

A Confirmatory Factor Analysis for Customer Perception toward Sustainable Business Model for Passenger Cars

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Article Info

Volume 83

Page Number: 537 - 545

Publication Issue:

May - June 2020

Article History

Article Received: 11 August 2019

Revised: 18 November 2019

Accepted: 23 January 2020

Publication: 09 May 2020

Abstract:

This study helps to find various indicators related to the traditional car business model using exploratory and confirmatory factor analysis. The purpose of this study is to focus on the factors which relate to the level of satisfaction and belief of consumer regarding Indian car business model. For this, a research tool is developed and surveys of existing car customers were carried out. The data is analysed to understand the related factors by employing exploratory factor analysis and confirmatory factor analysis. The factor analysis results showed that the four latent factors can be considered prominent, defined as the impact of agility, unorganized secondary market, environmental issue, and eco-leasing. Therefore, the four main factors extracted will relate to the customer perception about an existing business model widely employed in the Indian market along with the customer perception about a new business model based on the concept of Eco-leasing

Keywords: Factor Analysis, Indian Car Business Model, Environmental Issue.

I. INTRODUCTION

The present situation of the Indian car market is reflected maximum by the conventional business model, which relies more on selling the product to the customer. At the same time, other forms of business models emerged into the market which includes Car leasing, Carpooling or sharing, etc., but these methods of business are not yet become so popular among the customer and as and how with the manufacturers also. Now as the whole system has deviated in the direction of sustainable business solution, it leads to fresh thinking from industry and academia to re-evaluate the conventional business model for the Indian perspective too (Bhattacharya et.al, 2014). For the better survival of the environment and society and at the same time for firms also, sustainability is the way out (Shevchenko et.al, 2016).

The government is playing its part by taking steps through the various legislative regarding emissions and set up of various private-public partnerships for monitoring. Whereas industry is focused on

continuously changing product and improving a process, emission labelling, fast new product development, etc. leading to an agile environment. These continuously changing elements affect the existing customer using the product and may have an impact on them which needs to study. An attempt is made to study the various factors which influence customer satisfaction and belief toward the present business model. At the same time perception of the customer about the new style of business model making its foot into the market also needs to be checked. This further needs to be checked through various studies related to the point mentioned above. The system becomes agile as the new models are keeps on coming to match the consumer demand as well many times to stimulate the demand and thus all companies focus on rapid changes in their models so that consumer can be attracted toward their brand (Barve, 2011; Bhattacharya et.al., 2014). For the automobile industry, the changes in the well-established routines may cause resistance toward innovation among consumers (Ram & Sheth, 1989;

Schneberger et.al, 2018). This also makes the life cycle of passenger car models shorter day by day (Mahadevan, 2007; MacVaugh, 2010). All this leads to threatens the end-user regarding obsolescence and dissatisfaction about up-gradation in a small period of time. Another factor which arises due to this is the entry of customer early into the secondary market, which is for a country like India is considered to be 90 percent unorganized. The major limitation of the unorganized secondary car market is the lack of goodwill and more involvement of brokers (Sharma, 2012). The consumers are having low protection levels in this segment (Bhakta, 2018). A lot of ambiguity persists in the used car market, regarding the information on the quality and reliability of a product, which leads to customer dissatisfaction with the product and system (Bhandari & Phadtare, 2013). This becomes more worsen for a customer in terms of uncertainty with the enforcement of various legislative regarding the ban on the cars of a particular age. To understand environmental issues, the study is required to be done to access customer view about the role of government and dealer outlets regarding environmental issues like NGT legislative and support of dealers for creating awareness among consumers regarding pollution control. The actual

effects of steps and their perception of the consumer are required to assess rather than what suggested officially by adaptation of various regulations and legislation (Brand, 2016; Haq & Weiss, 2016). The environmental issue can be tackled by awareness and considering the relationships among environmental factors and consumer behaviour, at the same time his individual self-perception for combating the environmental problem (Berger & Corbin, 1992). Proper inspection and awareness are the most important factor to control the emissions under Indian perception (Kumar & Anand, 2012; Wells, 2008). So the consumer view regarding the impact of agility, unorganized secondary market, and environmental issues are important elements, which may relate to consumer belief toward the present business model. Also, it is important to understand how these factors can be moderated by adopting an alternate business model that focus on the sustainable solution without worrying about the consumer too much. The concept can be easily understood with the help of figure 1, which relies on the service rather than selling the product (Anand et.al, 2019).

