Original Research Paper

Factors Influencing Online Shopping in Mauritius: An Application of Principal Component Analysis and Binary Logistic Regression

Ramtohul, P., N. Mamode Khan and M. Hosenally

University of Mauritius, Mauritius

Abstract: In our modern world, the intensive use of internet has imposed new lifestyles and encouraged new behaviour amongst many across the globe. With the development in Internet technologies, the emergence of online shopping has altered the way businesses operate. While many of them have embraced this platform to present their offerings, many customers on the other hand, are finding it more cost-effective and convenient to carry out their transactions online. Therefore, the present study was undertaken to refine our understanding on consumers' attitudes, perception and behaviour towards online shopping in a Mauritian context. Data was collected among 224 respondents in Mauritius whereby a questionnaire was administered through personal interviews with the aim of achieving a higher response rate. Principle Component Analysis (PCA) was performed to reveal the underlying factors influencing people's perceptions and attitudes towards online shopping and the results uncovered that 'online shopping conveniences', 'security and product risk', 'complexity and waiting time' and 'enjoyment and pleasure' were major contributors to overall attitudes towards online shopping attributes. The binary regression model was also fitted and factors such as marital status and internet at home were the significant factors to contribute towards online shopping.

Keyword: Principal Component Analysis, Binary Logistic, Online Shopping, Security

Introduction

The Internet is a medium which is gaining popularity across the world. In an era of globalisation, the Internet has gone beyond networking and is now focusing on the delivering and trading of information, goods and services (Delafrooz *et al.*, 2009). Advances in Internet technology are allowing business transactions to take place and have resulted in an expansion of shopping choices, beyond traditional methods which may impose time and displacement constraints. Nowadays, people across the globe have moved towards intensive use of Internet as a market channel, due to the number of advantages it offers. For instance, traditional shopping inconveniences are eliminated which makes online shopping even more appealing. Therefore, from banking, bill payment to purchasing, the Internet has brought forward a new platform for these activities to be undertaken. From a business perspective, the Internet is significantly altering the way retailers present their offerings, advertise, sell and communicate with customers. However, the tremendous growth of online shopping is not only driven by the wide range of benefits it provides to customers, but also by the improvement in security systems which is more and more dispelling the idea that online shopping is a risky business (Kim and Kim, 2004). Although Mauritius is experiencing a gradual proliferation of online shopping, relatively little is currently known about Mauritian online shopping in particular. Traditional shopping methods still persist and the integration of online shopping in Mauritians' lifestyle is at a pace far from those of similar developed nations where online shopping is already a common practice. However, it is undeniable that growth of internet use has encouraged new behaviour and new attitudes which should be explored to get a better understanding. Consumers' attitude relates to their psychological frame of mind towards online shopping (Guo *et al.*, 2011) and is shaped by motivation and perception, which in turn

influences their online purchase decisions (Delafrooz *et al.*, 2009). Therefore, taking into consideration that online shopping is still in its early stage of development, the purpose of this study is to fill that knowledge gap by exploring Mauritian attitudes and behaviour towards online shopping, in other words how they relate to this new shopping channel. The aim of the study is to analyze and understand attitudes, perception and behaviour of Mauritian residents towards online shopping.

The objectives of the study are to identify the different factors influencing online shopping behaviour among Mauritian people and to enquire how online shopping behaviour is related to demographics such as age, gender, income, occupation, education, marital status, internet access at home and predict future online shopping intentions based on these factors. The organization of the paper is as follows: In the next section, an overview on e-commerce is presented. In section 3, we provide the methodology used to identify the factors based on the Principal Component Analysis (PCA). In the last section, the conclusions are presented.

