

PREDICTING CONSUMERS' PROBABILITY TO PURCHASE A PRODUCT ONLINE USING DISCRIMINANT ANALYSIS

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ABSTRACT

India has experienced a transformation in the field of retailing. Earlier, the retail sector in India was made up of organized retail and unorganized retail. But recently, a new phenomenon has occurred in the field of retailing. This is Online retailing or e-tailing. This is most likely the future of shopping in the world. With the widespread use of internet and change in the socio-economic structure, India has emerged as the ideal place for online retailing. Increased internet penetration, improved security measures, convenience, less time consumption and extensive choice are a few factors that are attracting more and more consumers to shop online. In this paper, an attempt has been made to predict the probability that an online consumer will purchase a product online. A structured questionnaire was used to collect the relevant data from online consumers of Visakhapatnam city. On the basis of data collected from 856 respondents, six factors emerged contributing to predict the probability of a consumer to purchase online. Discriminant analysis was then applied with these six factors as dependent variables, and the probability to purchase online as independent variable. The study shows clearly that 'evaluation of alternatives' is the most important discriminating factor among the predictors considered in this study which differentiates the online consumers with low probability to purchase online from the online consumers with high probability to purchase online.

Keywords: Online Shopping, Need Recognition, Information Search, Evaluation of alternatives, Social Media.

INTRODUCTION:

Retailing is the largest private sector industry in the world economy. It is the final stage of any economic activity. It occupies an important place in the world economy. It is a dynamic industry. In the past decade the retail industry has undergone a transition throughout the world. With India having 462 million Internet users in 2016, the e-tailing industry has seen unprecedented growth in last few years (PTI, 2016). The Indian online retail market is likely to touch US\$100 billion by 2020 (IBEF, 2017). This growth has been due to several factors like rapid adoption of technology by people, improvement in living standards, increase in the population of the youth, economic advancement, increased access to the internet and increased use of smart phones and tablets. Several e-tailing companies have entered into the market and are fiercely competing with each other to tap the e-tailing opportunity in India across various segments. This includes global e-tailing giants like Amazon and Alibaba, along with home-grown players like Flipkart.

Due to the increased competition the e-tailers are experimenting different ways to attract more online customers to their website. Some of the major steps taken by e-tailers in recent times are: increasing the number of vendors, designing customer-centric services and reaching out to the remote and rural parts of India for delivering their services. Thus, the primary goal of any e-tailer is to increase its sales. In order to increase their sales, an e-tailer must attract more consumers and convince them to buy the product online. This is possible when the e-tailer understands the online consumers' decision making process, time spent on online shopping websites and social media in a better manner. Therefore, the e-tailers need to know the probability of the consumer to purchase a product online and also which factor influences them the most to purchase a product online. In order to do this, the research paper considers the following predictors Need Recognition, Information Search, Evaluation of Alternatives, Time spent on online shopping websites, Social media and Post-Purchase.

OBJECTIVES OF THE PAPER:

The objectives of this paper are:

- To understand the factors influencing the probability of online consumers to purchase a product.
- To identify the factor that demarcates between the online consumers with low probability to purchase online, from the online consumers with high probability to purchase online.

HYPOTHESIS:

In order to study the objectives of the research paper the following is hypothesised:

H0: There is no significant discriminating power in the predictors.

H1: There is a significant discriminating power in the predictors.

LITERATURE REVIEW:

The dependent factors taken in this study are Need Recognition, Information Search, Evaluation of Alternatives, Time spent on online shopping websites, Social media and Post-Purchase.

Need Recognition:

The consumers' purchase decision making process begins with the stimulation of a need. This stimulation occurs when the consumer feels an imbalance between his/her actual and desired state (Bruner, 1985). When a consumer becomes aware of the discrepancy between the existing state and a desired state then a need is created (Mahatoo, 1985). The existing state and the desired state are influenced by the consumer's motive, personality, cultural and social influences and marketing stimuli (Evans and Berman, 1984). Need recognition signifies a person's readiness and willingness to act. It does not guarantee that the decision making process will continue. Only if the problem is important to the consumer and he or she believes that a solution is available, will the purchase decision making process continue (Baker 2000).