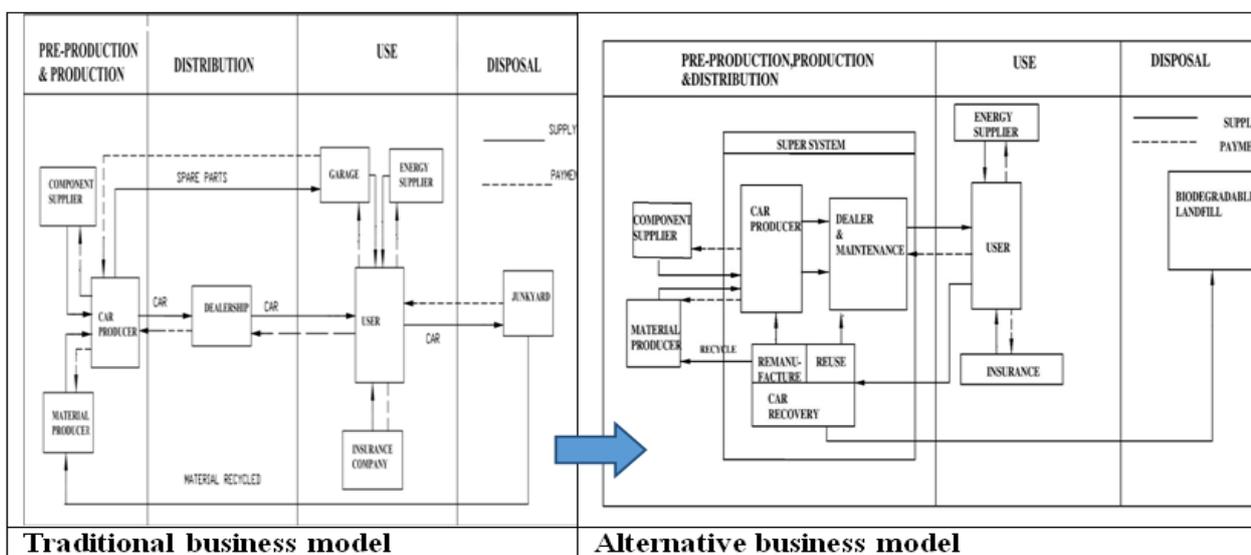


Figure 1 Transformation from Traditional to Alternate model (Anand et.al, 2019)

Leasing an automobile rather than purchasing can be an alternative business model and can reduce the

cost to the customer as well as improve on depreciation factors which makes the consumer worry (Aizcorbe & Starr-McCluer, 1997; Anand et.al., 2019). The view of the customer on this eco-leasing factor also requires to be checked. In this study, exploratory factor analysis is employed to extract the factors on the basis a research tool developed containing questions related to issues of agility, secondary market, environmental effects and leasing of an automobile. Then confirmatory factor analysis is carried out to get the factor structure and understand how important are these factors in view of customer satisfaction and belief toward the present business model and the alternate one.

II. METHOD

Data Collection

The data is gathered from questionnaires sent to existing car customers and quantitative analysis is done. The technique adopted for data collection is convenience sampling. The sample size used for the study is 320. An instrument for data collection involves a structured questionnaire. The questionnaire includes a series of 25 questions separated into two sets; the first set covers 6 demographic questions involving basic details about the Education, age of respondent and their car. Second, part of the questionnaire includes 17 questions. The questions were frame using a 5-point Likert scale. Cronbach's α test is used to check the reliability and the value greater than 0.70 is considered acceptable. (Peng et.al, 2018) .These questionnaires were tested for the reliability of Cronbach's alpha having a value of 0.834.

