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RESILIENCE AND SUSTAINABLE DEVELOPMENT

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Foreword

It gives me immense pleasure to introduce you to the edited volume brought out by MDI Murshidabad, titled Resilience and Sustainable Development.This book fosters the multidisciplinary discussion about emerging theories, concepts and models in general, and practical challenges encountered and solutions adopted in particular in the field of innovations in management practices. The book will create a strong landscape for academicians, managers, and practitioners to focus on Resilience and Sustainable Development. The five sections of the book cover various business domains such as Sustainable Marketing, Sustainable Finance, Sustainable HRM, Sustainable Operations and IT, and Sustainable Economics, Society and Environment.

MDI, a leading business school of India, launched its Murshidabad campus in the year 2014. MDI Murshidabad is fostering the culture of research among faculty members, researchers, corporates and students. This book is an effort in that direction.

Dr. Sunil Giri, Dr. Pinku Paul, Dr. Paroma Mitra and Dr. Neeraj Singhal have edited this book. All of them have rich experience in teaching, research, and writing books. And I am sure that this book will create interest among the readers, and will have a great impact on the society at large.

I wish them great success.

Prof. (Dr.) Atmanand
Director, MDI Murshidabad

Preface

MDI Murshidabad organized the International Conference on Sustainable Development: A Value Chain Perspective-2023 (SDVP-2023). This international conference was organized with an aim at capturing the role of innovations in management practices. The basic theme of the conference was **'Resilience and Sustainable Development'.**

Apart from this, one of the added advantages of SDVP-23 was to promote research and related activities in the area of Marketing, Finance, HRM, Operations, IT, Strategy, Economics, Social, Cultural, and Environment case studies with respect to various functional activities. The conference provided a platform to practitioners, researchers, consultants and students to exchange their thoughts and contribute or share their views and expertise in formulation and implementation of various strategies during these uncertain times. We hope this book will find some space in the minds of the stakeholders and provide some important strategies for the future.

Sunil Giri
Pinku Paul
Paroma Mitra
Neeraj Singhal

Acknowledgement

We would like to thank Prof. (Dr.) Atmanand, Director, MDI Murshidabad, West Bengal, India for his continuous support and encouragement in organizing this International Conference on Sustainable Development: A Value Chain Perspective-2023 (SDVP-2023). As an outcome of this conference, we are publishing this book with Bloomsbury India. We would also like to thank all the faculty members, non-teaching staff and students of MDI Murshidabad for extending their unwavering support at all times.

We would also like to thank the international conference advisory committee for their continuous support and encouragement in organizing this event. We take this opportunity to thank all keynote speakers and sessions' chairs for sharing their valuable insights during the conference. A sizable number of acclaimed authors from academia and seasoned managers from the industry showed immense interest in contributing their research papers and cases for this conference. As a result, we were able to come up with this book. We would like to thank our editorial team for their continued guidance, inputs, and review comments which helped immensely in enhancing the quality of the papers. We also thank Bloomsbury India, their editors, production experts and the entire team for their cooperation in bringing out this book in time.

We value the feedback and suggestions given by you to improve the quality of this book and look forward to your comments on email: sdvp@mdim.ac.in in order to bring out a better and more innovative book in the future.

Sunil Giri
Pinku Paul
Paroma Mitra
Neeraj Singhal

Section A

Sustainable Marketing

Identifying the Factors Affecting Customer Satisfaction in the Purchase of Apparel for Sustainability in the Organized Retail Sector – A Case Study of Pantaloons Retail, Durgapur

Dr. Arunava Mookherjee and Krishna Roy

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Abstract

This research study is focused on identifying the factors affecting customer satisfaction in purchase of apparels for sustainability in the organized retail sector using the binary logistic regression method. The sample included (279) customers at Pantaloons Retail Store, Durgapur, for the purpose of the study. The respondents visited the store during the months of August and September, 2022. The study initially included eighteen (18) independent variables and out of these only six (6) variables exhibited a significant effect and contribution to the logistic regression binary response (Unsatisfied (0), Satisfied (1). The binary logistic regression model deduced (6) variables namely Age, Price Consciousness, Brand Consciousness, Locus of Control, Family Influence and Celebrity Influence, having a significant effect on the Customer Satisfaction levels. The remaining twelve (12) variables showed no significant effect. The resultant classification of observations using the binary response logistic regression model had an accuracy of 87.1 per cent.

