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Research Article

A Study on Performance Measurement System for Three Wheelers' Aftermarket Dealers in Gujarat

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Abstract
The global automotive industry is a highly dynamic and complex sector, undergoing profound changes due to technological innovation, evolving consumer preferences, and regulatory shifts.
India's automotive sector, a critical component of the global market, is witnessing strong growth fuelled by rising domestic demand, an expanding middle class, and supportive government initiatives. Contributing approximately 7.1% to the nation's GDP.
Gujarat, a pivotal state in India's automotive landscape, has emerged as a key manufacturing hub due to its strategic location, excellent infrastructure, and investor-friendly policies. The state hosts several major automobile manufacturers and a thriving ancillary industry, contributing significantly to the state's economy.
The automotive aftermarket, both globally and in India, is a vital segment of the industry, encompassing the supply of replacement parts, accessories, equipment, and services for vehicle maintenance and enhancement. In Gujarat, the aftermarket industry is expanding rapidly, supported by a growing vehicle population and increasing demand for maintenance and customization services. The market is characterized by a large number of small and unorganized players, with significant opportunities for consolidation and technological advancements.
The objective here is the study on performance measurement system for three wheelers aftermarket dealers in Gujarat.

Key words: Automotive; aftermarket; #three wheelers; #dealers; #performance measurement

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Introduction

Global Overview

The global automotive sector has played a pivotal role in economic progress for more than a century, serving as a catalyst for technological advancements, employment opportunities, and overall economic expansion. This industry includes diverse entities engaged in vehicle design, production, marketing, and sales. Key market categories consist of passenger vehicles, commercial vehicles, electric vehicles (EVs), and premium automobiles.

According to Statista, the global automotive market was valued at approximately $3.5 trillion in 2022, with a compound annual growth rate (CAGR) of 4% from 2016 to 2022. The leading markets in the automotive industry include China, the United States, and the European Union. China has been the largest automotive market since 2009, with sales of around 25 million vehicles in 2022. The United States follows with approximately 15 million vehicles sold, while the European Union accounts for around 13 million vehicles.

India Overview

The automotive industry is a pillar of Indian economy and a key driver of macroeconomic growth and technological advancement. Currently, the automotive industry contributes more than 7% to the total GDP and provides employment to about 32 million people, directly and indirectly. It also contributes 8% of total exports.

India's vehicle sales have shown resilience despite economic challenges. In 2022, total vehicle sales reached around 22 million units, with two-wheelers accounting for approximately 16 million units and passenger cars making up around 3 million units.

Gujarat Overview

Gujarat, a state in western India, has emerged as a significant hub for the automobile industry in the country. Known for its investor-friendly policies, robust infrastructure, and strategic location, Gujarat has attracted several major automobile manufacturers and ancillary industries. This overview provides a detailed analysis of the automobile industry in Gujarat, highlighting its growth, key players, infrastructure, government initiatives, and future prospects.

The automobile industry in Gujarat has seen rapid growth over the past two decades. Initially known for its textile and chemical industries, the state has diversified its industrial base to include a strong presence in the automobile sector. The turning point came in 2008 when Tata Motors decided to relocate its Nano plant to Sanand in Gujarat, setting the stage for the state's rise as an automotive manufacturing hub.

Introduction to automotive aftermarket

The automobile aftermarket, often referred to as the secondary market, comprises industries focused on producing, distributing, selling, and installing vehicle parts, equipment, and accessories after a vehicle's initial sale. This sector offers a broad spectrum of products and services, such as replacement parts, performance upgrades, repair and maintenance services, and accessories designed to improve a vehicle's functionality or appearance.

Key Components of the Automobile Aftermarket

* Replacement Parts

Replacement parts are critical components in the automobile aftermarket. These parts are used to replace worn-out or damaged original equipment manufacturer (OEM) parts to ensure the vehicle continues to operate efficiently. Replacement parts can be categorized into:

* Accessories

Accessories are products that enhance the appearance, comfort, and functionality of a vehicle. These include:

* Maintenance Products

Regular maintenance is essential for the longevity and performance of a vehicle. The aftermarket provides a range of maintenance products, including lubricants

* Repair Services

The aftermarket also includes a wide range of repair and maintenance services provided by independent repair shops, service centres, and authorized dealers. These services include routine maintenance, diagnostics, and major repairs.

