JEMSI (Jurnal Ekonomi, Manajemen, dan Akuntansi)
Available at: https://journal.lembagakita.org/index.php/jemsi

E-ISSN: 2579-5635 | P-ISSN: 2460-5891
Volume 11 (4) Agustus 2025 | PP. 2966-2974
https://doi.org/10.35870/jemsi.v11i4.4783

RESEARCH ARTICLE

Optimizing the NSCOM System for Inventory Management Efficiency: A Case Study at PT Indonesia Nippon Seiki

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Histori Artikel:
Dikirim 20 Juni 2025; *Diterima dalam bentuk revisi* 10 Juli 2025; *Diterima* 20 Juli 2025; *Diterbitkan* 1 Agustus 2025. Semua hak dilindungi oleh Lembaga Otonom Lembaga Informasi dan Riset Indonesia (KITA INFO dan RISET) – Lembaga KITA.

Suggested citation:
Sugara, D., Isfianadewi, D., & Sudrajat, Y. (2025). Optimizing the NSCOM System for Inventory Management Efficiency: A Case Study at PT Indonesia Nippon Seiki. *JEMSI (Jurnal Ekonomi, Manajemen, Dan Akuntansi)*, *11*(4), 2966-2974. https://doi.org/10.35870/jemsi.v11i4.4783.

Abstrak

Studi ini menyelidiki optimalisasi NSCOM (Nippon Seiki Control Stock System) dalam mendukung operasi inventaris di divisi Warehouse Electric PT Indonesia Nippon Seiki. Dengan menggunakan pendekatan kualitatif, penelitian ini memanfaatkan observasi lapangan langsung, wawancara mendalam dengan empat personel gudang, dan analisis dokumen untuk mengeksplorasi bagaimana NSCOM berkontribusi pada efisiensi operasional. Temuan mengungkapkan bahwa NSCOM secara signifikan meningkatkan akurasi stok, mengurangi kesalahan manual, dan memungkinkan ketertelusuran waktu nyata melalui integrasi Handy Terminal. Data wawancara mengonfirmasi bahwa keandalan sistem dan sinkronisasi alur kerja merupakan manfaat utama, meskipun tantangan seperti akses pengguna terbatas dan masalah jaringan sesekali dicatat. Studi ini berkontribusi pada wacana tentang lean manufacturing digital dan subsistem ERP dengan menunjukkan bagaimana perangkat digital yang tepat sasaran dapat meningkatkan operasi gudang di industri presisi tinggi. Meskipun terdapat keterbatasan terkait akses dan cakupan data, penelitian ini menawarkan rekomendasi praktis untuk peningkatan sistem dan menyarankan studi masa depan tentang skalabilitas NSCOM dalam konteks yang lebih luas.

Kata Kunci: NSCOM; Manajemen Gudang; Pengendalian Inventaris; Penelitian Kualitatif; Lean Manufacturing Digital.

Abstract

This study investigates the optimization of the NSCOM (Nippon Seiki Control Stock System) in supporting inventory operations at PT Indonesia Nippon Seiki's Warehouse Electric division. Using a qualitative approach, the research draws on direct field observations, in-depth interviews with four warehouse personnel, and document analysis to explore how NSCOM contributes to operational efficiency. Findings reveal that NSCOM significantly improves stock accuracy, reduces manual errors, and enables real-time traceability through Handy Terminal integration. Interview data confirmed that system reliability and workflow synchronization were key benefits, although challenges such as limited user access and occasional network issues were noted. The study contributes to the discourse on digital lean manufacturing and ERP subsystems by demonstrating how targeted digital tools can enhance warehouse operations in high-precision industries. Despite limitations related to data access and scope, this research offers practical recommendations for system enhancement and suggests future studies on NSCOM's scalability in broader contexts.

Keyword: NSCOM; Warehouse Management; Inventory Control; Qualitative Research; Digital Lean Manufacturing.