Keywords: *Binary Logistic Regression, Confusion Matrix, Customer Satisfaction, Data Science, ROC curve.*

INTRODUCTION

The Indian apparel industry has its own distinction in the world market because of the ancient traditional crafts and techniques used. Unique and distinctive specialties are found in different parts of the country like Pashmina wool, Chikankari embroidery, Bandhani and Chanderi work, hand-woven Sambalpuri, block-printed Kalamkari, etc. Simultaneously the apparel industry is having to adopt Western-wear also due to changing fashion trends. The coveted Indian apparel industry has emerged to be one of the global leaders with a three trillion dollar market (Statista.com). India is one of the leading producers of jute and cotton. It is also the second largest producer of silk. The wide variety in the Indian apparel industry comes from the organized sector as well as traditional handlooms, woven silk, woolen clothes and a variety of handcrafts.

Approximately 100 million people work in these industries. (Statista.com, 2022). The Indian apparel industry exports significantly and its sustenance is important for the country's economy.

In retail business, India is considered as the fifth largest destination universally. According to the World Bank, (2020), India ranks 63rd. The Indian retail business is likely to grow exponentially as it has a sizable middle class and a yet-to-be tapped, large retail market. The consumer's purchase power is increasing leading to an affinity for branded products (https://www.ibef.org/industry/retail-india).

In an erstwhile study by several researchers, consumers' educational levels, income, occupation and marital status are the major demographic determinants affecting the purchase decision. The psychographic segments are determined on the basis of consumers' activities that include style, perceived value, referral groups, credibility of seller, etc. (Prasad, 2012). The factors that have maximum influence on Gen_Y consumer's purchase intention for fashion apparels are brand, style, price, and social identity(Valaei & Nikhashemi).

Thus a detailed study of consumer-related factors can give an apparel retailer the much needed edge over his/her competitors.

LITERATURE REVIEW

The Indian retail market ranks as the fifth largest in the world. The Indian retail market is mostly unorganized. It is expected that by 2025, share of organized retail (including e-commerce) will account for 30-35 per cent of the total retail business with share of traditional retail coming down to 65-70 per cent in India. The Indian retail business has witnessed a major change and has observed exponential growth in the last decade. The Indian retail market which was $690 billion in 2021, is expected to reach $2 trillion approx. by 2032 (https://www.investindia.gov.in). The retail industry contributes to 10 per cent of GDP and 8 per cent of employment (Sharma & Awasthi, 2019). The apparel retailing market which was earlier a tailored-to-order market has now seen a major shift to a ready-to-wear market. After the Multi Fiber Agreement under GATT expired in 2005, the apparel market faced open competition. It is believed that after China, India is the country with the highest potential to grow in this globalized market due to its cheap labour-force and abundance of raw materials and natural resources (I. Tyagi & A. Rani, 2015).

India is seeing an increase in disposable family income as more women are seeking employment these days. Occupations are also showing a changing trend leading to an increase in consumerism and affinity for approaching the organized retail market (Chandramana & Menaka, 2014). India is considered one of the most attractive countries for global retailers because it houses the largest purchasing population (I. Tyagi & A. Rani, 2015).

The largest source of foreign exchange for India is the textile and apparel sector. Additionally, it is the second-largest employer after agriculture and is crucial to the growth of the country's economy (Sharma & Awasthi, 2019).

Marketers face immense hurdles in retailing because they are not equipped with sufficient information about the consumer's buying behaviour. Hence, making a sufficient effort to identify the various aspects of consumer buying pattern has become utmost crucial for sustainability. Many theories have been proposed so far, with a plethora of dimensions studied in various set ups to draw a conclusive strategic framework (Hun et al., 1991).

To make the apparel retailing business sustainable, it is essential to identify the factors that are important to motivate a customer to increase the basket size.

After studying the consumer behaviour of apparel buyers it is suggested that the retailer should concentrate on particular product attributes; send out strong digital messages and try to popularize green apparels (Wiederhold & Martinez, 2018). Apparels manufactured keeping in mind sustainability and ethics are in demand because there is an increase in demand for transparency in the apparel market. Different brands are trying to look more transparent and are trying to be more open about their production methods. They are working on labeling their products accordingly while educating their customers regarding their claims (Byrd and Su, 2020). Along with food, water and shelter, one of the basic needs of human beings is clothing. Again the apparel also depicts one's lifestyle and socio-economic status (Bhanot, 2013).

