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Research Article

A Framework and Workable Model of Inventory Control in Manufacturing Industry

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ABSTRACT

This investigative study employed a robust analytical framework built on surveys to examine the key factors influencing the sustainability and performance of manufacturing industries in Chhattisgarh. The research utilized both qualitative and quantitative methods including stakeholder interviews and literature reviews, along with some structured questionnaires that measured responses on a five-point Likert scale. Data was collected in four stages, with a continuous refinement of the questionnaire supported by responses from participants. Data from 190 out of the 350 distributed survey questionnaires were analysed via statistical tools (SPSS version 20 and Microsoft Excel). Descriptive statistics, factor analysis, regression, correlation, and hypothesis testing were employed to assess significant relationships among the variables. The Cronbach's Alpha (0.874) test, KMO, and Bartlett's test confirmed the data's validity and reliability indicating internal consistency and sampling adequacy. The results suggested that each significant factor had a mean score above 4.0 indicating it would improve the performance of manufacturing industries. The findings reiterate the importance of statistical validity, reliability of data, and methodological rigour to industrial research. The implications of this research would support a successful improvement in operational efficiency, management practices, and sustainable industrial outcomes directed to manufacturing management and policy management in the Chhattisgarh manufacturing context..

INTRODUCTION

One of the most significant resources businesses manage is known as inventory. Provided that an inventory, or stock of goods was mentioned in 1601, it has been a vital aspect of industrial activities. The challenge of increasing productivity and profitability within manufacturing companies relies on inventory management, which includes more than accounting procedure, it is an organized control of the raw materials, work-in-progress, and finished goods, with all being considered current assets due to their relatively short duration till they can be converted to cash. Therefore maintaining desired levels of inventory is important, as variations of those levels will directly influence working capital, profit, and efficiency (Horngren, 2007).
In manufacturing, the inventory serves as a buffer between the supply and the production processes. It provides assurance that the materials needed are available when required, allowing for a partial independence from outside sources for fulfilling operations. Examples of inventory management failure that can arise when verification is not taking place are overstocking and stockouts, both produce inefficiencies, production disruptions, potential shutdowns, and a loss of profits.. According to studies, a company's inventory usually accounts for around 60% of its current assets and uses up a significant amount of working capital. According to a 1982 report by the U.S. Census Bureau, accounts receivable and inventories together made up almost 80% of the current assets of all manufacturing enterprises, with inventory alone accounting for over 30% of total assets. The need for strategic inventory management systems is highlighted by these figures.

Importance of efficient inventory control

One major component of a business's success or failure is inventory management. While too much inventory ties up resources while increasing holding costs and the risk of obsolescence, too little inventory can cause stockouts, halting production and disrupting the supply chain. Optimal inventory levels is positioned between too little and too much, as indicated by Charles T. Horngren (2007), assuring the availability of inventory with minimal costs. Inventory management focuses on preserving this balance, maximizing the trade-off between costs of shortfalls and inventory holding. Capital efficiency can also be supported through good inventory management. Several scholars argue that good inventory management can free up funds to be applicable towards additional uses (Ngubane et al., 2015). Conversely, poor inventory management methods can lead to substantial losses in operations and finance. This can include, manual recordkeeping, recordkeeping inaccuracies, and failing to monitor. Boyer (2017) noted that when using a manual accounting system, there can be numerical mistakes or consistency in data being wrongly read, while Raman, DeHoratius, and Ton (2001) determined that the inaccuracies of inventory records could cost a company as much as 10% off of profits. Major sources of inaccuracies include depletion (theft, damage or expiration), transaction error, and misplaced stock..

Inventory Management Challenges in SMES

Inept inventory development is a recurrent issue among manufacturing SMEs, particularly in areas like Chhattisgarh, India, which limits company performance (Ngubane et al., 2015). According to Aro-Gordon and Gupte (2016), inventory management is a strategic context containing information architecture, planning and control systems, organizational alignment, and physical structure. Sometimes, the reasons for poor inventory management in SMEs is inadequate technological infrastructure, absence of technical capacity, and lack of capital. Inefficiencies can sometimes result in delays in the production process, as well as depletion in raw materials, which ultimately lead to decreased competitiveness (Esther, 2019). Moreover, in addition to the physical inventory of raw materials and finished goods, organizations must also consider the management of intangible inventories of goods as work-in-progress, capital equipment, and consumables..

