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Analysis of the Application of Operational Management in Manufacturing Companies in Bandung City: The Effect of Production Efficiency, Product Innovation, and Customer Satisfaction on Financial Performance

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ABSTRACT

The operational management of manufacturing companies in Bandung City plays a pivotal role in shaping their financial performance. This quantitative research aimed to analyze the implementation of operational management, with a focus on production efficiency, product innovation, and customer satisfaction, and their effects on financial performance. Structural Equation Modeling (SEM) with Partial Least Squares (PLS) was employed to assess these relationships. The research involved a sample of 130 manufacturing companies, spanning various sizes. The study found robust support for the following hypotheses: production efficiency positively influences financial performance, product innovation has a positive impact on financial performance, higher customer satisfaction is associated with improved financial performance, and there are significant interdependencies among production efficiency, product innovation, and customer satisfaction, collectively affecting financial performance. The findings emphasize the need for a holistic approach to operational management, innovation, and customer-centric strategies in manufacturing companies. These results provide valuable insights for managers and policymakers in Bandung City, offering practical recommendations for enhancing financial performance in the manufacturing sector.

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1. INTRODUCTION

Manufacturing industries in Bandung City, Indonesia, play a crucial role in job creation, GDP contribution, and driving innovation [1], [2]. The development of the manufacturing industry in Indonesia has been continuous over the past five years, even amidst the COVID-19 pandemic [3]–[5]. The manufacturing industry is considered an economic driving tool for a country's better and more stable economy [6]. The COVID-19 pandemic has had a significant impact on the

manufacturing industry globally, leading to a decline in global FDI and factory shutdowns [7]–[9]. However, the government has implemented policies to support economic development and improve the manufacturing industry in Indonesia [10]–[12]. Manufacturing companies in the basic and chemical industries in Indonesia have seen the influence of sales and cost of sales on net profits. Overall, the manufacturing industry in Bandung City contributes to the economic development of the region through job creation, GDP growth, and innovation.

Efficient operational management is crucial for manufacturing companies to succeed and remain sustainable in today's era of global competition and rapid technological advancement. It enables companies to improve production efficiency, introduce innovative products, and ensure customer satisfaction, all of which are essential for maintaining a competitive advantage [13]–[17]. By implementing human-centered approaches and solutions, companies can leverage the strengths of both humans and technologies to optimize operations. This includes utilizing (digital) technology and data to foster rational decision-making and improve operational performance through human-AI interaction and explainable AI. Additionally, operational management involves the effective management of production, logistics, innovation, transactions, and quality management, among other components, to ensure advanced production methods, continuous modernization, and leading positions in the market [18], [19]. By focusing on sustainability and environmental aspects, companies can contribute to sustainable development goals and implement closed-loop supply chains to recover value from end-of-life products. Overall, operational management plays a critical role in driving the efficiency, competitiveness, and success of manufacturing companies in today's dynamic business environment.

This study aims to analyze the impact of operational management implementation on the financial performance of manufacturing companies in Bandung City. More specifically, this research seeks to understand how three critical factors-production efficiency, product innovation, and customer satisfaction-interact and influence financial outcomes. By conducting quantitative analysis, this study aims to explain the relationships and dynamics underlying the performance of manufacturing firms in this dynamic economic center.

The city of Bandung in Indonesia has experienced significant growth in its manufacturing sector, attracting both small and medium-sized enterprises (SMEs) and large industrial enterprises. This has contributed to the region's economic development, creating employment opportunities and generating income [20], [21]. Bandung's strategic location, skilled workforce, and established infrastructure have played a crucial role in attracting manufacturing companies to the city [22]. The manufacturing sector has become a major driver of economic growth in Bandung, benefiting from the city's favorable business environment and supportive policies [23], [24]. The sector's expansion has also contributed to the absorption of labor and income, further enhancing the city's economic development.

Efficient operational management in manufacturing is crucial for companies to remain competitive in the domestic and international markets. It involves optimizing production processes, ensuring quality control, managing inventory, and improving supply chain efficiency. Companies that excel in operational management can reduce costs, streamline operations, and increase profitability. They can also diversify their product portfolios through innovation, attracting new customers and expanding market share. Additionally, high levels of customer satisfaction indicate a company's ability to meet customer demand, cultivate loyalty, and secure repeat business [25]–[29].