Data Analysis

Two steps are adopted, the exploratory factor analysis to select the important variables for the measurement model is done primarily then secondly confirmatory factor analysis is done to get measurement model structure (Mulaik & Millsap, 2000). Exploratory factor analysis helps in determining the count of factors and their

relationship, using advanced statistical analysis to extract the factors. During this, the researcher adopted KMO, Bartlett's test of Sphericity to an examined preliminary agreement and determine the suitability and relevance of the data. Next factor extraction is done using principal component analysis (PCA) to obtained factors with Eigen values > 1 , After this Varimax rotation method is applied on the item to produce meaningful orthogonal factors (uncorrelated) and in the final stage of EFA naming of the factors are done.

In the second stage, confirmatory factor analysis (CFA) using Analysis of Moment Structure (AMOS) is used to derive the measurement model obtained from EFA. For this first model, the fit is determined and then the validity and reliability of the model are tested to have the hypothesized measurement model. (Hair, Black, Babin, Anderson, & Tatham, 2006)

III. RESULTS

The exploratory factor analysis (EFA) include KMO = 0.83, Bartlett's Test of Sphericity: Approx. Chi-Square =1936.47,df=136(p = .00) showing that the data is appropriate for the analyze of the relationship between elements, principal component analysis (PCA) is adopted and component's with Eigenvalues > 1 indicated that there were four factors, Varimax method of factor rotation is used, the variance of percentage is between 7.08 and 29.19 with a cumulative percentage of variance equal to 59.63. The component names are first the Environmental Issue(EI) having 7 indicators with weight indicators between 0.61 and 0.840, its Eigen values is equal to 4.96 and the percentage of variance is 29.19 along with the cumulative percentage of variance equal to 29.19, second, the Unorganized secondary market(USM) having 04 indicators with weight indicators between 0.67 and 0.79, its Eigen values is equal to 2.30 and the percentage of variance is 13.56 along with a cumulative percentage of variance equal to 42.75, Third the Eco-leasing(EL) having 04 indicators with weight indicators between 0.50 and 0.85, its Eigen values is 1.6 and the percentage of variance is 9.79

along with the cumulative percentage of variance equal to 52.55, and the fourth factor is Impact of Agility(IA) having 3 indicators with weight indicators between 0.71 and 0.79, its Eigenvalues is 1.2, and the percentage of variance is 7.08 along with the cumulative percentage of variance = 59.63). Next, the results of the confirmatory factor analysis include first the Model specification and model estimation, the model derived from EFA consist of 17 measurement indicators which are related to four latent constructs namely The Environmental Issue(EI), The Unorganized secondary market(USM), Eco-leasing(EL) and Impact of Agility(IA). This model is as per Bollen's criteria, as each latent variable is having a minimum of two indicators along with each observed variable are determined by one latent variable (Bollen, 1990). Hence the measurement model is then subjected to CFA by adopting a maximum likelihood estimation procedure.

variables come together to represent the construct and are used for validation and reliability checks. Next model fit & assessment of reliability and validity is checked. Based on CFA Model using SPSS AMOS, it is found that Chi-square (CMIN) = 177.526, Degree of freedom (DF) = 113 and probability level is about 0.000. CMIN/DF the minimum discrepancy is obtained equal to 1.571. Wheaton et al (1977) suggested that if its value is less than 5 the model is reasonable to fit. See Table 1 for the value of each parameter to test the model fit.

Table 1. Parameter value for model fit measures with SPSS Amos

Name of the Parameter	Value
Goodness of Fit Index (GFI)	0.938
Adjusted Goodness of Fit Index (AGFI)	0.917
Normed Fit Index (NFI)	0.914
Comparative Fit Index (CFI)	0.963
Tucker-Lewis Index (TLI)	0.955
Incremental Fit Index (IFI)	0.963
Relative Fit Index (RFI)	0.905
Root Mean Square Error of Approximation (RMSEA)	0.042

