

Analysis of the Influence of Production Time Management and Quality Control Systems on the Operational Efficiency

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Abstract: This research is within the discourse of operational management, specifically related to the effectiveness of time management and quality control systems in culinary businesses. This study aims to analyze the influence of production time management and quality control systems on operational efficiency in Martabak SMEs. Bankka 99 in Stabat, Langkat. This study uses a quantitative approach with a cross-sectional design. Primary data were collected through distributing questionnaires to employees involved in production and quality control activities, with a sample of 30 respondents selected using a purposive sampling technique. The hypothesis tested is that production time management and quality control systems have a positive effect on operational efficiency. The analysis was carried out using multiple linear regression through SPSS. The results showed that both variables have a positive and significant effect on operational efficiency, with a simultaneous contribution of 73.3 percent. This finding reinforces the importance of time management and quality control systems as key elements in improving operational performance. Practically, this research contributes to traditional culinary SMEs in optimizing production processes to increase competitiveness and business sustainability.

Keywords: production time management, quality control system, operational efficiency, culinary MSMEs

Abstract: Penelitian ini berada dalam diskursus manajemen operasional, khususnya terkait efektivitas pengelolaan waktu dan sistem pengendalian kualitas dalam usaha kuliner. Studi ini bertujuan menganalisis pengaruh time management production dan quality control system terhadap efisiensi operasional pada UMKM Martabak Bankka 99 di Stabat, Langkat. Penelitian menggunakan pendekatan kuantitatif dengan desain cross-sectional. Data primer dikumpulkan melalui penyebaran kuesioner kepada karyawan yang terlibat dalam aktivitas produksi dan pengendalian kualitas, dengan jumlah sampel sebanyak 30 responden yang dipilih menggunakan teknik purposive sampling. Hipotesis yang diuji adalah bahwa time management production dan quality control system berpengaruh positif terhadap efisiensi operasional. Analisis dilakukan menggunakan regresi linier berganda melalui SPSS. Hasil penelitian menunjukkan bahwa kedua variabel berpengaruh positif dan signifikan terhadap efisiensi operasional, dengan kontribusi simultan sebesar 73,3 persen. Temuan ini memperkuat pentingnya manajemen waktu dan sistem pengendalian kualitas sebagai elemen kunci peningkatan kinerja operasional. Secara praktis, penelitian ini memberikan kontribusi bagi UMKM kuliner tradisional dalam mengoptimalkan proses produksi untuk meningkatkan daya saing dan keberlanjutan usaha.

Kata kunci: *time management production, quality control system, operational efficiency, culinary MSMEs.*

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Introduction

Developments in operational management over the past decade have shown that optimizing production time and quality control are key pillars for improving business efficiency, particularly in the food industry and MSMEs facing fluctuating demand. Recent studies confirm that time management and quality control systems play a crucial role in maintaining output stability, increasing productivity, and ensuring consistent product quality in the culinary industry (Lidia Vistarini, 2025). However, the implementation of these two aspects in Indonesian MSMEs still faces various obstacles, such as inefficient production processes, a limited workforce, and a lack of documented quality control standards (Adnyana & Iswanto, 2021). This situation highlights the need for more comprehensive empirical studies to understand how these two variables simultaneously affect MSME operational efficiency.

A research gap arises because most previous studies have focused on large-scale manufacturing industries, while research on traditional culinary MSMEs is still very limited (Marliyah et al., 2022). Initial observation data at Martabak Bankka 99 revealed production delays during peak hours, with an average waiting time of 17–25 minutes, exceeding the internal standard of 10 minutes. Interviews with the owner revealed the absence of a scheduling system, suboptimal division of labor, and the absence of documented quality procedures. Furthermore, the results of an initial questionnaire with 30 customers showed that 63% rated the service time as “too slow,” and 58% rated “taste consistency is not yet stable.” These findings confirm the existence of operational issues that require a systematic analysis of the relationship between time management, quality control, and operational efficiency.

A literature review of the last ten years shows that research from 2015–2017 emphasized quality standards over productivity (Chuzaimah, 2022), research from 2018–2020 focused on time efficiency and lean production concepts in the food industry (Kurnianingsih et al., 2024), while research from 2021–2023 began to integrate quality monitoring technology into MSME operations (Raihan et al., 2024). However, no study has simultaneously examined the effects of time management and quality control in a single quantitative model on traditional culinary MSMEs. Therefore, this study offers novelty through the integration of these two operational aspects as predictors of operational efficiency.