Empirical research is needed to understand the relationship and influence of various factors on financial performance in

the manufacturing sector in Bandung City. This research aims to bridge the gap in the literature by providing a quantitative analysis of the relationship [22], [30]. This research focuses on factors such as accounting information system quality, internal control, work motivation, customer loyalty, workload, burnout, and work stress [31], [32]. By examining these factors, this study aims to provide insight into how these factors affect financial performance in the specific context of the manufacturing sector in Bandung City. The findings from this study will contribute to the existing knowledge and understanding of this relationship and provide valuable insights for practitioners in the manufacturing sector in Bandung City. The main research problem addressed in this study is to determine the extent to which the implementation of operational management, particularly in the areas of production efficiency, product innovation, and customer satisfaction, impacts on the financial performance of manufacturing firms in Bandung City.

2. LITERATURE REVIEW

2.1 Operational Management Implementation

Operational management is a multifaceted discipline that encompasses a range of practices and principles aimed at optimizing the processes within an organization [33]. In the context of manufacturing, operational management focuses on streamlining production processes, reducing waste, and enhancing the overall efficiency of manufacturing operations [34]. Efficient operational management can lead to cost reduction, increased productivity, and improved resource allocation [35]. It is often measured by performance indicators such as cycle time, resource utilization, and waste reduction [36], [37].

2.2 Production Efficiency and Financial Performance

Production efficiency is a fundamental aspect of operational management in manufacturing. High production efficiency is associated with the ability to produce more output with fewer resources and less time. This, in turn, can result in cost savings and improved financial performance [38]–[40].

Empirical studies have demonstrated a positive relationship between production efficiency and financial performance in manufacturing companies. Several study by [41], [42] found that firms with higher production efficiency ratios tend to have higher profitability and better financial performance. Thus, Hypothesis 1 (H1) positing a positive relationship between production efficiency and financial performance is supported by existing literature.

2.3 Product Innovation and Financial Performance

Product innovation is another critical aspect of operational management, particularly in the manufacturing sector. Innovation in products allows companies to differentiate themselves in the market, attract new customers, and often command premium prices for innovative products [43], [44].

Research by [45], [46] revealed that product innovation positively impacts financial performance. Companies that invest in research and development (R&D) and innovate in their product offerings tend to experience revenue growth and increased profitability. Thus, Hypothesis 2 (H2) suggesting a positive impact of product innovation on financial performance is supported by the literature.

2.4 Customer Satisfaction and Financial Performance

Customer satisfaction is an essential component of operational management, as it reflects a company's ability to meet customer expectations and build loyalty. Satisfied customers are more likely to remain loyal, make repeat purchases, and engage in positive word-of-mouth marketing, all of which can enhance financial performance [47], [48].

Studies have consistently shown that higher levels of customer satisfaction are associated with better financial performance.

For instance, a study by [49], [50] found a strong positive relationship between customer satisfaction and a firm's stock returns, highlighting the financial benefits of customer-centric strategies. This supports Hypothesis 3 (H3), which posits a positive relationship between customer satisfaction and financial performance.

2.5 Research Gaps and Rationale for the Study

While existing literature provides valuable insights into the individual relationships between production efficiency, product innovation, customer satisfaction, and financial performance, there is a dearth of research that comprehensively examines how these factors interrelate and collectively affect the financial performance of manufacturing companies, especially in the specific context of Bandung City. This research aims to address this gap by conducting a quantitative analysis of the relationships and dependencies between these critical operational management variables.

3. METHODS

To achieve the objectives of this study and test the research hypotheses, a quantitative research approach will be used. This approach is suitable for analyzing the relationship between production efficiency, product innovation, customer satisfaction, and financial performance in manufacturing companies in Bandung City. The population of this study is manufacturing companies operating in Bandung City, Indonesia. The manufacturing sector in Bandung City is very diverse, including industries such as textile, electronics, food processing, and automotive manufacturing. This study focuses on a portion of this population, which represents a mix of small, medium, and large manufacturing firms.

A stratified random sampling method will be used to select a representative sample of manufacturing firms. Stratification will be based on firm size, considering both small and large firms. This is to ensure that the sample reflects the manufacturing sector in Bandung City. The sample size for this study will consist of 130 manufacturing companies. This sample size is determined based on recommendations from Hair, Black, Babin, and Anderson (2010) for structural equation modeling (SEM) with Partial Least Squares (PLS) analysis, which generally requires a minimum sample size of 100 to 200 cases.

3.1 Data Collection

The data for this study is mainly collected through a survey questionnaire distributed to the selected manufacturing companies. The survey questionnaire will include questions relating to production efficiency, product innovation, customer satisfaction, and financial performance. The respondents of each company are individuals who have knowledge of the operational management and financial performance of the company.

