

DIGITALIZATION, INVENTORY MANAGEMENT, AND HUMAN RESOURCE IN ENHANCING SUPPLY CHAIN EFFECTIVENESS : A CASE STUDY AT PT.PAL INDONESIA

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Abstract.

Digitalization has been implemented in the shipbuilding industry, including at PT. PAL Indonesia, a world-class ship construction company in the maritime and energy sectors. Through the implementation of the Maritime Industry 4.0 (IM4) system, which adopts technologies such as Artificial Intelligence (AI), Internet of Things (IoT), Big Data, and Dashboard Monitoring, the company aims to enhance supply chain efficiency. This study aims to analyze the effectiveness of digital inventory management in supporting operational performance and supply chain integration. The research method involves collecting primary data through interviews and questionnaires, as well as secondary data from relevant documents. Data were analyzed using multiple regression analysis. The results indicate that supply chain performance is influenced by three main factors: IM4 digitalization (9.73%), inventory data management (2.12%), and human resource performance (1.15%). IM4 digitalization provides the greatest contribution through real-time data integration, automation, and IT-based management systems, which improve efficiency and flexibility. Although the contributions of inventory data management and human resource performance are smaller, they still play crucial roles in supporting decision accuracy and adaptability to digital transformation. These findings underscore the importance of digitalization in strengthening the integration and performance of the company's supply chain.

Keywords: Inventory Management, Supply Chain Performance, Maritime Industry 4.0

INTRODUCTION

PT PAL Indonesia has become a pioneer in digital transformation within the company by launching the Maritime Industry 4.0 system (IM.4) on May 20, 2022. This system integrates Artificial Intelligence (AI), Internet of Things (IoT), Big Data, and Dashboard Monitoring technologies to enhance company performance, provide more accurate and real-time data and information, and strengthen internal communication as well as communication with stakeholders. Additionally, IM.4 brings about a fairer work culture and improves employee welfare. The business transformation through IM.4 at PT PAL Indonesia is carried out in stages.

In the first stage, the company digitized operations by developing a specially designed Enterprise Resource Planning (ERP) software while also playing the role of Multi Shipyard Leader. Projects in this stage included modules for Project Management, Warehouse Management, and Dashboard. Following this, the company proceeded to the second stage by developing modules for E-Procurement, Back Office (finance), and Sales & Marketing. At this stage, the integration between the IM.4 application and IFS became the main reference for implementing the IM.4 ERP. The third stage focuses on key modules such as Human Resources

Information System (HRIS), Customer Relationship Management (CRM), Document Management System, and Asset & Facility Management. Before the implementation of IM.4, PT PAL Indonesia used the IFS (Industrial and Financial System). However, this system had several weaknesses, especially in the access to recording goods in supply chain operations, which could only be done through office computers. This caused inefficiencies because recorders had to come to the office to input data on incoming or outgoing goods and still used manual tables for recording. This situation prompted PT PAL Indonesia to pursue digitalization, not only to face the challenges of the Industry 5.0 revolution but also to integrate various systems within the company.

The main advantage of implementing IM.4, particularly in supply chain operations, is that data access can be done from anywhere and at any time, making operational processes more effective, efficient, and not hindered by location or time constraints (Wulan et al., 2024).

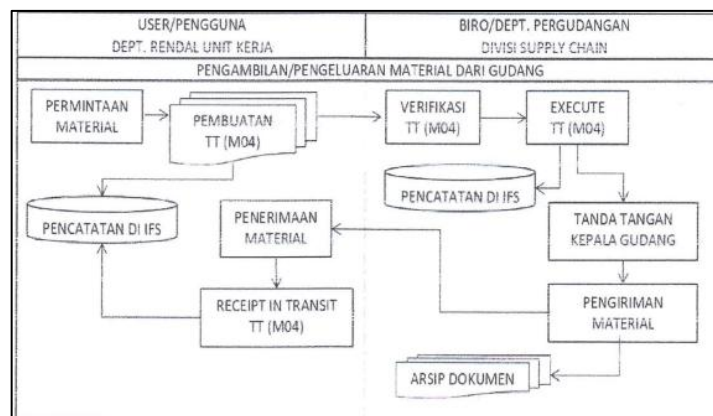


Image 1. Flow Chart of Material Withdrawal/Issuance from Warehouse Using IFS

Image 1 illustrates the flow chart of material withdrawal and issuance from the warehouse using the old system (IFS), while Image 2 (1.3) depicts the flow chart of material withdrawal and issuance from the warehouse using the new system (IM.4). In Image 1 and 2, there is a difference in the process flow, particularly in the involvement of departments.

