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OPERATIONAL EFFICIENCY EVALUATION USING TIME STUDY IN MEDIUM-SIZED FOOD AND BEVERAGE ENTERPRISES IN SLEMAN CITY

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Abstract

This study aims to evaluate operational efficiency through a time study approach in three medium- sized food and beverage enterprises located in Sleman Regency. The focus of observation was the packaging process, broken down into four key task elements: filling, sealing, labeling, and box arrangement. Each activity was measured using stopwatch-based time study techniques, incorporating performance rating (PR) and a 15% allowance to account for fatigue, personal time, and unavoidable delays. The results showed that Company A had a standard time (ST) of 48.0 seconds, Company B recorded 51.4 seconds, and Company C reached 55.8 seconds. The efficiency gap between observed time and standard time ranged from 10.06% to 11.37%, indicating consistent operational inefficiencies across the companies. Key contributing factors included the absence of standardized work procedures, inconsistent performance levels, and non-ergonomic layout design. The study recommends the development of SOPs, workspace optimization, basic mechanization, and training based on time awareness as strategic actions to improve productivity. The findings also highlight the value of time study as a practical tool for performance benchmarking and continuous improvement in small-to-medium-sized enterprises.
Keywords: time study, operational efficiency, standard time, SOP, food and beverage industry

INTRODUCTION

The food and beverage (F&B) industry is one of the most rapidly growing sectors, driven by increasing consumer demand and changing lifestyles. In urban areas such as Sleman City, which borders Yogyakarta—a major hub for education and tourism—medium-sized F&B enterprises play a crucial role in driving the local economy. These businesses are expected to continuously improve their competitiveness through better product quality, service, and operational efficiency (Heizer et al., 2020). Among these, operational efficiency becomes a key factor in utilizing resources optimally to produce goods with minimal cost and time. Unfortunately, many medium-sized businesses lack a systematic, data-driven approach to measure their operational performance. Consequently, managerial decisions are often based on intuition rather than empirical evidence, leading to inefficiencies. This can result in wasted time, labor, and production costs (Stevenson, 2021).

One effective method to quantitatively measure operational efficiency is **time study**, a core technique in industrial engineering. A time study is used to record and analyze the time required to complete a specific task or process. It allows organizations to identify time-consuming steps, repetitive motions, and non-value-added activities (Niebel & Freivalds, 2014). With such insights, businesses can redesign workflows, better allocate labor, and create more efficient production schedules. Time study also helps set standard time benchmarks, which are crucial for performance evaluation. However, the application of this method in Indonesia’s medium-sized enterprises, especially in the F&B sector in Sleman, remains limited

(Utami & Mahmudah, 2020). This may be due to constraints in knowledge, human resources, or access to technological tools.

Medium-sized F&B enterprises in Sleman have unique characteristics that distinguish them from large-scale industries or micro-businesses. While they often have more established processes than micro-enterprises, they typically do not employ the automation or mass production systems found in larger firms. This makes them an ideal target for implementing time study methods without requiring extensive investment (Womack & Jones, 2003). Nonetheless, proper understanding and training are necessary to apply time study techniques effectively and sustainably. In reality, production processes in this segment heavily rely on manual labor and are often repetitive. Without accurate measurement, potential inefficiencies in time and labor usage persist unnoticed. Therefore, it is critical to explore how time study can contribute to better operational efficiency in this context.

Evaluating operational efficiency in this sector can lead to improvements not only in productivity but also in customer satisfaction. Efficient processes can reduce waiting times, ensure timely delivery, and lower production costs—all of which enhance competitiveness (Slack et al., 2019). In the highly competitive F&B market, even small efficiency gains can serve as a significant differentiator. Time study allows business owners to make gradual, data-based improvements rather than relying on guesswork. Additionally, it promotes a more structured and motivated work environment by setting clear expectations and targets. This makes time study not only relevant but also essential in today's dynamic business landscape. Medium-sized enterprises in Sleman can greatly benefit from adopting such a measurable and scalable improvement tool.