With the increase in shopping due to a boost in the access platforms like online, traditional, organized retail outlets, choosing the best alternative is becoming a multi-level complex decision process for consumers (Nevin and Houston, 1980; Kirkup and Rafig, 1999). As a result, long-term profitability and sustainability depends on the retailers' ability cut the clutter and stand out amidst the stiff competition (Samli, 1998). Many researchers have pointed out that customer satisfaction from past interactions is a good predictor of future purchase behaviour (Newman and Webel, 1973; La Barbera and Mazursky, 1983; Kasper, 1988).

A plethora of literature in the yesteryears have identified several factors like personal factors of the customer (the demographic and psychographic factors), socio-cultural factors, situational variables and so on determine customer satisfaction and future purchase behaviour. This study attempts to identify the factors that lead to customer satisfaction and/or dissatisfaction in organized apparel retailing business so that sustainability is ensured.

OBJECTIVE

The current study has made an attempt to find a binary response Logistic Regression model by identifying the most significant variables affecting the Customer

Satisfaction Level in the organized apparel retailing business in the region of South Bengal.

METHODOLOGY

Research Design

The present investigation requested responses vide a structured questionnaire to be filled up by customers visiting the Pantaloon Retail store at junction mall, City centre, Durgapur, between August and September, 2022. Durgapur, is a major city in South Bengal. The convenience sampling method was used for this purpose. Respondents were from different apparel sections like wise men, women and children. They were asked to complete this survey and provide their opinions. A total of 300responses were collected. After cleaning the study was conducted using 279 responses.

Variables

The literature survey initially revealed several factors that can be used to predict the customer satisfaction in an apparel purchase. In this study we initially started with eighteen independent variables.

- *Purchase Situation variables* (four) being the
  - Section in the store (Children's Women and Men),
  - Co-shopping influence (who they are visiting the store with),
  - Store loyalty status (duration of association with the store),
  - Purchase motive (for whom the purchase is being made)
- *Personal Variables* (ten) like
  - Age,
  - Gender,
  - Occupation,
  - Locus of control (What I wear is mainly decided by myself),
  - Brand consciousness,
  - Price consciousness,
  - Quality consciousness,
  - Personality Type (based on body forms Ectomorphic, Mesomorphic, Endomorphic),
  - Attitude towards Online shopping,
  - Attitude towards Offline shopping.
- *Socio-Cultural Variables* (four) like
  - Peer-group influence,
  - Family influence,
  - Magazines/media influence,
  - Celebrity influence.

Tools

This study makes an attempt to apply Binary Logistic Regression to identify the most important explanatory variables that impact the Customer Satisfaction Level in the organized apparel retailing business in the region of South Bengal.

Binary Logistic Regression

The binary logistic regression analysis is used where the response variable is dichotomous (Success state = 1, Failure State = 0). This model helps to establish the relationship amidst the response variable (Y_{cs}), and explanatory variables (x_1, x_2..., ...X_n) and this association is expressed as follows:

For a binary response variable Y with two different levels having the explanatory variable X, let:

$$\pi(x) = P(Y_{cs} = 1|X = x) = 1 - P(Y_{cs} = 0|X = x) \quad ...(1)$$

Where, $\pi(x)$: The probability of response at $X = x$; (x): The explanatory variable where $(-\infty < x > \infty)$

Hence, the logit form of the logistic regression model has a linear representation for this probability

$$\text{Logit } [\pi(x)] = \log \pi(x)/(1 + \pi(x) = a + bx \quad ...(2)$$

Where, b, a are two model parameters to be evaluated.

$$\text{Odds} = \pi(x)/1 + \pi(x) = \exp(a + bx) \quad ...(3)$$

and logit is the logarithm of the odds.

Therefore,

$$\text{Logit } [\pi(x)] = \log \pi(x)/1 + \pi(x) = \log [\exp (a+ bx)] = a + bx \quad ...(4)$$

Hence logit has a linear estimation relationship. In other words, logit = logarithm of the odds. The rate of change in the S shaped curve of $\pi(x)$ determines parameter b. An ascending curve is indicated by a positive b and a descending curve is indicated by a negative b. $|b|$ increases when this change is accelerated.