In this regard, companies have to identify the circumstances that trigger a particular need. Bruner (1987) points out that among the consumers, there seem to be two different need recognition styles. Some consumers are actual state types, while others are desired state type. In actual state type, need recognition occurs when the consumer has a problem due to the failure of the product to perform satisfactorily. In the desired state type, need recognition takes place when the desire for something new triggers the purchase decision making process.

Information Search:

The second stage in the consumer purchase decision making process is 'Information search'. This stage begins once the consumer recognizes the need to purchase a product online. There are several sources of information search that the consumers refer in order to collect information about the product that they want to purchase. Broadly these sources are classified into External and Internal sources. These are also known as Public and Personal sources respectively. These sources of information influence consumers' decision-making process (Ardnt, 1967; Duhan et al., 1997; Gilly et al., 1998; Olshavsky & Granbois, 1979; Price & Feick, 1984). The number of sources of information that the consumer refers to before making a purchase decision varies with the product that he/she intends to buy. In the context of online shopping, the consumers' need for information is large. This is due to the lack of real interaction with the seller. One of the most commonly used public source of information is the internet which has a huge capacity for information storage, search and retrieval, information customization, and interactive communication. This makes it an efficient medium for information search for online purchase (Peterson, Balasubramanian, and Bronnenberg 1997). Information search on internet can significantly reduce pre-purchase anxiety among consumers (Ghose and Dou 1998). Thus, information search helps the consumers to evaluate the products in a better manner and also carry out the purchase process conveniently (Zeng and Reinartz 2003).

Evaluation of alternatives:

The third stage in the consumers' online purchase decision making process is the 'Evaluation of Alternatives'. Once the consumer has recognized the need to purchase a product online then he/she searches for information about it. This is followed by the evaluation of the various alternatives that he/she has come across during information search stage. Evaluation involves bringing together and analyzing the information that has been collected in the information search stage (Gay et al, 2010). From the several sources of information search an online consumer finds several alternatives, that may fulfill his/her need. This is a crucial stage as it will finally lead to taking the decision of purchase.

In the context of online shopping, the real challenge for the consumer is to collect information and evaluate the various alternatives. There are several varieties of products as well as several variations in the same brand that have the capacity to fulfill the consumers' need (Solomon, 2004). In such a situation, the consumer has to decide which product to purchase based on certain criterion. This is known as evaluative criteria. The evaluative criteria are based on several attributes or benefits expected from the product by the consumer. In other words, evaluative criteria are the standards based on which the consumer differentiates amongst the different varieties of products or brands. The different alternatives may be evaluated either based on objective features or subjective features. Objective features include the functional or the utilitarian aspects of the product like attributes of the product, benefits obtained from the product etc. On the other hand subjective features relate to the emotional or the hedonic aspects related to the product like status, convenience, privacy, security of transaction etc. Consumers purchasing a product for the first time carefully evaluate several varieties of the product while consumers making a habitual decision may not consider many alternatives. Extended evaluation of alternatives also takes place when the consumer faces conflict among the various alternatives of products available to him (Solomon, 2004).

Time spent on Online shopping websites and Social Media:

Online shopping websites allow consumers to access product information at any time via the internet. It provides the facility of real-time conversation and feedback. This leads to good customer relationship

management (Kalyanam and McIntyre, 2002). Social media helps to connect online shopping companies to consumers. This leads to development of a relationship between them which will make the online consumer loyal (Kaplan and Haenlein, 2010). A study by Vinerean et al. (2013), shows that the online consumers who have more experience of social media, spend less time on it. They are more likely to click on advertisements given by online shopping websites on social media. Consumers play a variety of roles on interactive medium which have an implication on marketing practices (Deighton and Kornfeld, 2009). These roles are a combination of the attributes of consumers and the information provided by the company. The buying behavior of consumers is influenced by the usage pattern of social media (Sliva et al., 2011). It also influences the relationship between the consumers and the company (Jahn and Kunz, 2012; Coulter and Roggeveen, 2012) and the buying decision (Bashar, Ahmed and Wasiq, 2012). Being an interactive medium, the type of posts on Face book also has a vital impact on the consumers.