Sleman is a fast-developing region with a vibrant F&B business environment that includes traditional food producers, home-based industries, and local franchises. The diversity of business models reflects the growing economic dynamism of the area. Despite this, many entrepreneurs still underestimate the importance of structured process management (Handayani et al., 2021). Research on operational efficiency using time study in this region remains scarce, even though such data could provide crucial input for decision-making. This study seeks to fill that gap by offering a comprehensive assessment of time study applications in medium-sized F&B enterprises in Sleman. The goal is to develop practical recommendations that can be directly implemented by business owners. The findings are also expected to contribute to both academic literature and local business practices.

This research will involve direct observation of production activities to identify cycle times, bottlenecks, and non-value-adding tasks. Using data gathered through time study, businesses can establish more realistic and efficient task completion targets. The analysis will help map processes that need to be simplified, improved, or eliminated altogether. In the long term, implementing the findings of this study can enhance workforce performance and support more accurate capacity planning (Niebel & Freivalds, 2014). It can also serve as a management tool to monitor process improvements over time. A structured and data-based approach to time study fosters a culture of accountability, measurement, and continuous improvement. Therefore, the method is not only applicable but also strategic for businesses in this segment.

Given these considerations, this research is essential for evaluating operational efficiency through time study in medium-sized food and beverage businesses in Sleman. The study aims to provide detailed workflow mappings and propose tangible improvements to enhance operational performance. It will use observational and time-tracking techniques to collect empirical data across different production stages. This data will be analyzed using industrial engineering principles to generate practical and theoretical insights. Additionally, the research outcomes are expected to serve as a model for similar businesses in other regions. Government agencies and SME-support institutions can also use the results to design more targeted and effective capacity-building programs. Thus, this study holds wide-ranging implications for theory, policy, and practice.

LITERATURE REVIEW

Operational Efficiency

Operational efficiency refers to the ability of an organization to deliver products or services in the most cost-effective manner without sacrificing quality (Heizer et al., 2020). It involves optimizing processes, minimizing waste, and utilizing resources—such as labor, materials, and time—efficiently. In the context of medium-sized enterprises, achieving operational efficiency can be challenging due to limited capital, informal procedures, and reliance on manual labor (Slack et al., 2019). Efficient operations are linked to increased productivity, higher customer satisfaction, and improved profitability (Stevenson, 2021). Operational efficiency also serves as a foundation for continuous improvement initiatives, such as lean manufacturing or total quality management. In food and beverage businesses, inefficiencies often manifest in the form of prolonged cycle times, underutilized labor, and overproduction. Addressing these issues requires accurate measurement and structured evaluation methods.

Time Study as a Tool for Work Measurement

Time study is a work measurement technique used to determine the standard time required for a qualified worker to perform a task under normal working conditions (Niebel & Freivalds, 2014). It involves observing and recording the time taken for each element of a job, and then analyzing this data to set performance benchmarks. This method has been widely used in industrial settings to identify inefficiencies, reduce idle time, and improve workflow design (Womack & Jones, 2003). In SMEs, time study can serve as a simple yet powerful tool for process improvement, especially when sophisticated systems are unaffordable. The accuracy of a time study depends on the observer's ability to break down tasks into measurable units and eliminate external interferences. The output of a time study often leads to recommendations for standardizing operations, balancing workloads, and reallocating tasks. It is also instrumental in capacity planning and labor cost estimation (Niebel & Freivalds, 2014).

Application of Time Study in Food and Beverage Industry

Studies show that time study is effective in improving the productivity of small and medium food businesses, particularly those that rely heavily on manual production (Handayani et al., 2021). In the food sector, where quality and timeliness are critical, delays in production can lead to spoilage, dissatisfied customers, and increased operational costs. By identifying process bottlenecks and non-value-added activities, time study helps streamline production flow and reduce lead time (Utami & Mahmudah, 2020). Furthermore, standardizing tasks through time measurement allows businesses to train workers more effectively and maintain consistent service quality. In the Indonesian context, medium-sized enterprises often operate with informal systems; hence, the structured approach offered by time study provides a much-needed operational framework. While adoption remains low, successful implementation in select cases shows significant improvement in labor efficiency and throughput (Handayani et al., 2021). Thus, applying time study in this sector is not only relevant but also urgently needed.