In the old system (Image 1), only two departments were involved: the Rendal Department as the user/work unit and the Warehouse Department of the Supply Chain Division. In contrast, in the new system (Image 2), three departments are involved: the PMO Division (Project Management Office), the Production Division, and the Supply Chain Division.

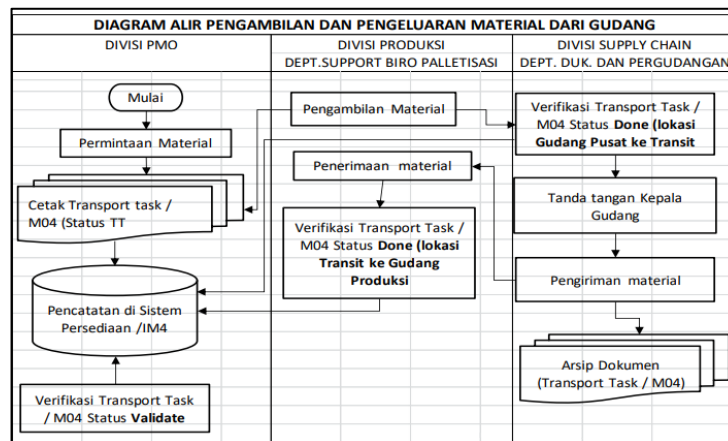


Image 2. Flow Chart of Material Withdrawal/Issuance from Warehouse Using IM.4

Another difference is in the flow chart, where the new system (IM.4) is more concise and clear for each division compared to the old system (IFS). The IFS system requires waiting for data verification when there is a material request, so recording is done twice (before and after). Meanwhile, in the IM.4 system, when there is a material request from the warehouse, the process is done only once. After submitting the request, the production division is ready to take the material according to the order. Recording is done at the end after going through the existing stages.

Digitalization in the supply chain division greatly helps monitor the procurement of material goods, especially for export and import needs. This digital system is developed as a solution to various challenges, such as document completeness, material specifications, vendor data, and other information needed in cross-border shipping processes. Export-import activities require accurate and organized processes, permits, and information. With digitalization, data management improves, leading to enhanced company performance and output, more optimal production, increased revenue, and reduced human error risks (Erika, 2025).

In a shipbuilding company, the entire process from ordering to material delivery must be reliable to enable the company to compete more effectively among vendors. Generally, the supply chain process includes identifying needs, purchase requests, supplier evaluation, request for quotation, offer analysis and negotiation, purchase order creation, monitoring and follow-up, material receipt and inspection, as well as administrative completion and payment. When these processes run effectively and efficiently, the operational performance of the company's supply chain can improve significantly.

Digitalization allows the company to better monitor and track every transaction, thereby increasing visibility over the supply chain flow (Supriadi et al., 2022). This is crucial to ensure that all supply chain processes and management are well controlled. In production and operations, the right supply chain management strategies greatly influence efficiency and revenue growth. Common strategies include Vendor-Managed Inventory (VMI), Enterprise Resource Planning (ERP), Collaborative Planning, Forecasting, and Replenishment (CPFR), Warehouse Management System (WMS), and Outsourcing (Heizer et al., 2016).

LITERATURE REVIEW

Inventory Management

Inventory management plays a crucial role in the continuity of a company's operations. Failure in inventory management can significantly impact the company's losses. According to (Sutarman, 2016), inventory is related to managing the optimal quantity and timing of ordering products or raw materials to support operational activities. Having too little or excessive inventory will incur high costs, so proper planning is needed to anticipate unexpected demand fluctuations. Warehouses also play an important role in maintaining smooth production by providing time flexibility and reducing operational pressure.

According to inventory is defined as raw materials, semi-finished goods, or finished goods stored for production purposes, resale, or as spare parts. In general, inventory includes all company assets prepared for sale, used in production, or in the production process.