Post-Purchase:

The decision making process of the consumer does not end with the purchase of the product by the consumer. Once the consumer has purchased the product, he/she will assess the product's performance. This will lead to satisfaction or dissatisfaction in the minds of the consumer. If the product's performance is up to the expectation of the consumer then he/she is 'satisfied'. If the product's performance is not up to the expectation of the consumer then he/she is 'dissatisfied'. If the product's performance is beyond the expectations of the consumer then he/she is 'delighted'. Foxall (2005) made an attempt to understand the influence of social media on consumer choice in the consumer buying decision making process. He found that the post-purchase stage is really important for consumers. This is because it influences the future purchase decisions of the consumers. It is also important as it influences the future purchase decision of the peer and family members of the consumer. Engel et al (1968) developed a consumer decision making model at The Ohio State University and it is known as Engel, Kollat and Blackwell model or EKB model. Later this model was renamed as Engel, Blackwell and Miniard model or EBM model to give credit to the inclusion of Professor Paul W. Miniard. The main aim of the model was to analyze how consumers sort out information and make logical purchase decisions. It also stated that the five stage purchase decision making process is not accurate. It suggested a seven stage purchase decision making process. The two stages that were added are Post-Consumption and Disinvestment. Taylor and Burns (1999) studied the changes in the pre and post purchase evaluative criteria of the consumers by exploring the consumers' satisfaction or dissatisfaction with their decision. Their aim was to study the shift in the evaluative criteria, the importance given to each criterion and analyze the extremity of the responses in the pre and post purchase stages. They found that for most of the consumers, the pre and post purchase evaluative criteria are not identical and the importance given to each criterion also varies. The shift in the evaluative criteria is due to regret or disappointment with the product purchased.

METHODOLOGY:

For the purpose of this study, primary data and secondary data was collected. Primary data was collected through a questionnaire. The questionnaire consists of 5-point Likert scale. The respondents' probability to purchase a product online and also the factor which discriminates between Low probability to purchase online group and High probability to purchase online group has been identified using Discriminant Analysis. Based on the responses of the sample respondents, they have been grouped into two groups i.e. Low probability to purchase online group and High probability to purchase online group. The two groups are discriminated on the basis of the predictor variables i.e. need recognition, information search, evaluation of alternatives, post-purchase behavior, time spent on online shopping websites and social media usage.

The discriminant function is a linear function of the predictor variables such that it can discriminate between the two groups of respondents i.e. Low probability to purchase online group and High probability to purchase online group. This is estimated by including all the predictors simultaneously by using the Direct method Discriminant Analysis.

Table - 1: Number of Respondents with different Probabilities to purchase online

Probability to Purchase Online	Predictors	Valid N (list wise)	
		Unweighted	Weighted
Low Probability to purchase online	Need Recognition	280	280.000
	Information Search	280	280.000
	Evaluation of Alternatives	280	280.000
	Time Spent on Online Shopping Websites	280	280.000
	Influence of Social Media	280	280.000
	Post-Purchase	280	280.000
High Probability to purchase online	Need Recognition	576	576.000
	Information Search	576	576.000
	Evaluation of Alternatives	576	576.000
	Time Spent on Online Shopping Websites	576	576.000
	Influence of Social Media	576	576.000
	Post-Purchase	576	576.000
Total	Need Recognition	856	856.000
	Information Search	856	856.000
	Evaluation of Alternatives	856	856.000
	Time Spent on Online Shopping Websites	856	856.000
	Influence of Social Media	856	856.000
	Post-Purchase	856	856.000

Table -1 presents the number of respondents belonging to the two groups of probability to purchase online and predictors. Among these 856 respondents in the present study, there are 280 respondents with Low probability to purchase online i.e. about 33 percent of the total respondents and 576 respondents with High probability to purchase online i.e. about 67 percent of the respondents belong to High probability to purchase online group.

The number of discriminant functions depends on the number of discriminating groups. Since in the present research, there are two discriminating groups based on probability to purchase online i.e. Low probability to purchase online group and High probability to purchase online, so only one discriminant function has been calculated. The discriminant function gives the projection of the data that best discriminates between the two groups.