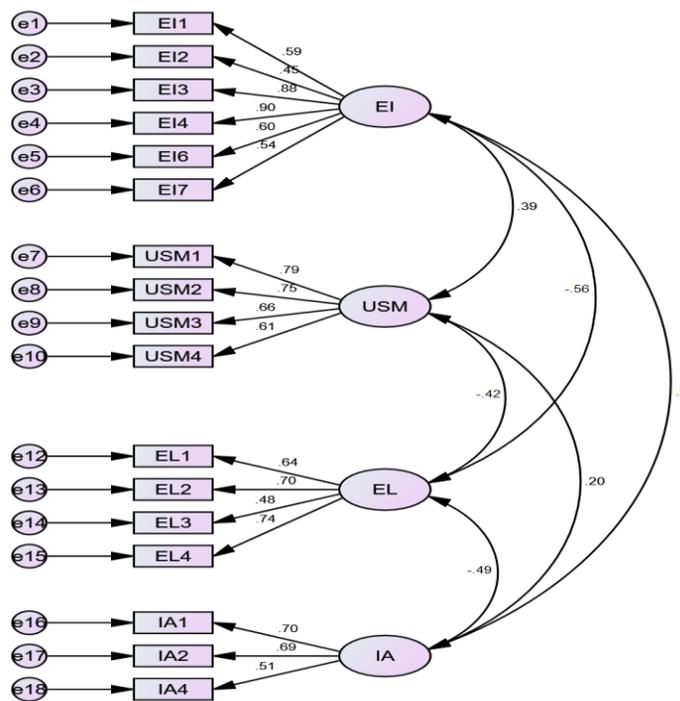


Figure 2.CFA Model

Figure 2 shows the measurement model, which indicates the pattern in which each measure loads on a particular factor. It shows how the measured

Taking the basis of various studies conducted by Bentler and Bonett (1980), Sörbom, D. (1974), Bollen's (1989) it can be agreed that if the Index value is greater than 0.9 and if RMSEA values are less than 0.05 the model is fit and can be accepted. Further the results of convergent validity are presented in table 2 showing AVE, factor loadings, CR and t-values. Indicating average variance extracted (AVE) from each latent construct above 0.5 (0.512 to 0.597). Also, Maximum Shared Variance (MSV) and Average Shared Variance (ASV) for all constructs are less than AVE, showing adequate convergent validity. Moreover, the standardized factor loadings of all observed variables are with the highest value of 0.904 and lowest value of 0.446 and the critical ratios (t-values) are higher than 1.96 ($p < 0.001$). Hence, it is concluded that there is enough confidence in the

discriminate validity of the measures and their corresponding constructs (Chin, 1998).

Table2. Test of Validity

Item	Latent Construct	Standardized Estimate	Critical Ratio(t-value)	Sig	C.R	AVE	MSV	ASV
EI1	EI	.586			0.830	0.565	0.176	0.100
EI2		.446	6.968	***				
EI3		.880	11.278	***				
EI4		.904	11.392	***				
EI6		.601	8.828	***				
EI7		.544	8.180	***				
USM1	USM	.791			0.797	0.597	0.277	0.173
USM2		.749	12.174	***				
USM3		.655	10.824	***				
USM4		.611	10.096	***				
EL1	EL	.640			0.740	0.521	0.191	0.100
EL2		.704	12.441	***				
EL3		.482	13.770	***				
EL4		.739	13.819	***				
IA1	IA	.704			0.773	0.512	0.228	0.118
IA2		.690	6.562	***				
IA4		.513	6.413	***				

Now by comparing the square root of average variance extracted (AVE) between two constructs, discriminant validity is checked (Fornell and Larcker, 1981). The inter-construct correlations and average variance extracted measures of each pair of constructs are given in table 3. Diagonal values represent the square root of average variance extracted and all diagonal values exceeded the inter-construct correlations, reflecting a high level of discriminant validity of the constructs. Thus all the constructs show strong evidence of discrimination.