Objectives and Purposes of Inventory Control

Managing inventory encompasses effective purchase pricing, quality assurance checks, optimizing storage space to ensure use of stock, forecasting consumption demands, and lowering waste through reductions. Each of these contributes to ensuring that materials are available when needed, while limiting losses due to poor management or excess purchase. The core goals of managing inventory is to lower acquisition costs, avoid inventory stockouts, stabilize consumption variability, and maintain high customer service levels. Due to competition, cost reductions are difficult to achieve, so the process necessitates a systematic approach based on data-driven forecasting techniques and computerized record management..

Factors Influencing Inventory Management

Inventory management effectiveness is impacted by a variety of factors including design complexity, financing options, market rate volatility, misunderstanding, and a lack of storage. Climate and environmental factors affect deterioration, in addition to over-stocking and mishandling products. The aforementioned events need to be monitored regularly to maintain equilibrium in the supply chain. For instance, shortages caused by poor planning creates a disruption in production, while too much stock creates spoiling, obsolescence, and unneeded carrying costs..

Critical Success Factors (CSFs) in Inventory Management

To enhance performance and safeguard competitive advantage, organizations need to identify and focus on critical success factors (CSFs) - those vital areas that ensure success if the proposed action or area is executed successfully. Rockart (1979) stated that CSFs are one of the few domains in which successful performance guarantees success for organizations. In a similar vein, Brotherton and Shaw (1996) defined CSFs as key management controlled processes or behaviors that affect the achievement of objectives. Importantly, CSFs are dynamic and can change as environmental conditions and organization priorities change. According to the Italian organization HERA, CSFs are element necessary to lead a firm in becoming superior to competitors, regardless of the level of the business model in achieving its objective. Brotherton (2004) also pointed out that CSFs are the focus of the most competitive power, meaning they should be the first consideration when allocating resources. For firms that want to raise productivity, decrease waste, and maximize profits, they are critical..

CSFs and Total Quality Management (TQM)

In the context of Total Quality Management (TQM), CSFs can be recognized as the key facilitators of operational excellence and continuous improvement. Saraph et al. (1989) mentions that identifying and implementing CSFs is a key component in achieving this goal with an organization. Rodriguez et al., (2018) emphasized that recognizing CSFs in TQM frameworks is also a facilitator of organizational learning and improves quality. Others have conducted extensive research focusing on the impact of CSFs that emphasize leadership commitment, employee involvement, process control, and customer orientation (Aquilani et al., 2017; Karuppusami and Gandhinathan, 2006; Sila and Ebrahimpour, 2002).

LITERATURE REVIEW

Untawale S.P. et al. (2004) discovered seven essential success factors for performance improvement in their study of Indian manufacturing businesses. The author also outlined a process to improve productivity and quality in Indian manufacturing sectors. Shrivastava S. et al. (2014), in their research of the Indian cement sector, discovered nine (9) critical success issues, or 43 characteristics, to support quality management. Manisha Lande et al. uncovered 17 Critical Success Factors while studying lean six sigma while studying Indian organizations. During exploratory investigation using the TQM management technique, he discovered the attributes of Critical Success Factors for Quality and Productivity Improvement. MinhajA.A. Rehman et al. (2015) researched the automotive industry, with 42 variables, determined 12 key success factors for green supply chain management in the automotive industry based in the Indian state of Maharashtra. In the context of their research on quality-productivity management concerning the sponge iron industry, Vinod S. Gorantiwar et al. (2014) determined that there are 50 qualities that should be treated with a high priority. Research focused specifically on the Indian industry in the area of remanufacturing has taken place, for example Amol Lokande (2014) found that there were 74 variables and 10 critical success factors for developing the remanufacturing industry in India. M.D. Singh et al. (2006) suggested that knowledge management (KM) incorporates methods and processes for locating, acquiring, and using knowledge to improve competitive advantage. To observe how KM methods influence Indian manufacturing businesses, the author surveyed and gathered information from 71 various industries. Aleksander Janes et al. (2013) considered and explained the cause-and-effect relationships of key performance metrics, which significantly increase the benefits of business process exploitation. Ahuja et al. (2008) examined the challenges faced by Indian manufacturing companies in adopting proactive Total Preventive Maintenance (TPM) programs.). To address the worldwide dilemma, they developed critical success factors to get beyond barriers to TPM deployment. Organizational, cultural, behavioral, technological, operational, financial, and departmental impediments are the primary implementation hurdles, according to their suggested approach. Research on Indian software businesses was done by Ayoob Ahmed Wali et al. (2000), who also provided an economic framework of globalization and liberalization. The competitiveness of the Indian software sector, which is based on quality traits like punctuality and delivery reliability, has been acknowledged on a global scale. Critical Success Factors for TQM are identified by their case study work. Critical Success Factors of Six Sigma Implementation in Indian Manufacturing Industries were underlined by Darshak Desai et al. (2012). With the aid of a questionnaire, they conducted exploratory research to examine the effects of various CSFs of six sigma adoption in various sizes and sectors of the Indian manufacturing industry. Critical success elements of Total Quality Management have been studied and ranked for Indian manufacturing industries by Harjeev K. Khanna et al. (2011). A systematic questionnaire was employed as the research tool. They came to the conclusion that the three most important elements for implementing TQM in Indian industrial sectors are process management, top management leadership, and customer focus.

