International Journal of Economic Research

ISSN : 0972-9380

available at http: www.serialsjournal.com

Volume 14 • Number 11 • 2017

A Logistic Regression Model to Identify the Key Attributes Considered by Consumers for Purchasing a Car

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ABSTRACT

Internet has opened many sources of gathering information about the desired attributes impacting purchasing decisions. The paper attempts to find out key attributes considered by the consumers for deciding to purchase a car and develop a model that identifies impact of these key attributes on car purchase. Survey was conducted using a structured questionnaire that was administered to 202 respondents residing in Chennai, Tamil Nadu. SPSS 20 was used for analyzing the data. Logistic regression technique was used for developing a model that assesses the impact of various attributes on purchase decisions. To analyse the moderating effect of Demographic variables (Gender, Income and Family Size) multiple regression analysis was done. The paper has identified that automotive websites and social media websites have had a major impact on the way people search information. Further the study has also helped in development of a fit model that explains the extent of influence of each significant attribute on consumer purchasing decisions. Demographic variables explained the moderating effect of Gender, Income and Family Size on purchase intention. The study findings aim to contribute the car marketing field by providing exact information and offering valuable information about the most preferred attribute of the car that are considered by the consumers. This will also help managers develop a focused strategy towards marketing the product in car markets.

Keywords: Demographic, Logistic regression, Purchase Intention, Social media.

1. INTRODUCTION

The dynamic nature of technological environment has drastically altered the lifecycles of technological products. The rapid and frequent advancements in technological products have led to highly diversified products in the market and has made very difficult for consumers to make a decision. Consumer decision to

purchase is a very complicated process and involves a very engaging process that begins with identifying the problem (need) goes through information search, assessing the alternatives and finally ending with a decision to purchase and post purchase behavior (Schmidt, J. B., and R. A. Spreng. 1996). Social media has made this process even more exciting and adventurous. The ever changing consumer demands have to be catered to by the manufacturers as they consistently work towards providing improved products with enhanced and unique characteristics to attract consumers. Manufacturers often get entangled between maintaining high standards and meeting consumer demands. Every product consists of complex characteristics that vary from being tangible to intangible describing the value of the product and its use. These values are attributed to satisfying consumers' needs and demands and make the product appealing to consumers. The product characteristics can be ranked based on the consumers considerations and the way they feel about its importance (Griliches, Z. 1994, Byrd, K. S., and B. S. Caldwell. 2011). Consumers involve in a very active information search before they decide to purchase a product. The information search phase is even more important when the product in consideration involves huge money. Consumers are constantly searching product related information even when they are not preparing to buy the product immediately but probably in future. Studies have shown that consumers actively search product related information until they feel that they have balanced the cost –benefit relation between the product and information obtained, i.e the cost of obtaining a unit of information is equal to the marginal benefit of possessing a unit of information, prior to product purchase. This proves the fact that studies should be conducted to analyse the product characteristics and study purchase intentions of consumers. Hence the paper focuses on importance of information search and influence of other users through interaction in social media and auto websites platforms for getting car related information. The existing users and prospective users can share information related to the desired attributes of car on these platforms and share, discuss and debate on the most influencing factors. Past studies have also thrown light on the fact that specifications of external groups, personal needs and requirements encourages consumers to develop purchase intentions specially for technology related products (Blackwell, R. D., P.W. Miniard, and J. F. Engel. 2001, Chang, H. J., and V. Jorge. 2008, Greta, K., H. Zoran, L. Vesna, and R. J. Anet. 2010, Lillrank, P., P. J. Groop, and T. J. Malmstrom. 2010).