Supply Chain Management

Supply Chain Management (SCM) is an integrated process involving various parties in managing the flow of goods, from the provision of raw materials to the distribution of final products to consumers. (Radhi & Hariningsih, 2015) define the supply chain as the entire physical network involved in the production and delivery of goods. Meanwhile, (Fathi et al., 2019) view SCM as an efficient effort to manage the entire production and distribution process, with the main goal of ensuring products reach customers on time and with high economic value. SCM encompasses the entire logistics process, from raw material procurement, production processes, storage, to final delivery, focusing on the efficiency of time, location, quantity, and product quality.

In this context, SCM is not limited to the relationship between producers and suppliers but also involves other parties such as warehouses, distributors, transportation providers, and retailers. As explained by (Dixit et al., 2024), all stages of fulfilling customer demand, both directly and indirectly, are part of an interconnected SCM system.

Therefore, appropriate planning strategies including demand and supply management, selecting the right partners, responsive production, as well as distribution and return management are key to building a resilient, adaptive, and competitive supply chain system.

METHOD

This research is correlational in nature and aims to identify and analyze the relationship between several independent variables and one dependent variable, namely supply chain performance as the main focus. The subjects of the study are employees of PT PAL Indonesia who work using the Maritime Industry 4.0 system (IM.4), particularly from the Material Department and the Support and Warehouse Department. This study examines the influence of digitalization of the IM.4 system, inventory data, and human resource performance on the effectiveness of the company's supply chain performance.

Data collection was conducted through two main sources. Primary data were obtained through interviews and direct observations of employees involved in inventory management and distribution operations to gather actual information regarding system implementation and supply chain activities in the field. Meanwhile, secondary data were collected from literature studies, internal company documents, relevant references, and workplace observations to strengthen and

complement the primary data while providing a theoretical foundation and managerial policy framework.

The analysis method used is multiple linear regression to predict the extent to which the independent variables digitalization of IM.4 (X1), inventory data (X2), and human resource performance (X3) affect the dependent variable, which is supply chain performance (Y). This analytical model allows for measuring the simultaneous and partial impacts of each independent variable on the dependent variable. Multiple linear regression is very useful for predicting changes in the dependent variable's value when there are changes in two or more independent variables, based on the basic equation.

RESULTS AND DISCUSSION

Digitalization has become a fundamental foundation in strengthening the effectiveness of supply chain management across various industries, including shipbuilding. PT PAL Indonesia, as one of the leading companies in its field, has adopted various digital technologies to optimize its operational processes. According to (Erika, 2025), igitalization significantly contributes to operational efficiency, cost reduction, as well as increased speed and accuracy in inventory management. The use of technologies such as the Internet of Things (IoT), big data, and cloud-based systems accelerates decision-making and expands supply chain visibility, making the entire process more transparent and able to be monitored in real-time (Sarjito, 2023). However, challenges such as high implementation costs and limited technological infrastructure still need to be addressed to achieve optimal results.

The implementation of digitalization at PT PAL Indonesia, according to (Cahyadi, 2025), provides many benefits for the efficiency and effectiveness of the company's operations. Digitalization enables real-time monitoring of the entire supply chain process, from raw material procurement to final product delivery, thereby increasing transparency and facilitating direct access to information for all related parties. Process automation and the use of IoT and artificial intelligence (AI) technologies help the company reduce operational time and costs while minimizing errors that could hinder productivity. Digitalization also allows PT PAL Indonesia to respond to customer needs more quickly and accurately, ultimately enhancing customer satisfaction and loyalty. Furthermore, digitalization promotes better collaboration among various parties in the supply chain, supports product and process innovation, and maintains the company's competitiveness in the global market.

Indicators of the effectiveness of supply chain management digitalization at PT PAL Indonesia can be seen from various operational aspects. Stock management efficiency has improved due to better stock data accuracy and a reduction in discrepancies between physical stock and the system, supported by IoT and cloud computing technologies that facilitate real-time tracking and reduce recording errors. The speed and accuracy of inventory processes have also increased because digital technology accelerates the receipt of goods from suppliers, searching for items in the warehouse, and item placement, with IoT systems capable of reducing operational time by up to 20% through real-time tracking (Widowati et al., 2023). Automation and system integration through the adoption of Enterprise Resource Planning (ERP), IoT, and AI enhance collaboration between departments and enable data synchronization with other supply chains, thereby reducing manual interventions. Operational cost reductions are achieved through lower labor costs, storage costs, and risks of overstock or stockout; in fact, some studies indicate that

adopting Supply Chain 4.0 can reduce operational costs by up to 30% (Kencana & Santosa, 2024). Additionally, the accuracy of stock prediction and planning improves with predictive analytics and big data, which enhance demand forecasting accuracy, thus minimizing the risks of overstock and stockout.