For several explanatory variables: Suppose we have k number of predictor variables for a dichotomous response Y_{cb} given by, $x_{2,}$ x_4 …, x_k, then log odds model is obtained as:

$$\text{Logit } [P(Y_{CS}) = 1] = a + b_1 x_1 + b_2 x_2 + b_3 x_3 + \ldots b_k x_k \quad ...(5)$$

And the other formula, straightaway representing $\pi(x)$ is

$$\pi(\text{x}) = \frac{\exp (a + b_1 x_1 + b_2 x_2 + b_3 x_3 + \ldots b_k x_k)}{1 - \exp (a + b_1 x_1 + b_2 x_2 + b_3 x_3 + \ldots b_k x_k)} \quad ...(6)$$

The parameter b_i shows the impact of x_i on the log odds that Y_{cs} =1, keeping other x_j constant, for instance, $\exp(b_i)$ is the multiplicative consequence on the odds of a one unit change x_i, at fixed levels of other x_j.

In the BLR model, the approximation for the parameter can be obtained, with reference to a baseline category.

Significance of the Test

Method I

Establishing the statistical significance of each independent variable individually using SPSS: Wald Statistics determines the statistical significance for each of the logistic regression coefficients. The hypotheses for this test are:

H_0: b = 0
H_1: b ≠ 0

The null hypothesis that the logistic regression factor associated with the independent variable equals zero is calculated and coded by following formula:

$$w^2 = (b / S.E_b)^2 \quad (7)$$

Where, *b*: refers to the value of the logistic regression coefficient of the independent variable (*x*); $S.E_b$: The value of the standard error refers to the logistic regression coefficient of the independent variable (*x*).

A statistically significant value of (*w*), means rejecting the null hypothesis which states that the logistic regression coefficient is not equal to zero (that is, the independent variable *x* influences the prediction of the value of the dependent variable).

A statistically insignificant value of (*w*) is interpreted as the scope for deletion of the corresponding independent *x* from the model..

Method II

Checking the robustness of the logistic regression model as a whole:

1. **Maximum Likelihood Ratio Test:** This ratio is used to establish the significance of parameters from their insignificance in logistic regression. It is determined from finding of sample results obtained when estimating model parameters. It is hypothesized that a good model is the one that has a large maximum likelihood ratio value of the observation results. Say we have n observations for each variable, (under idealistic situation, the model should give a value of 1 and the value of (–2 ln l) should be 0). If we have (*n*) observation per variable, the deviation (D) for the model defined is as follows :

$$D = -2 \log \left(\frac{\text{Likelihood of the fitting model}}{\text{Likelihood of the saturated model}} \right) \quad ...(8)$$

Hypotheses to be tested:

$H_0 : b_1 = b_2 = b_3 = ... = b_k = 0$
$H_1 : b_1 = b_2 = b_3 = ... = b_k \neq 0$

When we compare between the value of (D) that is obtained from the model that takes into account all the variables and the model that considers only the G = D (model without variable) – D (model with variable).

When the D-value is compared with the tabular critical value having P degrees of freedom (where p refers to the number of variables) if the value observed is > critical value, the null hypothesis is rejected, i.e. variables are significant.

2. **Hosmer-Lemeshow test:** The Hosmer-Lemeshow goodness of fit test is considered as one of the most authentic tests and is based on splitting the sample dataset into groups according to the expected probabilities or hazards. Specifically, depending on the predicted parameter values for the response variable state ($Y_{CS} = 1$). The test have been conducted using SPSS 20 for assessing how well the predicted model fits the data.

Reliability of the Model

After the model was developed, the Receiver Operator Characteristics (ROC) and other Machine Learning performance parameters were obtained to conclude the model's accuracy and reliability for reporting reasons.

$$\text{Precision } (P_C) = TP / (TP + FP) \quad ...(9)$$

$$\text{Recall (Sensitivity)}(R_C) = TP / (TP + FN) \quad ...(10)$$

$$\text{Accuracy} = (TP + TN) / N \quad ...(11)$$

$$F_{score} = 2 / \{(1 / P_C) + (1 / R_C)\} \quad ...(12)$$

$$\text{Specificity} = TN / (TN + FP) \quad ...(13)$$

Eq. 9 denotes precision, while Eq. 10 represents recall. By Eq. 11, we demonstrate the Accuracy. Eq. 12 represents the F score. The specificity is depicted in Eq. 13. They are all the performance parameters of the Machine Learning Predictor Model extracted from the two by two confusion matrix.

