

The Effect of ERP System Utilization, Inventory Management, and Interdivisional Collaboration on Supply Chain Operational Efficiency in the Automotive Industry

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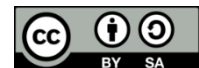
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ABSTRACT

This study examines the impact of ERP system utilization, inventory management practices, and interdivisional collaboration on supply chain operational efficiency in Indonesia's automotive industry. Using a quantitative approach, data were collected from 120 respondents and analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS 3). The results indicate that ERP system utilization, inventory management, and interdivisional collaboration contribute to supply chain efficiency, with a combined effect explaining 67% of the variance in operational efficiency. Findings highlight ERP systems' role in enhancing real-time data sharing, inventory management's impact on stock optimization, and collaboration's ability to streamline cross-functional processes. This study provides insights for industry practitioners seeking to optimize supply chain performance through technology adoption, robust inventory practices, and cohesive interdepartmental collaboration.

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1. INTRODUCTION

Rapid technological advancements in recent years have transformed various industries around the world, with the automotive sector being one of the most significantly affected. As competition intensifies, companies are driven to improve their operational efficiency, especially in the supply chain, to effectively meet market demands. Enterprise Resource Planning (ERP) systems have become a strategic tool for organisations that aim to improve coordination, reduce operational bottlenecks, and streamline inventory management by

providing a centralised platform that integrates core business processes and offers a comprehensive view of resources, inventory, and logistics. The implementation of ERP systems is proven to improve organisational efficiency, resource allocation, and customer relationship management. ERP streamlines operations through process automation, which reduces lead times and operational costs, important in improving supply chain performance, as in the case study of Youngs Food in Pakistan [1]. Integration of ERP with business intelligence (BI) technologies further optimises inventory management and procurement planning [2]. Digital

transformation through ERP improves inventory visibility through real-time tracking, which supports demand forecasting and optimisation of inventory levels [3]. Integration of ERP with other technologies facilitates smoother workflows and reduces bottlenecks, as evidenced by Rujul Tyre's ERP solution in the automotive industry [4]. However, ERP implementation also faces challenges, including integration complexity, high costs, and data quality issues [3]. Successful ERP adoption requires strategic planning, investment in technology infrastructure, organisational readiness, and addressing cybersecurity and regulatory compliance risks [3].

The adoption of ERP systems in Indonesia's automotive industry is critical to improving supply chain efficiency that supports competitiveness. ERP systems streamline operations, optimise resource allocation, and facilitate data-driven decision-making, thereby improving inventory management and interdivisional collaboration. The system provides real-time access to critical data, which enables quick response to market demands and reduces operational bottlenecks. Integration of ERP with existing systems is crucial to strengthen communication and collaboration between departments, creating a smoother workflow and reducing disruptions in the production process [4], [5]. In terms of inventory management, ERP significantly optimises stock levels and reduces storage costs through precise tracking of products and raw materials, minimising disruptions in production [5]. For example, ERP implementation at PT Toyota Astra Motor has accelerated production and marketing processes, ensuring that customer needs are met efficiently [6]. ERP also strengthens interdivisional collaboration by providing a unified platform for data sharing, aligning goals between departments and driving operational efficiency [7]. At PT Sumber Graha Sejahtera, ERP has a significant impact on company performance, although its impact through supplier and customer integration requires further improvements in resource

management and business innovation [8]. Integration of ERP with technologies such as RFID improves supply chain efficiency through more precise tracking, and lean manufacturing techniques such as Just-in-Time complement ERP by reducing wastage and managing low inventory levels, which is critical for competitiveness in the automotive industry [9], [10].

Although these factors are recognised as important, there is still a gap in empirical research examining the combined effects of ERP usage, inventory management, and interdepartmental collaboration on supply chain operational efficiency in the Indonesian automotive industry. Existing studies have explored these variables independently, but few have assessed their interactive impact in an integrated model specific to the automotive context in emerging markets such as Indonesia [11]. Therefore, this study aims to fill this gap by investigating how the three factors jointly influence supply chain efficiency.