All these indicators demonstrate that digitalization not only improves operational efficiency and effectiveness but also supports the sustainability and competitiveness of the company in the Industry 4.0 era.

The Influence of IM4 Digitalization, Inventory Data, and Human Resource Performance on Supply Chain Performance

Current supply chain performance is highly determined by digitalization (Inventory Management 4.0/IM 4), the quality of inventory data, and human resource (HR) competencies. These three factors are interconnected and must be managed holistically. Strengthening these three areas enhances supply chain visibility, transparency, and flexibility, enabling the company to respond quickly to market changes, reduce operational costs, and improve customer satisfaction (Ivanov & Dolgui, 2021). Amid ongoing digital transformation, the integration of advanced technologies such as the Internet of Things (IoT), artificial intelligence (AI), and big data analytics systems forms the core of Inventory Management 4.0 digitalization. The use of these technologies not only accelerates inventory management processes but also enables more accurate demand forecasting and responsive planning to market dynamics.

In the context of increasingly intense industry competition, a company's competitive advantage heavily depends on the optimization of digitalization, data accuracy, and continuous HR development. Digitalization without accurate data will lead to incorrect decisions, while incompetent HR can hinder the optimal utilization of existing technologies. Therefore, a holistic approach and cross-functional collaboration are essential to achieving competitive advantage in supply chain management. Failure in any one aspect can impede the overall effectiveness of the supply chain (Chopra, 2019).

Tabel 1. Results of Multiple Linear Regression Analysis on the Influence of IM.4 Digitalization, Inventory Data, and HR Performance on Supply Chain Performance

Model	Coefficients ^a				
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	1.477	2.076		.711	.483
Digitalisasi IM4	.973	.066	1.056	4.834	.000
Data Inventory	.212	.060	.246	3.525	.002
Kinerja SDM	.115	.051	.145	1.841	.127

The results of this study indicate that the digitalization of Inventory Management 4.0 (IM4) has a significant and positive effect on supply chain performance at PT PAL Indonesia. Digitalization contributes 9.73%, meaning that the higher the level of digital technology adoption, the greater the improvement in supply chain performance. This is supported by statistical analysis showing a significance value of 0.000, well below the 0.05 threshold, and a t-value of 4.834,

which is higher than the critical t-table value of 2.056. Innovations such as real-time data integration, process automation, and IT-based management systems have proven to accelerate the flow of information and goods, enhance coordination, and reduce operational errors. This aligns with the Supply Chain Digitalization Theory, which states that supply chain digitalization significantly contributes to improving efficiency, responsiveness, and competitiveness of companies (Nuraeni, 2023). In other words, more intensive adoption of IM.4 will strengthen supply chain performance in terms of speed, accuracy, and flexibility.

Meanwhile, the quality of inventory data also shows a positive contribution of 2.12% to improving supply chain performance. With a significance of 0.002 and a t-value of 3.525, this influence is considered significant. Accurate, up-to-date, and well-managed data enable the company to avoid stock shortages or excesses, speed up decision-making processes, and reduce logistics costs (Alfiansyah, 2023). his finding aligns with Inventory Management theory, which emphasizes the importance of proper inventory information management to maintain operational efficiency and optimal customer demand fulfillment (Muqoyyimah et al., 2025), and various other studies show that implementing integrated inventory management with ERP systems and advanced technologies significantly improves supply chain performance, accelerates customer demand fulfillment, and minimizes operational costs.

