Original article

Investigating Managerial Decision Constructs in Automotive Dealerships Using Confirmatory Factor Analysis

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Abstract - Knowing your clients' wants and staying current with changing market trends are crucial for the profitability of any product sales or service firm. Organizations across sectors are increasingly depending on statistical and probabilistic approaches to acquiring and retaining consumers. Dealers serve as an intermediary between manufacturers and customers, influencing the customer experience and product reach significantly. There are numerous efforts to build client bases and generate sales in industries such as electronics, autos, and Fast-Moving Consumer Goods (FMCG). To acquire a better understanding of such dynamics, structured data models are used to quantitatively correlate product sales and service performance. This study intends to identify the balanced scorecard aspects that influence the performance of automobile dealerships based on user impressions. Based on Confirmatory Factor Analysis (CFA), the study identifies sixteen statistically significant balanced scorecard components with a demonstrable impact on dealer performance.

Keywords - Total Quality Management, Confirmatory Factor Analysis, Customer, Statistical Approach, Iterations.

1. Introduction

Confirmatory Factor Analysis (CFA) is a statistical technique that tests predicted links between observable and latent variables using theoretical frameworks, empirical research, or both. It is mostly used to evaluate the validity of measurement models in which the number of variables and their relationships are predefined. By using theoretically created models with set parameters, CFA, a crucial technique in the broader family of Structural Equation Modeling (SEM), allows researchers to assess causal relationships between unknown variables and observable indicators. One of CFA's strengths is its ability to bridge the gap between theoretical predictions and empirical results. By evaluating how well the data fit a theory-based measurement model, where each item is anticipated to load on a particular construct, CFA offers useful information about model fit and highlights possible measurement item flaws. The CFA technique typically starts with model conception, which is followed by parameter specification, relationship estimation, model fit assessment, and iterative model modification as needed. CFA and SEM have been used in a number of studies to look at performance and quality factors in many sectors. For example, study [1] looked at how consumers' intentions to make purchases were affected by informational aspects on online auto dealership websites. Other research [2, 4] examined whether quality of service is ingrained as an organizational principle at car dealerships, concentrating on characteristics including top management support, customer attention, staff engagement, and process control. Building on this, different research measured key elements, including process optimization, customer satisfaction, and leadership commitment, to determine whether Total Quality Management (TQM) principles are actively used at South Australian dealerships. The intrinsic link between inventory and sales, in which dealerships modify inventory levels in response to anticipated demand, was the subject of another line of study [3]. Multiple-group SEM was used in survey research [5] of Malaysian car service consumers to evaluate service-related methods that adhered to TQM principles. Similarly, studies [6] looked at the sales methods utilized by top-performing dealerships in new-car sales processes. CFA was used in paper [7] to assess TQM processes in the Malaysian and Thai automotive industries. Another study [8] utilized 39 variables to evaluate car-buying behavior, reducing them to five underlying dimensions through exploratory and confirmatory factor analysis. Beyond automotive applications, CFA has been used in a variety of

industries. For example, research [9] used CFA to assess customer attitudes regarding urban bus systems for sustainable transport. Research [10] used intentional sampling in Thailand to collect 316 observations in the food business, which were then evaluated using SEM and CFA methods. Another popular tool is the Balanced Scorecard (BSC). While study [16] matched company performance to strategic goals, research [15] used the BSC to create a system for tracking performance for public healthcare institutions. The application of BSC in business banking and its benefits over conventional financial indicators were studied in research [17].

Expanding BSC frameworks to incorporate sustainability factors has been the subject of recent study. The changing importance of the Sustainable Balanced Score Card (SBSC) in encouraging energy and environmental efficiency was highlighted by research [18]. Using hybrid approaches like Analytical Hierarchy Process (AHP) and Decision-Making Trial and Evaluation Laboratory (DEMATEL) to evaluate performance within service institutions, other research [19-26] has concentrated on the implementation of BSC within Small and Medium-Sized Manufacturing firms (SMEs) in the United Kingdom. In this paper, a car dealership case study is analyzed using CFA. From the standpoint of the customer, it seeks to determine the most important factors affecting dealership decisions. Analysis is done using LISREL 8.5, and the model's validation threshold values are taken from recent research, particularly Bagozzi and Yi's recommendations (1988).

The literature on vehicle dealer performance has generally focused on assessing quantifiable outcomes such as sales growth, service efficiency, and customer satisfaction using regression or exploratory analysis. The writers of these works frequently believe that decision-making constructions are adequately expressed and legitimate; yet, in actuality, decision-making conceptions are latently and dimensionally multifaceted. Importantly, the present research gap is due to a lack of coordinated effort to validate decision-making conceptions prior to assessing performance links in order to strengthen the validity and generality of the theoretical constructs under consideration. To address this research gap, the current study specifies automotive dealership decision-making constructs using Confirmatory Factor Analysis (CFA). The study is also founded on decision theory and Total Quality Management concepts, with the research employing stratified random sampling and scale measurement validity. The CFA findings show an appropriate model fit with established validity and low multicollinearity.