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1. Introduction

In today's rapidly evolving economic landscape, the industrial sector has undergone significant transformation (Javaid *et al*., 2024), particularly in response to technological advancements and growing consumer demands (Isharyani *et al*., 2024). Companies are increasingly required to adopt innovative systems and processes to ensure high-quality outputs and efficient operations (Handoyo *et al*., 2023). One such company is PT Indonesia Nippon Seiki (PT INS), a leading manufacturer in the automotive electronics industry in Indonesia, producing components such as speedometers, speed sensors, and fuel unit senders. Amidst the global push for competitiveness and efficiency, effective inventory and material management have become critical success factors in manufacturing operations (Atnafu & Balda, 2018; Panigrahi *et al*., 2021). To meet this demand, PT INS has implemented the Nipponseiki Stock Control System (NSCOM) in its Warehouse Electric division. This system supports the operations of the Part Material Control (PMC) unit by streamlining the flow of materials—from inbound raw materials, storage, to timely distribution to the production line. Given the company's commitment to precision and zero-defect outcomes, the NSCOM system serves as the backbone of PT INS's material handling strategy. The NSCOM system is an IT-based solution designed to minimize human error, reduce lead times, and optimize inventory accuracy. Its role is particularly crucial in managing electronic components such as PCBs, cables, and sensors, which require accurate and timely supply to the production floor. Empirical evidence from previous studies supports the adoption of such digital inventory systems (e.g Ali *et al*., (2024); Holloway, (2024); Li, (2023); Tian & Wang, (2022)). For instance, Olawumi and Oladapo (2025) found that digital material control systems could reduce errors by up to 35% compared to conventional methods. Similarly, research by Oktavia (2024) and Ugbebor *et al*., (2024) showed that digital systems could increase inventory accuracy by 40%, thereby reducing operational costs.

However, the successful implementation of such systems relies heavily on several factors: robust IT infrastructure to support real-time data communication, human resource competencies in using and understanding the system, and strong managerial support to ensure continuous improvement (Cichosz *et al*., 2020; Haefner *et al*., 2023; Javaid *et al*., 2024; Peretz-Andersson *et al*., 2024; Saeed *et al*., 2023). Without these supporting elements, even the most sophisticated systems may underperform. This study was initiated based on the author's direct internship experience at PT Indonesia Nippon Seiki. Through field observations and involvement in daily operations, several challenges were identified in the implementation of the NSCOM system, particularly in managing inventory processes such as Stock In, Stock Out, Inventory Transfer, and Inventory Audits. These operational issues raised critical questions: To what extent does NSCOM improve efficiency and effectiveness in the PMC unit? What are the obstacles faced in its implementation, and how can they be mitigated? How does NSCOM contribute to the continuity and sustainability of production at PT INS? Accordingly, the objective of this paper is to analyze the effectiveness of the NSCOM system in supporting operational efficiency, identify challenges faced in its application, and propose practical recommendations for system optimization. The findings are expected to provide actionable insights for PT INS and contribute to the broader academic discourse on digital manufacturing systems and lean operations. Warehouse operations are a critical component of supply chain management, encompassing storage, material handling, and the distribution of goods. As Rushton *et al*., (2021) assert, warehouses now serve not merely as storage facilities but also as hubs of material flow coordination to enhance operational efficiency. Recent advancements in smart warehouse technologies, driven by the Internet of Things (IoT) and cyber-physical systems (CPS), have transformed traditional logistics into intelligent logistics systems (McFarlane *et al*., 2002). Kembro and Norman (2022) emphasize that smart warehouses integrate automated equipment and digital systems to streamline warehouse activities. Key features include real-time information interconnection, process integration, and environmental sustainability (Beltrami *et al*., 2021; Goel *et al*., 2024; Khan *et al*., 2025). These elements work in synergy to improve accuracy, reduce labor dependency, and support strategic operational decisions. Global manufacturing today demands greater flexibility and responsiveness due to shortened product life cycles and increased customization (Calignano & Mercurio, 2023; Vidhushini *et al*., 2022). Lean manufacturing, which focuses on waste elimination and continuous improvement (Womack, 2003),