The performance of human resources (HR) shows a relatively small partial contribution of 1.15%, with a significance value of 0.127, indicating that it does not have a statistically significant effect on the supply chain. Nevertheless, HR remains a strategic element in supply chain operations, particularly in terms of adapting to technology, cross-functional collaboration, and the effectiveness of task execution (Maulaya & Armaniah, 2024). his aligns with the Resource-Based View (RBV), which positions HR as a long-term competitive asset. Investment in training and capacity development of HR is still important to ensure the organization's readiness to face market dynamics and technological challenges (Condrobimo, 2025).

Overall, the results of this study indicate that digitalization and effective data management play a dominant role in improving supply chain performance, while the role of HR, although not statistically significant in partial testing, remains crucial in supporting the overall success of the system.

The Impact of Implementing the Maritime Industry 4.0 System on Supply Chain Integration at PT. PAL Indonesia

The implementation of the Maritime Industry 4.0 system (IM.4) at PT PAL Indonesia has been proven to have a significant impact on enhancing supply chain integration, particularly in terms of operational efficiency, cost reduction, process flexibility, and the ability to adapt to market changes. To analyze this strategically, the researcher employed a SWOT analysis approach, which evaluates strengths, weaknesses, opportunities, and threats to formulate appropriate development steps (Rangkuti, 2017).

From the internal strengths perspective, PT PAL Indonesia already has a digitalized system for material processing and procurement, good relationships with both local and international partners, as well as competent and certified human resources. These factors support smooth supply chain operations and increase partner trust (Janawi et al., 2024). However, there are several weaknesses that need improvement, such as complex internal bureaucracy, limited suppliers especially for military-specific components, suboptimal warehouse capacity, and

challenges in handling changes in project specifications that can slow down the procurement process.

Externally, the company has many opportunities, especially from increased government budgets for the defense sector, local content (TKDN) policies, ease of importing certain components, and support from state-owned enterprises (BUMN) and the government in the form of collaboration and funding. These opportunities can be leveraged to strengthen the supply chain and the company's competitiveness. Nevertheless, external threats such as geopolitical conflicts (for example, in the Middle East and Ukraine), changes in export-import regulations, currency depreciation, and fluctuations in material prices have the potential to disrupt supply chain stability and increase procurement costs.

Overall, the results of the SWOT analysis indicate that the IM.4 system is a strategic strength for PT PAL Indonesia in strengthening supply chain performance. However, the company also needs to continuously evaluate internal weaknesses and anticipate external threats to maintain operational sustainability and long-term supply chain resilience

Based on the coordinates (0.31, 0.06) in Image 3 of the SWOT quadrant, PT PAL Indonesia's strategic position is located near the Strengths-Opportunities (S-O) quadrant. This means the company possesses dominant internal strengths and faces greater external opportunities than threats. This position indicates a fairly favorable condition, where the recommended strategy is an aggressive one: maximizing strengths to pursue opportunities (Tambunan et al., 2022).

PT PAL Indonesia's strengths include the digitalization of processes based on Maritime Industry 4.0 (IM.4), the presence of competent human resources, and recognition through international certifications. These can be leveraged to respond to opportunities such as increased government spending in the defense sector, ease of imports, and collaborative support from state-owned enterprises (BUMN) and the government (Alam & Widjaja, 2024). However, despite being in a strong strategic position, the company must remain vigilant against internal weaknesses such as lengthy bureaucracy and limited supplier partners, as well as external challenges like global geopolitical issues and fluctuations in material prices. With the right strategy, PT PAL Indonesia has great potential to grow and enhance its competitiveness both nationally and internationally by optimally utilizing its strengths and opportunities (Kusumadini & Nirawati, 2025).