In the dynamic landscape of the automotive aftermarket industry, where competition is very high and customer expectations are constantly evolving, the need for a robust performance measurement system is topmost requirement. This necessity becomes even more pronounced when examining a niche sector such as three-wheelers in the Gujarat region from the perspective of dealers. Understanding and assessing performance metrics not only enables dealers to gauge their own effectiveness but also provides valuable insights for stakeholders across the supply chain, including manufacturers, distributors, and service providers.

The automotive aftermarket encompasses a vast ecosystem of businesses involved in the sale, distribution, and maintenance of automotive parts, accessories, and services. Unlike the primary automotive market, which primarily deals with the sale of new vehicles, the aftermarket sector caters to the diverse needs of vehicle owners, ranging from routine maintenance and repairs to customization and upgrades. Within this realm, three-wheelers represent a distinct segment, characterized by their utility, affordability, and widespread usage, particularly in urban and semi-urban areas.

Literature review

- There are different reports on automotive aftermarket published by various agencies which are available on internet mostly on paid basis.
- Such reports are mainly in the form of information collection and commercial purpose.
- The reports for research on finding solutions to the issues arising out for business of the aftermarket products and related topics are hardly found
- From the extensive review of literature made so far, it appears that there is no research done in the direction of topic selected.
- LR is done from the articles relevant to performance measurement system
- Categorization is done to identify Variables from the literatures
- Variables are identified

Research methodology

The following research methodology followed:

- Model selection: BSC: Balanced scorecard model is selected
- Variables finalization
- Questionnaire preparation
- Data collection - 101 dealers, across 6 districts, of Gujarat state
- Utilization of Smart PLS model for data analysis.

Particulars	Research Methodology
Population	Spare parts dealers
Research design	Descriptive research design
Sampling Unit	Major Cities of Gujarat- Ahmedabad, Vadodara, Bharuch, Surat, Rajkot, Palanpur
Sampling size	101 dealers
Sampling method	Non-random Convenience sampling
Data collection method	Personal survey method-Google forms
Data collection instrument	Structured questionnaire

Data collection and analysis

Gujarat, a state in western India, is not only a significant contributor to the country's automotive industry but also home to a thriving aftermarket sector. Dealers in Gujarat play a crucial role in bridging the gap between manufacturers and end-users, serving as primary touch-points for customers seeking products and services for their three-wheelers. The cities of Ahmedabad, Baroda, Surat, Rajkot, Bharuch and Palanpur are chosen as the focal points of this study, represent key hubs within the state's automotive landscape.

The objective is to study performance measurement system for the three-wheeler segment within the Gujarat automotive aftermarket, with a focus on the perspectives and challenges faced by dealers operating in the region. By employing advanced statistical techniques, such as Partial Least Squares (PLS) modeling, this research endeavors to identify the key performance indicators (KPIs) that drive success and sustainability in this unique market environment.

A survey was conducted for the performance measurement system. A total of 101 samples were drawn from dealerships across Ahmedabad, Baroda, Surat, Rajkot, Bharuch and Palanpur, representing a diverse cross-section of the Gujarat automotive aftermarket. The choice of these locations was strategic, considering their significance as commercial and industrial centers within the state, as well as their varying demographic profiles and market dynamics.

The utilization of the Smart PLS model allowed for the exploration of complex relationships between different variables, offering insights into the factors influencing dealership performance, customer satisfaction, and overall business outcomes. By analyzing data pertaining to sales volumes, customer feedback, inventory management, service quality, and other relevant parameters, this study sought to uncover patterns and correlations that can inform the development of a robust performance measurement framework.

This study endeavours to contribute to the advancement of the automotive aftermarket industry, particularly in the context of three-wheelers and the Gujarat region. By leveraging empirical data and advanced analytical tools, the aim is to empower dealers and stakeholders with actionable insights that drive operational efficiency, enhance customer experiences, and foster long-term success in a competitive marketplace.

Results and Discussion:

1. **Case processing summary**

Table 1: Case Processing Summary

		N	%
Cases	Valid	101	100.0
	Excluded[a]	0	.0
	Total	101	100.0

a. Listwise deletion based on all variables in the procedure.

Table 1 presents the Case Processing Summary for the study conducted in the Gujarat automotive aftermarket, specifically focusing on dealerships dealing with auto parts, who also deal with three-wheelers parts. This summary provides insights into the data collection process, including the number and percentage of valid cases and any exclusions made during the analysis.