Table – 2: Eigen Values of Discriminant Analysis

Function	Eigen value	Percentage of Variance	Cumulative Percentage	Canonical Correlation
1	0.816 ^a	100.0	100.0	0.617

First 1 canonical discriminant functions were used in the analysis.

Table - 2 depicts the eigen value, percentage of variance explained by the Discriminant function, and the Canonical correlation. It describes how best the discriminant function can discriminate between the two groups. The eigen value of the discriminant function is 0.816 and it accounts for 100% of the variance of the respondents' probability to purchase online. The cumulative percentage of the variance gives the current and preceding cumulative total of the variance. As there is only one discriminant function in the present study, the cumulative variance is 100 percent. The Canonical Correlation associated with this discriminant function is 0.617. The square of this correlation i.e. $(0.617)^2 = 0.38$, indicates that 38 percent of the variance in the probability to purchase online is explained by this model. The eigen value

gives the proportion of variance explained. A larger eigen value explains a strong function. The higher the correlations value, the better the function that discriminates the values. 1 (one) is considered as perfect. Here, the correlation is 0.617, which is comparatively high.

Testing hypothesis regarding discriminating power of the variables:

This hypothesis proposed in the research paper is tested by in Table-3. Confidence level of 95 percent is assumed and so the value of α is 0.05.

Table – 3: Wilks' Lambda of Discriminant Analysis

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	0.761	232.212	6	0.000

The value of significance is 0.000. So, the null hypothesis (H_0) is rejected and alternate hypothesis (H_1) is accepted. Therefore it can be concluded that there is a statistically significant discriminating power in the predictors included in the model. Thus, the Discriminant Equation can be developed. The Wilk's λ associated with this function is 0.761. The value of the Chi-Square is 232.212 with 6 degrees of freedom. This indicates that the group means of the predictors appear to differ. Hence, there is a significant discrimination in the probability to purchase a product online based on the factors selected in the model.

Checking for relative importance of each Predictor:

On comparing the standardized coefficient, it is possible to identify which independent variable is more discriminating than the other variables. The higher the discriminating power, the higher the standardized discriminant coefficient.

Table – 4: Standardized Canonical Discriminant function coefficients

Predictor variables	Function 1	Rank
Need Recognition	0.577	3 rd rank
Information Search	-0.027	6 th rank
Evaluation of Alternatives	0.862	1 st rank
Time Spent on Online Shopping websites	0.283	4 th rank
Influence of Social Media	0.121	5 th rank
Post-Purchase	-0.681	2 nd rank

The Standardized Canonical discriminant function coefficients are given in Table - 4. The predictors with relatively large standardized coefficients contribute more to the discriminating power of the function. The evaluation of alternatives of the respondents has the highest discriminating power as it has the highest discriminant coefficient of 0.862 followed by post-purchase and need recognition of the respondents. This indicates that the 'evaluation of alternatives' of the respondents is the best predictor of the probability of a respondent to purchase a product online. The standardized canonical discriminant function coefficient is used to rank the relatively important predictor variables. This is shown in Rank column of Table - 4. The 1st rank is given to evaluation of alternatives while the last rank or the 6th rank is given to information search. A high standardized canonical discriminant function coefficient means that the groups differ the most on that variable. In the present study, the two groups of respondents based on their probability to purchase online i.e. Low probability to purchase online group and High probability to purchase online group, differ a lot based on their evaluation of alternatives followed by their post-purchase, need recognition, time spent on online shopping websites, influence of social media and information search variables respectively.

In order to formulate the discriminant function, the Unstandardized Canonical Discriminant Function Coefficients of the predictors are required. This is calculated in Table - 5.

Table – 5: Unstandardized Canonical Discriminant function Coefficients

Predictors	Function 1
Need Recognition	0.074
Information Search	-0.005
Evaluation of Alternatives	0.113
Post-Purchase	-0.192
Time Spent on Online Shopping websites	0.459
Influence of Social Media	0.148
(Constant)	-5.805

Unstandardized coefficients

Using these coefficients, discriminant function is formulated.