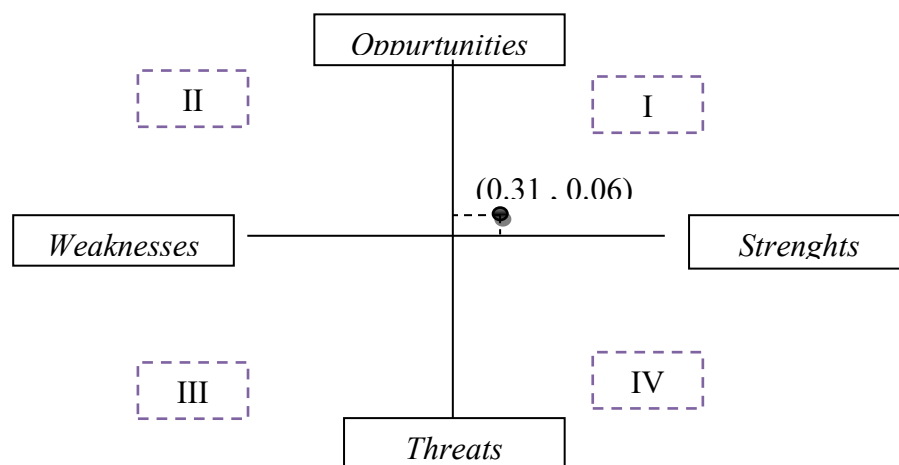


Image 3. SWOT Analysis Quadrant Matrix of the IM.4 System at PT. PAL Indonesia

CONCLUSION

The digitalization of Maritime Industry 4.0 (IM4) at PT PAL Indonesia has brought positive changes to supply chain performance. Technologies such as the Internet of Things (IoT), big data, cloud computing, and ERP have increased efficiency and transparency in real-time inventory management. Digitalization has also reduced operational costs and improved customer satisfaction, despite challenges such as the need for significant investment and human resource development.

There are three main factors influencing supply chain performance: IM4 digitalization, inventory data management, and human resource performance. IM4 digitalization contributes the most, followed by inventory data management and HR performance.

A strategy based on strengths and opportunities is highly relevant for PT PAL Indonesia, emphasizing collaboration and continuous training. It is recommended to strengthen and expand digitalization, enhance HR competencies, and conduct regular evaluations of digital systems. Effective inventory data management and fostering a culture of innovation are also important. Overall, digitalization has improved performance, although challenges remain that need to be addressed to maintain competitiveness.

REFERENCES

- Alam, M., & Widjaja, T. (2024). Digital Transformation and Industry 4.0 in Indonesian Shipyards (Case Study at PT PAL Indonesia). *2024 IEEE International Symposium on Consumer Technology (ISCT)*, 765–770. <https://doi.org/10.1109/ISCT62336.2024.10791162>
- Alfiansyah, A. R. (2023). Pengaruh Pengelolaan Persediaan Dan Pengiriman Komponen Active dan Passive Terhadap Kinerja Operasional. *Jurnal Bisnis, Logistik Dan Supply Chain (BLOGCHAIN)*, 3(1), 33–40. <https://doi.org/10.55122/blogchain.v3i1.690>
- Cahyadi, A. (2025, February 12). *Digitalisasi Supply Chain Management: Strategi untuk Efisiensi dan Transparansi yang Lebih Baik*. Binus University. <https://sis.binus.ac.id/2025/02/12/digitalisasi-supply-chain-management-strategi-untuk-efisiensi-dan-transparansi-yang-lebih-baik/>
- Chopra, S. (2019). *Supply Chain Management: Strategy, Planning, and Operation* (7th ed.). Pearson Education.
- Condrobimo, A. R. (2025, January 10). *Peran Teknologi dalam Supply Chain Management*. Binus. <https://sis.binus.ac.id/2025/01/10/peran-teknologi-dalam-supply-chain-management/>
- Dixit, V. K., Malviya, R. K., Kumar, V., & Shankar, R. (2024). An analysis of the strategies for overcoming digital supply chain implementation barriers. *Decision Analytics Journal*, 10, 100389. <https://doi.org/10.1016/j.dajour.2023.100389>
- Erika. (2025). Pengaruh Digitalisasi Terhadap Efisiensi Supply Chain Management Di Indonesia. *Presisi*, 27.
- Fathi, Z. M., Ridwan, A. Y., & Saputra, M. (2019). Perancangan Sistem Erp Manajemen Rantai Pasok Halal Untuk Industri Makanan Modul Sales Management Dengan Metode Asap (studi Kasus: Vannisa Brownies). *E-Proceeding of Engineering*, 6(2), 8264–8274.

