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Supply Chain Optimization on Company Performance in Indonesia's Free Trade Zone, Batam City

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Abstract

Purpose: This study analyzes the influence of four key elements of supply chain management inventory, supplier relationships, delivery, and information technology on operational performance and firm performance among supplier companies in Indonesia's free trade zone, specifically Batam City. The research examines how internal resources contribute to efficiency, competitiveness, and overall business outcomes.

Methodology/approach: A quantitative approach was employed through questionnaires distributed to 253 respondents from supplier companies in Batam City. Purposive sampling was used based on criteria related to supply chain activities. Data were analyzed using SmartPLS.

Results/findings: The findings show that inventory, supplier relationships, delivery, and IT each have a positive and significant effect on operational and firm performance, with inventory management showing the strongest influence. Operational performance also positively affects firm performance, emphasizing the role of efficiency and reliability in achieving competitive advantage.

Conclusions: Effective inventory control, strong supplier collaboration, reliable delivery, and IT utilization significantly improve company performance, supporting operational efficiency, sustainability, and the strategic value of digital and integrated supply chain management.

Limitations: This study is limited to the free trade zone in Batam City and relies on self-reported data, which may introduce response bias. External factors such as policy, market conditions, and macroeconomic influences were not included.

Contribution: This research provides empirical evidence on the role of supply chain resources in enhancing performance and offers insights for managers and policymakers, reinforcing RBV theory in developing regions like Batam.

Keywords: *Firm Performance, Information Technology, Operational Performance, Supplier Relationship, Supply Chain Management*

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1. Introduction

Supply chains are strongly influenced by suppliers, particularly with regard to raw material quality, delivery accuracy, and the smooth distribution of final products (Abuzaid et al., 2024). Nevertheless, supplier firms continue to face significant challenges in achieving optimal firm performance (Onukwulu et al., 2025). One of the main performance-related issues faced by supplier companies is the mismatch between raw material specifications and customer requirements (Bieniek, 2025; Lin et al., 2024).

Such specification mismatches can directly affect inventory management. This occurs because non-conforming raw materials may be returned or improperly recorded in the system, resulting in inventory mismatches that disrupt the continuity of the production process (Sugiarto & Suprayitno, 2023). These discrepancies also reflect weak supplier relationship management, where poor relationships may lead to frequent supplier changes, resulting in variations in raw material quality and specifications, as well as decreased customer satisfaction (Widjaja & Darmawan, 2022). A related impact is observed in the delivery process, as specification mismatches also directly affect delivery performance. Returned goods or replacement requirements extend lead times and cause delivery delays to customers.

This situation creates inefficiencies within the supply chain and undermines the reliability of delivery services (Pramudita & Guslan, 2025). Furthermore, the integration of information systems in supply chain management has been proven to enhance visibility and coordination, enabling firms to respond more effectively to disruptions in production and distribution processes, including delays caused by raw material specification issues (Amira S, 2024). These conditions negatively affect operational performance by disrupting production flows, reducing efficiency, and lowering service reliability (Siregar et al., 2023). Firm performance also declines when supply chain quality management is not optimally implemented, as imbalances in quality, production processes, and customer service hinder the achievement of organizational performance objectives (Liu & Jiang, 2025).

This study is of particular interest because the four variables inventory, supplier relationship, delivery, and information technology are critical components that significantly influence firm performance. These variables are also key factors in building effective supply chain management systems (Prananta & Hidayat, 2024). However, empirical studies examining these four variables simultaneously within the context of Indonesia's free trade zones, particularly in Batam City, remain limited (Septriana & Zai, 2023). This limitation indicates a research gap in the form of the lack of a comprehensive model integrating inventory, supplier relationship, delivery, and information technology with operational performance and firm performance in strategic industrial regions such as Batam.

The uniqueness of this study lies in its focus on Batam as a free trade zone, the use of a more comprehensive variable model compared to previous studies, and the integration of the Resource-Based View (RBV) as the underlying theoretical perspective. This study offers theoretical novelty by strengthening the RBV framework through empirical evidence showing that four internal supply chain resources can directly contribute to improvements in operational performance and firm performance.

The research questions addressed in this study are as follows: (1) How do inventory, supplier relationship, delivery, and information technology affect the operational performance of supplier firms in Batam City? (2) How does operational performance influence firm performance? (3) Which variable has the most dominant effect in enhancing firm performance? Accordingly, the objectives of this study are to empirically analyze the effects of inventory, supplier relationship, delivery, and information technology on operational performance and firm performance; to identify the most dominant variable; and to strengthen the theoretical understanding of RBV in the context of supply chain management within Batam's free trade zone.

This study adopts a quantitative approach, with data collected through questionnaires distributed to supplier companies operating in the Batam region. The findings are expected to provide theoretical contributions by reinforcing the RBV framework in the supply chain context, as well as practical contributions by assisting firms in developing performance improvement strategies based on internal resources.