Where, *TP* = count of True Positive events; *TN* = count of True Negative events; *FP* = count of False Positive events; *FN* = Count of False Negatives events; *N* = the total no. of observations/events.

RESULTS AND ANALYSIS

The sample included (279) respondents who visited the Pantaloon Retail Store, Durgapur for the purpose of the focused study. The study included (18) independent variables which were adopted from the literature review and were tested whether they have a significant influence and contribution to the binary response variable (Unsatisfied (0), Satisfied (1)) in the logistic regression equation that we intend to propose. The Table 1 collates the responses for the 19 variables.

Table 1: Summary of the Responses

		N	*Marginal Percentage*
Satisfaction level (Y_{CS})	Unsatisfied (0)	70	25.1%
	Satisfied (1)	209	74.9%
Section (X_1)	Womens Wear	135	48.4%
	Childrens' Wear	60	21.5%
	Mens' wear	84	30.1%
Age (X_2)	In 20's (20-30 years)	117	41.9%
	In 30's(30-40 years)	78	28.0%
	In 40's (40-50 years)	48	17.2%
	Elderly (50 + years)	36	12.9%
Gender (X_3)	Male	126	45.2%
	Female	153	54.8%
Motive (purchasing_clothes_for) (X_4)	Self	105	37.6%
	Children / Sibling / Parent	117	41.9%
	Friends and Relatives	57	20.4%
Co-shopping influence (X_5)	Alone	81	29.0%
	With Family	138	49.5%
	With Friends	60	21.5%
Occupation (X_6)	Homemaker	90	32.3%
	Service	96	34.4%
	Professional (Dr./Advocate/CA)	39	14.0%
	Business	54	19.4%
Quality_Consciousness (X_7)	High	174	62.4%
	Moderate	45	16.1%
	Low	60	21.5%
Price_Consciuosness (X_8)	High	150	53.8%
	Moderate	69	24.7%
	Low	60	21.5%
Brand_Consciousness (X_9)	High	129	46.2%
	Moderate	90	32.3%
	Low	60	21.5%
Store Loyalty Status (store_visiting period) (X_{10})	Questionmark loyals (Less than a year)	108	38.7%
	Softcore loyals (1-3 yrs)	90	32.3%
	Hardcore loyals (> 3 yrs)	81	29.0%
Personality_Type (X_{11})	Ectomorphic	90	32.3%
	Mesomorphic	105	37.6%
	Endomorphic	84	30.1%

		N	*Marginal Percentage*
Locus of control X_{12})	Strongly Internal	15	5.4%
	Internal	15	5.4%
	Neutral	33	11.8%
	External	36	12.9%
	Strongly External	180	64.5%
Peer group influence (X_{13})	Strong Aversion	18	6.5%
	Avoided	42	15.1%
	Neutral	57	20.4%
	Slightly influenced	93	33.3%
	Strongly Influenced	69	24.7%
Family Influence(X_{14})	Strong Aversion	30	10.8%
	Avoided	24	8.6%
	Neutral	93	33.3%
	Slightly influenced	60	21.5%
	Strongly Influenced	72	25.8%
Media Influence (X_{15})	Strong Aversion	6	2.2%
	Avoided	42	15.1%
	Neutral	75	26.9%
	Slightly influenced	93	33.3%
	Strongly Influenced	63	22.6%
Celebrity Influence(X_{16})	Strong Aversion	36	12.9%
	Avoided	33	11.8%
	Neutral	87	31.2%
	Slightly influenced	66	23.7%
	Strongly Influenced	57	20.4%
Attitude towards Offline Purchasing (X_{17})	Strongly Negative	18	6.5%
	Negative	42	15.1%
	Neutral	66	23.7%
	Positive	63	22.6%
	Strongly Positive	90	32.3%
Attitude towards Online Purchasing (X_{18})	Strongly Negative	28	10.0%
	Negative	41	14.7%
	Neutral	75	26.9%
	Positive	81	29.0%
	Strongly Positive	54	19.4%
Valid		279	100.0%
Missing		0	
Total		279	

Table 2: Customer Satisfaction Level (the dependent variable of the study)

Summarized Classification of the Responses			
Response	*Categorical Value*	*Count*	*Percentage*
Unsatisfied	0	70	25.08%
Satisfied	1	209	74.91%
			100.00%

From Table 2, it was found that the major proportion of responses was of Satisfied Customers. The next part of our study will try to delve into the explanation of factors that affect satisfaction.