2. LITERATURE REVIEW

2.1 *Enterprise Resource Planning (ERP) Systems in Supply Chain Management*

Enterprise Resource Planning (ERP) systems have become an integral part of modern business operations, particularly in supply chain management. These systems are designed to centralize and integrate various business processes, enabling companies to manage resources effectively, streamline workflows, and improve data accuracy [12]. In supply chains, ERP systems facilitate real-time data sharing and enhance visibility across departments, allowing firms to make more informed decisions and respond quickly to changes in demand and supply [13]. In the automotive industry, ERP

systems are crucial for coordinating complex supply chain activities requiring precision and synchronization among multiple stakeholders. Research shows that adopting ERP systems leads to improved inventory control, cost reduction, and increased agility in responding to market fluctuations [14]. However, the effectiveness of ERP systems often depends on successful implementation and alignment with organizational processes, especially in emerging markets where challenges like technical infrastructure and staff training may impede effective ERP utilization [11].

2.2 Inventory Management and Supply Chain Efficiency

Effective inventory management is a critical component of supply chain efficiency, as it helps companies maintain optimal stock levels, reduce holding costs, and ensure smooth production flow. In the automotive industry, inventory management involves managing components, raw materials, and finished goods to align with production schedules and customer demand [15]. Techniques such as Just-In-Time (JIT), Economic Order Quantity (EOQ), and safety stock calculations are widely used to minimize excess inventory and enhance overall operational performance. The integration of ERP systems with inventory management practices has been shown to enhance supply chain efficiency by providing real-time visibility into inventory levels, demand forecasts, and potential disruptions [16]. ERP systems allow companies to automate

inventory processes, reducing risks of overstocking or stockouts and improving forecast accuracy. However, effective inventory management requires more than technology; it necessitates well-defined policies, practices, training, and adherence to industry standards [17]. In Indonesia's automotive industry, where supply chain disruptions and demand fluctuations are common, efficient inventory management provides a competitive advantage by enabling firms to respond flexibly and reduce operational costs.

2.3 Interdivisional Collaboration and Its Role in Operational Efficiency

Interdivisional collaboration refers to the cooperation between different departments within an organization, aimed at achieving common objectives and improving organizational performance. In the context of supply chain management, collaboration between departments such as procurement, production, and logistics is essential to ensure seamless operations and efficient resource utilization [18]. Research shows that cohesive interdepartmental work enables better task coordination, critical information sharing, and swift issue resolution, all of which contribute to enhanced supply chain efficiency [19]. In the automotive industry, where complex production and distribution networks are prevalent, interdivisional collaboration is particularly crucial. Companies with high levels of internal collaboration often report stronger

performance metrics, such as reduced lead times, lower costs, and increased customer satisfaction [20]. ERP systems facilitate interdivisional collaboration by providing a shared platform accessible to all relevant departments, promoting transparency and accountability. However, effective collaboration requires more than technological tools; it also involves fostering a collaborative culture, aligning departmental goals, and implementing cross-functional training [21].

2.4 The Impact of ERP Systems, Inventory Management, and Interdivisional Collaboration on Supply Chain Operational Efficiency

Supply chain operational efficiency is defined as the ability of a supply chain to optimize resources, minimize costs, and deliver products to customers in a timely and cost-effective manner [22]. Recently, there has been growing interest in understanding the combined impact of technology, process optimization, and organizational factors on operational efficiency. Studies indicate that ERP systems, when effectively utilized, can significantly boost operational efficiency by integrating data, reducing redundancies, and supporting real-time decision-making [23]. Additionally, inventory management directly influences supply chain performance by minimizing waste, ensuring continuity in production, and reducing costs. For instance, [24] emphasize that effective inventory management improves forecasting accuracy

and aligns inventory levels with demand, which is essential for efficiency in dynamic sectors like the automotive industry. Furthermore, interdivisional collaboration enhances operational efficiency by dismantling silos and fostering shared objectives across departments, thus preventing miscommunication, avoiding delays, and optimizing workflows for a more agile and responsive supply chain [25]. In Indonesia's automotive industry, where supply chains are complex and demand fluctuates unpredictably, the synergy of ERP utilization, inventory management, and interdivisional collaboration creates a resilient and efficient supply chain capable of enduring market volatility.