2. Literature Review and Hypothesis Development

2.1. Main Theoretical Framework

2.1.1. Resource-Based View (RBV)

This study is grounded in the Resource-Based View (RBV) approach, which posits that firm performance depends on the extent to which organizations are able to effectively manage and utilize their internal resources (Barney, 1991). Resources such as inventory management systems, delivery

systems, supplier relationship quality, and information technology infrastructure represent key elements that can create value and competitive differentiation for supplier firms. RBV argues that firms are more likely to achieve sustained performance improvement when these resources possess the characteristics of being valuable, rare, inimitable, and non-substitutable (VRIN) (Qin & Chen, 2022).

2.1.2. Supply Chain Management Theory

Supply Chain Management (SCM) theory explains that operational performance and firm performance are strongly influenced by the level of integration among supply chain actors, including suppliers, manufacturers, distributors, and customers. SCM emphasizes the importance of comprehensive coordination across procurement, inventory management, production processes, and product delivery to end customers. Such integration aims to minimize inefficiencies, reduce costs, and accelerate the flow of goods and information. According to (Simwa & Barasa, 2024) firms with strong supply chain integration tend to exhibit more stable operational processes, as they are better able to mitigate disruptions such as supply delays or excess inventory.

2.1.3. Technology Adoption Theory

Technology Adoption Theory focuses on how organizations accept, implement, and utilize technology to enhance operational effectiveness and productivity. In the supply chain context, information technology plays a critical role as a central enabler of data flows across divisions and among actors within logistics networks. The adoption of technologies such as Enterprise Resource Planning (ERP), big data analytics, the Internet of Things (IoT), and automation enables firms to monitor material flows in real time, reduce manual errors, and accelerate data-driven decision-making.

(Ali et al., 2024) emphasize that technology adoption shortens process cycle times, improves the accuracy of operational reporting, and enhances inventory management precision. Meanwhile, (Bueno et al., 2024) argue that structured digitalization strengthens supply chain integration by improving data transparency and visibility. In addition, (Adhi & Amaruddin, 2022) demonstrate that effective inter-organizational relationship management within supply chains positively contributes to strategic decision-making, particularly in sectors that require timeliness and distribution reliability.

2.2. Inventory and Operational Performance

Inventory refers to goods or resources held in stock. Based on inventory functions, four types of inventory management systems are commonly identified: service inventory, distribution inventory, manufacturing inventory, and retail inventory (Al-Momani et al., 2020). Effective inventory management minimizes holding costs and ensures smooth material flows, thereby contributing to improved operational performance. By maintaining optimal inventory levels, firms can reduce lead times, enhance process efficiency, and ensure product availability (Kansime, 2022). (Simwa & Barasa, 2024) found that inventory management techniques significantly improve operational performance, particularly in public sector organizations. Their findings indicate that appropriate inventory systems enhance operational efficiency, reduce waste, and improve service delivery.

H1: Inventory has a positive effect on operational performance.

2.3. Supplier Relationship and Operational Performance

Supplier relationship management is a critical factor in supporting smooth operational processes. Strong supplier relationships enable firms to ensure raw material availability and reduce issues such as delivery delays, thereby improving operational performance (Adhi & Amaruddin, 2022) (Latuconsina & Sariwating, 2020). (Sundari & Uripi, 2021) demonstrate that supplier relationships enhance operational performance across various industries. Firms with well-established supplier relationships are better positioned to respond quickly and efficiently to market changes (Laulita, 2021).

H2: Supplier relationship has a positive effect on operational performance.

2.4. Delivery and Operational Performance

Delivery management directly influences response time and customer satisfaction, making it a critical variable in supporting the hypothesis that delivery management positively affects operational performance. Prior studies suggest that delivery flexibility helps firms achieve competitive advantage

(Campo-Sierra et al., 2024 ; Holopainen). Effective delivery management ensures timely distribution and reliability, thereby strengthening operational performance.
H3: Delivery has a positive effect on operational performance.

2.5. Information Technology and Operational Performance
The use of information technology plays a significant role in improving operational performance by reducing human errors, accelerating production processes, and enhancing output quality (Ali et al., 2024). (Bueno et al., 2024) confirm that digitalization strengthens integration among operational divisions, increases transparency, and supports real-time data-driven decision-making, enabling firms to respond more rapidly to market changes. Moreover, modern technologies optimize resource utilization, accelerate processes, reduce costs, and enhance productivity (de Oliveira et al., 2024). Technologies developed collaboratively with suppliers and customers further improve supply chain coordination and operational efficiency (Pakkala et al., 2024; Vrakas et al., 2021).
H4: Information technology has a positive effect on operational performance.