Referring to Table 3, which compiles the estimation of the logistic regression model's parameters (the 'b' coefficients) using the maximum likelihood technique for all 6 of the model's significant parameters and ignoring other non-significant components. The 6 factors namely *Age(X_2), Price_Consciousness(X_8), Brand_Consciousness (X_9), Locus of control (X_{12}), Family Influence (X_{14}), Celebrity Influence (X_{16})*.were all found to be significant (Sig < 0.05). The constant, the standard error values for each parameter, the corresponding (Wald) statistic, the number of degrees of freedom as collated were concluded to have a significant impact on the binary response variable (Unsatisfied (0), Satisfied (1)) in the logistic regression equation.

Table 3: The Parameter Estimates of the Logistic Regression Model using the Maximum Likelihood Method

Variables to be Considered in the Equation						
Variables	*b*	*Std. Error*	*Wald Stat (w^2)*	*df*	*Significance (p-value) ($\alpha = 0.05$)*	*Exp(b)*
Age (X_2)	-2.438	.321	57.87	1	.000	.087
Price_Consciousness (X_8)	.740	.272	7.413	1	.006	2.096
Brand_Consciousness (X_9)	.684	.294	5.390	1	.020	1.981
Locus of control (X_{12})	-.450	.183	6.028	1	.014	.638
Family Influence (X_{14})	-.654	.209	9.765	1	.002	.520
Celebrity Influence (X_{16})	.548	.210	6.794	1	.009	1.730
Constant	9.184	1.733	28.10	1	.000	9742.459

Using the six (6) factors in the model namely *Age (X_2), Price Consciousness (X_8), Brand Consciousness (X_9), Locus of control (X_{12}), Family Influence (X_{14}), Celebrity Influence (X_{16})* we can formulate the binary logistic regression model as follows:

$$Y_{CS} = 9.184 - 2.438X_2 + 0.74X_8 + 0.684X_9 - 0.45X_{12} - 0.654X_{14} + 0.548X_{16} \quad ...(14)$$

It is noticed that the variable 'Age' X_2 is the most significant variable influencing customer satisfaction, since the regression coefficient of the variable is –2.438 suggesting a negative relation. This indicates that the satisfaction rates are lower in people of higher

age groups. The younger customers tend to be more satisfied than the older once. The reason could be Durgapur being a Peri-urban locality the options of unorganized sector is quite predominant which makes available apparel at a much cheaper cost. Organized Retailing is quite new, further with Covid intruding the learning curve has snapped. People are very apprehensive with their spending as there has been a very high inflation rate.

The next most important factor is 'Price consciousness' (X_8) where the regression coefficient is +0.740 suggesting the Satisfaction rates increase with decrease in price consciousness levels. This is because the scale of measurement was (High = 1, medium = 2, low = 3). Followed by 'Brand consciousness' (X_9) (regression coefficient = +0.684) suggesting the Satisfaction rates increase with decrease in Brand consciousness levels. This is because the scale of measurement was (High = 1, medium = 2, low = 3). These two findings definitely suggest that people perceive Pantaloon Retail as a high cost brand but with limited brand value as compared to other premium brands. Which means organized retailing requires to put in a lot of effort to ensure sustainability.

The next important variable 'Family Influence' (X_{14}) (regression coefficient = –0.654) suggesting the Satisfaction rates increase with decrease in family influence levels. Word of mouth as such doesn't seem to have gained ground as yet and a lot more effort has to go in.

The next important variable 'Celebrity Influence' (X_{16}) (regression coefficient = + 0.548) suggesting the Satisfaction rates increase with increase in Celebrity influence levels. This is indeed a positive finding and gives the organized retail chain a route as how the approach can be made via the Celebrity Channel.

The least important variable 'Locus of control' (X_{12}) (regression coefficient = –0.45) suggesting the Satisfaction rates increase as the shift takes place from internal to external locus of control. This is indeed a positive finding and gives the organized retail chain requires to rope in more promotional efforts.

Test for Model – Fitness: Omnibus Tests of the Model Coefficients

H_0: There are no appreciable difference between proposed model and the model when the constant term is the only explanatory factor.