Literature Review

De Swardt (2008) refers to online shopping as "any form of shopping that takes place via the Internet where electronic means are used to make purchases at virtual stores". Chiu *et al*. (2009) described that online shopping can be viewed as an exchange of time, effort and money for buying and receiving products and services while Zhang (2009) describes e-commerce as sweeping over all trading procedures such as online marketing, placing orders, payment and delivery system and also giving assistance to the marketing lifecycle. In this era of globalisation, the Internet plays an important role in human history and is soaring in popularity in almost every facet of the world. From networking to sharing information, the Internet has gone beyond that to become also a business tool, focusing on the delivering and trading of information, goods and services (Delafrooz *et al*., 2009). The Internet has been characterised as a global marketing channel where transactions can take place. The growth of Internet usage has been of an unprecedented magnitude and has fostered changes in lifestyles and behaviour of customer purchasing process. Ebay and Amazon are among the most widely recognised websites offering online shopping facilities (Park and Jun, 2003; Guo *et al*., 2011). A Nielsen Global Online Survey on online shopping habits in 2010 revealed that 824 million people across the globe have purchased online, mostly involved in the purchase of books followed by fashion related products, booking of air tickets and electronic equipment (D'Alessandro *et al*., 2012).

Along with the development of more shopping websites, the proliferation of online shopping has reshaped consumers' shopping behaviour across the world and its scope can therefore be extended to replace traditional methods of shopping (Cao, 2010). However, this e-market environment poses new challenges for businesses, inciting them to revise their marketing strategies to win and secure more targeted customers. Moreover, with online shopping, economic exchanges are not restricted by time investment, geographical locations or spatial barriers (Eastlick and Lotz, 2011). In the next section, we describe the methods used to identify the factors influencing online shopping in Mauritius.

Methodology and Results

In this section, we use the Principal Component Analysis (PCA) to obtain the relevant set of variables based on a sample of 224 respondents Table 1-8. We have circulated a questionnaire consisting of the following variables.

Table 1. List of variables

Variables	Labels
V1	Can shop any time
V2	Can save the effort of visiting stores
V3	Can save time
V4	More variety in terms of choice
V5	Products are of better quality
V6	Products are available at lower prices
V7	Can get good product information online
V8	Access to feedbacks from previous buyers
V9	To try a new experience for fun
V10	Web design/ features are attractive
V11	Lack of trust in online companies/ websites
V12	May not receive product ordered
V13	Credit card number may not be secure
V14	Inability to touch and examine products
V15	May receive incorrect product instead of the one ordered
V16	Quality of products may not match description on the Internet
V17	No interpersonal interaction between buyer and seller
V18	Too complicated to place an order
V19	Pictures take too long to come up on screen
V20	Must wait too long before delivery

Table 2. KMO and bartlett's test

Kaiser-meyer-olkin measure of sampling adequacy		0.875
Bartlett's test of sphericity	Approx. Chi-square	2749.789
	Df	190.000
	Sig.	0.000

Table 3. Communalities table

Communalities

	Initial	Extraction
V1	1.000	0.787
V2	1.000	0.798
V3	1.000	0.773
V4	1.000	0.703
V5	1.000	0.711
V6	1.000	0.422
V7	1.000	0.674
V8	1.000	0.602
V9	1.000	0.613
V10	1.000	0.712
V11	1.000	0.600
V12	1.000	0.724
V13	1.000	0.632
V14	1.000	0.624
V15	1.000	0.681
V16	1.000	0.754
V17	1.000	0.611
V18	1.000	0.692
V19	1.000	0.712
V20	1.000	0.510

Extraction method: Principal component analysis

In order to perform the analysis, the scale was inverted for variables V11 to V20. A simple correlation analysis reveals that several pairs of variables are highly correlated. For instance, correlation between V1 and V2 is 0.788 and this implies that V1 is very likely to share the same factor as V2. However, if correlations between variables were small, factor analysis would not have been appropriate. As a preliminary step to a PCA, it was verified that the data adheres well to the suppositions of the model. The Mayer-Kaiser-Olkin (KMO) measure of sampling adequacy gives a value of 0.872 (>0.5), which suggests that correlations between pairs of variables can be explained by other variables and therefore, factor analysis is appropriate for the data set. Also, the null hypothesis that the correlation matrix is an identity matrix is rejected, as shown by the small p-value of the Bartlett's Test of Sphericity.

The table of communalities shows the amount of common variation shared with the remaining variables after the desired numbers of factors have been extracted. For example, variable V2 has 0.799 in the communalities table below and this implies that 79.9% of that variable can be obtained from the other variables. However, the remaining 20.1% of that variable is unique to itself.

