82
Below Average	5.03	0.72	3.25
Excellent	25.14	3.59	16.27
Good	65.37	9.34	42.3
Poor	0.59	0.08	0.36

Table 2



Graph 2 Calculation of χ^2 Value:

Observed Value	Expected Value	(O-E)	(O-E)²	(O-E)²/E
O	E			
31	22.9	8.1	65.61	2.865
8	3.27	4.73	22.3729	6.8419
2	14.82	-12.82	164.3524	11.09
4	5.03	-1.03	1.0609	0.2109
5	0.72	4.28	18.3184	25.4422
0	3.25	-3.25	10.5625	3.2385
19	25.14	-6.14	37.6996	1.4995
0	3.59	-3.59	12.8881	3.5902
26	16.27	9.73	94.6729	5.8189
64	65.37	-1.37	1.8769	0.0287
4	9.34	-5.34	28.5156	3.0531
49	42.3	6.7	44.89	1.0612
1	0.59	0.41	0.1681	0.2849
0	0.08	-0.08	0.0064	0.08
0	0.36	-0.36	0.1296	0.36
			χ^2= 65.465	

Table 3

The Chi Square Calculated Value is **65.465**
Comparison of the Calculated Value of the χ^2 with the Tabulated Value is done.

χ^2 Tabulated Value:

For this, the degrees of freedom have to be calculated. The formula for degrees of freedom is:

Degree of Freedom = (Coloumn -1) (Row-1)
f = (3-1) (5-1)
f = 8

Then using the chi square table for degrees of freedom 8 and significance value of 0.05, the χ^2 Tabulated Value is calculated.

So χ^2 tabulated value will be 15.507
If the Chi Square Calculated Value is more than the Chi Square Tabulated Value or the critical value, then the Null Hypothesis (H_0) is rejected and the Alternate Hypothesis (H_1) is accepted. Accordingly, the Null Hypothesis (H_0) 'The future of Electric cars in India is not good' is rejected and the Alternate Hypothesis (H_1) 'The future of Electric cars in India is good' is accepted.

As the calculated value is more than the critical value, we have sufficient evidence to say that there is an association between future of electric cars and purchase of electric cars by the consumer. Hence the Null Hypothesis (H_0) 'There is no relation between future of electric cars and consideration of purchase of electric cars by the consumer' is rejected and the Alternate Hypothesis (H_1) 'There is a relation between future of electric cars and consideration of purchase of electric cars by the consumer' is accepted.

This further shows that the as the critical value is greater than the expected value, it cannot be attributed to chance and our sample supports the hypothesis of a difference.
This can further be ascertained by calculating the p value.

Calculation of p value:

The two tailed p value with a Chi Square Calculated Value of 65.465 and degrees of freedom 8 equals 0.0001.

If the p value is smaller than or equal to 0.05, then the variables have a statistically significant association and the Null Hypothesis (H_0) can be rejected.
ie. $p \leq \alpha$
or $p \leq 0.05$
$0.0001 \leq 0.05$

If the p value is less than or equal to the significance level, the Null Hypothesis (H_0) is rejected and concluded that there is a statistically significant association between the variables. And by conventional criteria, the difference is considered to be very statistically significant. Therefore, the Null Hypothesis (H_0) 'The future of Electric cars in India is not good' can be rejected and the Alternate Hypothesis (H_1) 'The future of Electric cars in India is good' can be accepted. Similarly, the Null Hypothesis (H_0) 'There is no relation between future of electric cars and consideration of purchase of electric cars by the consumer' is rejected and the Alternate Hypothesis (H_1) 'There is a relation between future of electric cars and consideration of purchase of electric cars by the consumer' is accepted.

Future of Electric Cars	**Values**	**Purchase of Electric Car by the Consumer**			**Total**	**%**
		Maybe, if it satisfies my choice factors	**No, Never**	**Yes, Definitely**		
Average	**Observed Value**	31	8	2	41	19.25
	Expected Value	22.9	3.27	14.82		
Below Average	**Observed Value**	4	5	0	9	4.22
	Expected Value	5.03	0.72	3.25		
Excellent	**Observed Value**	19	0	26	45	21.13

	Expected Value	25.14	3.59	16.27		
Good	**Observed Value**	64	4	49	117	54.93
	Expected Value	65.37	9.34	42.3		
Poor	**Observed Value**	1	0	0	1	0.47
	Expected Value	0.59	0.08	0.36		
Total		119	17	77	213	
%		55.87	7.98	36.15		100

Table 4

From the above table, following observations can be made:

1. The electric car segment seems to be on its growth path in the Indian market; though at a slow pace. This can be seen from the fact that only 0.47% and 4.22% of the respondents felt that the market for electric cars in India is in the poor or below average category. The respondents have even not predicted a high growth rate for this segment as only 21.13% of the respondents have rated it as an excellent opportunity for electric cars. Similarly, only 19.25% of the respondents have stated an average future of the electric car market. This shows that neither the market is growing at a fast pace nor it is moving at a slower pace. The interesting thing to note here is that 54.93% of the respondents feel that the future of electric cars in India is good.
2. Even though 54.93% of the respondents feel that the future of electric cars in India is good, only 36.15% of the total respondents will definitely consider purchasing an electric car. And 55.87% of them may consider purchasing an electric car, if it satisfies their choice criteria. And these statistics are only for consideration and not final decision to purchase.
3. Now on comparing the average, excellent and good future of the electric cars in the Indian market. it was found out that:
    a. The observed value for consideration of the purchase of electric car in the maybe (if it satisfies my choice criteria) category of average, good and excellent future of electric cars in India is 31, 64 and 19 respectively; therefore amounting to 26.05%, 53.78% and 15.97% respondents respectively. The expected value for consideration of the purchase of electric car stands at 22.9, 65.37 and 25.14 respectively. This means that the expected value of good and excellent future of electric cars in the maybe (if it satisfies my choice criteria) category was higher than the observed value and the expected value of average future of electric cars in this category was lower than the observed value.
    b. The observed value for consideration of the purchase of electric car in the no, never category of average, good and excellent future of electric cars in India is 8, 4 and 0 respectively; therefore amounting to 47.06% and 23.53% respectively. The expected value for consideration of the purchase of electric car stands at 3.27, 9.34 and 3.59 respectively. This means that the expected value of good and excellent future of electric cars in the no, never category was higher than the

observed value and the expected value of average future of electric cars in this category was lower than the observed value.

c. The observed value for consideration of the purchase of electric car in the yes, definitely category of average, good and excellent future of electric cars in India is 2, 49 and 26 respectively; therefore amounting to 2.6%, 63.64% and 33.77% respectively. The expected value for consideration of the purchase of electric car stands at 14.82, 42.3 and 16.27 respectively. This means that the expected value of average future of electric cars in the yes, definitely category was higher than the observed value and the expected value of good and excellent future of electric cars in this category was lower than the observed value.

4. While comparing observed and expected cell counts, it was found out that in the category of average future of electric cars in the Indian market, the observed value for maybe (if it satisfies my choice criteria) was 31 while the expected value was 22.9. Similarly, the observed value for yes definitely was 2 while the expected value was 14.82. This means that these are the cells which have more or less observations than would be expected if H_0 were true. It can also be seen for good future of electric cars in the Indian market. The observed value for no never is 4 as compared to the expected value of 9.34; and the observed value for yes definitely is 49 as compared to the expected value of 42.3. Similarly, for excellent future of electric cars in the Indian market, the observed value for maybe (if it satisfies my choice criteria) is 19 as compared to its expected value of 25.14; and the observed value for yes definitely is 26 as compared to its expected value of 16.27.

If the two variables are associated, then the distribution of observations for one variable will defer depending on the category of the second variable. If two variables are independent, then the distribution of observations for one variable will be similar for all categories of the second variable.

Keeping this into consideration, we can say that in case of average future of electric cars in the Indian market, the observed value for yes definitely was 2 and the expected value is 14.82. The expected value is much more than the observed value than if the variables were independent. This shows that the two variables (average future of electric cars in the Indian market and yes definitely purchase an electric car) are associated. Similarly again in the case of average future of electric cars in the Indian market and maybe purchase an electric car (if it satisfies my choice criteria), the observed value is 31 and the expected value is 22.9. Here the observed count seems to be much larger than would be expected if the variables were independent.

Similarly, we can say that in the case of the excellent future of electric cars in the Indian market and yes definitely, the observed value is 26 and the expected value is 16.27. Here the observed count seems to be much larger than would be expected if the variables were independent. This shows that the two variables (excellent future of electric cars in the Indian market and yes definitely) are associated. Similarly again in the case of excellent future of electric cars in the Indian market and maybe (if it satisfies my choice criteria), the observed value is 19 and the expected value is 25.14. Here the expected value is much more than the observed value than if the variables were independent. This shows that the two variables (excellent future of electric cars in the Indian market and maybe (if it satisfies my choice criteria) are associated.

Furthermore, again in the case of the good or favorable future of electric cars in the Indian market and yes definitely, the observed value is 49 and the expected value is 42.3. Here the observed count seems to be much larger than would be expected if the variables were independent. This shows that the two variables (good or favorable future of electric cars in the Indian market and yes definitely) are

associated. Similarly again in the case of (good or favorable future of electric cars in the Indian market and no never category, the observed value is 4 and the expected value is 9.34. Here the expected value is much more than the observed value than if the variables were independent. This shows that the two variables (good or favorable future of electric cars in the Indian market and no never category) are associated.

Summary:

In this research article, we can see that the future of electric cars in the Indian market is favourable; though people do not have a clear conviction to purchase it. They like the idea of a futuristic car in the market but are hesitant to purchase it as they are not aware about the functioning and efficiency of this car on a cost benefit analysis. The organizations should try to create awareness amongst the consumers about the functions addressing the different requirements of theirs along with the contributions which the consumers can make towards an environmentally safe environment. In short, the organizations have to change the mindset of the Indian consumer regarding electric vehicles.

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