H_1: There lies a difference between the proposed model and the model when the constant term is the only explanatory factor.

Table 4: Omnibus Tests for the Model Coefficients

Omnibus Test Results (SPSS output)				
		Chi-square	*df*	*Sig.*
Step1	Step	149.294	7	.000
	Block	149.294	7	.000
	Model	149.294	7	.000

Referring to the Table 4, which displays the test of the significance of the relationship between the response variable (Customer satisfaction) and the 6 explanatory variables, the model is found to be statistically significant and fits the data well.

A closer look and analysis of the final value of chi-square, which is 149.294 in the model with a degree of freedom of 7, and a significance level (p-value = 0.000 < 0.05) suggests rejecting the null hypothesis. So, we may conclude that the model is statistically significant and closely matches the data based on the 6 explanatory factors. In short, the explanatory variables included in the proposed model do have an impact, significance, and contribution to the classification.

Test for Model – Fitness: Maximum Log Likelihood Ratio Test and Pseudo R^2

Table 5: Model Goodness of Fit Summary

Model Fitness Summary (Maximum Log Likelihood Ratio Test and Pseudo R^2)			
Model	*D = –2 Log Likelihood*	*Cox & Snell R^2*	*Nagelkerke R^2*
Constant + 6 Explanatory Variables	165.037[a]	.414	.613

[a] Estimation process terminated at iteration number six (6) since parameter estimates changed by less than .001.

H_0: There are no appreciable difference between proposed model and the model when the constant term is the only explanatory factor.

H_1: There lies a difference between the proposed model and the model when the constant term is the only explanatory factor.

The D-value or deviance critically compares with the tabular critical value with M degrees of freedom and α = 0.05 (M = number of variables). 165.037 (Calculated value) > Tabular value entails rejection of H_0 hence suggesting the variables are having a significant impact on the response variable.

Additionally, the values for the explained variation calculated using the Cox & Snell and Nagelkerke pseudo R^2 techniques are included in table no. 5 above. According to the results from the Cox & Snell R^2 or Nagelkerke R^2 methods, the explained variation in the dependent variable based on our suggested model ranges from41.4 per cent to 61.3 per cent. Which is quite substantial, though not excellent.

Test for Model – Fitness: Hosmer-Lemeshow Test

Table 6: Hosmer-Lemeshow Test for Model Fitness

χ^2 Value and Significance of Hosmer-Lemeshow Test Statistic			
Step	*Chi-square*	*df*	*Sig.*
1	3.926	8	.701

The Hosmer-Lemeshow test, one of the crucial tests for gauging how well the logistic regression model fits the data, is demonstrated in Table 6. The test confirms

how well the observed probability of a state match those predicted, With 8 degrees of freedom and a significant p-value (= 0.701 > 0.05), the chi-square test value is 3.926. It is a crucial aspect of the model's fit (That is, the model fits well with the data).

Additionally, the dataset was divided into ten groups and defined in ascending order in order to validate the model that was reconciled to the data. The same has been collated in Table 7. The results in there also re-emphasize an overall good fitness of the model to the data.

Table 7: Hosmer – Lemeshow Test – Contingency Table

		Satisfaction Level = Unsatisfied		*Satisfaction Level = Satisfied*		*Total*
		Observed	*Expected*	*Observed*	*Expected*	
Step 1	1	27	25.043	0	1.957	27
	2	19	18.197	8	8.803	27
	3	11	12.697	16	14.303	27
	4	7	6.856	20	20.144	27
	5	0	3.521	27	23.479	27
	6	2	1.581	25	25.419	27
	7	1	1.028	26	25.972	27
	8	1	.604	26	26.396	27
	9	0	.321	27	26.679	27
	10	0	.152	35	35.848	35

Reliability Measures of the Model using ROC

Table 8: Classification Table[a]

	Observed		*Predicted*		
			Satisfaction Level		*Percentage Correct*
			Unsatisfied	*Satisfied*	
Step 1	Satisfaction level	Unsatisfied	50	20	71.4
		Satisfied	16	193	92.3
	Overall Percentage				87.1

[a] The cut-off point is .500

Confusion Matrix (Table 9) generated from the above classification table is as follows:

Table 9: Confusion Matrix

Observed Satisfaction	*Predicted Satisfaction*	
	Unsatisfied(0)	*Satisfied(1)*
Unsatisfied (0)	50 (True Negative)	20 (False Positive)
Satisfied (1)	16 (False Negative)	193 (True Positive)

Precision = 193 / 213 = 0.906 ...(15)

Precision tries to tell about the accuracy of a predictor model based on how good the model is in predicting positive cases. A value above 0.906 says the model has a precision of 90.6 per cent.