The table indicates that a total of 101 cases were included in the analysis, representing the entirety of the sample collected for the study. These cases are deemed "valid" as they contain complete data for all variables considered in the analytical procedure. Each case corresponds to a dealership within the selected cities of Ahmedabad, Baroda, Surat, Rajkot, Palanpur and Bharuch, offering a comprehensive representation of the Gujarat automotive aftermarket landscape.

Notably, there were no cases excluded from the analysis, as indicated by the absence of entries under the "Excluded" category. This suggests that all collected data met the criteria for inclusion and underwent analysis without the need for any data points to be removed or omitted. The decision to employ listwise deletion, which involves excluding cases with missing data on any variable included in the analysis, ensures the integrity and reliability of the results by focusing solely on complete cases.

The utilization of listwise deletion reflects a rigorous approach to data analysis, wherein only cases with complete information across all variables are considered for the study. While this may result in a smaller sample size compared to other methods of handling missing data, such as imputation, it minimizes the potential for bias and ensures that the findings are based on the most complete dataset available.

Overall, Table 1 provides a clear and concise summary of the case processing procedures undertaken in the study, affirming the integrity and reliability of the dataset used for analysis. This robust foundation sets the stage for subsequent statistical analyses, such as Partial Least Squares (PLS) modeling, aimed at identifying key performance indicators and driving actionable insights for dealerships operating in the Gujarat automotive aftermarket.

2. Reliability and Validity Test

Table 2: Reliability Statistics

Cronbach's Alpha	N of Items
.756	33

Table 2 presents the reliability statistics for the variables included in the study conducted within the Gujarat automotive aftermarket. Specifically, the table displays the Cronbach's Alpha coefficient alongside the number of items (variables) analyzed to assess the internal consistency and reliability of the measurement scale.

Cronbach's Alpha is a widely used measure of reliability that evaluates the extent to which a set of items (or variables) within a scale consistently measure the same underlying construct or concept. It ranges from 0 to 1, with higher values indicating greater internal consistency among the items. In this case, the calculated Cronbach's Alpha coefficient is 0.756, suggesting a moderate to high level of internal consistency among the variables analyzed.

The number of items included in the analysis is also provided in the table, totaling 33. These items represent the various factors or dimensions under consideration in the study, such as sales performance, customer satisfaction, inventory management, and service quality, among others. The reliability analysis assesses how effectively these items collectively measure the intended constructs, providing valuable insights into the overall reliability of the measurement scale employed.

A Cronbach's Alpha coefficient of 0.756 indicates that the set of items included in the analysis exhibits a satisfactory level of internal consistency, suggesting that they are measuring the intended constructs reliably. However, it's essential to interpret this coefficient in conjunction with other factors such as the context of the study, the nature of the variables, and the specific objectives being addressed.

Overall, Table 2 serves as a critical assessment of the reliability of the measurement scale used in the study, providing researchers and stakeholders with confidence in the consistency and dependability of the data collected. This reliability analysis forms a foundational step in ensuring the validity and robustness of subsequent analyses and conclusions drawn from the study findings.

3 **KMO and Bartlett's Test**

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.581
Bartlett's Test of Sphericity	Approx. Chi-Square	1111.374
	Df	528
	Sig.	.000

Table 3 presents the results of the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity, both of which are commonly used in factor analysis to assess the suitability of data for such analysis.

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) evaluates the overall sampling adequacy of the data for conducting a factor analysis. It ranges from 0 to 1, with values closer to 1 indicating better suitability for factor analysis. In this case, the KMO value is 0.581, suggesting that the data may be marginally adequate for factor analysis. While this value falls below the ideal threshold of 0.6, it still indicates some degree of suitability for conducting the analysis.

Bartlett's Test of Sphericity assesses whether correlations among variables are sufficiently large for factor analysis to be appropriate. The test statistic, reported as an approximate chi-square value, along with its degrees of freedom (df) and associated significance level (Sig.), helps determine whether the correlations between variables are significantly different from zero. In this instance, the approximate chi-square value is 1111.374, with 528 degrees of freedom, and a significance level (Sig.) of .000, indicating that the correlations among variables are statistically significant. Overall, while the KMO value falls slightly below the desired threshold, Bartlett's Test of Sphericity confirms that the correlations among variables are significant, supporting the suitability of the data for factor analysis. However, researchers should interpret the results cautiously, considering the marginal adequacy indicated by the KMO value and potentially exploring ways to improve the sampling adequacy of the data for more robust factor analysis.

