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Cost efficiency analysis of logistics and warehouse business

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ABSTRACT

Cost efficiency is a key focus in various aspects of a company's operational activities, and the supply chain plays an important role in achieving this goal. To better understand how the supply chain may affect cost-effectiveness, this study examines just-in-time, total quality management, and performance measurement systems in the context of Kosambi Warehouse Area, Tangerang, which involves collecting primary and secondary data using a quantitative approach. A total of 138 respondents were selected using a simple random sampling technique. SPSS software was used to analyze the data. The findings demonstrate that just-in-time has a negative and significant effect on cost efficiency. However, total quality management has a positive and significant influence on cost efficiency. The performance measurement system has a positive and significant influence on cost efficiency.

1. Introduction

Transportation and warehousing companies in the industrial era 4.0 are dynamic, with intense competition (Belhadi, 2021). Increasing globalization and complex customer demands require innovative logistics management strategies. Therefore, companies need to introduce their best products and services to customers, reduce costs, and maximize operational performance (Khan, 2021). Based on data from the Central Bureau of Statistics for 2022, the growth rate of Gross Domestic Product (GDP) of the transportation and warehousing industry in Indonesia from 2022 to 2023 is the fastest-growing industry among other industries. This can lead to a hypercompetitive market characterized by the emergence of many new competitors. For this reason, the company must review the entire implemented system so that the company's operational processes can continue to run at the most efficient cost possible, one of which is to implement a supply chain strategy (Kumar, 2021).

Supply chain strategy consists of many aspects, one of which is just in time (JIT) (Karamouz et al., 2021). According to earlier studies by Hussein and Zayed (2021) and Haekal and Setiawan (2020), the purpose of JIT is to improve production performance by removing pointless expenses and activities. This allows businesses to aim for the lowest production costs,

while achieving greater productivity. A good supply chain strategy considers quality by implementing total quality management (TQM) (Chiarini, 2020). Chiarini (2020) and Abbas (2020) states that when a product is produced, and there are still defective products or not in accordance with established standards, these defects become a waste for the company because repair costs are needed; even if the goods have reached the hands of consumers, it will cause the company's reputation to become bad. For this reason, TQM is important to be applied to make costs efficient. A performance measurement system (PMS) must be put in place to support the execution of the supply chain strategy so that businesses and employees may use it as a benchmark; research (Giannakis et al., 2020) states that a company will have difficulty determining the good and bad performance of employees if a clear measurement system does not accompany it. Mapping data related to JIT, TQM, PMS, and cost efficiency (CE) is an important source of accurate information. To achieve this goal, a systematic approach using bibliometric analysis facilitated by Publish or Perish and VOS-Viewer is needed.