2.6. Inventory and Firm Performance
Effective inventory management encompasses procurement planning, contract management, and supplier partnerships, enabling firms to ensure optimal availability of goods and materials. This not only supports operational efficiency but also positively affects firm performance (Acquah, 2024). Additionally, effective inventory management enables firms to innovate, maintain competitiveness, and improve overall performance through appropriate inventory strategies (Haque et al., 2024). By optimizing inventory levels and limiting excess stock, firms can allocate resources more efficiently, thereby enhancing profitability and operational efficiency. The implementation of Standard Operating Procedures (SOPs) and accounting systems in inventory management significantly influences firm performance. SOPs reduce inefficiencies and minimize recording errors, while accounting systems support more accurate inventory-related decision-making (R. R. Putra & Zefanya, 2022).
H5: Inventory has a positive effect on firm performance.

2.7. Supplier Relationship and Firm Performance
Transparent and collaborative supplier relationships enhance operational effectiveness and support faster, more accurate decision-making (Putra Permana, 2023). Trust, commitment, and effective supplier relationship management foster strong collaboration and long-term support, thereby contributing to improved firm performance (Shan et al., 2023). Long-term supplier relationships also provide access to sustainable and competitive resources, which are essential for achieving strategic objectives (Shebeshe & Sharma, 2024). Partnerships built through effective procurement planning and contract management have been shown to enhance firm performance (Acquah, 2024). Dengan demikian, A strong relationship with suppliers can be regarded as a critical factor in strengthening overall firm performance.
H6: Supplier relationship has a positive effect on firm performance.

2.8. Delivery and Firm Performance
Improvements in delivery management contribute positively to firm performance, particularly in logistics-intensive organizations. Effective delivery management enhances efficiency and customer satisfaction, which directly impacts firm performance. Efficient delivery systems ensure timely distribution at minimal cost, thereby supporting profitability and strengthening client relationships (Aćimović et al., 2022).

Supporting infrastructure for effective delivery management enables firms to increase service capacity, reduce delivery times, and lower logistics costs. Efficient infrastructure allows transportation firms to achieve more accurate distribution and better meet customer demand, improving overall firm performance in both financial and operational dimensions (Agnusdei et al., 2022).
H7: Delivery has a positive effect on firm performance.

2.9. Information Technology and Firm Performance

Information technology enhances firm performance by strengthening supply chain coordination, communication, and transparent information sharing between suppliers and customers (Putra Permana, 2023; Waqar et al., 2023). The adoption of technologies such as artificial intelligence (AI), big data, and the Internet of Things (IoT) illustrates how technology implementation creates competitive advantage and operational efficiency. AI and big data enable firms to analyze large volumes of information, supporting faster and more accurate decision-making (Oduro et al., 2023). Information technology capability, digital orientation, and digital transformation are critical determinants of optimal firm performance. Technologies that support digital leadership, data-driven decision-making, and quality improvement through cloud-based accounting systems clearly demonstrate that information technology not only enhances efficiency but also enables firms to adapt to market and technological changes (Barba-Sánchez et al., 2024; Hung et al., 2023).

H8: Information technology has a positive effect on firm performance.

2.10. Operational Performance and Company Performance

Operational performance plays a crucial role in determining firm performance, as it encompasses process efficiency, reliability, and responsiveness to business environment dynamics (Domenek et al., 2022). Enhanced operational capabilities significantly improve firm performance by enabling firms to address competitive challenges and create added value through quality improvement and continuous improvement initiatives (Battesini et al., 2021). (Phan et al., 2021) demonstrate that operational performance is positively correlated with firm performance, as observed in the hospitality sector in Vietnam. These improvements influence not only production processes but also financial and non-financial performance outcomes. Moreover, studies in the context of green supply chain management and business risk management reveal that improvements in operational performance such as compliance with environmental standards and risk reduction contribute significantly to firm performance (Abdallah & Al-Ghwayeen, 2020; Virglerova et al., 2022).

H9: Operational performance has a positive effect on firm performance.

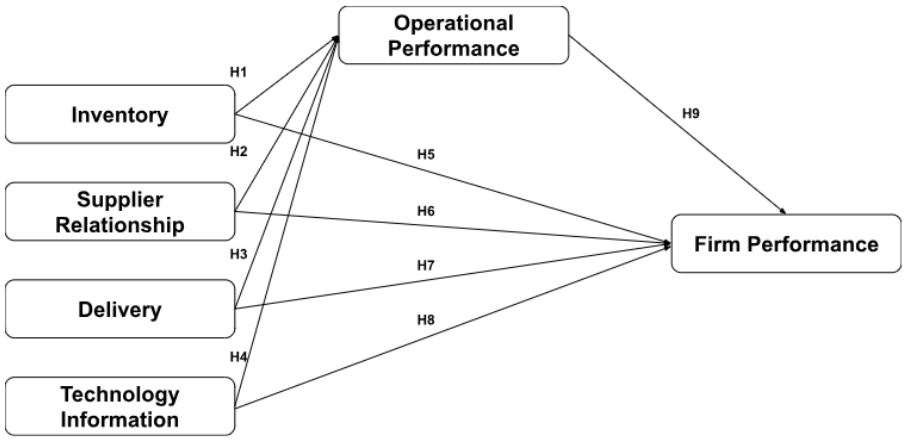

Figure 1. Research Model
Source: Authors' analysis (2025)