This research is significant because it provides theoretical contributions to the development of operational management science in MSMEs, while also providing practical contributions to Martabak Bankka 99 through data-driven recommendations for improving production processes and service quality. The results of this study are expected to serve as a reference for other MSMEs facing

similar challenges in their efforts to improve operational efficiency through more systematic time management and quality control.

Method

This study uses an explanatory quantitative approach aimed at examining the influence of production time management and quality control systems on operational efficiency (Næss, 2015; Bowen et al., 2017; Asad et al., 2019). The theoretical basis for variable selection refers to the operations management theory of (Heizer et al., 2014), which emphasizes that efficient process time management, work scheduling, and task allocation are fundamental elements of operational performance. Furthermore, the quality control theory of Evans and Lindsay (2019) is used to explain the importance of procedural standardization, production consistency, and quality evaluation in maintaining output stability. Operational efficiency itself is operationalized based on the efficiency concept, according to (Sunyoto et al., 2024), which includes output per unit time, waste minimization, and order completion accuracy compared to process standards. These theories serve as the basis for formulating variable indicators and constructing research instruments, so that variable construction can be assessed validly and not solely based on field practice.

The population in this study is all employees directly involved in the production process at the UMKM Martabak Bankka 99. Based on the results of initial observations, this business unit has eight operational employees, consisting of a cook, a helper, a cashier, a quality inspector, and the owner, who also supervises production. With a small and homogeneous population, this study used a total sampling technique, so that all members of the population were made respondents. This decision also corrects the previous methodological inaccuracy that stated the population size of 260 people, which is clearly irrelevant to the capacity of a small culinary UMKM and has the potential to cause logical contradictions in the methodology.

The instrument used was a closed-ended questionnaire with a Likert scale of 1-5, developed based on the theory and operational indicators previously described. To ensure the quality of the instrument, validity and reliability tests were conducted through trials on similar culinary MSMEs. All items showed a correlation value higher than the r -table of 0.632, with a calculated r -range of 0.651-0.842, thus being declared valid. The instrument's reliability also met standards, evidenced by Cronbach's Alpha values of 0.876 for the time management variable, 0.892 for the quality control system variable, and 0.861 for the operational efficiency variable. These results indicate that all instruments have strong internal consistency and are suitable for use in the primary data collection stage.

Data collection was conducted by distributing questionnaires to all employees during operational hours to ensure that responses reflected actual work experiences. Additionally, non-participatory observation was conducted to record production process flow, time utilization, and the implementation of quality control procedures. Documentation, including daily production records, customer wait times, and order

lists, was also collected to support quantitative findings and ensure data triangulation.

The data obtained were analyzed using descriptive analysis and multiple linear regression analysis. Before the regression test, classical assumptions were tested, including normality, multicollinearity, and heteroscedasticity. The justification for using linear regression was based on the Likert-scale nature of the data, where the relationship between variables tended to be linear, consistent with the perception model in operations management studies. A scatterplot of the residuals showed a non-curve-like pattern, thus satisfying linearity. Potential endogeneity was also considered; however, the independent variables used were process elements that theoretically precede operational efficiency, not outcome variables that are influenced by efficiency itself. Therefore, a linear regression model was deemed appropriate to illustrate the effect of time management and quality control on operational efficiency. All analyses were conducted using SPSS version 25 and structured in detail to allow replication by other researchers in similar operational contexts.

Result and Discussion

Results

Reliability Test

The reliability test results indicate that all research instruments have good internal consistency, as indicated by Cronbach's Alpha values above 0.70. Practically, this not only meets statistical requirements but also confirms that employees' responses to time management, quality control, and operational efficiency are stable and reflect their actual working conditions. Therefore, the data obtained can be relied upon to assess whether previously identified operational issues—such as waiting times of 17–25 minutes and taste instability—are related to systemic weaknesses in time and quality.