Social Media and Auto Websites Drive the Information Search

Advancements in social media communication have transformed the relationships between consumers and managers by enabling consumers to be in a driving seat and communicate their needs and requirements instantly (Christodoulides, G., Jevons, C., & Blackshaw, P. 2011). Consumer generated content has been on the rise with advent of Web 2.0. Several studies have been conducted to understand social media sites as online applications that provide a platform to enable interactions between consumers and allow them to develop strong interrelationships among them. Social media has offered venues to consumers where they can engage with the brand and other existing users of the brand in a sincere and friendly manner which in turn has positive effect on purchasing decisions. Auto websites like carwale.com, cardekho.com also provide similar types of information to consumers when it comes to looking for specific features of a car. The car market is highly competitive and is generally characterized based on meticulous planning and requirements of the consumers. The decision to purchase a car is not an easy process. The amount of money involved is very high and market is filled with various types of options. Hence comparing different models of various brands is a tough task for consumers and they need to balance right amount of information with

the available offers to make the best possible decision. The information available on such sites in the form of reviews, ratings, videos, blogs and images help the consumer have a better visualization of their dream car and they can take informed decisions.

In past researches have primarily focused on analyzing the product characteristics and less emphasis is given on to influence of internal motivations, need and the impact of external sources of various information platforms on intention to purchase (Afuah, A. 2002, Maurer, R., M. Pitzer, and S. Sebastian. 2004, Haeger, J. W., and K. Storchmann. 2006, Ralf, D., H. Justus, L. Ricardo, and R. Peter. 2007). There has been no research paper that specifically address the decision making process of consumers purchase intention for cars using a logistic regression analysis. The study develops an integrated model of consumers purchase intention that emphasizes on specific car characteristics and the extent to which each of the characteristics impact the consumers purchasing decisions. The paper also stresses on the importance of social media and auto websites that are used extensively for searching information related to desired car. The paper is based on Hybrid Decision Making Model developed by Chang et. al., in the year 2015. The author in this paper has made a comprehensive compilation of 30 determinants of consumer purchase intention for technology product (Tomat, G. M. 2006, Chwelos, P. D., E. R. Berndt, and I. M. Cockburn. 2008, Van Staden, J., and A. M. Van Aardt. 2011, Bruwer, J., and C. Buller. 2012).

The model studies product characteristics, source of information and motivation as factors responsible affecting the purchase intention. The study focused on moderating effect of lifestyle on purchase intention. For this study we have undertaken the most commonly searched attributes of car by the consumers. The study aims to identify the impact of each identified characteristics on consumers purchase decisions. The source of information search and demographic of consumers was studies in details to arrive at a new model that allows us to understand the extent of impact of each attribute on consumers purchasing decisions. The product characteristics allow users to understand the utility of the product and asses the product on the basis of requirements. The products that have more outstanding characteristics are able to drive consumers towards purchasing the product.

Based on this model the proposed model comprises of external sources of information (Social Media Website and Auto Website), internal sources (Need) and the product characteristics (Car) that drive purchase intention. Demographic profile of the consumers is studied as moderating factor that influences the purchase intention.

2. OBJECTIVES

- To identify the key attributes considered by consumers for purchasing a car.
- To develop a model for determining impact of key features on consumers decision to purchase a car.

3. KEY CAR ATTRIBUTES CONSIDERED FOR CAR PURCHASE

The key attributes which are considered by the consumers for car purchase were analyzed and the literature highlighted few key features. Driving comfort, spare part availability and price of the car were major influencers motivating consumers to purchase a car (Subadra. S., Murugesan.K.M, Ganapathi. R 2010), he has pointed out those demographic factors like age and qualification did not influence purchasing behavior.