The standard form of the discriminant Function is:

$$Z = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 \dots + b_nx_n$$

Where,

Z is the dependent variable

‘ a’ is the constant term

$b_1, b_2, b_3 \dots b_n$ are the corresponding unstandardized discriminant function coefficient $x_1, x_2, x_3 \dots x_n$ are the independent variables.

Here there are 6 predictor factors i.e. need recognition, information search, evaluation of alternatives, post-purchase, time spent on online shopping websites and influence of social media.

$$Z = -5.805 + 0.074 \text{ (need recognition)} - 0.005 \text{ (information search)} + 0.113 \text{ (evaluation of alternatives)} - 0.192 \text{ (post-purchase)} + 0.459 \text{ (time spent on online shopping websites)} + 0.148 \text{ (influence of social media)}$$

Example: By inserting values for the different predictor variables of a respondent in the above formula, we get the following:

$$Z = -5.805 + 0.074 (43) - 0.005 (19) + 0.113 (38) - 0.192 (15) + 0.459 (1) + 0.148 (3)$$

$$Z = -5.805 + 3.182 - 0.095 + 4.294 - 2.88 + 0.459 + 0.444$$

$$Z = -0.401$$

Thus, the Z score of the respondent is -0.401.

Based on the discriminant function, the discriminant score of each respondent can be calculated. This discriminant score helps to identify whether the respondent belongs to High probability to purchase group or Low probability to purchase group. Table - 6 provides the average Discriminant score of the two groups.

Table – 6: Average Discriminant score of Discriminating groups

Probability to Purchase	Function 1
Low Probability to purchase online	-0.802
High Probability to purchase online	0.390

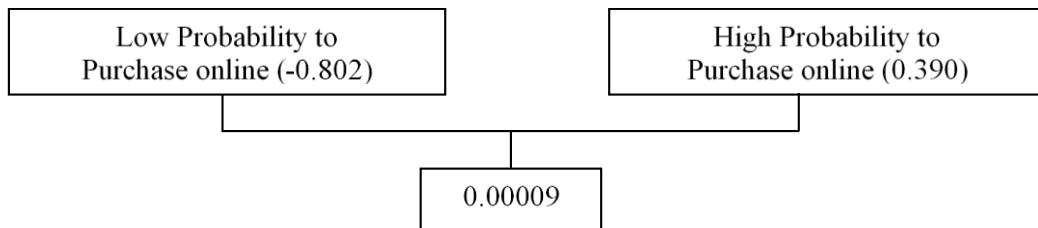
Unstandardized canonical discriminant functions evaluated at group means

The average discriminant score of the Low probability to purchase online group is -0.802 and that of High probability to purchase online group is 0.390. These two discriminant scores are not equal in absolute values and have opposite signs that denote the 2 groups i.e. High probability to purchase online and Low probability to purchase online. The cut-off or dividing point is calculated as follows:

$$\begin{aligned}
 &= \frac{\{(280) * (-0.802)\} + \{(576) * (0.390)\}}{(280 + 576)} \\
 &= \frac{(-224.56) + (224.69)}{856}
 \end{aligned}$$

$$= \frac{0.08}{856} \\ = 0.00009$$

The above calculation shows that the cut off is 0.00009. This cut off or dividing point will help to identify the group to which the respondent belongs. If the respondents' discriminant score is less than 0.00009 then the probability to purchase online is low, while if the discriminant score is more than 0.00009 then the probability to purchase online is high. This can be diagrammatically represented as follows:



The decision rule for classification is:

Predict and classify as Low probability to purchase online if $-0.802 > Z > 0.00009$

Predict and classify as High probability to purchase online if $0.00009 < Z < 0.390$

Where, Z is the Discriminant Score of the respondent.

In the above example, the value of the Z score is -0.401 which is lesser than 0.00009. So, the respondents' Z score indicates that the respondent has Low probability to purchase online.

In the following tables, the predictive capacity of the discriminant function is tested.

Table – 7: Classification Processing Summary

	Processed	856
Excluded	Missing or out-of-range group codes	0
	At least one missing discriminating variable	0
	Used in Output	856

Table -7 presents the classification processing summary. It gives the summary of all the cases that have been processed in the analysis. In the present research, all the 856 responses have been processed successfully.