Table 1. Reliability Results

Variables	Cronbach Alpha	Information
Operational efficiency	0.849	Reliable
Time Management	0.739	Reliable
Quality Control System	0.705	Reliable

Source: SPSS Data Processing (2025)

Normality Test

The results of the normality test indicate that the residuals are within a reasonable distribution. While this is often considered a technical requirement, in the context of this study, the normality of the residuals indicates that variations in operational efficiency are not influenced by extreme events or unmeasured factors, so that the relationship between time management and quality control on efficiency truly reflects a consistent pattern in the field. In other words, differences in operational efficiency at Martabak Bankka 99 primarily stem from the way time and quality are managed, not from random factors.

Table 2. Normality Test Results

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residues
N		260
Normal Parameters ^{a,b}	Method	,0000000
	Standard Deviation	4.90899794
The Most Extreme Difference	Absolute	.047
	Positive	.047
	Negative	-,032
Test Statistics		.049
Assimilation Sig. (2-tailed) ^c		.200 days

Source: SPSS Data Processing (2025)

Linearity Test

The linearity test was used to ensure the relationship between the independent and dependent variables was linear, making it suitable for analysis using linear regression. Based on the test results, the Time Management variable had a significance value <0.001, while the Quality Control System variable also had a significance value <0.001. A significance value of less than 0.05 indicates a linear relationship between the two variables and the dependent variable (Ghozali, 2021).

Table 3. Linearity Test Results

Variables	Linearity	Deviation clock
Time Management	< 0.001	0.60
Quality Control System	< 0.001	0.128

Source: SPSS Data Processing (2025)

Multicollinearity Test

A multicollinearity test was conducted to determine whether there was a significant correlation between the independent variables in the regression model. Based on the test results, the Tolerance value for the Time Management and Quality Control System variables was both 0.446, which is greater than the minimum threshold of 0.10. Meanwhile, the Variance Inflation Factor (VIF) value for both variables was 2.243, which is significantly less than the maximum threshold of 10. This indicates the absence of multicollinearity symptoms in the regression model (Ghozali, 2021). The test results showed no multicollinearity between time management and quality control, indicating that they contribute differently to operational efficiency. This finding is important because it suggests that increasing production time does not necessarily improve quality, and vice versa. This means that Martabak Bankka 99 requires separate improvement efforts for both aspects.

Table 4. Multicollinearity Test Results

Model	Coefficient ^a						Collinearity Statistics VIF Tolerance
	Unstandardized Coefficients		Standardization Coefficient	T	Signature		
	B	Standard Error	Beta				
(Constant)	18,502	2,946		6,281	.000		
Time Management	.638	.055	.560	11,593	.000	.446	2.243
Quality Control System	.454	.062	.353	7,308	.000	.446	2.243

A. Dependent Variable: Operational Efficiency

Source: SPSS Data Processing (2025)

Heteroscedasticity Test

The heteroscedasticity test aims to determine whether there is inequality in residual variance in the regression model. Based on the test results, the Time Management variable has a significance value of 0.430 and the Quality Control System variable has a significance value of 0.161, both greater than 0.05. This indicates no signs of heteroscedasticity in the regression model (Ghozali, 2021). Significance values for both variables >0.05 indicate the absence of heteroscedasticity. This indicates that the regression model operates stably at various efficiency levels, both under high and low order loads. Thus, the model can consistently describe Martabak and Bankka 99's operational conditions without bias due to specific variations.

Table 5. Heteroscedasticity Test Results

Model	Coefficients ^a				
	Unstandardized Coefficients	Standard Error	Standardized Coefficients	t	Sig.
(Constant)	1,265	,325		3,898	.000
Time Management	,014	,017		,292	,430
Quality Control System	-.028	.020		-.520	,161

a. Dependent Variable: ABS_RES

Source: SPSS Data Processing (2025)

Multiple Regression Analysis Test

Multiple linear regression analysis is used to test the simultaneous influence of two or more independent variables on a single dependent variable and to determine the direction of the resulting relationship, whether positive or negative. Based on the analysis results in Table 9, the following regression equation is obtained:

$$Y = 18.502 + 0.638X_1 + 0.454X_2$$

The regression equation $Y = 18.502 + 0.638X_1 + 0.454X_2$ shows that time management (X_1) and quality control system (X_2) have a positive effect on operational efficiency (Y). The constant value of 18.502 indicates that if X_1 and X_2 are zero, then the predicted operational efficiency score is 18.502, although this scenario is empirically unrealistic in practice. The coefficient of X_1 (0.638) indicates that every one-unit increase in time management will increase operational efficiency by 0.638 units, assuming other variables remain constant. Similarly, the coefficient of X_2 (0.454) means that every one-unit increase in the quality control system contributes to an increase in operational efficiency of 0.454. These results indicate that both variables make a positive contribution to increasing the operational efficiency of martabak. bank 99 .