Market volatility, digitization, and rising customer expectations have all contributed to the complexity of management decision-making in the automobile business. Recent studies on automobile management have focused mostly on decision-making and its possible performance or consequence, such as increased sales, consumer happiness, or process improvement using regression or exploratory analytic approaches. These methodologies and strategies hinder their comprehension of the inherent and diverse nature of management decision constructions. Furthermore, most research studies to date have not subjected managerial decision constructs to proper and rigorous validation analysis, resulting in possible constructs and measures for managerial decision making in automotive dealerships that may be unreliable and result in the absence of construct validity.

The research article recommends bridging the current gap by conducting Confirmatory Factor Analysis on the validation of management decision structures in the automobile sector. This study will be unique in that it will employ a theory-driven approach to confirming and investigating the factor structure of managerial decision-making in the automotive industry using standardized factor weights, individual construct reliability, and average variance extracted using convergent and discriminant validation techniques, respectively. The research work's originality lies in its attempt to design and establish a statistically robust and proper framework for research in order to increase theoretical refinement and suitability for carrying out additional research work under stringent parameters and aspects for validating and accurate high-level managerial decision-making efficacy.

2. Case Study
This case study uses Confirmatory Factor Analysis (CFA) to analyze the factor structure of an organized survey in order to evaluate the construct reliability of evaluation criteria for car dealerships. Verifying the proposed relationships between hidden assumptions and the relevant observable variables is the main objective. The questionnaire's sixteen components are designed to assess the 4 most crucial components of the Balanced Scorecard Framework: Financial Perspective (FP), Customer Perspective (CP), Internal Process Perspective (IPP), and Learning and Growth Perspective (LGP). The information was gathered through a survey that was distributed to various stakeholders involved in dealership operations. The CFA hypotheses generated by this study are shown below.

3. Hypotheses
Hypothesis 1: Financial Perspectives will impact the choice of auto dealerships.

Hypothesis 2: The Success of auto dealerships is influenced by the viewpoint of their customers.

Hypothesis 3: The Internal Processes Perspective will have an impact on auto dealership selection.

Hypothesis 4: Learning & Growth Perspective will impact auto dealership selection.

Based on the results of Confirmatory Factor Analysis, this study proposes a model with recommended performance enhancers for selecting auto dealerships.

3.1. Automotive Dealerships Selection Criteria

Important factors taken into account in the case study are as follows.

3.1.1. Financial Perspectives

FP1   Revenue growth from auto sales is a result of effective sales procedures and excellent customer service.

FP2   Parts and service profit margins show perceived service value and operational efficacy.

FP3   When savings are reinvested, cost-control measures enhance customer service.

FP4   The degree to which stock satisfies customer demand is shown by inventory turnover.

3.1.2. Customer Perspectives

CP1   Evaluates how satisfied customers are with sales and service.

CP2   Monitors recommendations and recurring business as measures of service excellence.

CP3   Captures client retention and loyalty through reliable service.

CP4   Shows effectiveness by measuring how long it takes to address grievances or problems.

3.1.3. Internal Processes Perspectives

IPP1   Reflects consumer wait times and service speed.

IPP2   Evaluates the effectiveness of inventories in avoiding service delays.

IPP3   Uses error and rework rates to show dependability.

IPP4   Uses the time needed to consummate a deal to demonstrate the effectiveness of the sales process.

3.1.4. Learning & Growth Perspectives

LGP1   Reflects initiatives to improve customer service via staff development.

LGP2   Monitors employee happiness and attrition, both of which have an impact on service quality.

LGP3   Represents ongoing employee upskilling via the acquisition of new competencies or certifications that enhance customer service.

LGP4   Ability to adapt to new automotive trends, e.g., electric vehicles or autonomous driving: Shows the dealership's commitment to meeting evolving customer needs.

3.2. Procedure

A diverse group of participants was questioned, including academics, private employees, customers, government personnel, and showroom staff.

There were 360 acceptable surveys of the 400 received. The results showed that 90.0 percent of respondents were able to react successfully. Table 1 provides an overview of the demographic data.

Table 1. Demographic Information

Stakeholder Category	Frequency	Percentage
Academia	93	25
Private Employees	43	12.1
Customers	57	16.4
Govt. Employees	55	15.4
Showroom Employees	112	30.3

3.3. Scale and measures

Participants are invited to complete a freshly devised questionnaire. The participants react to all 16 items using a five-point Likert scale. 1- Very low; 2- low; 3- medium; 4- high; 5- extremely high.