RESULT AND DISCUSSION

The information supplied by the respondents and how they handled the data they obtained for the survey analysis are covered in this chapter. This section's primary goal is to illustrate the methods used to gather, compile, and prepare the data for additional analysis. To make it easier to review the data and make inferences, the company profiles are described, along with a summary of the responses about the elements that were obtained from the questionnaire. Following the identification of the variables, this study employs statistical techniques including factor analysis, regression analysis, correlation analysis, descriptive statistics, and hypothesis testing. The model's sensitivity and reliability are examined. The model has undergone optimization. Statistics is the basic method to confirm the hypothesis we have put forth in this research. The results were analyzed using statistical package SPSS version 20 and by using MS-Excel software.

Data collection and Initial Screening

To improve the qualitative analysis, this study reviewed the literature and conducted in-depth interviews with stakeholders. Chhattisgarh State's industries were surveyed utilizing a closed questionnaire, with an emphasis on various manufacturing sectors according to turnover, size, and product offerings. Direct field observations, open-ended interviews, and stakeholder interviews comprised the four stages of the fieldwork. 50 respondents from various manufacturing industries participated in the initial survey, which employed a closed questionnaire to test hypotheses and give a thorough picture of the industries under study. The data gathered in the second phase of the study is analyzed in the third section. In response to the respondent's comments, certain criteria were removed from the questionnaire, while others were included. Additionally, the questionnaire was examined for any missing factors.

The final questionnaire is revised in light of the respondents' comments. Using an updated questionnaire for several industrial industries, a comprehensive survey was conducted in the last (fourth) phase of the fieldwork.

Only 190 distinct stakeholders completed the questionnaire and provided the necessary information out of the 350 respondents. After that, the responses are screened to see if every question has been correctly checked. The fully completed surveys were then sorted and used for additional analysis. Subsequently, all data was meticulously recorded using Microsoft Excel.

Details of respondents

Questionnaire is prepared with number of questions based on Likert's scale explaining the parameter 1= "Not important" to 5 = "Most important". Initially some respondents in firms had difficulty in filling the response. For instance, they had problems in understanding the difference between "strongly agree" and "strongly disagree" and because of this they were not able to express their thoughts or feelings in strong words. After properly educating the respondents, they were able to select the right option understanding its significance. Lastly, feedback was taken to make sure that they understood the relevancy of questions.

Table 1. Phases of field work

	Outcomes
Preliminary research	Identification of research sample
Phase-I	Interviews and their evaluations
Phase-II	Pilot study
Phase-III	Preliminary impressions and evaluations of the framework
Phase-IV	Final study

Response Rate & Profile of the Respondents

Following the delivery of the questionnaire to the respondents, a continual follow-up was conducted, which led to the receipt of 190 genuine responses, yielding a very impressive response rate of 54.03 percent. Table No. 4.2 displays the response rate of certain authors' earlier research that employed a questionnaire to gather data.