4. Factor Loading and Hypothesis Test

Table 4: Factor Loading

	CP	FB	IN	IBR
CP1	0.571			
CP10	0.632			
CP11	0.497			
CP2	0.629			
CP3	0.628			
CP4	0.311			
CP5	0.482			
CP6	0.494			
CP7	0.537			
CP8	0.004			
CP9	0.212			
FP1		0.745*		
FP2		0.800*		
FP3		0.701*		
FP4		0.633		
FP5		0.491		
IBR1				0.595
IBR10				0.723*
IBR11				0.614
IBR12				0.402
IBR13				0.353
IBR14				0.224
IBR2				0.522
IBR3				0.412
IBR4				0.221
IBR5				0.102
IBR6				0.146
IBR7				0.279
IBR8				0.185
IBR9				-0.244
IN1			0.868*	
IN2			0.806*	
IN3			0.501	
Note : CP- Customers Perspective, IN- Innovation, FP- Financial Perspectives, IBR- Internal Banking Perspective				

Table 4 presents the factor loadings derived from the factor analysis conducted on the variables representing different perspectives within the automotive aftermarket context. Factor loadings indicate the strength and direction of the relationship between each variable and its underlying factor or dimension.

The table is structured such that each row corresponds to a specific variable, while each column represents a factor or dimension extracted through factor analysis. The factors are labeled according to their respective perspectives: CP (Customer Perspective), IN (Innovation), FP (Financial Perspectives), and IBP (Internal Business Perspective).

Factor loadings are indicated by numerical values ranging from -1 to 1. A positive loading suggests a positive relationship between the variable and the factor, while a negative loading indicates an inverse relationship. Values closer to 1 (or -1) signify a stronger relationship between the variable and the factor.

For example:

- The variable CP1 (Customer Perspective 1) has a factor loading of 0.571 under the CP factor, indicating a moderately strong positive relationship with the Customer Perspective factor.
- The variable FP2 (Financial Perspectives 2) has a factor loading of 0.800* under the FP factor, suggesting a very strong positive relationship with the Financial Perspectives factor. The asterisk (*) denotes that this loading is statistically significant.

• The variable IBR9 (Internal Business Perspective 9) has a factor loading of -0.244 under the IBR factor, indicating a weak negative relationship with the Internal Business Perspective factor.

It's important to note that factor loadings above a certain threshold (often set at 0.3 or 0.4) are typically considered meaningful. Variables with low or negligible loadings may not contribute significantly to the underlying factors and may be candidates for removal or further investigation.

Overall, Table 4 provides valuable insights into the relationships between individual variables and the underlying factors extracted through factor analysis, offering a structured understanding of the key dimensions driving performance within the automotive aftermarket from various perspectives.

5 Alpha and AVE Values

Table 5: Alpha and AVE Values

	C' Alpha	**Com. Reliability(a)**	**Com. Reliability(c)**	**AVE**
CP	0.639	0.7	0.75	0.243
FP	0.704	0.713	0.81	0.466
IN	0.633	0.726	0.779	0.551
IBP	0.548	0.585	0.637	0.163
Note : CP- Customers Perspective, IN- Innovation, FP- Financial Perspectives, IBR- Internal Business Perspective				

Table 5 presents the values of Cronbach's Alpha (Cronbach's α), Composite Reliability (CR), and Average Variance Extracted (AVE) for each factor extracted through the factor analysis conducted on variables representing different perspectives within the automotive aftermarket context. Cronbach's Alpha is a measure of internal consistency reliability, indicating the extent to which items within a factor or dimension are correlated with each other. Higher values of Cronbach's Alpha suggest greater internal consistency among the items.

Composite Reliability (CR) is another measure of reliability, specifically tailored for use in structural equation modeling (SEM) contexts. Like Cronbach's Alpha, CR assesses the internal consistency of the items within a factor, with values closer to 1 indicating higher reliability. Average Variance Extracted (AVE) assesses the amount of variance captured by the items in relation to the variance attributable to measurement error. It reflects the convergent validity of the measurement model, with higher values indicating a stronger relationship between the items and their underlying factor.