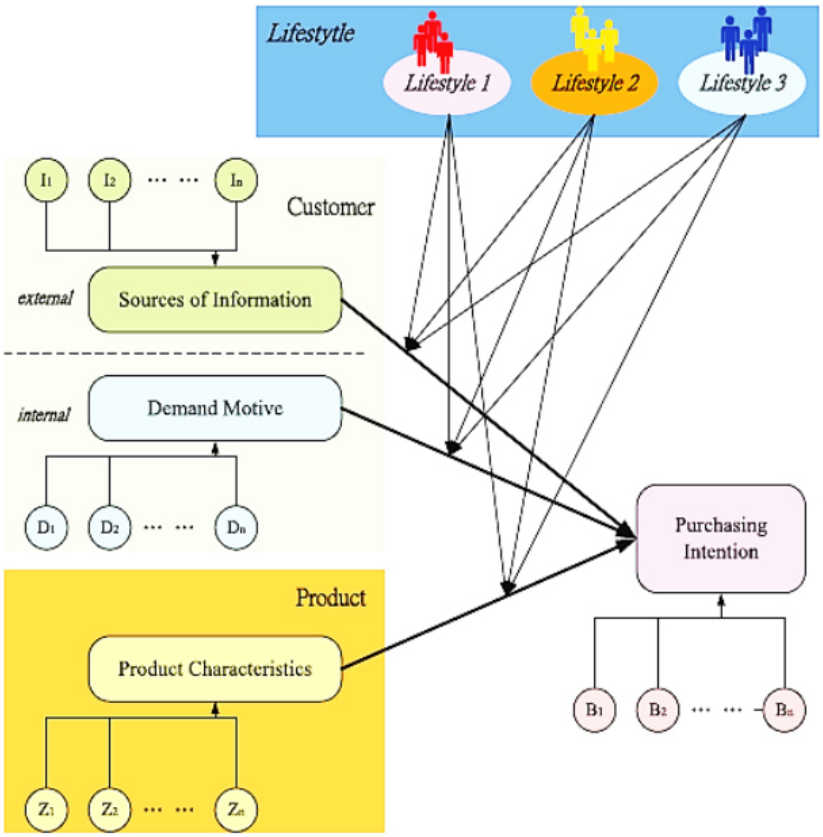

Figure 1: Hybrid Decision making model for technology products, Chang et. al., 2015

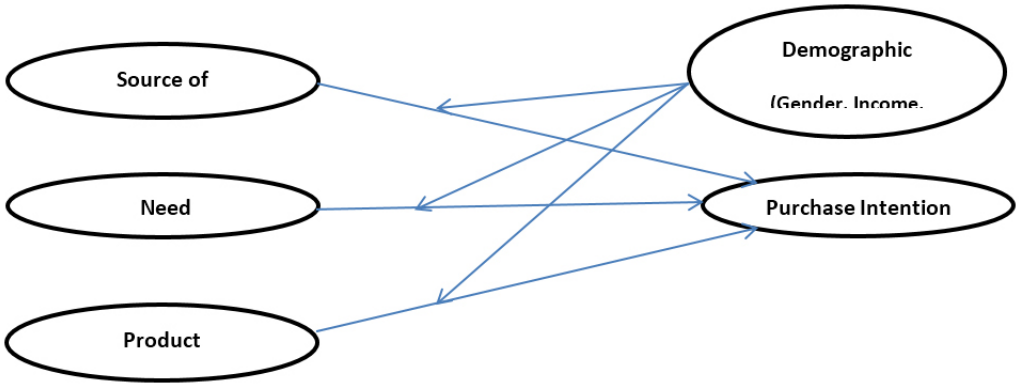

Figure 2: Authors Model

Study conducted by Shimpi Shriram (2012) has suggested that family income and gender have found to have significant impact on consumers intention to purchase cars. Friends and family members have also been found to be significant influencers while deciding on specific segment of car purchase (Clement Sudhakar J., and Venkatapathy R. 2009). Various other studies have been conducted to assess consumer attitude towards European, American or Japanese manufacturers and country of origin, car brand, dealership and distributers reputation have been found to be significantly impacting consumers' choice. Study has highlighted that consumers who are more cost and utility conscious prefer to purchase cars that belong to passenger segment namely compact cars and mini cars. The choice of a particular segment is mainly

driven by the need and preference for a particular make and model belonging to a specific segment. Few other factors that contributed to encouraging customers for deciding to purchase a car have been identified by several authors, they include celebrity endorsements done by various car manufacturers, flexibility in payment system, efficient service and delivery bundles offered by car dealers and safety features leverages consumers towards car purchase decision (K. Vidyavathi (2012), Kotwal, Shapur 2009). Car buyers of mid-sized vehicle are more inclined towards space, luxury and comfort. Factors like reliability of the product, monetary value, trendy appeal, promotional activities, brand trustworthiness and association with the brand were also identified as major influencers (M. Prasanna Mohan Raj, Jishnu Sasikumar, S.Sriram 2013). Study has highlighted the fact that reliability, safety, and price have been contributing significantly towards influencing the consumer for purchasing the car. Other factors considered were, quality of the product, efficient fuel economy, after sale service, battery capacity of car and its safety record, location, country of origin, brand, design, warranty and demographic. Hence the results have revealed that price, fuel efficiency and endorsements by reference group have strong influence on purchasing decisions.