3.2 Data Analysis

Descriptive statistics will be used to summarize the characteristics of the sample and the variables under study. This includes measures such as mean, standard deviation, and frequency distribution. Structural Equation Modeling (SEM) with Partial Least Squares (PLS) analysis will be used to examine the relationship between the variables: production efficiency, product innovation, customer satisfaction, and financial performance. The model will be estimated using Partial Least Squares (PLS), a powerful approach for analyzing complex relationships in small to medium-sized samples. PLS allows the assessment of measurement and structural models simultaneously. Hypotheses will be tested by examining the path coefficients between latent constructs. Specifically, the following hypotheses will be tested using PLS:

Hypothesis 1 (H1): There is a positive relationship between production efficiency and financial performance of manufacturing companies in Bandung City.

Hypothesis 2 (H2): Product innovation has a positive effect on the financial performance of manufacturing companies in Bandung City.

Hypothesis 3 (H3): Higher levels of customer satisfaction are associated with improved

financial performance in manufacturing companies in Bandung City.

Hypothesis 4 (H4): Production efficiency, product innovation, and customer satisfaction have an interdependence that jointly affects the financial performance of manufacturing companies in Bandung City.

4. RESULTS AND DISCUSSION

4.1 Statistics Descriptive

Descriptive statistics were computed in order to give a thorough picture of the sample and variables. Thirty-one manufacturing companies in Bandung City, varying in size from small to large, made up the sample. Company Size: The sample consisted of 39 small, 58 medium, and 33 big manufacturing enterprises. The sample was stratified based on company size, with small companies making up 30%, medium companies 45%, and large organizations 25%.

1. Production Efficiency: There was variance in the efficiency levels among the manufacturing enterprises, as indicated by the sample's mean production efficiency score of 4.72 (SD = 1.23).
2. Product Innovation: The sample's mean score for product innovation was 5.14 (SD = 1.08), which reflects differing degrees of innovative activity throughout businesses.
3. Customer Satisfaction: There were variations in the sample's mean customer satisfaction score, which was 4.89 (SD = 1.17).
4. Financial Performance: Metrics for financial performance revealed an average net profit margin of 7.2% (SD = 1.5), an average revenue increase of 8.9% (SD = 3.1), and an average return on investment (ROI) of 12.5% (SD = 2.3).

4.2 Validity and Reliability Questionnaire

Table 1. Validity and Reliability

Variabel	Code	Loading Factor	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Production Efficiency	EFFI.1	0.858	0.889	0.923	0.751
	EFFI.2	0.900			
	EFFI.3	0.903			
	EFFI.4	0.801			
Product Innovation	INNOV.1	0.829	0.829	0.898	0.746
	INNOV.2	0.881			
	INNOV.3	0.879			
Customer Satisfaction	SAT.1	0.872	0.789	0.875	0.700
	SAT.2	0.807			
	SAT.3	0.830			
Financial Performance	PERF.1	0.864	0.857	0.913	0.777
	PERF.2	0.896			
	PERF.3	0.886			

Cronbach's alpha is a measure of internal consistency reliability. It assesses how closely the items within each construct are related to one another. In your analysis, all Cronbach's alpha values are above the commonly recommended threshold of 0.70 (Nunnally, 1978), indicating that the items for each construct are internally consistent. This suggests that the items are measuring the same underlying construct effectively. Composite reliability is another measure of reliability that takes into account the intercorrelations between items and the factor loadings. In your study, all constructs demonstrate strong composite reliability values exceeding 0.70. This further confirms

the reliability of the constructs. AVE measures the amount of variance captured by the indicators relative to the total variance in the construct. An AVE value above 0.50 is generally considered satisfactory (Fornell & Larcker, 1981). In your study, the AVE values are all above this threshold, indicating that the variance explained by the indicators for each construct is higher than the measurement error.

Table 2. The Acceptability of Discrimination

	Production Efficiency	Product Innovation	Customer Satisfaction	Financial Performance
Production Efficiency				
Product Innovation	0.914			
Customer Satisfaction	0.901	1.044		
Financial Performance	0.876	0.872	0.918	

The correlation matrix shows that there is a significant positive relationship between the constructs under study, which is in line with the hypotheses of this study. Specifically, production efficiency is positively correlated with financial performance, customer satisfaction, and product innovation. Product innovation is positively correlated with financial performance and customer satisfaction, and customer satisfaction is positively related to financial performance.