3. Research Methodology

This study employs a quantitative research approach, with the population consisting of supplier companies operating in Indonesia's free trade zone, specifically in Batam City. This approach is used to test theories, examine relationships among variables, explain statistical results, and establish empirical evidence (Sari et al., 2023). The sampling technique applied in this study is non-probability sampling, using a purposive sampling method in which respondents are selected based on specific criteria determined by the researcher (Stratton, 2023).

According to (Hair et al., 2011), the minimum required sample size should be at least ten times the number of formative indicators used to measure the constructs. With a total of 18 questionnaire items,

the minimum required sample size was 180 respondents. The respondent criteria included distributors, procurement officers, purchasing staff, general suppliers, agents, retailers, and resellers, as these groups are directly involved in supply chain activities and firm operational performance. A total of 180 valid responses were successfully collected. The questionnaires were distributed online using Google Forms. This study utilized a Likert-scale questionnaire as the research instrument, with a five-point scale ranging from 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, to 5 = Strongly Agree (Utari et al., 2023). Data collection was conducted between July and August 2025 and was carried out entirely online via Google Forms. The research location focused on supplier companies operating in Batam City.

The data were analyzed using the Partial Least Squares–Structural Equation Modeling (PLS-SEM) approach. PLS-SEM was selected because it is capable of estimating complex models, supports both reflective and formative measurement constructs, and is suitable for moderate sample sizes. Compared to alternative methods such as covariance-based SEM (CB-SEM), which requires normally distributed data and larger samples, PLS-SEM is more appropriate for exploratory and predictive research related to operational and firm performance.

The collected data were processed using the SmartPLS software to assess construct validity and reliability. All research procedures adhered to ethical research principles, including obtaining informed consent from respondents, ensuring the confidentiality of responses, and confirming that participation was voluntary and free from coercion.

3.1. Questionnaire

Table 1. Research Questionnaire Items

Variable	Indicator		Source
Inventory Management	INV1	The company's inventory is managed through policies and procedures to prevent stockouts	(Kansime, 2022)
	INV2	Inventory management in the company helps improve planning and scheduling.	
	INV3	Implemented inventory management practices reduce costs and improve cash flow and profitability.	
Supplier Relationship	SR1	The company's relationship with supply chain partners builds mutual trust.	(Shan et al., 2023)
	SR2	The company's relationship with supply chain partners encourages both parties to honor commitments.	
	SR3	The company's relationship with supply chain partners ensures the confidentiality of shared information.	
Delivery Performance	DE1	The company provides on-time delivery to customers.	(Campo-Sierra et al., 2024)
	DE2	The company is able to deliver products quickly or with short lead times.	
	DE3	The company provides reliable delivery services to customers.	
Information Technology	IT1	The company digitalizes various business processes whenever possible.	((Hung et al., 2023)
	IT2	The company collects large volumes of data from multiple sources.	
	IT3	The company strengthens the integration of business processes through digital technology.	
Information Technology	OP1	The company's sales growth and profitability have increased in recent years.	(Shebeshe & Sharma, 2024)
	OP2	The company has successfully increased its market share compared to competitors.	

	OP3	The company has achieved operational efficiency that contributes to cost savings.	
Firm Performance	FP1	Our company is more profitable than other companies.	(Abdul Wahab & Radmehr, 2024)
	FP2	Our company's sales growth exceeds that of other companies.	
	FP3	Overall, our company's performance is better than that of other companies.	

Source: Processed Primary Data (2025)

4. Results and Discussion

This study was analyzed based on several respondent characteristics and background information, including gender, age, job position, firm age, and monthly revenue. The questionnaire was distributed via Google Forms, resulting in data collected from a total of 253 respondents. Based on the data, male respondents numbered 127 (50.2%), while female respondents totaled 126 (49.8%), indicating a balanced gender distribution. In terms of age, the majority of respondents were within the 32–46 years age group (49%), followed by those aged 17–31 years (45.8%), with a small proportion aged 47–60 years (5.1%). This distribution indicates that most respondents belong to the productive age group.

Regarding job positions, the largest proportion of respondents came from the Purchasing division (20.2%), followed by Procurement (14.6%) and Vendors (11.1%). The smallest proportions were from Import (2.8%) and Supplier Relations (3.2%). With respect to firm age, most companies had been operating for 5–10 years (56.5%), followed by those operating for 11–15 years (33.2%). Only a small number of firms had been operating for less than 5 years (5.9%) or more than 15 years (4.3%).