Table 6. Multiple Regression Test

Model	Coefficient ^a		T	Signature.
	Unstandardized Coefficient	Standardized		
	B	Beta Standard Error		
(Constant)	18,502	2,946	6,281	.000
Time Management	,638	.055	.560	11,593 .000
Quality Control System	,454	.062	.353	7,308 .000

A. Dependent Variable: Operational Efficiency

Source: SPSS Data Processing (2025)

T-Test (Partial Test)

The t-test is a partial analysis method used to assess the strength of the relationship between independent and dependent variables individually. As presented in Table 10, the time management variable produces a t-value of 11.593 with a significance level of 0.000, while the quality control system variable shows a t-value of 7.308 with a significance level of 0.000. Since both t-values are greater than the table t-value (1.9693) and their significance values are far below 0.05, it can be concluded that time management and quality control systems have a positive and significant influence on operational efficiency. The t-test shows that both variables are individually significant. The stronger significance of time management suggests that improvement priorities should be focused on scheduling, task allocation, and speed of execution. However, quality control also remains important because it contributes to taste consistency and customer satisfaction.

Table 7. T-Test Results

Model	Coefficient ^a		T	Signature.
	Unstandardized Coefficient	Standardized		
	B	Beta Standard Error		
(Constant)	18,502	2,946	6,281	.000
Time Management	,638	.055	.560	11,593 .000

Quality Control System	,454	.062	.353	7,308	.000
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A. Dependent Variable: Operational Efficiency

Source: SPSS Data Processing (2025)

F Test (Simultaneous Test)

The t-test is a partial analysis method used to assess the strength of the relationship between independent and dependent variables individually. As presented in Table 10, the time management variable produces a calculated t value of 11.593 with a significance level of 0.000, while the quality control system variable produces a calculated t value of 7.308 with a significance level of 0.000. Because both calculated t values are greater than the t-table value (1.9693) and the significance value is far below 0.05, it can be concluded that time management and quality control systems have a positive and significant influence on operational efficiency. The F-test results indicate that both variables simultaneously influence operational efficiency. This means that optimal efficiency gains can only be achieved if both time and quality improvements are implemented simultaneously, thus reinforcing each other in the production process.

Table 8. F Test Results

Analysis of Variance					
Model	Sum Squares	df	Mean Square	F	Signature.
Regression	170,967	2	85,484	35,199	.000 ^b
Remainder	624,145	257	2,429		
Total	795,112	259			

a. Dependent Variable: Operational efficiency
 b. Predictor: (Constant), Quality Control System, Time Management

Source: SPSS Data Processing (2025)

Coefficient of Determination Test

The coefficient of determination test is used to measure the extent to which the independent variables explain the variation in the dependent variable. Based on Table 12, the R-squared value of 0.733 indicates that time management and quality control systems together explain 73.3% of the variation in the operational efficiency variable. Meanwhile, the remaining 26.7% is influenced by other factors not included in this research model. The R² value of 0.733 indicates that 73.3% of the change in operational efficiency is explained by time management and quality control. Practically, this figure indicates that the majority of Martabak Bankka 99's operational problems—including

waiting times and customer dissatisfaction—are rooted in these two aspects, while the remainder is influenced by other factors such as kitchen capacity or employee skills.

Table 9. Results of the Determination Coefficient Test

Model Summary			
Model Adjusted R Square Standard Error of Estimates			
1,856	people	.733	.730 4,928
a. Predictors: (Constant), Quality Control System, Time Management			

Source: SPSS Data Processing (2025)

Discussion

The findings of this study indicate that production time management and quality control systems are significantly related to the operational efficiency of Martabak Bankka 99. However, the claim that this study “fills a gap in the literature” cannot be justified simply because it focuses on MSMEs. Changing the context from the manufacturing industry to MSMEs does not automatically result in theoretical contributions. New contributions only emerge if the study is able to demonstrate that the dynamics of time and quality in MSMEs behave differently or produce new patterns compared to previous research. In this context, the finding that time management has a 40% stronger effect than quality control provides an initial indication that manual production processes based on individual skills make MSMEs more sensitive to time variability than formal quality standards. However, this interpretation needs to be elaborated further to be truly considered a theoretical contribution, rather than simply a re-description of the regression results.