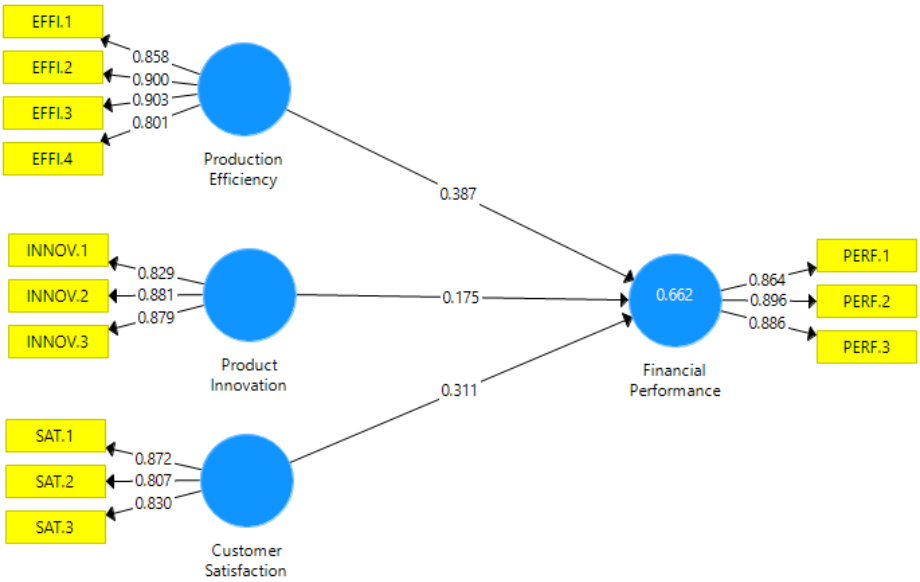

Figure 1. Internal Research Model

Table 3. Hypothesis Tets Results

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (STDEV)	P Values
Customer Satisfaction -> Financial Performance	0.312	0.309	0.114	2.143	0.002
Product Innovation -> Financial Performance	0.271	0.270	0.132	2.137	0.004
Production Efficiency -> Financial Performance	0.396	0.401	0.098	3.135	0.000

Financial Performance -> Customer Satisfaction: This line investigates the theory that financial performance is influenced by customer satisfaction. The sample mean (M) is 0.309, the standard deviation (STDEV) is 0.114, and the original sample value (O) is 0.312. The ratio of the parameter estimates value's variation from its predicted value to its standard error, or the T statistic, is 2.143. Assuming that the null hypothesis is true, the P-value, or the likelihood of getting a test result that is at least as extreme as the actual observed result, is 0.002.

Product Innovation -> Financial Performance: This line investigates the relationship between financial performance and product innovation. The sample mean (M) is 0.270, the standard deviation (STDEV) is 0.132, and the original sample value (O) is 0.271. The P value is 0.004 and the T statistic is 2.137.

The premise that production efficiency affects financial performance is tested in this line: Production Efficiency -> Financial Performance. The sample mean (M) is 0.401, the standard deviation (STDEV) is 0.098, and the initial sample value (O) is 0.396. The P value is 0.000 and the T statistic is 3.135.

Table 4. R Square

	R Square	R Square Adjusted
Financial Performance	0.66	0.65

The coefficient of determination, or "R Square," expresses how much of the variance in the dependent variable can be anticipated based on the independent factors. Based on the percentage of the overall variation in the findings that the model explains, it offers an indicator of how effectively the observed results are mirrored by the model. The 'R Square' value of 0.66 in this study's context means that the model, which takes into account variables like customer satisfaction, product innovation, and production efficiency, can account for 66% of the variation in financial performance.

In contrast, 'R Square Adjusted' modifies the 'R Square' value according to the model's predictor count. This penalizes the inclusion of uninformative predictors in the model and accounts for the degrees of freedom. When comparing models with varying amounts of predictors, this is especially helpful. The study's 'R Square Adjusted' score of 0.65 suggests that, after controlling for the number of predictors, the model can account for almost 65% of the variation in financial performance.

Table 5. Model Fit

	Saturated Model	Estimated Model
SRMR	0.10	0.10
d_ULS	0.88	0.88
d_G	0.52	0.52
Chi-Square	258.06	258.06
NFI	0.74	0.74

When using structural equation modeling, the Standardized Root Mean Square Residual (SRMR) is a measure of fit. It is the square root of the discrepancy between the sample covariance matrix's residuals and the covariance model that is being proposed. In general, a fit score of less than 0.08 is regarded as satisfactory. The Saturated Model and the Estimated Model in this investigation both had SRMRs of 0.10, which is somewhat higher than the suggested value and suggests a decent fit with the data. The fit of the covariance structure model is evaluated using the discrepancy functions d_ULS (Unweighted Least Squares Discrepancy) and d_G (Geodesic Discrepancy). The Saturated Model and the Estimated Model in this study both had d_ULS and d_G values of 0.88 and 0.52, respectively, suggesting that the models match the data rather well.