In terms of monthly revenue, the majority of respondents reported revenues ranging from IDR 501 million to IDR 1 billion (79.8%), while 11.9% reported revenues below IDR 500 million, and 8.3% reported revenues above IDR 1 billion. Overall, these findings indicate that the respondents are predominantly individuals of productive age working in procurement and logistics-related roles, representing companies that have been operating for a considerable period and exhibit relatively stable revenue levels.

Table 2. Outer Model

Construct	Item	Convergent Validity (Outer Loading)	VIF	Discriminant Validity (AVE)	Composite Reliability	Cronbach Alpha	R Square
Inventory	INV1	0.932	3.907				
	INV2	0.910	3.323	0.875	0.955	0.930	
	INV3	0.964	4.469				
Supplier Relationship	SR1	0.911	2.758				
	SR2	0.882	2.378	0.821	0.932	0.891	
	SR3	0.924	2.852				
Delivery	DE1	0.918	3.261				
	DE2	0.933	3.169	0.862	0.949	0.921	
	DE3	0.934	3.985				
Information Technology	IT1	0.921	2.673				
	IT2	0.892	2.635	0.829	0.935	0.897	
	IT3	0.918	2.994				

Operational Performance	OP1	0.924	3.429				
	OP2	0.905	2.841	0.858	0.948	0.917	0.163
	OP3	0.950	4.275				
Firm Performance	FP1	0.907	2.661				
	FP2	0.899	2.561	0.825	0.934	0.894	0.606
	FP3	0.919	2.873				

Source: Processed Primary Data (2025)

The data obtained represent the outer loadings from the measurement model analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM). Based on the results presented in the outer loadings table, all indicators across constructs exhibit loading factor values above 0.60, ranging from 0.882 to 0.964. These results indicate that the indicators demonstrate strong convergent validity and adequately represent their respective constructs (Hair et al., 2024). High outer loading values suggest that the manifest variables contribute substantially to the latent variables being measured. Accordingly, the constructs of inventory, supplier relationship, delivery, information technology, operational performance, and firm performance can be considered empirically valid. Furthermore, the Average Variance Extracted (AVE) values for all constructs exceed 0.50, indicating that more than 50% of the variance in the indicators is explained by their latent constructs, thereby satisfying the criteria for convergent validity (Shrestha, 2021).

In addition, the Variance Inflation Factor (VIF) results range from 2.378 to 4.985, remaining below the recommended threshold of 5 as suggested by (Hair et al., 2011). This finding indicates the absence of serious multicollinearity issues among the indicators. According to Diamantopoulos and Siguaw (2006), VIF values exceeding **3.3** may signal potential high correlations among indicators; however, in this study, all VIF values remain within acceptable limits. Therefore, the measurement model can be considered free from multicollinearity, and each construct independently explains the measured variables.

The construct reliability test results show that the Composite Reliability values for all variables exceed 0.90, while Cronbach's Alpha values are above 0.85. These results indicate excellent internal consistency among the indicators (Munizu et al., 2020). This confirms that all measurement items exhibit a high level of reliability in capturing their respective constructs.

Table 3. HTMT

	Delivery	Firm Performance	Information Technology	Inventory	Operational Performance	Supplier Relationship
Delivery						
Firm Performance	0.460					
Information Technology	0.644	0.262				
Inventory	0.549	0.270	0.397			
Operational Performance	0.298	0.464	0.187	0.107		
Supplier Relationship	0.756	0.458	0.788	0.517	0.108	

Source: Processed Primary Data (2025)

The results of the Heterotrait–Monotrait Ratio of Correlations (HTMT) test indicate that the measurement model demonstrates adequate discriminant validity. The HTMT assessment is employed to ensure that each construct in the model represents a distinct concept and that no conceptual overlap exists among the latent variables. According to(Roemer et al., 2021) ideal HTMT values should be below 0.90 for theoretically distinct constructs and below 0.85 for constructs that are conceptually

closely related. This criterion is further supported by (Hasman, 2015) who states that HTMT values of ≤ 0.90 indicate the absence of discriminant validity issues in social and management research.

Based on the test results, all HTMT values in the model fall below the 0.90 threshold, such as the relationship between Inventory and Operational Performance (0.107), Information Technology and Firm Performance (0.262), and Supplier Relationship and Firm Performance (0.458). These values indicate that each construct is able to stand independently and that no excessive correlation exists among the variables.

Although several HTMT values are relatively high such as between Supplier Relationship and Information Technology (0.788) they remain within acceptable limits. This may be attributed to the interrelated nature of these variables in the supply chain management context, where effective supplier relationships are often supported by the use of information technology to facilitate coordination and communication. Nevertheless, the two constructs remain conceptually distinct: supplier relationship emphasizes trust and commitment, whereas information technology focuses on digital system integration to enhance process efficiency. Overall, these results confirm that the research model satisfies the criteria for discriminant validity, indicating that the constructs used in this study are empirically and theoretically valid.