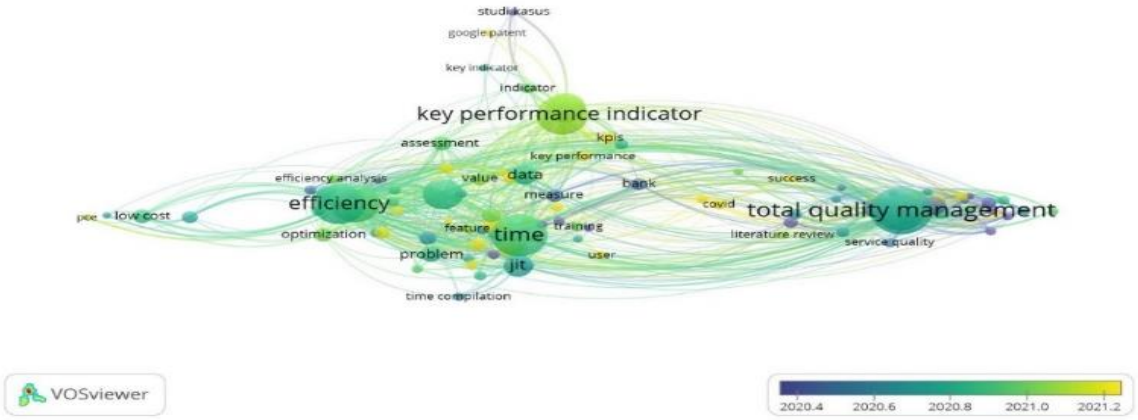

Figure 1. Topic Area Overlay Visualization Using VOS-Viewer

Based on the Figure 1, it shows the historical traces of previous studies where there are four clusters consisting of 110 items, which means that there is a relationship between one topic and another. This shows the trend and novelty of research with keywords that are often used: a comprehensive approach to quality management, time, efficiency, cost, and key performance indicators. In addition, there is a gap in previous research conducted by Khalfallah and Lakhal (2021), showing that JIT has a positive and significant effect in industrial manufacturing, while research conducted by Ye et al. (2022) shows that JIT has no effect. In addition to the topic of JIT, there is also a research gap for the topic of TQM and PMS, as indicated by Shafiq et al. (2019), who state that TQM has a positive and significant effect on organizational performance, while Msallam et al. (2020) show that TQM has no effect on employee performance. Furthermore, research on PMS conducted by Patrucco et al. (2021) mention that it has a significant effect, but research by Frederico et al. (2021) shows that the PMS is not significant. Therefore, this study is important to discuss JIT, TQM, and PMS in terms of CE.

2. Literature Review and Hypothesis Development

2.1. Literature Review

2.1.1. Supply Chain Strategy

Strategy is not just one choice or action; instead, it is a combination of choices and actions initiated by an organization or many organizations that work together (Lahane et al., 2020). Lambert and Cooper (2000), states that the supply chain is the process of suppliers providing products, services, and information that increase value for

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customers and stakeholders through the integration of business processes. The strategy itself can maximize the supply chain management prepared by a company. Therefore, the strategy must be able to facilitate the performance of all members who participate in it. This strategy can be used to design and develop new products or services, expand new factories or production facilities, implement just-in-time systems, reduce the number of suppliers, transfer inventory management responsibilities to third parties, and implement quality control systems and PMS (Frederico, 2020).

2.1.2. Just In Time

JIT is a system implemented by companies where the company's operational processes are carried out if there is a request from the customer (Tine et al., 2020). JIT, the main goal is to eliminate any activities at all levels of the company that do not add value (non-value-added activities) and maximize activities that can add value (added value) (Khalfallah & Lakhal, 2021). The following are indicators of JIT according to Khalfallah and Lakhal (2021). First, there is limited use of suppliers, which means that the selected suppliers are long-term partners who have signed a cooperation contract with the company, so these suppliers must be committed that the quality of the materials sent to the company is of high quality with timely delivery. Second, the minimum possible inventory was. Third, the layout of the factory allows cost savings by placing operational facilities in strategic locations. Fourth, set up time efficiency, how the setup time of all tools used can be as effective as possible so that there is not much time wasted. Fifth, in a quality control system, the company must receive raw materials from suppliers without any defects or rejects.

2.1.3. Total Quality Management

There is general agreement that implementing TQM is essential for achieving organizational success. TQM is an inescapable strategic and business growth instrument (Khalfallah & Lakhal, 2021). A method of continuous improvement known as TQM is a collection of procedures created to satisfy the needs and demands of both present and potential stakeholders and clients (Albloushi, 2023). The following are indicators of TQM according to Chiarini (2020). First, customer focus is an indicator of TQM because consumers are the end users of products or services. Therefore, satisfaction and feedback must be prioritized. Second, obsession with the quality that implements TQM in their management system will undoubtedly be obsessed with continuously improving quality in terms of products or services, resources, and others. Third, teamwork must be conducted at every level of the company to create an excellent working climate. Fourth, continuous improvement that needs to be done so that quality is maintained and continues to increase so that, later, it will form an organizational culture that is oriented towards improvement. Fifth, the controlled freedom of the company gives each employee the freedom to make decisions so that each employee has a sense of responsibility. Sixth, education and training so that there is no employee gap, and later, the company can compete with its competitors if it has quality human resources.

2.1.4. Performance Measurement System

For businesses to determine whether each employee's work plan is being implemented and whether their performance meets the company's objectives, performance measurement is crucial (Agarwal, 2021). Therefore, an accurate and measurable performance measure is required (Giannakis et al., 2020). The PMS itself can be defined as a company's process of measuring the performance of its employees with the aim of achieving the company's expected targets (Nudurupati et al., 2021). The

indicators of the PMS are adjustment to customer satisfaction, synchronize the measurement model with future customers, the causes of product or service errors were prevented, and minimized product errors (Karamouz et al., 2021).