Based on this table, the variables account for at least 50% of variation in each of the variable, which is a highly satisfactory result. In the PCA, the proposed model only retains factors with an Eigen value >1 and eliminates other factors with Eigen value less than one. Hence, the table of Total Variance Explained below shows that a 4 factor model was extracted, accounting for 66.677% of the total variation in the data. From the table below, it can be observed that the first extracted factor accounts for a large part of the total variance explained in the data, followed by the other factors which account for lesser and lesser of the total variance.

The unrotated correlation yielded that all variables had high loadings on the first factor and thus the Varimax rotation had to be applied as a factor rotation technique for ease of interpretation.

The 4 factors can be categorized as:

Factor 1: Convenience, Product Selection and Information Search regrouping V1 to V8 variables

Factor 2: Security and Product Risk regrouping V11 to V16 variables

Factor 3: Lack of Physical Presence and Waiting time regrouping V17 to V20 variables

Factor 4: Enjoyment and Pleasure consisting V9 and V10 variables

The concluding note after performing factor analysis is that individuals based their perception towards online shopping on these four dimensions.

Moreover, the explanatory variables which might determine behaviour are: Gender, Age, Occupational group, Level of education, Head of household, Marital status, Family size, Internet access at home, Skills with respect to using the Internet and Frequency of going shopping in malls/shops.

A series of logistic regressions were fitted to the data in R and the G-statistics are listed below.

From the table above, it was found that seven predictors had statistically significant reduction in deviance, namely Age, Occupational group, Level of education, Marital status, Internet access at home, Rating of skills and Frequency of shopping in malls. The Pearson chi-square and Spearman correlation coefficient were used to look for any association between predictors, given some variables were nominal while others involved ranking. Variables having significant p-value ($p < 0.05$) were rejected since small p-values provide enough evidence against the null hypothesis that there is no association between the pair of variables. Initially, Occupational group was dropped while performing chi-square association since it was highly associated with other nominal variables like Marital status and Internet at

home. On the other hand, an inspection of the correlation matrix suggested that Rating of skills had to be dropped since it was highly correlated with Age, Education and Frequency of shopping. Furthermore, Education was eliminated and association between the remaining variables and the other variables were tested using Pearson chi-square. Correlation between pairs of variables like Age and Internet at home and Internet at home and Marital status were found to be insignificant (p>0.05) but however Age had to be dropped since it was correlated with Marital status. Thus, Marital status and

Internet access at home and Frequency of shopping in malls/shops were found to be suitable for the model. Hence, the model proposed is Online Shopping Behaviour = f (Marital status, Internet at home, Frequency of shopping in malls/shops), as illustrated below:

$$\log it\left(\frac{\pi_i}{1-\pi_i}\right) = cons\tan t + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$$

where, π_i is the probability of a person shopping online.

Table 4. Extraction method: Principal component analysis

Component	Initial Eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.29	36.423	36.423	7.29	36.423	36.423	4.66	23.284	23.284
2	3.61	18.047	54.471	3.61	18.047	54.471	4.16	20.798	44.081
3	1.42	7.103	61.574	1.42	7.103	61.574	2.41	12.07	56.151
4	1.02	5.103	66.677	1.02	5.103	66.677	2.11	10.526	66.677
5	0.85	4.271	70.948						
6	0.75	3.767	74.715						
7	0.65	3.271	77.986						
8	0.63	3.167	81.152						
9	0.58	2.916	84.068						
10	0.49	2.458	86.526						
11	0.44	2.200	88.726						
12	0.40	2.019	90.745						
13	0.34	1.701	92.447						
14	0.30	1.503	93.950						
15	0.26	1.307	95.257						
16	0.25	1.241	96.498						
17	0.22	1.080	97.578						
18	0.19	0.923	98.502						
19	0.15	0.770	99.272						
20	0.15	0.728	100.000						