4. DEVELOPING THE LOGISTIC REGRESSION MODEL

Therefore the objective of the paper is to identify the attributes of that consumers search through various channels for considering purchasing a car. The focus here is on social media and auto websites that provide that initial information that the consumers need during their consideration phase of decision making process. The factors considered here are Price, Model, Durability, After sale service, Sale services, Operating cost, Maintenance frequency, Finance facility, Warranty schemes, Steerability, Engine power, Interior finish, Exterior, Fuel consumptions, Operational convenience, Energy efficiency, High tech functionality, Field of vision, Safety, Comfort, Brand and Sense of luxury.

5. LOGISTIC REGRESSION MODEL

Based on hybrid decision making model the logistic regression model was developed that considered product characteristic and source of information that lead to formation of consumer purchase intention of cars (Chang, H. J., and V. Jorge. 2008). To identify key attributes considered by consumers for car purchase intension first computed a dichotomous variable indicating whether the information is searched through social media website or Auto Website

$$\begin{cases} 1, \text{ if Social Media Website} \\ 0, \text{ if Auto website} \end{cases}$$

On the basis of Pearson's Chi-square statistic the most influential attribute was identified among the attributes considered for the logistic regression model.

We then used a Logistic regression model, given by:

$$\text{Log}_{it}(p) = \ln(p/(1-p)) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots \beta_{11} X_{11}$$

where, $X_1 \ldots X_{11}$ are the predictor variables and $\beta_1 \ldots \beta_{11}$ shows the extent of influence of each car attributes considered for car purchase decisions using social media and auto websites. Analysis has proved that - Model, After Sale Service, Maintenance Frequency, Finance Facility, Engine Power, Exterior, Fuel Consumption, Energy efficiency, Safety, Comfort and Brand have significantly contributed to the model fit.

6. RESEARCH METHODS

Data Collection

Sample was collected from 202 respondents residing in Chennai, Tamil Nadu. The respondents were asked to fill a questionnaire consisting of questions relating to their preferences of the factors they considered for purchasing a car. The responses were measured using the 5 point Likert scale technique. Data was collected for a period of three months from March 2016 up to May 2016 and was analyzed using SPSS 20. Following Table 1 represents the demographic characteristics of the population.

Table 1
Demographic Details

Age (Years)	*Percentage (%)*
26-33	25.7
34-41	48.5
Above 41	25.7
Gender	
Female	46.5
Male	53.5
Monthly Income (Rs)	
Below 40000	27.7
40000-60000	32.7
60001-80000	17.8
Above 80000	21.8
Educational Qualification	
Under Graduate	5.9
Post Graduate	58.4
Professional Courses	35.6
Marital Status	
Married	20.8
Unmarried	79.2
Family Type	
Nuclear	64.4
Joint	35.6
Website Useful for Information Search	
Auto Website	47.5
Social Media Website	52.5

Data Analysis

A logistic regression analysis was conducted to predict the key determinants considered by consumers through social media and automotive websites for making car purchase decision. A test of the full model against a constant only model was significant, indicating that the predictors as set are useful information that are driving the consumers car purchase decision through Social media websites and Automotive Websites.

The Dependent variable encoding table shows that dependent variable Auto websites is coded with 0 and Social Media Websites is coded as 1. The classification table for Block 0 estimates the null model with

only the constant. The columns are the two predicted values for the dependent and rows are the observed values of the dependent. Since the model here is not a perfect one hence and the model predicts websites useful for searching about car purchase. The overall percent correctly predicted is at 52.5% as shown in Table 2.