Table 4. Inner Model

X-Y	t-statistic	p-value	Conclusion	Information
Inventory -> Operational Performance	4.896	0.000	Significant	H1 Accepted
Supplier Relationship -> Operational Performance	2.594	0.010	Significant	H2 Accepted
Delivery -> Operational Performance	5.546	0.000	Significant	H3 Accepted
Information Technology -> Operational Performance	2.078	0.038	Significant	H4 Accepted
Inventory -> Firm Performance	11.465	0.000	Significant	H5 Accepted
Supplier Relationship -> Firm Performance	6.800	0.000	Significant	H6 Accepted
Delivery -> Firm Performance	6.217	0.000	Significant	H7 Accepted
Information Technology -> Firm Performance	3.144	0.002	Significant	H8 Accepted
Operational Performance -> Firm Performance	6.730	0.000	Significant	H9 Accepted

Source: Processed Primary Data (2025)

4.1. Discussion

4.1.1. The Effect of Inventory on Operational Performance

The t-test results indicate that inventory has a positive and significant effect on operational performance, with a t-statistic of 4.896 and a p-value of 0.000; therefore, H1 is accepted. This finding implies that better inventory management leads to more optimal operational performance. This result is consistent with the findings of (Zahra et al., 2025) who emphasize that structured inventory management can enhance operational efficiency by preventing stock shortages or excess inventory and by utilizing technologies such as ERP systems and barcode systems to monitor inventory in real time. In addition, (Rahmana & Nursyamsiah, 2023) demonstrate that inventory management practices significantly affect operational performance, where reductions in excess inventory improve profitability and workflow efficiency.

Similar findings are reported by (Kumar & Santhosh, 2024) who explain that modern techniques such as Just-in-Time (JIT), demand forecasting, and inventory automation can reduce operational costs, increase productivity, and strengthen firm competitiveness. Thus, inventory management is proven to be a strategic factor in improving overall operational performance. Recent supply chain management studies further indicate that optimizing inventory management is a critical factor in enhancing

operational performance. This aligns with the view of (Bazyar & Abbasi, 2025) who argue that efficient multi-level supply chain planning can reduce uncertainty and improve operational accuracy.

4.1.2. The Effect of Supplier Relationship on Operational Performance

The test results show that supplier relationship has a positive and significant effect on operational performance, with a t-statistic of 2.594 and a p-value of 0.010; therefore, H2 is accepted. This indicates that stronger relationships between firms and suppliers lead to better operational performance. Strong collaborative relationships enable improved coordination, communication, and trust within the supply chain, thereby enhancing procurement and distribution efficiency. This finding is consistent with (Prananta & Hidayat, 2024) who state that strong supplier collaboration improves quality, reduces costs, and fosters innovation in the supply chain, (Haryanto & Arianto, 2024; Yamoah et al., 2022) find that supplier involvement in decision-making and financial support enhances operational flexibility and efficiency. The importance of supplier relationships is also emphasized in modern supply chain studies, where strategic collaboration is considered a key driver of operational excellence. (Mitiku & Nega, 2021) explain that strong supply chain integration improves information and material flows, thereby significantly enhancing operational performance.

4.1.3. The Effect of Delivery on Operational Performance

The t-test results indicate that delivery has a positive and significant effect on operational performance, with a t-statistic of 5.546 and a p-value of 0.000; therefore, H3 is accepted. This finding suggests that the better the delivery process or distribution service, the higher the operational efficiency and performance achieved. Fast, timely, and responsive delivery improves customer satisfaction, accelerates material flows, and reduces operational costs. This result is supported by (Ramadhan et al., 2022) who find that delivery significantly influences business performance, as timeliness and responsiveness to customer needs contribute to higher efficiency and customer satisfaction.

This result is further reinforced by (Syntia et al., 2020) who report that implementing appropriate delivery systems can improve operational efficiency by reducing process time by up to 81%, decreasing queues by 85%, and lowering costs by 60%. Accordingly, efficient and integrated delivery strategies play a vital role in enhancing overall operational performance. Other supply chain management studies also show that distribution efficiency is closely linked to competitive advantage. (Mbamalu et al., 2023) state that responsive and sustainable distribution management supports superior organizational performance.

4.1.4. The Effect of Information Technology on Operational Performance

The t-test results show that information technology has a positive and significant effect on operational performance, with a t-statistic of 2.078 and a p-value of 0.038; therefore, H4 is accepted. This indicates that higher levels of information technology implementation lead to greater efficiency and effectiveness in operational performance. Integrated information systems enable firms to accelerate decision-making, enhance productivity, and reduce human error in work processes. This finding is supported by (Leksono, et al., 2019) who report that information technology adoption has a direct impact on improving integrated, real-time data-based operational performance.