Table 5. Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser normalization

	Component			
	1	2	3	4
V1	0.878			
V2	0.885			
V3	0.867			
V4	0.728			
V5	0.723			
V6	0.539			
V7	0.583			
V8	0.571			
V9				0.696
V10				0.817
V11		0.705		
V12		0.831		
V13		0.718		
V14		0.723		
V15		0.803		
V16		0.862		
V17			0.612	
V18			0.737	
V19			0.800	
V20			0.561	

Table 6. Explanatory variables and reduction in deviance

Explanatory variables	G-statistic	p-value
Gender	1.391	0.289
Age	15.903	0.003
Occupational group	24.611	0.000
Level of education	14.226	0.002
Head of household	2.775	0.096
Marital status	13.459	0.004
Family size	0.165	0.684
Internet access at home	15.270	0.000
Rating of skills	39.935	0.000
Frequency of shopping in malls	21.307	0.001

Table 7. Degree of fit

Model	Deviance	d.f	Chi-square	Degree of fit
Null model	28.616	7	14.067	Lack of fit
One Factor				
Marital status	13.459	3	7.815	Lack of fit
Internet at home	15.270	1	3.841	Lack of fit
Two factors				
M + I	2.3812	3	7.814	Adequate fit
Saturated Model				
M + I + MI	0.000	0	0.000	Perfect fit

Table 8. Probability table for best model

Internet access at home	Marital status	π_{ij}	Logit	Odds	Probability
Yes	Single	π_{11}	0.1946	1.2148	0.5485
	Married with children	π_{21}	-0.6604	0.5166	0.3406
	Married without children	π_{31}	0.1877	1.2065	0.5468
	Widowed/Divorced/Separated	π_{41}	-19.8454	0.0000	0.0000
No	Single	π_{12}	-1.5204	0.2186	0.1794
	Married with children	π_{22}	-2.3754	0.0930	0.0851
	Married without children	π_{32}	-1.5272	0.2171	0.1784
	Widowed/Divorced/Separated	π_{42}	-21.9204	0.0000	0.0000

The null hypothesis was therefore rejected if deviance was greater than the chi- square at 5% significance level. Starting with the null model, it can be concluded that there is enough evidence to reject the null hypothesis since the value for the deviance is greater than the critical value for χ^2 at 7 degrees of freedom (i.e., 28.616>14.067) at 5% level of significance. Thus, a lack of fit in the null model indicates that a better model should be looked for.

After introducing Marital status in the model, the deviance reduces to 13.459 on 3 degrees of freedom. Since the value for the deviance is bigger than the critical value, Ho is rejected and it can be concluded that there is lack of fit in this model as well. After introducing Internet access at home in the model, the deviance reduces to 15.27 on 1 degree of freedom. Since the value for the deviance is bigger than the critical value, Ho is rejected and it can be concluded that there is lack of fit in this model and proceed to check for the next model. Introducing both Marital and Internet access at home in the model reduces the deviance to 7.814 on 3 degrees of freedom. Since,

deviance is smaller than the critical value for χ^2 at 3 degrees of freedom and 5% level of significance (i.e., 2.381<7.814), there is not enough evidence to reject the null hypothesis that there is no lack of fit. Thus, since Marital status and Internet access at home added together improve the fit of the model, this was chosen as the best model and is presented as follows:

$$\log it\left(\pi_i\right) = \eta + \alpha_i + \beta_j$$

where, η = logit for the reference category for both Marital status and Internet access at home

Conclusion

PCA results showed that 20 variables have been summarised into four factors which are namely 'convenience, product selection and Information search', 'Security and product risk', 'Lack of physical presence and waiting time' and lastly 'Enjoyment and pleasure'. Therefore attitudes towards online shopping are mostly

influenced by these four factors in Mauritius. Furthermore, a Binary Logistic regression revealed that Marital status and Internet access at home are important predictors of online shopping behaviour. The model explains that online shopping behaviour, that is to shop online or not to shop, in terms of Marital status and if an individual has internet access at home or not, in an additive model. Results showed that respondents who were single and having internet access at home were found to have higher probability of shopping online.

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Author's Contributions

All authors equally contributed in this work.

Ethics

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues involved.

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