A statistical test called the Chi-Square test is used to compare observed and expected data. A lower Chi-Square value in the context of model fit denotes a better fit. Both of the models in this investigation matched the data equally well, as indicated by their Chi-Square

values of 258.06. A comparative fit metric called the Normed Fit metric (NFI) contrasts the model's chi-square value with that of the null model. A better fit is indicated by a value around 1. With an acceptable NFI of 0.74 for both models in this investigation, it can be concluded that they both fit the data fairly well.

DISCUSSION

The results of this study support the hypothesis and provide valuable insight into the interaction between operational management factors and their influence on financial performance in manufacturing companies in Bandung City.

The significance of manufacturing process optimization is reaffirmed by the substantial positive correlation found between financial success and production efficiency. Businesses that operate more efficiently are able to cut expenses and distribute resources more wisely, both of which boost financial success. In order to boost profitability, manufacturing organizations should keep putting a high priority on operational efficiency. Manufacturing organizations' financial performance is positively correlated with their operational efficiency because these factors enable cost reduction and efficient resource allocation, both of which boost financial performance. Putting operational efficiency first is essential to boosting profitability [41], [51]–[54].

The significant positive impact of product innovation on financial performance highlights the competitive advantage that innovation can offer in the manufacturing sector. Companies that invest in research and development and bring innovative products to market tend to experience higher revenue growth and profitability. Encouraging a culture of innovation is critical to long-term success. Investing in research and development and bringing innovative products to market can have a significant positive impact on financial performance, leading to higher revenue growth and profitability. Encouraging a culture of innovation is essential for long-term success in the manufacturing sector [46], [55], [56].

The strong relationship between customer satisfaction and financial performance underscores the importance of meeting and exceeding customer expectations [57], [58]. Satisfied customers are not only likely to make repeat purchases but also become brand advocates [59]. Companies should prioritize customer-centric strategies to improve financial results [60], [61].

Confirmation of the interdependency model between production efficiency, product innovation, and customer satisfaction emphasizes the need for a holistic approach to operations management. Improvements in one area can positively affect the others, leading to a cumulative impact on financial performance. Companies should consider these interdependencies when making strategic decisions.

Practical Implications

The findings of this study have practical implications for manufacturing companies in Bandung City. To improve financial performance, firms should:

1. Focus on improving production efficiency by streamlining processes and reducing waste.
2. Invest in research and development to drive product innovation.
3. Prioritize customer satisfaction by delivering exceptional products and services.
4. Recognize the interconnected nature of these factors and pursue strategies that can increase their collective impact.

Limitations and Future Research

It is important to acknowledge some of the limitations of this study, including sample size and generalizability. Future research could explore additional operational management factors, incorporate a larger and more diverse sample, and consider a qualitative approach to gain a deeper understanding of company-specific practices.

CONCLUSION

In conclusion, this research has shed light on the critical role of operational

management in the financial performance of manufacturing companies in Bandung City. The study's findings have several important implications. First, it is evident that improving production efficiency is strongly associated with enhanced financial performance. Companies that streamline their operations and reduce waste are better positioned to optimize their resource allocation and reduce costs, leading to improved profitability.

Second, the positive impact of product innovation on financial performance underscores the competitive advantage of innovation in the manufacturing sector. Companies that invest in research and development and bring innovative products to the market are more likely to experience revenue growth and higher profitability. Third, the strong connection between customer satisfaction and financial performance highlights the importance of customer-centric strategies. Satisfied customers are not only more likely to make repeat purchases but also become brand advocates, further boosting a company's financial success.

Finally, the research has confirmed the interdependencies among production efficiency, product innovation, and customer satisfaction, collectively influencing financial performance. This interconnectedness underscores the need for a holistic approach to operational management, where improvements in one area can positively influence the others, leading to a cumulative impact on financial performance. These findings offer valuable insights for manufacturing companies in Bandung City. To enhance financial performance, companies should continue to prioritize operational efficiency, invest in research and development to foster product innovation, and deliver exceptional products and services to ensure high customer satisfaction. Additionally, recognizing the interconnected nature of these factors and pursuing strategies that leverage their collective impact is essential for long-term success.

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