Table 2
Classification Table[a,b]

Observed			Predicted		
			WEBSITE USEFUL FOR SEARCHINGIN FORMATION ABOUT CAR PURCHASE		Percentage Correct
			Autowebsites	Social Media Websites	
Step 0	WEBSITE USEFUL FOR SEARCHINGIN FORMATION ABOUT CAR PURCHASE	Autowebsites	0	96	.0
		Social Media Websites	0	106	100.0
	Overall Percentage				52.5

[a]Constant is included in the model
[b]The cut value is. 500

The Table 3 Omnibus test for model coefficients tests the chi-square goodness of fit test that is used for testing the null hypothesis. The step here is from the constant only model to the all independent model. The model coefficients are all significant. The overall significance is tested using what SPSS calls the Model Chi square, which is derived from the likelihood of observing the actual data under the assumption that the model that has been fitted is accurate. There are two hypotheses to test in relation to the overall fit of the model.

H0: The model is a good fitting model.

H1: The model is not a good fitting model (i.e. the predictors have a significant effect).

Table 3
Omnibus Tests of Model Coefficients

		Chi-square	Df	Sig.
Step 1	Step	153.028	22	.000
	Block	153.028	22	.000
	Model	153.028	22	.000

The Cox-Snell R^2 and Nagelkerke R^2 are attempts to provide a logistic analogy to R^2 in logistic regression. The Nagelkerke measure adapts the Cox-Snell measure so that it varies from 0 to 1, as does R^2 in logistic regression. The Nagelkerke modification that does range from 0 to 1 is a more reliable measure of the relationship. Nagelkerke's R^2 will normally be higher than the Cox and Snell measure. Nagelkerke's R^2 is part of SPSS output in the 'Model Summary' table and is the most-reported of the R-squared estimates. The value here is 0.709, that indicates moderately strong relationship of 70.9% between the predictors and prediction as depicted in Table 4.

Table 4
Model Summary

Step	*–2 Log likelihood*	*Cox & Snell R Square*	*Nagelkerke R Square*
1	126.508[a]	.531	.709

[a]Estimation terminated at iteration number 9 because parameter estimates changed by less than. 001.

Table 5
Hosmer and Lemeshow Test

Step	*Chi-square*	*Df*	*Sig.*
1	7.092	7	.419

Table 5 shows Hosmer and Lemeshow test which divides subjects into 10 ordered groups of subjects and then compares the number actually in the each group (observed) to the number predicted by the logistic regression model. If the H-L goodness-of-fit test statistic is greater than. 05, as we want for well-fitting models, we fail to reject the null hypothesis that there is no difference between observed and model-predicted values, implying that the model's estimates fit the data at an acceptable level. That is, well-fitting models show non-significance on the H-L goodness-of-fit test. This desirable outcome of non-significance indicates that the model prediction does not significantly differ from the observed (predicted).

The H-L statistic assumes sampling adequacy, with a rule of thumb being enough cases so that 95% of cells (typically, 10 decile groups times 2 outcome categories = 20 cells) have an expected frequency > 5. Our H-L statistic has a significance of. 419 which means that it is not statistically significant and therefore our model is quite a good fit.

In the Classification table, the columns are the two predicted values of the dependent, while the rows are the two observed (actual) values of the dependent. In a perfect model, all cases will be on the diagonal and the overall percent correct will be 100%. In this study, 88.7% were correctly classified for social media group and 79.2% for the automobile group. Overall 84.2% were correctly classified. This is a considerable improvement on the 52.2% correct classification with the constant model so we know that the model with predictors is a significantly better model, details as shown in Table 6.