For each factor—CP (Customer Perspective), FP (Financial Perspectives), IN (Innovation), and IBP (Internal Business Perspective)—Table 5 provides the following values:

1. Cronbach's Alpha (C' Alpha): This value represents the internal consistency of the items within each factor. For example, FP has a Cronbach's Alpha of 0.704, indicating moderate to high internal consistency among the items representing Financial Perspectives.

2. Composite Reliability (Com. Reliability): These values reflect the reliability of the measurement model, specifically in the context of structural equation modeling. For instance, the Composite Reliability for IN (Innovation) is reported as 0.726, indicating satisfactory reliability of the measurement model for this factor.

3. Average Variance Extracted (AVE): These values indicate the amount of variance captured by the items in relation to measurement error. For example, the AVE for FP (Financial Perspectives) is reported as 0.466, suggesting that the items within this factor capture approximately 46.6% of the variance in the construct they represent.

Overall, Table 5 provides a comprehensive assessment of the reliability and validity of the measurement model for each factor extracted through factor analysis within the automotive aftermarket context. These values serve as critical indicators of the robustness and quality of the measurement instrument used in the study.

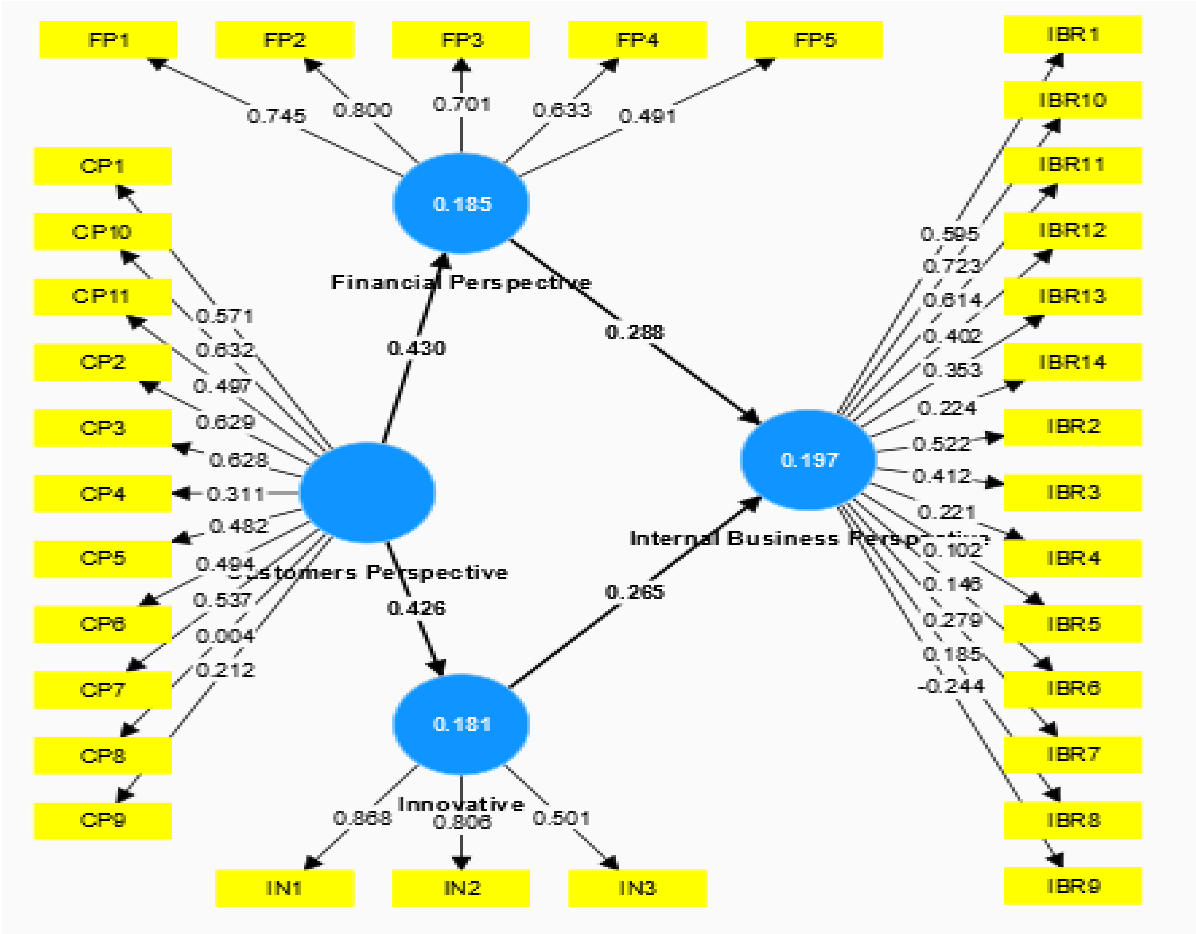

Figure 1: Smart PLS Factor Loading Model

6 P value and hypothesis testing

Table 6: *P Values* and Hypothesis Testing

	Ori. Samples	Sample Mean	Std. Dev.	T Stat.	P Values
CP-> FP	0.43	0.474	0.072	5.946	0.000**
CP-> IN	0.426	0.462	0.093	4.6	0.000**
FP-> IBR	0.291	0.277	0.217	1.342	0.180
IN->IBR	0.262	0.307	0.222	1.179	0.238