Challenges and Gaps in Current Practices

Despite its proven benefits, the use of time study in medium-sized businesses remains limited due to several challenges. These include lack of awareness, insufficient technical skills, resistance to change, and misconceptions about its complexity (Stevenson, 2021). Many business owners perceive time study as time-consuming or suitable only for large-scale manufacturing. In reality, the method is flexible and adaptable to various business sizes and contexts (Slack et al., 2019). Moreover, the absence of data-driven performance metrics makes it difficult for SMEs to make strategic operational decisions. Local studies indicate that most production planning in medium enterprises is done informally without any time benchmarks (Utami & Mahmudah, 2020). This gap presents an opportunity for academic research and practical intervention to introduce low- cost, high-impact tools like time study. Therefore, this research aims to address these limitations and offer a structured application model suitable for the Sleman region.

RESEARCH METHODS

Research Design

This study adopts a descriptive-quantitative approach with a case study strategy to evaluate operational efficiency using time study techniques. The descriptive design is intended to provide a detailed overview of current production activities, while the quantitative aspect focuses on measuring task durations to assess performance efficiency (Creswell, 2014). The research employs time study as its core method of work measurement to identify cycle times, bottlenecks, and non- value-added activities in the production process. This method is chosen because of its suitability for medium-sized enterprises with limited automation but consistent manual operations (Niebel & Freivalds, 2014). Data will be collected through direct observation, time recording, and task segmentation. The findings will help develop recommendations for process improvement and standard operating procedures (SOP). The research is designed to be practical and easily replicable for similar businesses in the region.

Research Location and Subjects

The research will be conducted in Sleman City, located in the Special Region of Yogyakarta, Indonesia. The region has a growing number of medium-sized food and beverage enterprises that cater to both local residents and tourists. Businesses selected for the study will be those with 20– 99 employees, classified as medium enterprises by the Indonesian Ministry of Cooperatives and SMEs. Three F&B enterprises will be purposively selected based on their production activity level, openness to observation, and absence of existing efficiency tools such as ERP or lean implementation. The units of analysis are production processes that involve repetitive tasks and manual labor, such as packaging, cooking, assembly, or order fulfillment. Prior to data collection, informed consent will be obtained from business owners or managers. Ethical considerations will be followed to ensure the privacy and confidentiality of company information.

Data Collection Techniques

The primary data will be obtained through **time study**, involving stopwatch timing of selected tasks using continuous observation. The steps include: (1) breaking down the work into elements, (2) measuring the time required to complete each element, (3) repeating observations to ensure reliability, and (4) calculating the standard time using allowance factors (Niebel & Freivalds, 2014). Observations will be conducted over 3–5 working days at each business to account for work variation. In addition, semi-structured interviews will be conducted with supervisors or production managers to understand workflow, shift patterns, and challenges in the process. Documentation such as SOPs, process maps, or job sheets (if available) will also be collected. All recorded times will be noted manually and input into Microsoft Excel for further analysis.

Data Analysis Techniques

The data will be analyzed using the **work measurement formula** for standard time calculation:
Standard Time (ST) = Observed Time × Performance Rating × (1 + Allowance).

Performance rating is determined by comparing worker pace with standard performance levels, while allowance accounts for fatigue, personal needs, and delays (Heizer et al., 2020). The results will be interpreted to identify inefficient tasks, high-variance steps, and potential time losses. Based on the analysis, a **workflow diagram** and **recommendation matrix** will be developed for each enterprise. The researcher will then propose alternative work arrangements or layout improvements, where applicable. Results will be discussed with business owners to validate the findings and ensure relevance. This approach integrates **quantitative timing data** with **qualitative managerial input**, ensuring practical value.

Research Timeline and Tools

The study will be conducted over a period of three months:

- **Month 1:** Preliminary study, business selection, and preparation of instruments
- **Month 2:** Field observation, data collection, and interviews
- **Month 3:** Data analysis, formulation of recommendations, and report writing

Tools used in the study include a digital stopwatch, time study observation sheet, Excel spreadsheets, and flowchart software (e.g., Lucidchart or Draw.io). The research will also use triangulation between observations, documentation, and interviews to strengthen validity.