Table3. Discriminant Validity check

	EL	EI	USM	IA
EL	0.721			
EI	0.562	0.751		
USM	0.593	0.386	0.772	
IA	0.186	0.272	0.200	0.715

IV. DISCUSSION AND CONCLUSION

CFA is used to examine 17 items obtained on the basis of EFA results (Gerbing and Hamilton, 1996). The approach is adopted to examine the dimensionality of each variable or factor, at the same time to test the model fit of the four dimensions or factors related to customer perception about the traditional business model and the alternate one. The results show that the confirmatory factors analysis consisted of four latent factors. The findings supported the concepts proposed by various scholars (Anderson & Gerbing, 1988, Hanchon, P., & Rinthaisong, I. (2018); Gerbing, D. W., & Hamilton, J. G. (1996); Hakstian, A. R., Rogers, W. T., & Cattell, R. B. (1982), arguing that the important characteristics that make the perception about traditional and alternate business model consisted of four dimensions: 1) The Environmental Issue(EI) which mainly affected by the legislative made by government authorities, awareness level among the

customer as well the service provider, effectiveness in coping pollution effects by public-private partnership models used by government 2)The Unorganized secondary market(USM) leading to ambiguity among customer about the correct value and quality of product, 3)Impact of Agility(IA) which is mainly impacting the existing customers using the product, Frequent changes in model leads to a shorter product life ,customer entering in secondary market early,4) Eco-leasing(EL) which is based on the alternate business model proposed by author (Anand et.al, 2019) and is based on the principle of circular economy . The factor results in the perception of customers toward the alternate model. In the analysis of confirmatory factors, it was found that the factors were the same major factors. Therefore, it is shown that these four factors played significant roles in understanding the consumer view about the present traditional car business model, which needed to be modified with the alternate model. Lacking any of the factors may affect consumer perception, which could become a reason for dissatisfaction.

This study tries to analyze the factors which actually are responsible for the level of satisfaction and the belief of customer on the situation highlighted. With the light of literature review, various issues highlighted are studied and concluded as a little work done on getting a sense of the impact of various issues like agility, shorter car life cycle, the impact of legislation, awareness of consumer regarding pollution effect, etc. on the existing consumer. For this, a tool is needed to evaluate the perception of existing customers on the issue raised. The indignity of the research mainly lies in the fact that a questionnaire is tried to be developed and validated in order to get results of the hypothesis developed. These various questions were developed with the help of studies available, suggestions from experts and with the experience in the field of study. The tool developed is primarily tested for a small sample of respondents and evaluating the results leads to restructuring and modification of the questionnaire. With the validation of pilot testing

the questionnaire developed is then used to collect data from various existing car customers. The method adopted was convenience sampling for the collection of data. As the study was undertaken is based on the fact that not much previous history prevails or tools available, it confirms the use of exploratory factor analysis (EFA) for the analysis of data collected. Before doing analysis, the tool is needed to be validated for the test of sampling adequacy, which is done through the Kaiser-Meyer-Olkin (KMO) test of sampling adequacy and Bartlett's test of Sphericity along with anti-image correlation matrix, both of which validates the results as given in the methodology section. Four factors are categorized namely Impact of agility, Unorganized secondary market, Environment issue, and eco-leasing. With the help of this study, a measurement tool is developed and validated. Further confirmatory factor analysis (CFA) using AMOS is carried out. For this first model, fit is determined by considering goodness-of-fit indices criteria; and second, the validity and reliability of the measurement model is tested. On the basis of which factor relation structure is established and validated through this study.

V. RECOMMENDATION

The traditional business car model which mainly based on the selling of the product to the customer needs to be evaluated in order to make the whole business process as well as the use process sustainable. The agile environment of business along with various legislative imposed by the government on the age of a particular type of vehicle forces the customer to deal with the secondary car market quite early for selling their existing car to get a new improved model. The secondary car market in a country like India is not yet an organized one and mostly handled by inexperienced mediators. All these issues have an effect on the existing car customer on the level of satisfaction during use as well as at use end. The analysis of data extracts the various factors and shows the customer perception about the traditional business model and the alternate

business model. This study is limited to the development of scale and analysis of related factors. Practically these factors can help in understanding the view of consumer toward the traditional sale business model presently effective in Indian car market at the same time these factors could be related to the sustainable business model which focus on service along with the sale for Indian car market as is the global trend now. These factors can be used further, to form the structural equation model to develop an alternative business model focusing on leasing cars for the Indian market.

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