Table 2. Response rates of the previous studies

S.NO	**Author**	**Response rate %**
1.	Saraph, J.V, Benson P.G. and Schroeder, R.G,1989	91.01
2.	Adam E.E.,1994	45.72
3.	Badri, M.A., Davis Donald, Davis Donna., 1995	49.6
4.	Wali, A.A., Deshmukh, S.G., Gupta, A.D., 2003	22.8
5.	Shrivastava, R.L, Mohanty, R.P, Lakhe, R.R.,2006	57
6.	Deshmukh S.V., Lakhe R. R.,2009	19.7
7.	Siddique S.N, Ganguly S.K,2019	65
8.	Lande.M, Shrivastava R.L, Seth Dinesh, 2015	69.42

Following Figure shows and present below the classification of the respondent to the questionnaire and their information

Zone wise representation of the responses

Sr. No.	Name of Zone	No. of Responses	%
1	Central India	176	50.72
2	South	62	17.86
3	East	52	14.98
4	West	34	9.79
5	North	23	6.62
	Total	347	

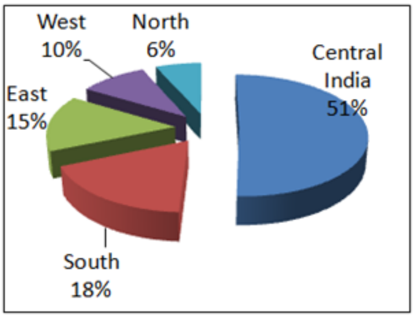
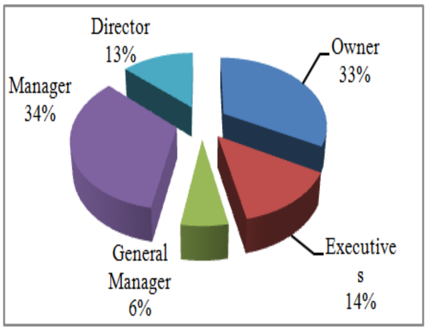


Figure 1. Zone Wise Representations

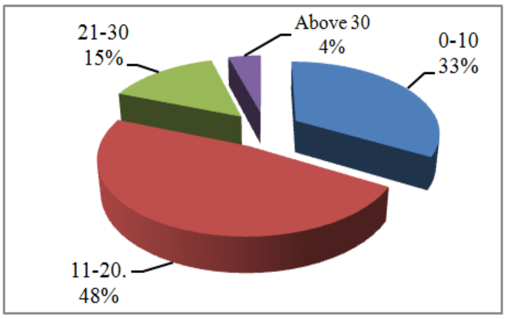
Position or Title of respondent



Scale	Content	No.	Percentage
1	Owner	114	33
2	Executives	48	14
3	General Manager	21	6
4	Manager	118	34
5	Director	46	13
	Total	347	100

Figure 2. Positions of the Respondents

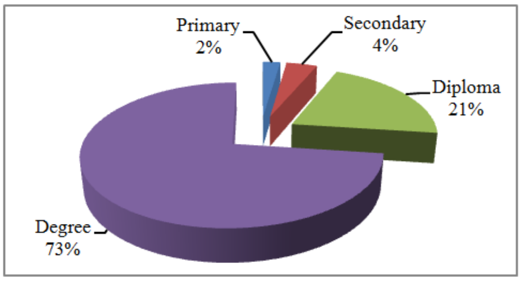
Year of Experience



Scale	Content	No.	Percentage
1	0-10	115	33
2	11-20.	166	48
3	21-30	51	15
4	Above 30	15	4
	Total	347	100

Figure 3. Year of Experience of Respondents

Qualification of respondent



Scale	Content	No.	Percentage
1	Primary	8	2
2	Secondary	14	4
3	Diploma	72	21
4	Degree	253	73
	Total	347	100

Figure 4. Qualifications of Respondents

Data Analysis

In order to measure input and output factors, the data analysis employed statistical methods such as the mean and standard deviation. With a mean score of more than 4.0 for all questions, performance improvement is highly important. Normality, Reliability, Adequacy, and Validity were the four main measurement techniques. Normality testing made sure the data had a normal distribution, while Adequacy evaluated the data's sufficiency, accuracy, and precision. Because it is essential for statistical tests like t-tests, the normality test is a statistical test that determines if data has a normal distribution. A reliability test called Cronbach Alpha is used in SPSS to assess a questionnaire's internal consistency, especially when it contains comments from several Likert scales. The percentage of response variability attributable to respondent variations is known as reliability.