Table – 8: Prior Probabilities for groups

Probability to Purchase	Prior	Cases Used in Analysis	
		Unweighted	Weighted
Low Probability to purchase online	0.500	280	280.000
High Probability to purchase online	0.500	576	576.000
Total	1.000	856	856.000

Table - 8 depicts the prior probabilities for the two groups of respondents. It shows the total number of respondents and the distribution of the respondents into the two groups. The table states that 280 respondents belong to Low probability to purchase online group while 576 respondents belong to High probability to purchase online group. The classification of the respondents into the two groups has been shown in the classification Table - 9.

Table – 9: Classification Results of Discriminant Analysis^a

Particulars		Probability to Purchase	Predicted Group Membership		Total
			Low Probability to purchase online	High Probability to purchase online	
Original	Count	Low Probability to purchase online	196	84	280
		High Probability to purchase online	158	418	576
	Percentage	Low Probability to purchase online	70.0	30.0	100.0
		High Probability to purchase online	27.4	72.6	100.0

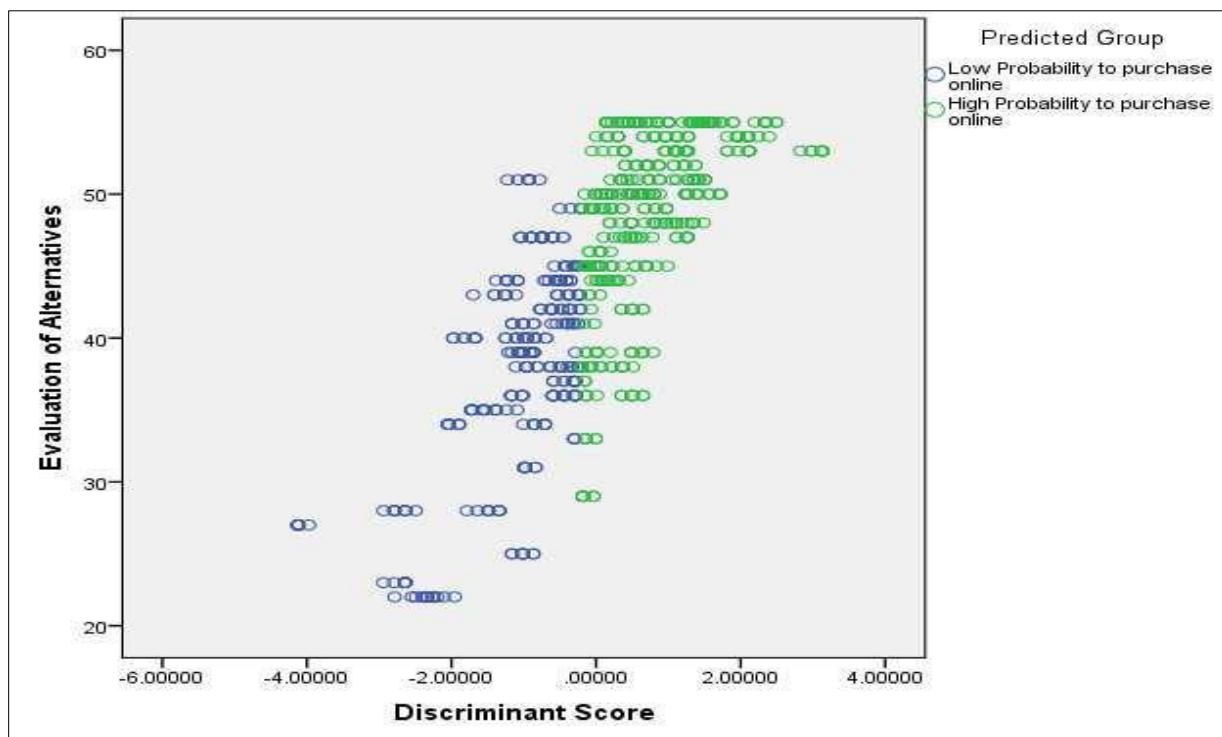
a. 71.7% of original grouped cases correctly classified.