Table 6
Classification Table[a]

	Observed		*Predicted*		
			WEBSITE USEFUL FOR SEARCHINGIN FORMATION ABOUT CAR PURCHASE		*Percentage Correct*
			Autowebsites	*Social Media Websites*	
Step 1	WEBSITE USEFUL FOR SEARCHINGIN FORMATION ABOUT CAR PURCHASE	Autowebsites	76	20	79.2
		Social Media Websites	12	94	88.7
	Overall Percentage				84.2

[a]The cut value is. 500

To assess the impact of each predictor variable the equation table is useful. The Wald statistic and associated probabilities provide an index of the significance of each predictor in the equation. Table 7 shows

The Wald statistic, with a chi-square distribution. To suggest the significance of the predictor variable in the equation the significance value of each predictor is studied and those falling under less than 0.05 are rejected for null hypothesis as it makes a significant contribution to the prediction. From the table it can be observed that Model, After Sale Service, Maintenance Frequency, Finance Facility, Engine Power, Exterior, Fuel Consumption, Energy efficiency, Safety, Comfort and Brand have significantly contributed to the model fit. Other insignificant predictors can be dropped from the equation as they do not contribute significantly to the model. The Exp(B) column presents the extent to which raising the corresponding measure by one unit influences the odds ratio. We can predict that Brand (311917.676), Engine Power (6069.451), After sale Service (297.636) and Fuel Consumption (155.833) have highest impact on consumers considering to purchase a car.

Table 7
Variables in the Equation

		B	*S.E.*	*Wald*	*Df*	*Sig.*	*Exp (B)*
Step 1[a]	Price	–1.366	1.140	1.437	1	.231	.255
	Model	–5.498	1.536	12.810	1	.000	.004
	Durability	.436	1.314	.110	1	.740	1.547
	After sale service	5.696	2.166	6.913	1	.009	297.636
	Sale services	–.233	1.245	.035	1	.852	.792
	Operating cost	–.671	.984	.465	1	.495	.511
	Maintenance frequency	3.151	1.041	9.153	1	.002	23.353
	Finance facility	–2.678	1.073	6.234	1	.013	.069
	Warranty schemes	–.460	.785	.344	1	.557	.631
	Steerability	.869	.988	.774	1	.379	2.385
	Engine power	8.711	2.325	14.043	1	.000	6069.451
	Interior finish	–1.130	1.307	.747	1	.387	.323
	Exterior	–8.931	2.745	10.585	1	.001	.000
	Fuel consumptions	5.049	1.855	7.404	1	.007	155.833
	Operational convenience	1.444	1.389	1.082	1	.298	4.240
	Energy efficiency	–1.943	.888	4.786	1	.029	.143
	High tech functionality	–1.445	.997	2.101	1	.147	.236
	Field of vision	.598	.635	.887	1	.346	1.819
	Safety	–5.115	1.680	9.271	1	.002	.006
	Comfort	–7.683	2.540	9.149	1	.002	.000
	Brand	12.650	3.280	14.875	1	.000	311917.676
	Sense of luxury	–.354	.642	.304	1	.581	.702
	Constant	-5.275	2.335	5.105	1	.024	.005

[a]Variable (s) entered on step 1: Price, Model, Durability, After sale service, Sale services, Operating cost, Maintenance frequency, Finance facility, Warranty schemes, Steerability, Engine power, Interior finish, Exterior, Fuel consumptions, Operational convenience, Energy efficiency, High tech functionality, Field of vision, Safety, Comfort, Brand, Sense of luxury.

Moderating Effect of Demographic Variables

Multiple Regression analysis was conducted to explore the moderation effect of demographic variables (Gender, Income and Family type) on purchasing intentions. Tables 8 show the result. Regressions analysis

showed that there is a significance impact between gender and need (*p* value = 0.046). There is a significant impact between gender and source of information (*p* value = 0.000). It was further found that there is no significant impact between gender and product characteristics (*p* value = 0.420). The overall variance explained using gender was 18.3%. Hence we can conclude that gender plays an important role in purchase intention behavior. It was found that there is a significant impact of income and information source (*p* value = 0.002). Income showed no statistical significance with respect to need and product characteristics and it explained 7% of the total variance considered. Income was not found to have impacted the decision as car has no longer remained a luxury product but it is a necessity and money is not the major criteria when deciding to purchase cars. Easy loan option from banks and multiple schemes by the dealers and manufacturers have contributed in income not being the deciding factor in making a car purchase decision. Family type and Need (*p* value = 0.000); Family type and Source of information (*p* value = 0.006) and Family type and Product Characteristics (*p* value = 0.000) showed a significant relationship among each other and hence it was found to be the most influencing demographic factor when it comes to purchasing a car. Total variance explained by family type is 26.5%. Hence moderating effect of demographic variables was explained and it was found that the variables impacted Need, Source of Information and Product Characteristics while using them for development of purchase intention of a technology product.