The reliability of the questionnaire is demonstrated by a Cronbach's alpha value of 0.874 for 34 input items and 0.874 for 24 output items. The Kaiser-Meyer-Olkin (KMO) Test evaluates the sampling adequacy of each variable and the overall model to determine the suitability of data for factor analysis. It computes the proportion of variance common to all variables. Bartlett's test of sphericity, with P values below 0.05, evaluates the null hypothesis of uncorrelated variables inside a population correlation matrix. Validity refers to the process of ensuring that an instrument accurately assesses its intended purpose. Criteria-related validity, construct validity, and content validity are essential components of validation methods. A comprehensive analysis of the survey items ensures content validity. Criterion validity evaluates the precision of a variable's predictive capacity using data from other variables. Construct validity assesses a test's capacity to effectively measure its intended construct. The verification is conducted by comparing the test with other analogous assessments to ascertain correlation.

Normality test for input variables

Case Processing Summary

Table 3. Normality test: Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
input variables	43	100.0%	0	0.0%	43	100.0%

Descriptives

Table 4. Normality test: Descriptives

			Statistic	Std. Error
input variables	Mean		3.5500	.09190
	95% Confidence Interval for Mean	Lower Bound	3.3645	
		Upper Bound	3.7355	
	5% Trimmed Mean		3.5991	
	Median		3.6667	
	Variance		.363	
	Std. Deviation		.60265	
	Minimum		1.70	
	Maximum		4.32	
	Range		2.62	
	Interquartile Range		.42	
	Skewness		-1.523	.361
	Kurtosis		2.405	.709

Tests of Normality

Table 5. Shapiro-test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
input variables	.237	43	.000	.823	43	.000
a. Lilliefors Significance Correction						

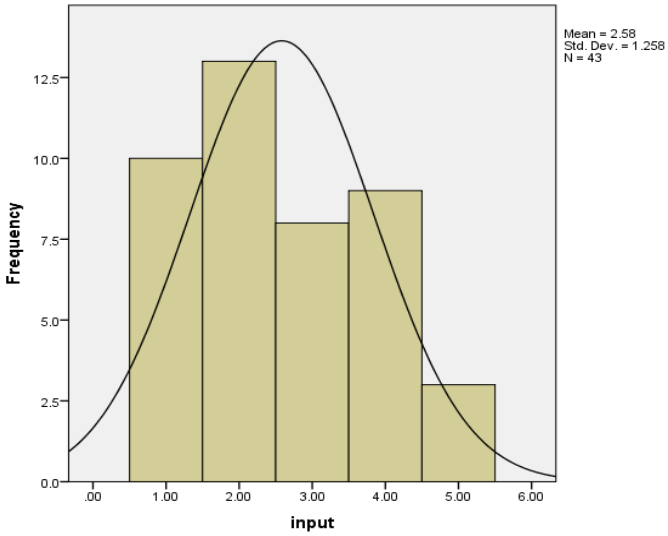


Figure 6. Normality Test

Normality Test for output variables
Case Processing Summary

Table 6. Normality Test: Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
output	29	100.0%	0	0.0%	29	100.0%

Descriptives

Table 7. Normality Test: Descriptives

			Statistic	Std. Error
output	Mean		3.8112	.08971
	95% Confidence Interval for Mean	Lower Bound	3.6274	
		Upper Bound	3.9949	
	5% Trimmed Mean		3.8716	
	Median		3.9365	
	Variance		.233	
	Std. Deviation		.48308	
	Minimum		1.70	
	Maximum		4.32	
	Range		2.61	
	Interquartile Range		.41	
	Skewness		-3.084	.434
	Kurtosis		12.928	.845

Tests of Normality

Table 8. Shapiro test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
output	.176	29	.022	.703	29	.000
a. Lilliefors Significance Correction						