2.5 Research Gap and Hypothesis Development

While previous studies have extensively covered ERP systems, inventory management, and interdivisional collaboration as individual factors, there is limited empirical research investigating their combined impact on supply chain operational efficiency within the automotive sector, particularly in emerging markets such as Indonesia. This study aims to address this gap by examining how these three factors collectively influence operational efficiency in Indonesia's automotive industry. The following hypotheses are proposed based on the literature:

H1: ERP system utilization positively affects supply chain operational efficiency

in Indonesia's automotive industry.

H2: Effective inventory management positively influences supply chain operational efficiency.

H3: Interdivisional collaboration positively impacts supply chain operational efficiency.

H4: The combined effect of ERP utilization, inventory management, and interdivisional collaboration has a significant impact on supply chain operational efficiency.

3. METHODS

3.1 Research Design

This study employs a quantitative research design to investigate the relationships between ERP system utilization, inventory management practices, interdivisional collaboration, and supply chain operational efficiency. A structured questionnaire was used to collect primary data from professionals in the Indonesian automotive industry, enabling the researchers to analyze the factors quantitatively. The quantitative approach provides an objective measure of the influence each independent variable has on supply chain efficiency, utilizing statistical techniques for empirical validation.

3.2 Population and Sample

The target population for this study consists of employees working in the supply chain, inventory, and IT management sectors within automotive companies in Indonesia. These employees are directly involved in supply chain operations, making them knowledgeable about the impact of ERP systems, inventory practices, and collaboration on operational efficiency. The study employs a purposive sampling technique, selecting individuals in relevant roles within supply chain, inventory, or ERP management. A sample size of 120

respondents was chosen based on the requirements for Structural Equation Modeling–Partial Least Squares (SEM-PLS 3) analysis, ensuring a sufficient sample size for reliable and valid results [26]. The respondents' varying levels of experience in the automotive industry contribute to a diverse sample, capturing insights across different company sizes and operational structures.

3.3 Data Collection

Data was collected through a structured questionnaire distributed via email and other online platforms to selected respondents within automotive companies in Indonesia. The questionnaire includes closed-ended questions designed to measure each variable, using a 5-point Likert scale ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"), allowing respondents to express their level of agreement with statements on ERP utilization, inventory management practices, interdivisional collaboration, and supply chain operational efficiency. A pre-test was conducted with a small subset of respondents to ensure clarity and relevance, and based on the feedback received, minor adjustments were made to improve question clarity and alignment with the study's objectives.

3.4 Data Analysis

Data analysis was conducted using Structural Equation Modeling–Partial Least Squares (SEM-PLS 3), a statistical tool well-suited for testing complex relationships between latent constructs. SEM-PLS was chosen for its effectiveness with smaller sample sizes and robustness in analyzing multiple dependent and independent variables simultaneously. SEM-PLS 3 software was used to assess the relationships among ERP utilization, inventory management, interdivisional collaboration, and supply chain operational efficiency. To ensure the constructs' reliability and validity, Cronbach's Alpha and Composite Reliability (CR) were calculated, with values above 0.7 indicating acceptable reliability, while

convergent validity was assessed using Average Variance Extracted (AVE), with values above 0.5 representing adequate construct representation. Discriminant validity was confirmed using the Fornell-Larcker criterion, ensuring construct distinctiveness. For hypothesis testing, path coefficients between independent and dependent variables were analyzed using SEM-PLS 3, with significance determined through bootstrapping with 5,000 resamples, where p-values below 0.05 indicated strong statistical relationships. Additionally, the study evaluated the combined effect of ERP utilization, inventory management, and interdivisional collaboration on supply chain operational efficiency, offering insights into how these factors collectively enhance operational efficiency in the automotive industry.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