Note : CP- Customers Perspective, IN- Innovation, FP- Financial Perspectives, IBR- Internal Banking Perspective					

Table 6 provides the results of hypothesis testing, specifically examining the relationships between different perspectives within the automotive aftermarket context. The table presents the original (Ori.) samples, sample mean, standard deviation (Std. Dev.), t-statistic (T Stat.), and p-values for each hypothesis tested.

Hypothesis testing is a statistical method used to evaluate whether there is a significant relationship between variables or factors of interest. In this case, the hypotheses being tested involve the directional relationships between Customer Perspective (CP), Financial Perspectives (FP), Innovation (IN), and Internal Banking Perspective (IBR).

For each hypothesis tested, the table reports the following:

1. Original Samples: The original correlation coefficient between the variables representing the perspectives being tested. For example, the original sample correlation coefficient between Customer Perspective (CP) and Financial Perspectives (FP) is reported as 0.43.
2. Sample Mean: The mean correlation coefficient calculated from the sample data collected for the study. For instance, the mean correlation coefficient between CP and FP is reported as 0.474.
3. Standard Deviation: The measure of the dispersion or variability of the correlation coefficients within the sample data. It indicates how much the correlation coefficients deviate from the mean. For example, the standard deviation for the correlation coefficients between CP and FP is reported as 0.072.
4. T Statistic (T Stat.): The calculated t-statistic, which measures the strength of the relationship between variables relative to the variability observed in the sample data. For example, the t-statistic for the relationship between CP and FP is reported as 5.946.