2.1.5. Cost Efficiency

Cost is a crucial part of helping business activities achieve their goals. If the costs incurred have been appropriately determined, then CE will run in the organization (Abdurahimovna & Sultanbekovna, 2022). Quoted from research conducted by Sjödin et al. (2020), efficiency occurs if company inputs (time, cost, and energy) can be calculated and there is no loss or waste. Abdurahimovna and Sultanbekovna (2022) identified three indices of CE. First, direct material costs, which are the entire amount of money spent by the business on the acquisition of raw materials, as well as additional component costs, such as taxes, packing, transportation, and storage expenses. Second, direct labor costs are the total costs incurred by the company to pay wages and other benefits to company workers for the work they do. Third, overhead costs are the ongoing costs of running a business, excluding the direct costs associated with manufacturing a product.

2.2. Hypothesis Development

2.2.1. The Effect of Just In Time on Cost Efficiency

JIT is often interpreted as a method implemented in companies where the production process is only carried out when there is consumer demand (Liu & Nishi, 2020). Based on this, it is expected to have an impact on lower inventory costs, so that they can be transferred to other costs that have more value so that the company's CE can be achieved (Ye et al., 2022). In addition, the purpose of just-in-time itself is not to achieve inventory levels to 0 (zero), but only to reduce and minimize inventory in order to streamline the costs incurred due to storage (Balkhi et al., 2022). Previous research has stated that JIT has a positive effect on CE (Green et al., 2019; Khalfallah & Lakhal, 2021; Ye et al., 2022).

H_1: Just In Time Has a Positive Effect on Cost Efficiency

2.2.2. The Effect of Total Quality Management on Cost Efficiency

TQM can be interpreted as a customer-focused methodology that presents systematic changes and continuous improvement of all activities in companies that implement it (Alzoubi et al., 2022). TQM is also frequently understood as a framework that involves all parties engaged in the business and places high priority on quality as a business strategy that ultimately leads to customer loyalty (Phan et al., 2019). TQM can have an impact on a company's CE because if a company implements TQM properly, it is expected that unexpected costs such as reject costs and return costs due to quality can be avoided. There is no gap according to previous research by Elvina (2020), Abbas (2020), and Khalfallah and Lakhal (2021), which shows that TQM leads to considerable savings in operational costs.

H_2: Total Quality Management Has a Positive Effect on Cost Efficiency

2.2.3. The Effect of Performance Measurement System on Cost Efficiency

The PMS is the organization's capacity to measure how well workers perform, and meets company guidelines and continues to develop consistently over time (Kamble et al., 2020). The PMS can be used to produce and motivate workers or employees to work well in addition to evaluating them (Agarwal, 2021). According to Lopes and Martins (2021) the performance research system can streamline costs by setting employee performance targets so that activities within the company can run effectively. Previous

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research conducted by Patrucco et al. (2021) and Kraus et al. (2020) states that there is no gap indicating a positive impact of the measurement system method on cost effectiveness.

H_3: Performance Measurement System Has a Positive Effect on Cost Efficiency

2.3. Research Framework

Figure 2 illustrates the research framework. The purpose of this study is to determine the effect or relationship of JIT, TQM, and PMS on CE.