In Table - 9, the predicted group membership gives the predicted frequencies of groups from the analysis. The number of observations given in this column indicates how many respondents have been correctly and incorrectly classified. The count row gives the number of observations falling into the given category and the percentage row shows the percentage of observations in a given group. The discriminant function thus developed, was subjected to predict how many of the respondents have Low probability to purchase online or High probability to purchase online.

It is observed that almost 72 percent of data was correctly classified as High probability to purchase online and Low probability to purchase online by the discriminant function. It is also noticed that out of the 280 respondents with Low probability to purchase online, 196 respondents i.e. about 70 percent have been correctly classified as Low probability to purchase online. Out of the 576 respondents with High probability to purchase online, 418 respondents i.e. about 72.6 percent have been correctly classified as High probability to purchase online. Hence, the accuracy of the model may be considered adequate. This indicates a very good predictive capacity of the discriminant function. It has good capacity to predict whether a respondent has a High probability to purchase online or a Low probability to purchase online based on the Discriminant Score.

The above calculations show that the two groups of probability to purchase online can be discriminated based on the evaluation of alternatives score of the respondents. In other words, the evaluation of alternatives of the respondents is the most important discriminating factor which determines whether a respondent will have Low probability to purchase online or High probability to purchase online. This is explained in Chart 1.

Chart – 1: Probability to purchase online based on Evaluation of Alternatives and Discriminant score



In Chart - 1 the discriminant scores are on x-axis and evaluation of alternatives scores are on y-axis. The Low probability to purchase online is represented by blue dots and the High probability to purchase online is represented by green dots. The chart shows that when the evaluation of alternatives score and the discriminant score of the respondents is less, the probability to purchase online is also low. But when the evaluation of alternatives score and the discriminant score of the respondents is high then the probability to purchase online is high. Based on the above analysis it is found that, 280 respondents have Low probability to purchase and 576 respondents have High probability to purchase online. The discriminating factor between these two groups is their evaluation of alternatives. Thus, it can be said that the two groups of probability to purchase online can be clearly demarcated based on respondents' evaluation of alternatives score and discriminant score.

FINDINGS AND DISCUSSION:

Among the 856 respondents, 33 percent belong to Low probability to purchase online group while 67 percent belong to High probability to purchase online group. The study also observed that 'evaluation of alternatives' is the most important discriminating factor among the predictors considered in this study which differentiates between Low probability to purchase online group and High probability to purchase online group.

The above finding implies that the e-tailers should concentrate on the 'evaluation of alternatives' in order to ensure that the online consumers purchase the product. This can be done by increasing the number of vendors in their online store who can provide a wider variety of products to the online consumers. The website of the e-tailers should also be modified such that it becomes user-friendly and easy for the online consumers to evaluate various alternatives. The e-tailer should ensure that the various evaluative criteria should be included in the website. Some of the important evaluative criteria include Price of the product, Quality of product, Brand Name, Discounts and Deals, Offers on the product, Consumer Reviews etc. The various alternatives should be available with the vendor and the information regarding the availability should be updated on the website from time to time. They should make provisions on their website for the online consumers to sort the products based on the different evaluative criteria. In this way, the e-tailer can ensure that the online consumers will evaluate the various available products and the more they evaluate, the more the chances are that they will purchase a product from the e-tailer.

CONCLUSION:

There are number of factors which influence the probability of the online consumers to purchase a product online. In this research paper, six factors were identified i.e. Need Recognition, Information Search, Evaluation of Alternatives, Time spent on online shopping websites, Social media and Post-Purchase, and discriminant analysis is used to predict the probability of the online consumers to purchase online. It is found that all the six factors have significant influence on the probability of the online consumer to purchase a product online. However, 'evaluation of alternatives' is the main factor that demarcates the consumers with low probability to purchase and the consumers with high probability to purchase. In other words it can be said that, the more the online consumers evaluate the alternatives, the more they are likely to purchase a product online. Thus, the paper suggests that e-tailers should concentrate on providing more options and better ways of evaluating the various alternatives to the online consumer in order to make them purchase online.

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