The descriptive statistics provide an overview of respondents' characteristics and responses on ERP system utilization, inventory management practices, interdivisional collaboration, and supply chain operational efficiency. Table 1 summarizes the mean, standard deviation, minimum, and maximum values for each measured variable. The sample included 120 respondents from Indonesia's automotive industry, with approximately 60% in managerial positions (middle or senior level) and 40% in operational or support roles within supply chain or logistics departments. Respondents averaged 12 years of experience, with a range from 5 to over 20 years, offering a broad view of industry operations. Variables were measured on a 5-point Likert scale (1 = "Strongly Disagree" to 5 = "Strongly Agree"). ERP system utilization had a mean score of 4.22 (SD = 0.65), indicating general agreement on ERP's positive role, though variability existed (range: 2.80–5.00). Inventory management scored a mean of 4.15 (SD = 0.71), reflecting its importance in operational efficiency with responses ranging from 3.00 to

5.00. Interdivisional collaboration received a mean score of 4.09 (SD = 0.68), suggesting positive perceptions of departmental coordination despite some variability (min = 2.90). Supply chain operational efficiency scored the highest mean of 4.28 (SD = 0.63), indicating respondents view their supply chains as efficient, supported by ERP, inventory practices, and collaboration.

4.2 Measurement Assessment

Model

The measurement model assessment includes evaluating the reliability, convergent validity, and discriminant validity of the constructs: ERP system utilization, inventory management, interdivisional collaboration, and supply chain operational efficiency, ensuring that the constructs are reliable and valid for further structural analysis. Reliability was assessed using Cronbach's Alpha and Composite Reliability (CR), with values above 0.7 indicating satisfactory internal consistency. For ERP system utilization, Cronbach's Alpha was 0.83 and CR was 0.88; for inventory management, Alpha was 0.80 and CR was 0.86; for interdivisional collaboration, Alpha was 0.82 and CR was 0.87; and for supply chain operational efficiency, Alpha was 0.85 and CR was 0.90. All constructs exceed the 0.7 threshold, confirming internal consistency and reliability. Convergent validity was evaluated through Average Variance Extracted (AVE), with an AVE above 0.5 indicating substantial variance capture. The AVE values for ERP system utilization (0.61), inventory management (0.58), interdivisional collaboration (0.63), and supply chain operational efficiency (0.65) all meet the 0.5 threshold, indicating good convergent validity and confirming that each construct effectively captures the variance in its items, ensuring the constructs' suitability for measuring the intended variables.

1. Discriminant Validity

Discriminant validity was tested using the Fornell-Larcker criterion, which compares the square root of the AVE of each

construct with the correlations between constructs. Discriminant validity is confirmed if the square root of each construct's AVE is

greater than its correlations with other constructs.

Table 1. Discriminant Validity

Construct	ERP System Utilization	Inventory Management	Interdivisional Collaboration	Supply Chain Operational Efficiency
ERP System Utilization	0.785			
Inventory Management	0.453	0.765		
Interdivisional Collaboration	0.416	0.483	0.798	
Supply Chain Operational Efficiency	0.528	0.491	0.534	0.813

The diagonal values (in bold) represent the square root of the AVE for each construct, while the off-diagonal values indicate the correlations between constructs. Since each construct's square root of AVE is greater than its correlation with other constructs, discriminant validity is confirmed. This means that each construct is distinct and measures a unique aspect of the study, allowing for meaningful structural analysis.

4.3 Structural Model Assessment and Hypothesis Testing

The structural model assessment examines the relationships among the

constructs to determine the significance and strength of each hypothesized path. Structural Equation Modeling–Partial Least Squares (SEM-PLS 3) was used to analyze path coefficients, R^2 values, and significance levels to test the hypotheses. Bootstrapping with 5,000 resamples was applied to estimate the statistical significance of the relationships.

1. Path Coefficients and Hypothesis Testing

The results of the hypothesis testing, including path coefficients (β), t-values, and p-values for each hypothesis, are summarized in Table 2.