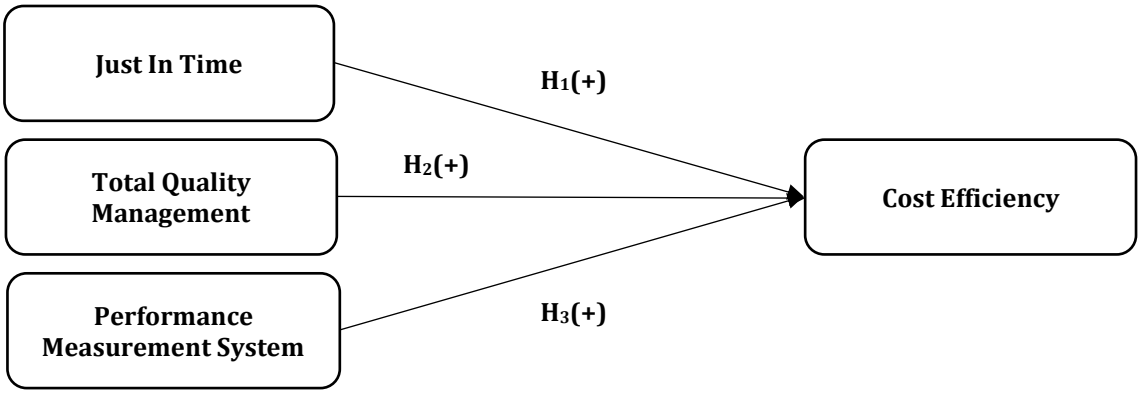

Figure 2. Research Framework

3. Research Method

3.1. Population and Sampling Method

Population is very closely related to the research study, so it allows the research study to be more targeted (Lohr, 2021). The researcher observes that the research object is a group of employees, including managers, supervisors, and heads of warehouse and transportation company departments located in the Kosambi Warehouse Area, Tangerang, which has 210 companies. A sample is part of a population that characterizes its characteristics (Sekaran, 2017). As a result, a portion of the population serves as a representative sample, which is meant to generalize to all populations. The researcher selected the following criteria for the sample: First, employees included managers, supervisors, operational departments, and distribution department. Second, the employee had been working in the company for more than one year. The sampling technique is a probability sampling technique. This technique is usually performed randomly but provides the same probability or opportunity for each sample (Sugiyono, 2019). To calculate the number of samples to be collected with a significance value of 5%, the researchers in this study utilized simple random sampling using the "Slovin" method. This yielded a sample of 138 respondents.

3.2. Data Collection Method

Both primary and secondary data sources were used in this study. All those who have been chosen are given questionnaires to complete in order to obtain primary data. This was done with the intention of obtaining responses from respondents as the data to be processed. After the questionnaire was completed based on the dimensions and indicators, it was distributed to respondents directly or indirectly. JIT contains five indicators according to Khalfallah and Lakhal (2021), TQM consists of six indicators based on Chiarini (2020), the PMS consists of four indicators according to Karamouz et al. (2021), and CE has three indicators based on Abdurahimovna and Sultanbekovna (2022).

3.3. Data Analysis Method

Validity testing is crucial to determine which research statements are true and which are not. The correlation between the number of assessment scores for each statement in the questionnaire and the total score was calculated to analyze the validity of each statement using the corrected item-total correlation method (Ewing & Park, 2020). The corrected item-total correlation method was applied to the validity test. The results of this test will produce output in the form of r_{count} to be compared with the numbers in the correlation table (r_{table}). If the value of r_{count} is greater than r_{table}, then the statements in the study are valid (Ewing & Park, 2020). Researchers conducting this test used a significance degree of 5%; therefore, if you look at the correlation table for a sample size of 138 samples, the r_{table} value is 0.140. Reliability testing refers to the Cronbach's alpha value in the tests conducted using SPSS. According to Sadriddinovich (2023), a reliable test has a Cronbach's alpha score greater than 0.6. Hypothesis testing is performed by comparing the p value with the significance coefficient by stating that the hypothesis is declared influential if the p value is smaller than the significance coefficient value. The p value used in this study is 5% (0.05), so the hypothesis is declared influential if the significance value is smaller than 0.05 (Damasceno, 2020).

4. Result and Discussion

4.1. Validity Test

Table 1. Validity Test Result

Indicator	Just In Time	Total Quality Management	Performance Measurement System	Cost Efficiency
JIT 1	0.300			
JIT 2	0.306			
JIT 3	0.196			
JIT 4	0.246			
JIT 5	0.261			
JIT 6	0.292			
JIT 7	0.330			
JIT 8	0.289			
JIT 9	0.335			
JIT 10	0.276			
JIT 11	0.411			
TQM 1		0.253		
TQM 2		0.229		
TQM 3		0.384		
TQM 4		0.213		
TQM 5		0.315		
TQM 6		0.436		
TQM 7		0.472		
TQM 8		0.495		
TQM 9		0.457		
TQM 10		0.418		
PMS 1			0.499	
PMS 2			0.491	
PMS 3			0.726	
PMS 4			0.523	
PMS 5			0.614	
CE 1				0.686
CE 2				0.608
CE 3				0.681

Source: Data Primary Processed

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Table 1 shows the results of the validity test using a questionnaire containing the statement indicators for each variable. The r_{count} value of each statement indicator of the JIT, TQM, PMS, and CE variables is greater than 0.140, so it is concluded that all statements in this study are valid.

4.2. Reliability Test

Table 2 shows the results of the reliability test on each variable. The statements in this test are declared reliable, this is evidenced by the Cronbach's alpha value of the JIT, TQM, PMS, and CE greater than 0.6.