Recall (sensitivity) =193 / 209 = 0.923 ...(16)

It tells how good a model is in predicting pertinent observations. A sensitivity value above 0.5 is considered good. In this case it is 0.923 suggesting a 92.3 per cent competence level in predicting true positives of each category by the proposed model.

Accuracy = 243 / 279 = 0.871 ...(17)

Accuracy describes how the independent variables in the model now correctly classifies the cases overall. A value higher than or equal to 80 per cent is considered to be good enough. This model has crossed the threshold scores with a value of 87.1 per cent suggesting the model is adequately robust in predicting accurate results with only 12.9 per cent inaccurate prediction.

$F_{score} = 2/(1.11 + 1.08) = 0.917$ ...(18)

When binary Classification is used, as in the case of this model, F-score measures how accurately a model concerns a particular dataset. F-score lies between 0 and 1. Here a value of 0.917 shows a good F-score & represented in Eq. 18.

Specificity = 50 / 70 = 0.714 ...(19)

Specificity indicates how many actual negatives were correctly predicted. It is shown by the Eq. 19. It is recommended that sensitivity + specificity be more than 1.5, i.e., midway between 1 and 2, for the test to be valuable. Here this value is 0.923 + 0.714 = 1.637.

Table 10: Summary Statistics-Performance Metrics

No of Cases	*No Correct*	*Accuracy*	*Sensitivity*	*Specificity*	*Pos Cases Missed*	*Neg Cases Missed*	*Empiric ROC Area*
279	243	87.1%	92.3%	71.4%	16	20	0.819

The ROC (receiver operator characteristic) curve has been used here to depict a trade-off between the sensitivity and specificity of the model with binary predictors. The ROC curve is moderately satisfactory. Table 10 represents performance metrics. The Table 11 depicts the Observed Operating Points for plotting the ROC Curve.

Table 11: Observed Operating Points

FPF:	0.0000	0.2857	1.0000
TPF:	0.0000	0.9234	1.0000

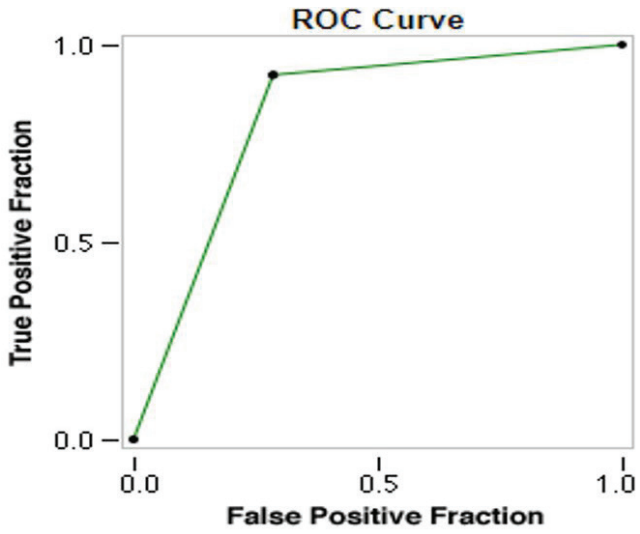

Figure 1: ROC Curve

CONCLUSION

1. Six (6) out of eighteen (18) independent variables considered in the study were found to have a significant influence and contribution to the binary response (Unsatisfied (0), Satisfied(1)) of the logistic regression model. The six (6) variables are identified as: Age, Price Consciousness, Brand Consciousness, Locus of control, Family Influence and Celebrity Influence.
2. Since the overall accurate classification rate was 87.1 per cent and the overall incorrect classification rate was only 12.9 per cent, the predictability of the suggested binary logistic regression model can be considered to be reliable enough.
3. The confusion matrix and the ROC curve which were used to determine the model's robustness indicates that the model has adequate strength. Since, the specificity rate was 71.4 per cent, sensitivity was 92.3 per cent, and accuracy was 87.1 per cent. Sensitivity + Specificity = 1.637. The empirical ROCareais0.819.

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