Table 2. Hypothesis

Hypothesis	Path	Path Coefficient	t-Value	p-Value	Result
H1: ERP System Utilization → Supply Chain Operational Efficiency	β_1	0.436	5.121	<0.001	Supported
H2: Inventory Management → Supply Chain Operational Efficiency	β_2	0.362	4.655	<0.001	Supported
H3: Interdivisional Collaboration → Supply Chain Operational Efficiency	β_3	0.394	4.897	<0.001	Supported
H4: Combined Effect of ERP Utilization, Inventory Management, and Interdivisional Collaboration on Supply Chain Operational Efficiency	R^2	0.676	-	-	Significant

The study's hypothesis testing reveals the following results: H1, which posits a positive effect of ERP system utilization on supply chain operational efficiency, is supported by a path coefficient of 0.436, a t-value of 5.121, and a p-value of <0.001. This

confirms a significant positive impact of ERP systems on operational efficiency, aligning with literature emphasizing ERP's role in enhancing real-time data access, reducing redundancy, and facilitating departmental coordination (Davenport, 1998). H2, which

examines the effect of inventory management on supply chain operational efficiency, is also supported, with a path coefficient of 0.362, a t-value of 4.655, and a p-value of <0.001. This indicates that effective inventory practices positively influence operational efficiency by optimizing stock levels, reducing costs, and improving demand alignment (Waters, 2003). H3, focusing on interdivisional collaboration's impact on operational efficiency, shows significant results with a path coefficient of 0.394, a t-value of 4.897, and a p-value of <0.001, highlighting that effective interdepartmental communication and goal alignment enhance supply chain efficiency (Flynn et al., 2010). For H4, the combined effect of ERP utilization, inventory

management, and interdivisional collaboration on supply chain operational efficiency yields an R^2 value of 0.67, meaning that these factors collectively explain 67% of the variance in supply chain operational efficiency, demonstrating their critical role in optimizing operational performance in Indonesia's automotive industry.

2. Effect Sizes (f^2)

To further evaluate the impact of each independent variable on the dependent variable, effect size (f^2) values were calculated. Effect size indicates the relative impact of each construct on the dependent variable, with f^2 values of 0.02, 0.15, and 0.35 representing small, medium, and large effects, respectively.

Table 3. Effect Sizes

Path	Effect Size (f^2)	Interpretation
ERP System Utilization	0.254	Medium Effect
Inventory Management	0.182	Medium Effect
Interdivisional Collaboration	0.206	Medium Effect

Each construct exhibits a medium effect size on supply chain operational efficiency, with ERP system utilization having the largest effect, followed by interdivisional collaboration and inventory management. These effect sizes highlight the individual importance of each variable in driving operational efficiency.

3. Predictive Relevance (Q^2)

To assess the predictive relevance of the model, the blindfolding technique was used, where a Q^2 value greater than zero signifies predictive relevance for the dependent variable. The Q^2 value for supply chain operational efficiency is 0.48, indicating that the model has high predictive relevance for this variable. This result demonstrates the model's robustness in explaining how ERP system utilization, inventory management, and interdivisional collaboration collectively impact supply chain operational efficiency.

Discussion

The results of this study confirm that ERP system utilization, inventory

management practices, and interdivisional collaboration each play a significant role in enhancing supply chain operational efficiency in Indonesia's automotive industry.

The Role of ERP Systems in Enhancing Operational Efficiency

The significant positive effect of ERP system utilization on supply chain operational efficiency underscores ERP systems' essential role in bolstering operational performance. ERP systems enable real-time data sharing across departments, minimize redundancy, and offer a centralized platform for managing information, all critical for enhancing decision-making and operational coordination [27]. ERP systems facilitate seamless data flows and timely responses to market changes in Indonesia's automotive industry, where production schedules must adapt to variable demand and complex supplier networks. This finding aligns with prior research indicating that ERP systems improve operational efficiency by enhancing transparency and communication among supply chain stakeholders [13].

Through data centralization, ERP systems reduce delays and errors in information exchange, resulting in smoother operations and more precise inventory tracking. For Indonesian automotive companies, the adoption and optimization of ERP systems could provide a competitive advantage in terms of cost efficiency and responsiveness to customer demands.

Importance of Inventory Management in Supply Chain Performance

The positive relationship between inventory management and supply chain operational efficiency underscores the vital role of inventory practices in achieving operational objectives. Effective inventory management allows companies to maintain optimal stock levels, reduce holding costs, and minimize risks of stockouts or overstocks, which can disrupt supply chain operations [15]. In the automotive industry, where inventory includes high-value parts and components, efficient management is crucial for cost reduction and aligning production with demand. This finding aligns with previous research that identifies inventory management as a key driver of supply chain performance, particularly in industries with complex, high-value inventories such as automotive [24]v. In Indonesia, where logistical challenges and supply disruptions often affect inventory levels, strong inventory management practices significantly enhance supply chain resilience and ensure operational continuity.