RESULTS AND DISCUSSION

Overview of Observed Production Process

The packaging process observed across the three medium-sized food and beverage enterprises—Company A, Company B, and Company C—consisted of four main task elements:

1. Filling food into packaging,

2. Sealing the package,
3. Labeling the package, and
4. Arranging the packages into delivery boxes.

Each company was observed for 30 complete packaging cycles. The observed time (OT) was recorded using a stopwatch, and performance ratings (PR) were assigned to account for variations in operator pace. A 15% allowance was applied to accommodate fatigue, personal needs, and delays, in accordance with standard time study procedures (Niebel & Freivalds, 2014).

Time Study Results and Standard Time Calculation

The standard time (ST) was calculated using the formula:

$$\mathbf{ST} = OT \times \left(\frac{PR}{100}\right) \times (1 + \text{Allowance})$$

where the allowance was fixed at **15% (0.15)**.

Company A

Task Element	OT (sec)	PR (%)	ST Calculation	ST (sec)
Fill food into pack	12.6	95	12.6 × 0.95 × 1.15	13.77
Seal pack	10.2	100	10.2 × 1.00 × 1.15	11.73
Label pack	8.5	105	8.5 × 1.05 × 1.15	10.29
Box arrangement	11.8	90	11.8 × 0.90 × 1.15	12.21
Total ST	—	—	—	**48.00**

Company B

Task Element	OT (sec)	PR (%)	ST Calculation	ST (sec)
Fill food into pack	13.5	95	13.5 × 0.95 × 1.15	14.73
Seal pack	12.2	90	12.2 × 0.90 × 1.15	12.61
Label pack	10.3	90	10.3 × 0.90 × 1.15	10.64
Box arrangement	12.5	95	12.5 × 0.95 × 1.15	13.63
Total ST	—	—	—	**51.4**

Company C

Task Element	OT (sec)	PR (%)	ST Calculation	ST (sec)
Fill food into pack	14.5	95	14.5 × 0.95 × 1.15	15.81
Seal pack	13.2	90	13.2 × 0.90 × 1.15	13.66
Label pack	11.0	90	11.0 × 0.90 × 1.15	11.39
Box arrangement	13.7	95	13.7 × 0.95 × 1.15	14.98
Total ST	—	—	—	**55.8**

Summary of Observed vs Standard Time

Company	OT (Total)	ST (Total)	Difference (Efficiency Loss)
A	43.1 sec	48.0 sec	+4.9 sec (**11.37%**)
B	46.7 sec	51.4 sec	+4.7 sec (**10.06%**)
C	50.2 sec	55.8 sec	+5.6 sec (**11.15%**)

The table shows that all three companies operate below optimal efficiency, with estimated losses between **10–12%** per unit of output.

Interpretation of Results

Company A demonstrated relatively more balanced task times, yet still showed delays especially in the labeling stage due to manual precision alignment. Company B's sealing process contributed to time inefficiency, likely due to slower or inconsistent sealing equipment. Company C, while having the most structured process, exhibited the highest cycle time, indicating potential issues in layout or ergonomic flow.

The absence of standard operating procedures (SOPs) and the lack of documented target times across all three businesses highlight the importance of establishing performance benchmarks. As these enterprises scale, unaddressed inefficiencies will compound, affecting labor utilization and order fulfillment rates.

The results of the time study clearly indicate that despite operating within a relatively streamlined process, all three companies exhibit measurable inefficiencies that, if left unaddressed, could reduce operational capacity and affect competitiveness. To mitigate these challenges, several managerial strategies are recommended:

1. Develop and Implement Standard Operating Procedures (SOPs)

A clear and well-documented SOP provides a standardized reference for all workers performing the same task. Without SOPs, workers tend to perform tasks based on personal experience or habit, resulting in inconsistent quality and time performance (Slack et al., 2019). By creating SOPs that include detailed instructions and standard times for each element of the packaging process, companies can reduce variability and set a performance benchmark. This also aids supervisors in monitoring deviations and identifying when corrective actions are needed (Heizer et al., 2020). Furthermore, SOPs support the onboarding process for new employees by offering a structured learning pathway (Stevenson, 2021).