Similar results are found by (Shilamaya & Sisdianto, 2024) who show that information technology implementation at PT Pertamina significantly improves productivity, cost efficiency, and service quality. Additionally (Humaida et al., 2025) explain that well-planned information technology infrastructure strengthens service speed, operational efficiency, and competitiveness in transportation companies. Thus, information technology adoption is a strategic factor in strengthening operational performance. More broadly, information technology utilization is also considered a key enabler of adaptive and knowledge-based operational processes. As noted by (Torabi et al., 2025), technology-based knowledge management in supply chains enhances coordination and operational effectiveness.

4.1.5. The Effect of Inventory on Firm Performance

The t-test results indicate that inventory has a positive and significant effect on firm performance, with a t-statistic of 11.465 and a p-value of 0.000; therefore, H5 is accepted. This finding implies that more

effective inventory management leads to improved firm financial performance. Efficient inventory management allows firms to reduce holding costs, avoid stock shortages, and accelerate production and distribution cycles, thereby positively affecting profitability and firm value. This result is supported by (Srour & Marwa, 2021) who demonstrate that inventory management has a direct impact on firm performance.

Similar findings are reported by (Afrifa et al., 2021) who find that among all working capital components, inventory has the strongest influence on firm performance due to its sensitivity to profitability and efficiency. Moreover, (Laghari et al., 2023) confirm that cash flow and working capital management, including inventory control, significantly affect firm performance across various industries. Accordingly, effective inventory management is a strategic factor that strengthens firm performance and competitiveness. From a global supply chain perspective, inventory management effectiveness also contributes to organizational competitiveness. (Zahedi et al., 2020) emphasize that lean and agile supply chain implementation optimizes inventory and supports improved firm performance.

4.1.6. The Effect of Supplier Relationship on Firm Performance

The t-test results show that supplier relationship has a positive and significant effect on firm performance, with a t-statistic of 6.800 and a p-value of 0.000; therefore, H6 is accepted. This indicates that stronger collaboration between firms and suppliers leads to better firm performance. Well-established relationships enhance coordination, trust, and efficiency in production and distribution processes, resulting in improved profitability and competitiveness. This finding aligns with (Saragih et al., 2020) This finding emphasizes that relationships with suppliers have a direct influence on company performance through enhanced operational capabilities and strategic collaboration. These results are reinforced by (Tundunaung et al., 2021) who state that long-term collaboration and trust between companies and suppliers are proven to improve business performance by increasing efficiency, reducing conflict, and creating mutually beneficial strategic relationships. Therefore, strong partnerships with suppliers are a critical element in driving sustainable company performance.

4.1.7. The Effect of Delivery on Company Performance

The results of the t-test indicate that the delivery variable has a positive and significant effect on company performance, with a t-statistic value of 6.217 and a p-value of 0.000; thus, H7 is accepted. This means that the better and more efficient the company's delivery system, the higher the company's performance. Timeliness, speed, and reliability in the delivery process not only enhance operational efficiency but also strengthen customer trust, expand market share, and increase company profitability.

This finding is supported by (Surabaya, 2022) who explains that a company's ability to deliver products quickly, on time, and with minimal errors directly contributes to increased profitability, efficiency, and market share growth. Furthermore, a study by (Lulagala et al., 2023) on delivery cycle time shows that strong operational coordination among departments (production, purchasing, and marketing) can reduce delivery time and enhance a company's competitive advantage, thereby indirectly improving company performance. In addition, (Charles & Benson Ochieng, 2023) argue that service speed and effective logistics process integration are key elements of corporate strategy in achieving superior operational performance, particularly in highly competitive environments. Thus, efficient and integrated delivery management becomes a strategic factor in improving company performance and sustainability.

4.1.8. The Effect of Information Technology on Company Performance

The t-test results show that information technology has a positive and significant effect on company performance, with a t-statistic value of 3.144 and a p-value of 0.002; therefore, H8 is accepted. This indicates that the higher the level of information technology implementation in company operational activities, the better the company's performance. Information technology supports effectiveness and efficiency in decision-making, accelerates information flow, and enhances cross-functional and supply chain coordination, ultimately contributing to increased productivity and competitiveness. This finding is consistent with (Hautala-Kankaanpää, 2022) who explains that digitalization and the use of digital

platforms significantly improve supply chain capabilities and company performance through information integration and enhanced decision-making capacity. Similarly.

(Pasaribu et al., 2023) state that efficient information technology management can improve productivity and global company performance by strengthening competitive advantage and operational effectiveness. These results are further supported by (Rahayu et al., 2020) who emphasize that information technology capabilities play a crucial role in creating competitive advantage through a company's ability to manage and utilize technological resources to enhance performance and firm value. Therefore, investment in and effective management of information technology are strategic factors in improving company performance at both national and global levels.