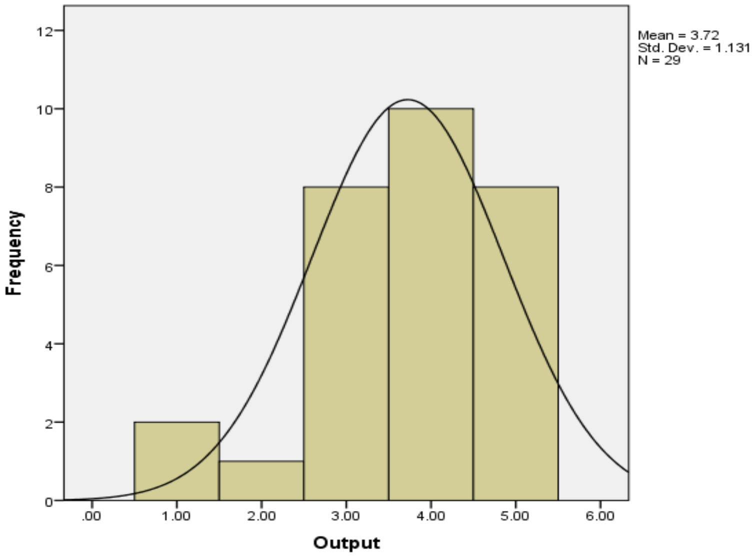


Figure 7. Tests of Normality: Shapiro test

Reliability Statistics

Table 9. Reliability of output data

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.880	.874	34

Reliability Statistics

Table 10. Results of KMO and Bartlett's test of Input Factors

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.877	.874	24

Table 11. Results of KMO and Bartlett's test of Output Factors

S.NO	Input Factors	KMO	Bartlett's test of sphericity		
			Approx. Chi-square	df	Sig.
1	Top Management Involvement	0.703	153.176	6	0.000
2	Process Management	0.798	314.818	10	0.000
3	Quality Management	0.744	449.530	21	0.000
4	Organizational Culture	0.627	130.679	10	0.000
5	Employee Involvement	.527	578.623	6	0.000
6	Human Resource Management	.521	17.214	6	.009
7	Government Policy	.565	152.167	6	.000

Table 12. Bivariate Correlations among the input and output factors

S.NO	Output Factors	KMO	Bartlett's test of sphericity		
			Approx. Chi-square	df	Sig.
1	Productivity Improvement	0.728	291.701	15	0.000
2	Quality Performance	0.645	170.702	15	0.000
3	Employee Satisfaction	0.680	168.843	6	0.000
4	Financial Performance	0.550	48.646	10	0.000
5	Time Dimension	.485	47.493	15	.000

Correlations

Table 13. Reliability Statistics: Correlations

	OF1	**OF2**	**OF3**	**OF4**	**OF5**
IF1	.004	-.202**	.026	-.087	-.087
IF2	.595**	.213**	.067	.702**	.702**
IF3	.201**	.206**	.818**	.260**	.260**
IF4	.711**	.418**	.229**	.770**	.770**
IF5	.200**	.222**	.842**	.271**	.271**
IF6	.311**	.315**	.098	.257**	.257**
IF7	.300**	.282**	.103	.273**	.273**
**. Correlation is significant at the 0.01 level (2-tailed).					
*. Correlation is significant at the 0.05 level (2-tailed).					

CONCLUSION

The data collecting, preparation, and analysis procedures used in the study were methodically presented in this chapter. To guarantee both quantitative and qualitative rigor, the study used a structured survey approach bolstered by stakeholder interviews and literature studies. Based on respondent comments, the questionnaire—which was created using a five-point Likert scale—was improved for relevance and clarity. 190 valid replies were collected from the 350 distributed questionnaires, and SPSS (version 20) and Microsoft Excel were used for analysis. To find important factors and test hypotheses, statistical techniques like factor analysis, regression, correlation, and descriptive statistics were used.

Cronbach's Alpha (0.874), KMO, and Bartlett's tests were used to verify the data's validity and reliability, guaranteeing internal consistency and adequate sampling. The findings demonstrated the significance of each important factor in enhancing industrial performance by showing that they all had high mean values. Robustness in analysis was guaranteed by the thorough use of the Normality, Reliability, Adequacy, and Validity tests. Overall, the research findings are more credible due to the methodical approach and statistical validation, which offer a solid basis for model optimization and hypothesis confirmation in the analysis of Chhattisgarh's manufacturing sectors.

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