Table 2. Reliability Test Result

Variable	Cronbach's Alpha
Just In Time	0.651
Total Quality Management	0.600
Performance Measurement System	0.623
Cost Efficiency	0.635

Source: Data Primary Processed

4.3. Hypothesis Test

Table 3 shows the results of hypothesis testing to determine the effect of JIT, TQM, and PMS on CE. Based on the results of the hypothesis test calculation, it can be seen that JIT does not have a positive effect on CE (the first hypothesis is rejected), TQM has a positive effect on CE (the second hypothesis is accepted), and the PMS has a positive effect on CE (the third hypothesis is accepted).

Table 3. Hypothesis Test Result

Model	Unstandardized Coefficient		Standardized Coefficient	t	Sig.
	B	Std. Error	Beta		
Just in Time → Cost Efficiency	-0.244	0.049	-0.374	-4.993	0.000
Total Quality Management → Cost Efficiency	0.156	0.039	0.298	3.991	0.000
Performance Measurement System → Cost Efficiency	0.167	0.055	0.226	3.041	0.003

Source: Data Primary Processed

4.4. Discussion

4.4.1. The Effect of Just In Time on Cost Efficiency

The first hypothesis testing shows that JIT has a negative influence on CE, which means that the time variable is not suitable when applied to the transportation and warehousing sector, especially in the Kosambi Warehouse Area in Tangerang. According to Zhou and Peng (2017), JIT is not suitable for application in the transportation and warehousing industry because of the limited infrastructure and inconsistency of rules in the field. This research finding is reinforced by previous research by Liao (2023) and Reddivari et al. (2019), which states that JIT is more suitable for industries with cluster

systems and industries with assembly process systems, such as the automotive, garment, and electronic assembly industries. For the transportation and warehousing industry, according to Ma et al. (2024) and Kula et al. (2022), a more appropriate measurement tool to assess CE is on-time delivery.

4.4.2. The Effect of Total Quality Time on Cost Efficiency

The second hypothesis shows that TQM has a positive effect on CE, which means that the higher the TQM implemented in a company, the higher the CE achieved. This is because TQM can help control costs by reducing product costs after repairs and unnecessary costs (Yusuf et al., 2022). In addition, in the transportation and logistics industry, TQM focuses on ensuring high-quality products and customer satisfaction by mentoring employees, focusing on the core of the company, developing staff through training and education, and continuously improving performance (Msallam et al., 2020). TQM can provide positive feedback, achieve customer satisfaction and operational efficiency, and reduce non-zero costs, such as returns, quality assurance, and product rejection (Chen et al., 2020). The results of this study are in line with previous research conducted by Elvina (2020), Abbas (2020), and Khalfallah and Lakhal (2021).

4.4.3. The Effect of Performance Measurement System on Cost Efficiency

The third hypothesis shows that the PMS has a positive effect on CE, which means that if the implementation of the PMS is more routine, CE will be greater. According to research conducted by Msallam et al. (2020) to measure employee satisfaction and performance, performance management systems in companies use indicators to assess various operational and strategic aspects, such as product quality, production efficiency, daily output, capacity utilization, production time, employee performance, absenteeism, and turnover rates. Each company has certain criteria related to these operational and strategic aspects, but they share the same CE goal. This is in line with the research conducted by Giannakis et al. (2020) and Nugroho et al. (2022), which shows that the research results are positive and significant.

5. Conclusion

This study aimed to determine whether JIT, TQM, and PMS substantially influence CE. The results showed that transportation and warehousing companies in the Kosambi Warehouse Area, Tangerang, became more financially efficient after implementing JIT, thus accepting the first hypothesis. This means that if the JIT value is lower, the CE will increase where the JIT value is lower, meaning that the time needed to complete the work is shorter. In addition, the second hypothesis is accepted, indicating that TQM significantly improves CE. Furthermore, the third hypothesis is supported, which indicates a significant increase in the CE generated by the PMS. According to the fourth accepted hypothesis, the last option is timely performance measurement and TQM significantly improves CE. Consequently, installing a more comprehensive TQM and performance monitoring system will increase CE. Researchers have provided the following recommendations that companies should consider while evaluating efficiency. This research can be developed by strengthening the independent variable, namely the variable of delivery accuracy on service performance in accordance with research from Ma et al. (2024) and Chi et al. (2020). Next, increase the number of respondents in the study to improve the accuracy of the results. Finally, we explore research objects other than companies in the transportation and warehouse sectors to compare the application of JIT, TQM, and PMS for CE in different industries.

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