4.1.9. The Effect of Operational Performance on Company Performance

The t-test results indicate that operational performance has a positive and significant effect on company performance, with a t-statistic value of 6.730 and a p-value of 0.000; thus, H9 is accepted. This implies that higher operational performance leads to better overall company performance in terms of efficiency, productivity, and profitability. Improved operational performance enables companies to optimize resources, shorten production lead times, and enhance service quality, which in turn positively affects financial performance and competitiveness.

This finding is in line with (Domenek et al., 2022) ho explain that operational capabilities play an important mediating role in the relationship between collaborative supply chain management and operational performance, with direct implications for overall company performance. Similarly, (Saragih et al., 2020) conclude that operational capabilities significantly enhance company performance through effective operational performance implementation. Consistent results are also reported by (Junius et al., 2020) who find that operational performance and good governance are essential components in strengthening the relationship between sustainability performance and firm market value. Therefore, improving operational performance not only affects internal efficiency but also enhances corporate reputation, investor trust, and long-term firm value.

Table 5. GoF Index

Average AVE	Average Adjusted R Square	GoF
0,845	0,374	0,561

Source: Processed Primary Data (2025)

The results of data processing using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach indicate that the Average Variance Extracted (AVE) value of 0.845 meets the criteria for convergent validity. According to Shrestha, (2021), an AVE value ≥ 0.50 indicates that a construct is able to explain more than half of the variance of its indicators, implying that the indicators within the model demonstrate strong internal consistency and good convergent validity.

Furthermore, the average Adjusted R-Square value of 0.374 suggests that the model has a sufficiently adequate level of explanatory power for the dependent variables. In regression analysis, the R^2 value represents the proportion of variance in the dependent variable that can be explained by the independent variables (Chicco et al., 2021). Moreover, the calculated Goodness of Fit (GoF) value of 0.561 was obtained using the formula $\sqrt{(AVE \times Adjusted\ R^2)}$. Based on (Putra, 2022) a GoF value greater than 0.36 indicates a high level of model fit or a large category. Therefore, the GoF value of 0.561 indicates that this research model demonstrates a strong level of fit and good overall quality, making it reliable for explaining the relationships among variables in the context of supply chain optimization in Batam City.

5. Conclusions

5.1. Conclusion

In synthesis, this study confirms that supply chain optimization serves as a strategic foundation for enhancing the performance of supplier companies in Batam City. The four key elements inventory

management, supplier relationships, delivery reliability, and the utilization of information technology are proven to significantly improve operational performance while also exerting a direct impact on overall firm performance. These findings reinforce the Resource-Based View (RBV) perspective by positioning internal supply chain resources as critical sources of competitive advantage, particularly in special economic zones such as Batam.

Accordingly, this study provides empirical evidence that the synergistic integration and management of these four elements are essential prerequisites for creating efficiency, resilience, and business competitiveness. The results offer clear practical contributions for MSMEs and industry practitioners by presenting a concrete framework that highlights fundamental supply chain aspects that should be prioritized to foster business growth and sustainability.

5.2. Recommendations

Based on the research findings, several recommendations can be proposed. First, MSME actors and company managers in Batam are encouraged to allocate resources toward adopting integrated information technology systems to enhance inventory data accuracy and improve coordination with suppliers. Second, the development of collaborative and long-term partnerships with key suppliers should be intensified to reduce material specification discrepancies and enhance delivery reliability. For future researchers, it is recommended to explore the influence of external factors, such as government policy dynamics and global market fluctuations, as well as to expand the scope of the study to more diverse industrial sectors in order to enrich perspectives on supply chain optimization.

5.3. Limitations and Future Research

This study has several limitations that should be acknowledged. First, the research was conducted solely on supplier companies in Batam City; therefore, the findings may not be generalizable to other regions or industrial sectors. Second, data collection was carried out through online questionnaires using a self-assessment approach, which may introduce respondent subjectivity bias. Third, the research variables were limited to four main factors inventory, supplier relationships, delivery, and information technology while external factors such as market conditions, government policies, and the macroeconomic environment were not included in the analytical model. In addition, this study employed a quantitative approach that was unable to explore in depth the qualitative dynamics of relationships among variables, such as behavioral factors, organizational culture, or the quality of collaboration within the supply chain.

Future research is recommended to expand the research object to other industrial sectors, such as manufacturing, logistics, or retail trade, as well as to other regions in Indonesia to obtain more comprehensive and comparable results across regions. Furthermore, a mixed-methods approach that combines quantitative and qualitative analyses may provide deeper insights into the mechanisms underlying relationships among variables in supply chain management. Future studies may also incorporate additional variables such as innovation, service quality, human resource capabilities, and environmental sustainability factors to enrich the research model. The application of advanced analytical methods, such as covariance-based structural equation modeling (SEM) or machine learning techniques, may also help examine the complexity of inter-variable relationships with higher accuracy.

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