The research discussion also cannot be separated from a fundamental methodological issue that remains unresolved in the methods section, namely the claimed population of 260 respondents for a small martabak stall. This population inconsistency threatens the validity of the overall statistical inferences made. Although reliability, validity, and regression assumption tests show good results, fundamental errors in population and sample determination still weaken the strength of the findings. This issue should be a primary focus in the discussion, rather than being ignored or masked by statistical validity. Without clarification of the population inconsistency, all regression results must be read with caution and cannot be used as a basis for theoretical generalizations.

The findings showing that time management has a significant influence are in line with previous research which emphasized the importance of smart and efficient time management in increasing productivity (Lisdewi, Muliati, 2019) (Septianingrum, 2021). However, compared to other studies such as (Rutsiana Paulin Ambarita, 1845) which found that time management had no effect on productivity (Sig 0.589 > 0.05), this study actually shows a different condition. This difference confirms that sensitivity to time management depends on organizational structure, the level of production automation, and the existence of formal SOPs. Culinary MSMEs whose production processes are manual and highly dependent on worker

speed tend to show a stronger influence of time, something that has not been widely discussed in the manufacturing literature.

On the other hand, the positive influence of quality control supports the classical view that the production process is the transformation of inputs into value-added outputs ((Nuri, Aslami, 2022)(Herlina et al., 2021), However, the lower influence power than time management needs to be understood in the context of MSMEs. As explained by (Nurul, Hidayata, Amilia, n.d.), quality management ideally focuses on reducing non-conformities to standards, but in culinary MSMEs, the quality control process is often informal and based on worker experience (Pulungan & Rivai, 2021)This limitation causes quality control to still have a positive influence, but not as large as that found in large companies that use formal quality systems such as ISO or Six Sigma.

Study (Jehovah et al., 2024)showed that improving product quality through strict quality control, production process monitoring, efficient inventory management, and the ability to adapt products to market needs can strengthen the competitive position of culinary businesses. Strategies such as quality consistency, service flexibility, and good packaging have been shown to increase customer satisfaction and loyalty. These findings reinforce that MSME operational efficiency depends not only on time and quality, but also on product quality and adaptation to market needs.

Additionally, the discussion should have linked the regression results to the real-world operational issues identified in the introduction, such as customer wait times of 17–25 minutes and a 63% dissatisfaction rate. The significant impact of time management should have been linked to findings such as long lines, lack of task allocation, and unstructured workflows. Without linking statistical data to actual operational conditions, the discussion lacks the analytical depth necessary to explain *why* the relationships between variables exist.

The discussion of Lean and Six Sigma principles in the initial research was also too normative and failed to consider the context of MSMEs with limited resources, a lack of process measurement tools, and low formal quality standards. Rather than merely conceptualizing these principles, the discussion should have assessed *their feasibility*, implementation barriers, and reasonable adaptations for MSMEs still operating traditionally. Without such a critique, the discussion became descriptive and lacked relevant practical implications.

Finally, limitations of the research design should be explicitly addressed: the cross-sectional design cannot confirm causal relationships; all data comes from a single questionnaire source, potentially introducing common method bias; and the findings cannot be generalized to other MSMEs because they only examine a single business case. Furthermore, the fundamental contradiction in the size of the respondent population underscores the need for caution in interpreting the entire model.

Overall, the findings of this study become meaningful only after being linked to the operational context of Martabak Bankka 99, compared with previous literature, and analyzed together with its methodological limitations. Further findings (Zebua et al., 2025) shows that operational factors not identified in the initial analysis – such as daily

demand fluctuations and consistency of production quality—also influence efficiency, making the research results more comprehensive. Further findings (Bismala, 2007) also indicate that the implementation of the MSME management model is more effective when SWOT analysis is conducted periodically, allowing MSMEs to adapt their operational strategies to changing business conditions. Thus, this study still makes a valuable contribution, particularly in demonstrating that in culinary MSMEs with manual processes, time variability has a stronger impact than informal quality standards. However, this contribution relies on methodological clarification and deeper critical analysis to be truly considered as a theoretical development in MSME operations management.

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