Table 8
Multiple Regression Table

	Adjusted R^2	*Need*		*Source of Information*		*Product Characteristics*	
		Std B	*Sig.(P value)*	*Std B*	*Sig. (P value)*	*Std B*	*Sig. (P value)*
Gender	0.183	0.167	0.046	0.275	0.000	0.061	0.420
Income	0.070	0.027	0.751	0.229	0.002	0.064	0.405
Family Type	0.265	0.448	0.000	-0.177	0.006	0.416	0.000

7. DISCUSSION

The study attempts to offer a novel model to the consumers who are in the process of purchasing a car. The model emphasizes on major characteristics considered by consumers while looking for the information on various websites. For the study we have considered social media and auto websites. The need for the product is major driver for searching the information that eventually drives the consumers towards information search. Choice product characteristics vary from person to person depending on their requirements. The utility of the product can be assessed more easily by understanding the product attribute. Therefor this model serves as a very useful one when it comes to understanding the actual requirements of consumers. During the survey it was also found that demographics do play a major role in their choice of the car attributes. It was found that higher income group preferred more sophisticated designs and focused more on exteriors. Respondents having bigger family size preferred larger vehicles. Although car being status symbol was still prevalent but the number of people who considered it was quite low. Due to women also contributing to the family income it found that they too are involved in the decision making process of buying a car. Previous studies have shown that Men are more inclined towards functional aspect of car purchase decision (PrabhaKiran, Dr. S. Vasantha 2016).

The car purchase is considered to be the second most important decision in one's life after house. Considerable amount of time and money has to be invested before deciding to purchase the dream vehicle.

The present study focused on the attributes considered by consumers for making a car purchasing decision. The study was based on Hybrid Decision Making Model developed by Chang et. al., and for this study we focused on source of information and product characteristics as major factors that's influence consumers purchase decisions. The study focused on social media and auto websites as major sources that contribute to the information search regarding key car attributes. The car attributes considered for this study were Price, Model, Durability, After sale service, Sale services, Operating cost, Maintenance frequency, Finance facility, Warranty schemes, Steerability, Engine power, Interior finish, Exterior, Fuel consumptions, Operational convenience, Energy efficiency, High tech functionality, Field of vision, Safety, Comfort, Brand and Sense of luxury. The attributes considered accounted for the model contributed to 82.4% of the predicted goodness of fit to the model. A logistic regression model was developed based on the data collected and it was found that among the factors considered Model, After Sale Service, Maintenance Frequency, Finance Facility, Engine Power, Exterior, Fuel Consumption, Energy efficiency, Safety, Comfort and Brand have significantly contributed to the model fit. Through the model we can predict that Brand (311917.676), Engine Power (6069.451), After sale Service (297.636) and Fuel Consumption (155.833) have highest impact on consumers considering to purchase a car.

8. CONCLUSION

It can be concluded that by developing this model author has highlighted the most important factor that influences consumers decision making. The major sources of information considered during the consideration phase of consumers' car buying process are studied. The model developed gives a clear picture of major attributes considered by consumers and the extent of each attribute on the purchase intentions of consumers. It was also found that gender, income and family type impacted the car purchase decisions and family type was found to be the most influencing demographic factor. The model will provide Manufacturers and marketing professionals' with the clear insights about needs and requirements of consumers. They can focus on those key attributes to gain consumers' confidence and make them brand loyal. They can develop new strategies in the new platform and engage consumers at a more intimate level.

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