- Heizer, J., Render, B., & Munsun, C. (2016). *Operations Management: Sustainability and Supply Chain Management* (12th ed.). Pearson Education.
- Ivanov, D., & Dolgui, A. (2021). A digital supply chain twin for managing the disruption risks and resilience in the era of Industry 4.0. *Production Planning & Control*, 32(9), 775–788. <https://doi.org/10.1080/09537287.2020.1768450>
- Janawi, Zulkifli, M., & Pandjaitan, M. B. (2024). Kerjasama Industri Pertahanan pada Pembuatan Kapal Selam DSME dengan Korea Selatan Guna Meningkatkan Kekuatan Maritim Indonesia. *JlIP - Jurnal Ilmiah Ilmu Pendidikan*, 7(8), 8487–8492. <https://doi.org/10.54371/jiip.v7i8.5766>
- Kencana, M. E., & Santosa, W. (2024). Dampak Digitalisasi Rantai Pasok terhadap Praktik Operasi Ramping pada Perusahaan Distributor Makanan Kucing. *El-Mal Jurnal Kajian Ekonomi & Bisnis Islam*, 5.
- Kusumadini, L. R., & Nirawati, L. (2025). Analisis Jam Orang (JO) Pada Proyek Kapal BRS dan Perencanaan Pengadaan Material Kapal di PT PAL Indonesia Divisi Production Management Office. *Business and Investment Review*. <https://doi.org/10.61292/birev.171>
- Maulaya, N., & Armaniah, H. (2024). Pengaruh Pelatihan dan Motivasi terhadap Kinerja Karyawan pada PT. Andalan Rantai Pasok Indonesia (Arpilog). *Lokawati: Jurnal Penelitian Manajemen Dan Inovasi Riset*, 2(5), 453–473. <https://doi.org/10.61132/lokawati.v2i5.1228>
- Muqoyyimah, Fatimah, S., Falekh, I., & Romadona, R. (2025). Pengaruh Persediaan dan Distribusi terhadap Efisiensi Supply Chain Management pada Produk IWF NON-PRIME di PT Krakatau Baja Konstruksi. *Jurnal Inovasi Manajemen, Kewirausahaan, Bisnis Dan Digital*, 2(1), 01–12.
- Nuraeni, F. (2023). Pengaruh Layanan E-Payment dan E-Commerce Terhadap Kinerja Supply Chain: Dalam Digitalisasi Usaha Mikro, Kecil, dan Usaha Menengah (UMKM) Di Kabupaten Karawang. *El-Mal: Jurnal Kajian Ekonomi & Bisnis Islam*, 5(3), 1431–1444. <https://doi.org/10.47467/elmal.v5i3.5033>
- Radhi, F., & Hariningsih, E. (2015). Analisis Penerapan Supply Chain Management Studi Kasus pada Perusahaan Retailer. *JBTI Jurnal Bisnis : Teori Dan Implementasi*, 6(1).
- Rangkuti, F. (2017). *Analisis SWOT, Cetakan Keduapuluh*. Pt. Gramedia Pustaka Utama.
- Sarjito, A. (2023). Peran Teknologi Dalam Pembangunan Kemaritiman Indonesia. *Jurnal Lemhannas RI*, 11.
- Supriadi, Y. N., Urbach, N., & Saputra, J. (2022). Implications of Working Environment Job Stress Moderated Employee Engagement to Improve Employee Performance in the Electronic Transaction Service Industry. *International Business and Accounting Research Journal*, 6(1), 24–36.
- Sutarman, M. (2016). *Dasar-dasar Manajemen Logistik*. PT. Reflika Aditama.
- Tambunan, A. S., Lazuardi, R., & Pudiasuti, E. T. (2022). Cost-Benefit Analysis Of The PT. PAL'S Submarine Project Development In Realizing Defense Industry Independence. *Jurnal Pertahanan: Media Informasi Ttg Kajian & Strategi Pertahanan Yang Mengedepankan Identity, Nasionalism & Integrity*, 8(2), 234. <https://doi.org/10.33172/jp.v8i2.1701>
- Widowati, D., Darasih, R., & Ibrahim, H. D. (2023). Digitalisasi Rantai Pasok Terhadap Kinerja Perusahaan Yang Dimediasi Integrasi Internal. *Action Research Literate*, 7.

- Wulan, T. S., Novika, P. W., Nurvianti, E., & Putra, F. A. (2024). Impact of ERP System Implementation on Operational and Financial Efficiency in Manufacturing Industry. *Journal of Economic Education and Entrepreneurship Studies*, 5(3), 491–501. <https://doi.org/10.62794/je3s.v5i3.4328>