A confirmatory factor analysis was performed to evaluate the balanced scorecard factors for performance evaluation of automobile dealerships, using data acquired from the questionnaire.
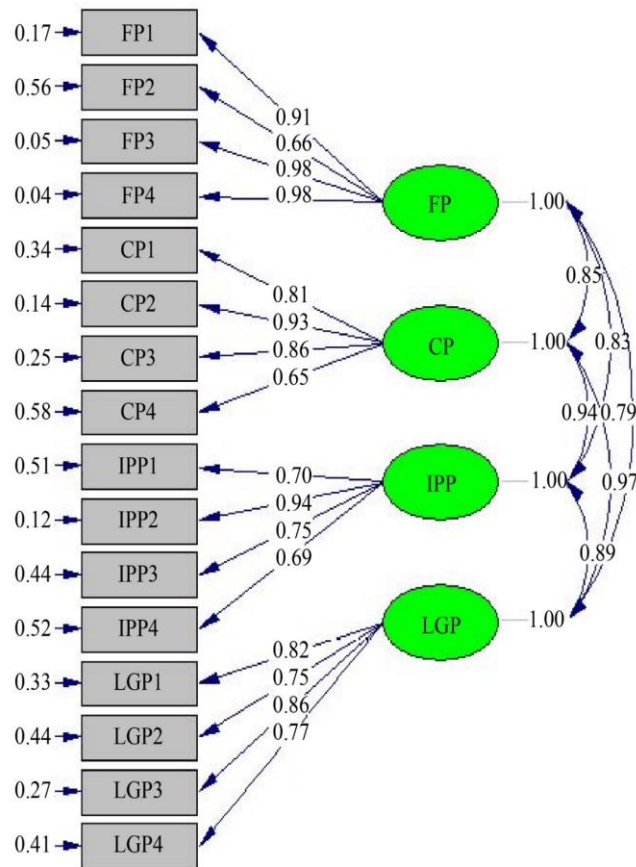
4. Results and Discussion

4.1. Confirmatory Factor Analysis

The validity of the items related to the corresponding constructs is examined using confirmatory factor analysis with data from the questionnaire collected using LISREL 8.52 statistical software. The measuring items for evaluating car dealerships are validated by CFA. Model chi-square goodness-of-fit and approximation fit indices are used to determine if the measurement model matches the data.

Table 2 shows the computed mean and standard deviation, as well as the dependability statistics (Cronbach's Alpha), and also shows the composite reliability, standardized factor loadings, error loadings, and average variance. Figure 1 shows the path diagram that was obtained. The outcomes of the CFA are described below. Table 2 shows that all Cronbach's alpha values are above 0.80, indicating that the accepted constructs have sufficient internal consistency. It also shows the highest dependability of all elements in the corresponding construct.

Table 2. Mean, standard deviation, and reliability statistics

Construct	Number of items	Mean	Standard Deviation	Cronbach's Alpha
Financial Perspective	FP1	3.069498	1.602746	0.9315
	FP2	3.243243	1.40552	
	FP3	3.011583	1.538857	
	FP4	3.011583	1.566319	
Customer Perspective	CP1	2.907336	1.475611	0.8830
	CP2	3	1.375308	
	CP3	2.861004	1.404583	
	CP4	3.374517	1.592949	
Internal Processes Perspective	IPP1	2.532819	1.428491	0.8563
	IPP2	2.957529	1.512907	
	IPP3	2.339768	1.460196	
	IPP4	3.208494	1.597893	
Learning & Growth Perspective	LGP1	2.532819	1.423054	0.8715
	LGP2	3.223938	1.440031	
	LGP3	2.826255	1.413091	
	LGP4	3.023166	1.552519	

Chi-Square=248.09, df=98, P-value=0.00000, RMSEA=0.077

Fig. 1 Path diagram of CFA

4.2. Reliability Assessment

The word "reliability" in Confirmatory Factor Analysis (CFA) refers to how well items within a component assess the same underlying variable. Composite Reliability (CR) is a typical measure for measuring reliability; it may range from 0 to 1, with higher values indicating greater dependability. All of the study's constructs had composite reliabilities of more than 0.8, indicating that the items within each construct are highly trustworthy. Average variance and composite reliability.

4.3. Convergent Validity

The Average Variance Extracted (AVE) quantifies the level of variance captured by the latent construct as a percentage of the total variance, less the amount of variance attributable to measurement error.

The convergent validity of the measurement model is evaluated using it. It is usually believed that good convergent validity is indicated by AVE values equal to or above 0.50. Results show a lot of shared variances, with AVE values between 0.7 and 0.6 in this investigation.