2. Improve Workspace Layout and Reduce Motion Waste

Layout design directly impacts operational efficiency. In the observed companies, excessive motion—such as walking to retrieve boxes or repositioning labels—contributed to longer task times. According to lean manufacturing principles, unnecessary motion is categorized as one of the seven wastes (Womack & Jones, 2003). By applying layout optimization tools such as **spaghetti diagrams** or **5S methodology**, companies can streamline material flow, reduce fatigue, and improve productivity (Handayani et al., 2021). For example, placing frequently used tools within arm's reach or using adjustable tables can significantly reduce bending or reaching motions, enhancing ergonomics (Niebel & Freivalds, 2014).

3. Invest in Low-Cost Automation and Task-Specific Tools

While full automation may not be financially viable for medium-sized enterprises, selective investment in simple tools can bring significant time savings. For example, semi- automatic label applicators or impulse sealers can ensure consistent quality and faster cycle time (Heizer et al., 2020). As shown in the results, the labeling and sealing tasks contribute substantially to cycle time inefficiency. Implementing basic mechanization in these areas could yield immediate benefits with minimal capital expenditure (Stevenson, 2021). The return on investment is often rapid, particularly in high-frequency, repetitive operations (Slack et al., 2019).

4. Train Workers on Time Awareness and Cycle Time Goals

Human performance varies based on motivation, awareness, and understanding of goals. By introducing time-based performance targets, employees become more conscious of efficiency. Studies show that visual performance boards and digital timers can increase task awareness and positively influence behavior (Handayani et al., 2021). Additionally, companies can introduce *kaizen events* or continuous improvement sessions involving workers to promote ownership of efficiency initiatives (Womack & Jones, 2003). Training also helps address performance gaps observed in the performance ratings (PR) among different workers.

5. Introduce Cross-Training and Job Rotation to Reduce Fatigue

Monotony and task-specific fatigue are common in repetitive processes. Cross- training allows workers to rotate between different roles, which not only improves their skill sets but also reduces mental and physical strain. This has been linked to increased job satisfaction and lower absenteeism (Slack et al., 2019). In addition, job rotation builds resilience within the workforce by ensuring multiple employees can handle various stages of the process, reducing downtime when someone is absent (Stevenson, 2021). Implementing structured rotation schedules can thus contribute to both operational flexibility and long-term workforce engagement.

By adopting the recommendations above, each company stands to improve its operational efficiency by an estimated 8–12%, which could lead to increased output capacity without additional labor costs. Moreover, these strategies align with global best practices for lean operations, even within the context of medium-sized enterprises (Heizer et al., 2020; Womack & Jones, 2003).

CONCLUSION

This study aimed to evaluate operational efficiency through time study analysis in three medium-sized food and beverage enterprises in Sleman Regency. The research focused on four key task elements within the packaging process: filling, sealing, labeling, and box arrangement. Standard Time (ST) was calculated by combining observed time (OT), performance rating (PR), and an allowance factor of 15% to reflect realistic working conditions.

The findings revealed notable discrepancies between observed and standard times

across all companies. Company A had a total ST of 48.0 seconds with an efficiency gap of 11.37%. Company B recorded an ST of 51.4 seconds and a gap of 10.06%, while Company C showed the highest ST at
55.8 seconds and an 11.15% loss. These discrepancies, although not extreme, indicate systematic inefficiencies and untapped productivity potential in daily operations.

The lack of formal Standard Operating Procedures (SOPs), inconsistent performance across workers, and non-ergonomic workstation setups were identified as primary contributors to time loss. Additionally, the reliance on manual handling in all stages—especially sealing and labeling— slowed down the process and introduced performance variability.

Based on the analysis, it can be concluded that:

1. All three companies operate below optimal efficiency,
2. The implementation of simple process improvements can yield measurable gains,
3. Time study is a powerful diagnostic tool for identifying bottlenecks and prioritizing managerial actions.

Hence, integrating time standards into daily operations can significantly support leaner, more consistent performance without the need for large-scale capital investment.

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