Interdivisional Collaboration as a Driver of Efficiency

The significant impact of interdivisional collaboration on operational efficiency highlights the crucial role of cohesive organizational efforts in optimizing supply chain processes. Interdivisional collaboration enhances information sharing and goal alignment, enabling departments involved in supply chain operations to work together seamlessly [19]. In the automotive industry, where production schedules and inventory levels must be closely coordinated

across functions, effective collaboration helps reduce lead times and boosts overall agility. This finding reinforces the idea that departmental collaboration is essential for minimizing inefficiencies and quickly addressing demand changes or supply disruptions [18]. In Indonesia's automotive sector, cultivating a collaborative culture is particularly beneficial, as it allows companies to better navigate market shifts and tackle operational challenges. Through cross-functional communication, companies can improve response times and minimize the risk of operational bottlenecks.

Integrated Approach to Achieving Supply Chain Efficiency

The combined effect of ERP system utilization, inventory management, and interdivisional collaboration ($R^2 = 0.67$) underscores the importance of an integrated approach to supply chain management for achieving high operational efficiency. These findings highlight that while each factor individually enhances efficiency, their impact is greatest when implemented together. In the automotive industry, achieving a balance between technological integration, inventory optimization, and organizational cohesion is essential for maintaining efficient, responsive, and cost-effective supply chains. This result aligns with [22] concept of supply chain efficiency, which advocates for a holistic strategy encompassing both technological and human elements. For Indonesian automotive companies, optimal performance can be attained not only by adopting ERP systems but also by aligning inventory management practices and fostering interdepartmental collaboration. Such an integrated approach promotes agile and resilient supply chain operations, crucial in an industry where production must adapt swiftly to shifts in consumer demand and supply chain dynamics.

Implications for Practice

The findings offer valuable insights for supply chain managers and decision-makers in the automotive industry:

ERP System Optimization: Managers should focus on fully leveraging ERP systems, ensuring they are integrated across departments involved in the supply chain. By centralizing data and improving real-time visibility, ERP systems can help automotive companies achieve streamlined operations and faster decision-making.

Enhanced Inventory Management: Inventory practices should be optimized to balance stock levels, reduce holding costs, and prevent stockouts. Techniques like Just-In-Time (JIT) and Economic Order Quantity (EOQ) can be used to enhance efficiency, particularly in industries with high-value inventory like automotive.

Promoting a Collaborative Culture: Organizations should foster collaboration across departments to ensure alignment of goals and seamless communication. Training programs and cross-functional teams can encourage departments to work together effectively, promoting a cohesive approach to supply chain management.

Limitations and Directions for Future Research

Despite its contributions, this study has some limitations. The use of a single industry and geographic focus may limit the generalizability of the findings. Future research could extend the scope to include other sectors and regions, exploring variations in the impact of ERP systems, inventory management, and collaboration on supply chain efficiency. Additionally, longitudinal studies could offer insights into

the long-term effects of these variables on operational performance, as well as any potential challenges or shifts that may occur with prolonged ERP utilization or evolving inventory practices.

5. CONCLUSION

This research provides empirical evidence supporting the positive effects of ERP system utilization, inventory management, and interdivisional collaboration on supply chain operational efficiency in Indonesia's automotive industry. The results underscore that each factor significantly enhances operational performance, with a combined effect explaining 67% of the variance in supply chain efficiency. ERP systems facilitate real-time data integration, inventory management optimizes stock levels, and interdivisional collaboration aligns departmental goals, reducing lead times and fostering agility. For Indonesian automotive companies, this integrated approach represents a strategic pathway to achieving competitive supply chain performance.

Future studies could extend this research by exploring other industries or geographic regions and examining the long-term effects of these variables on supply chain sustainability. This study's findings offer valuable guidance for supply chain managers aiming to leverage technology, optimize inventory control, and promote a collaborative culture to drive operational excellence in a dynamic market environment.

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