Table 3. Composite Reliability and Average Variance

	Item	Standardized factor loading	Error loading	Composite Reliability (CR)	Average Variance Extracted (AVE)
FP	FP1	0.91	0.17	0.938	0.795
	FP2	0.66	0.56		
	FP3	0.98	0.05		
	FP4	0.98	0.04		
CP	CP1	0.81	0..34	0.889	0.671
	CP2	0.93	0.14		
	CP3	0.86	0..25		
	CP4	0.65	0.58		
IPP	IPP1	0.70	0.51	0.856	0.602
	IPP2	0.94	0.12		
	IPP3	0.75	0.44		
	IPP4	0.69	0.52		
LGP	IGP1	0..82	0.33	0.875	0.639
	IGP2	0.75	0.44		
	IGP3	0.86	0.27		
	IGP4	0.77	0.41		

4.4. SFL

Standardized Factor Loadings (SFL) can range between zero and one. When factor loadings are larger, it indicates that the observed variable is more closely connected to the latent construct.

The factors in the research demonstrated a substantial relationship with their respective constructs, as seen by factor loadings ranging from 0.6 to 0.98. In Confirmatory Factor Analysis (CFA), goodness-of-fit indicators assess the suggested measurement model's appropriateness in comparison to the observed data. Table 3 shows a range of goodness-of-fit measures used to test the CFA model's fit.

In this case, the chi-square is used to determine whether or not the hypothesis is consistent with the observed pattern of co-variation between the variables. $x^2/d.f$ value (2.5) <3.0 indicates that all the hypotheses are consistent. For the chi-square statistic, small values indicate a good fit rather than large ones.

The relative and absolute propriety indicators are closer to the ideal values (Bogozzi and Yi, 1988) and indicate a good fit of the model with sixteen-performance enablers under four performance dimensions. According to the fit indices shown in Table 4, the conceptual model was satisfactorily fitted to the data.

Table 4. Fit indices of the structural model

Indicators	Propriety indicators	Research findings
Absolute propriety indicators	$\chi 2/d.f$	2.5
	GFI	0.893
	AGFI	0.851
	SRMR	0.044
	RMSEA	0.077
Relative propriety indicators	NNFI	0.98
	NFI	0.97
	CFI	0.98

5. Testing of the Hypothesis

Hypothesis 1: The hypothesis that items under the Financial Perspective will affect the performance evaluation of the automotive dealership.

Hypothesis 2: It was hypothesized that the items under Customer Perspective would have an impact on the performance evaluation of the automotive dealership.

Hypothesis 3: The hypothesis that items under the Internal Processes Perspective will influence the performance evaluation of the automotive dealership.

Hypothesis 4: Growth and Learning predicts that perspective considerations have a major impact on car dealerships' performance rating.

CFA findings strengthen the management decision-making framework and are consistent with contemporary TQM models, emphasizing structured decision-making procedures, process regularity, and continuous improvement as the underlying causes of total organizational efficiency.

The strength of the factor loadings, combined with measures of reliability and validity, strongly suggests that the decision-making constructs themselves are valid and useful in ways that support current notions of CFA studies of TQM, emphasizing organizational decision-making as a primary component of overall quality management strategy and outcomes. This study overcomes the challenges of measuring and theorizing in exploratory investigations of dealerships and service sectors by directly examining their performance in a method that ensures more precision in measurement, as proposed in this study, with constructs verified before testing of outcomes. The RMSEA, CFI, and TLI values indicate that this study is nearing good model fit and agrees with improved theoretical practices proposed in this study, as well as modern theoretical models proposed in quality and management studies this decade.

Furthermore, the absence of multicollinearity in this study confirms that decision-making constructs have distinct characteristics and have been one of the major critical elements addressed in CFA and in its support and advancement of organizational theories in an effective TQM initiative in automotive dealership management. The superior outcomes revealed in this study, in contrast to many current models of CFA assistance, might be attributable to the management, philosophies, and practices proposed in this study and in this decade.

6. Conclusion

According to Confirmatory Factor Analysis, this study verifies that 16 elements through 4 viewpoints of the Balanced Scorecard are crucial for assessing car dealerships' success. While AVE values (ranging from 0.60 to 0.70) showed significant variation shared throughout items, all constructs had good composite reliability scores (higher than 0.80), indicating internal consistency. The observed variables were further verified in connection with their latent structures by strong factor loadings ranging from 0.60 to 0.98.

The claim that there is a fairly good match between the theoretical model and observed data is further supported by the degree of freedom, 2.5, which is still below the cutoff of 3.0. Revenue increase from car sales (0.91), inventory turnover rate (0.98), inventory management effectiveness (0.94), repeat business or word-of-mouth (0.93), and cost reduction and control measures (0.98) were factors with the greatest loading. According to findings, these variables appear to be the most powerful indicators of dealership success and client views of efficiency.

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