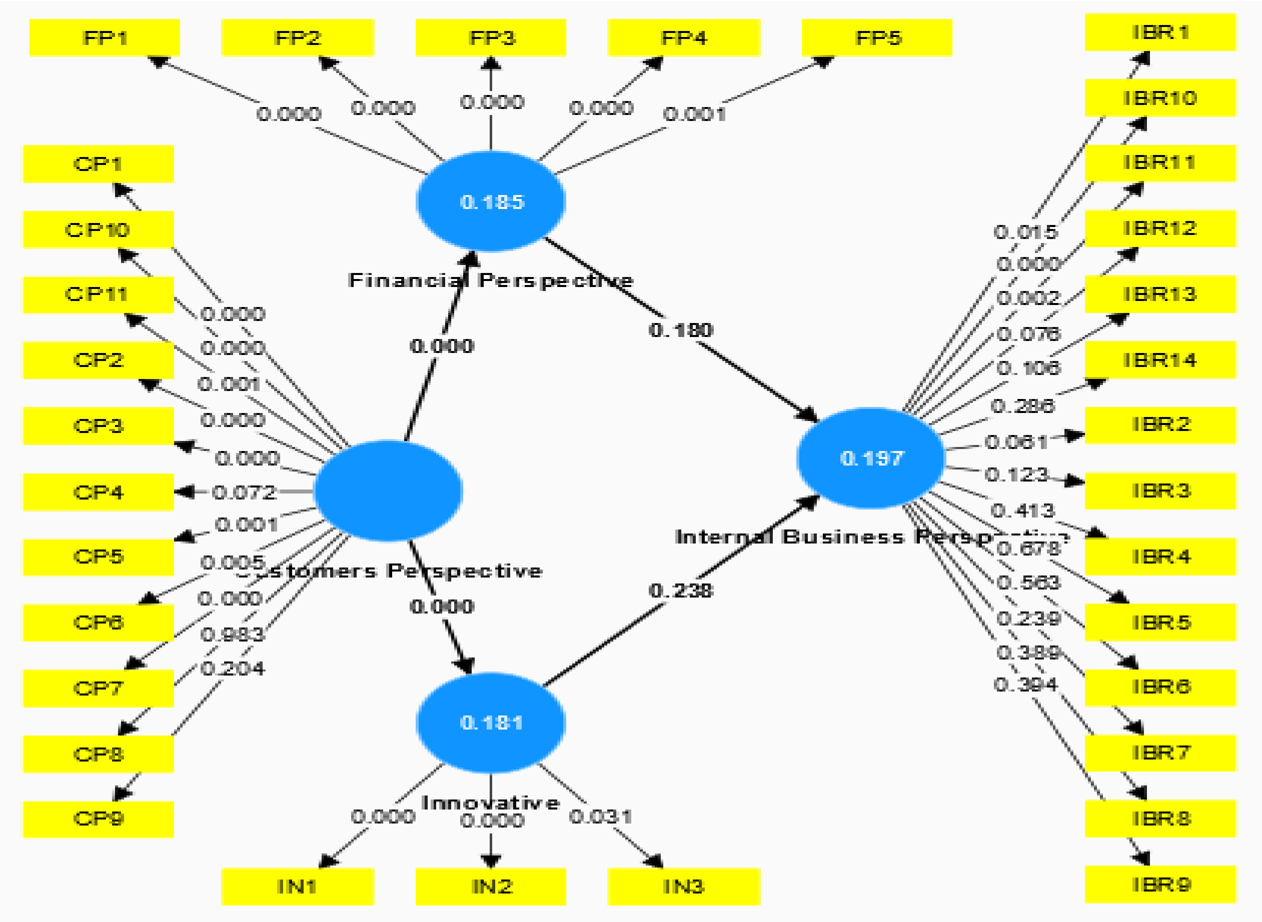

Figure 2: Smart PLS Factor *P-Value* Model

5. P Values: The probability associated with the t-statistic, indicating the likelihood of obtaining the observed results if the null hypothesis (no relationship between variables) is true. P-values less than a predefined significance level (often 0.05 or 0.01) indicate statistical significance. For example, the p-value for the relationship between CP and FP is reported as 0.000**, indicating a highly significant relationship.

Overall, Table 6 provides insights into the statistical significance of the relationships between different perspectives within the automotive aftermarket, based on the sample data collected for the study. Significant relationships, as indicated by low p-values, suggest meaningful associations between the variables under consideration, informing strategic decision-making and further research in the field.

Conclusion

- The study aimed to develop a performance measurement system tailored to the three-wheeler segment within the Gujarat automotive aftermarket, focusing on dealer perspectives.
- A diverse sample of 101 dealerships across Ahmedabad, Baroda, Surat, Rajkot, and Bharuch was analyzed using advanced statistical techniques, including Partial Least Squares (PLS) modeling.
- The Case Processing Summary indicates that all collected data were valid and included in the analysis, ensuring the integrity of the dataset.
- Reliability statistics, including Cronbach's Alpha and Factor Loadings, demonstrated satisfactory internal consistency and relationships among variables representing different perspectives.
- The Kaiser-Meyer-Olkin (KMO) Measure and Bartlett's Test of Sphericity affirmed the suitability of the data for factor analysis, despite some marginal adequacy.
- Factor loadings revealed meaningful relationships between variables and underlying factors, providing insights into key dimensions driving performance within the automotive aftermarket.
- Alpha and AVE values showcased the reliability and convergent validity of the measurement model for each factor extracted through factor analysis.
- Hypothesis testing results indicated significant relationships between Customer Perspective (CP) and Financial Perspectives (FP), as well as CP and Innovation (IN), while relationships between FP and Internal Banking Perspective (IBR), and IN and IBR were not statistically significant.
- Overall, the study lays a solid foundation for further research in developing a comprehensive performance measurement system tailored to the Gujarat automotive aftermarket, offering valuable insights for dealerships and stakeholders to enhance operational efficiency and customer satisfaction.

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