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has long been a dominant approach to operational efficiency. However, recent developments in Industry 4.0 have introduced new opportunities for integrating digital technologies into lean systems ((Buer *et al*., 2018; Kagermann *et al*., 2013). While traditional lean systems avoid complex IT systems to preserve transparency and simplicity, the convergence of digitalization and lean manufacturing offers potential synergies. When digital tools enhance, rather than replace, lean principles such as real-time inventory visibility they can create more agile and data-informed production environments (Tashkinov, 2024). Effective inventory management ensures the balance between cost efficiency and service reliability. According to Heizer *et al*. (2024), inventory control plays a crucial role in minimizing stockouts while avoiding excess inventory that may lead to obsolescence or financial loss. Metrics like inventory turnover ratio help monitor the efficiency of inventory use (Fernando, 2024), and real-time inventory tracking systems help optimize material flow and support production continuity (Unhelkar *et al*., 2022; Villegas-Ch *et al*., 2024). In digital warehouse systems such as NSCOM, automation and information integration enable faster and more accurate inventory processes, reducing human error and lead times. This supports the just-in-time (JIT) philosophy while meeting high standards for delivery precision in automotive manufacturing (Taylor, 2008).

2. Research Methodology

This research adopts a qualitative, single-case study design based on the framework proposed by Eisenhardt (1989), which is widely used to explore complex, context-specific phenomena in real-life settings. The qualitative approach was chosen to explore operational processes, challenges, and opportunities for improvement more deeply and holistically. It allows the researcher to understand the context in its natural setting, focusing on experiences, behaviors, and interactions as they unfold in real operational environments. The qualitative method relies on various data collection techniques such as in-depth interviews, direct observation, and document analysis. As Creswell (2023) emphasize, qualitative research is characterized by: (1) natural settings, (2) the researcher as the key instrument, (3) multiple data sources, (4) inductive and deductive data analysis, (5) participant meanings, (6) emergent design, (7) reflexivity, and (8) a holistic account of the phenomenon studied.

2.1 Unit of Analysis

The unit of analysis for this research is the operational activities within the Warehouse Electric Part Material Control at PT Indonesia Nippon Seiki, with a particular emphasis on the optimization of the NSCOM system. The research focuses on the following units:

1) Warehouse Operational Processes: Covering core processes such as Stock In, Stock Out, Inventory Transfer, and Stock Taking. These processes are examined to determine how NSCOM enhances efficiency and accuracy.
2) NSCOM System Usage: Focusing on key features like Acceptance, Common Operations, and Master Maintenance, evaluated for their effectiveness in supporting warehouse needs.
3) Employees and Their Roles: Including staff members directly involved in warehouse operations and system usage. Their understanding, skills, and challenges in using NSCOM are examined.
4) Documentation and SOPs: Operational documents such as SOPs and daily reports are analyzed to understand how standard procedures integrate with the NSCOM system.

2.2 Data Sources and Collection Techniques

This study employed both primary and secondary data to obtain a comprehensive understanding of the operational use of NSCOM in the Electric Warehouse Division. Primary data were collected through field observations, in-depth interviews with key personnel, and daily documentation of warehouse activities such as stock in, stock out, inventory transfer, and stock taking. Interviews were conducted with four warehouse employees who interact directly with the system. Secondary data were obtained from internal company reports, operational documents, and relevant academic literature. Additional instruments

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included interview guides, research notebooks, and scientific databases to support data interpretation and analysis. Interview Respondents:

a) RS – WH Electric Leader
b) TI – WH Electric Staff
c) MRS – WH Electric Staff
d) SL – WH Electric Staff

2.3 Data Analysis Techniques

To ensure the credibility and consistency of the findings, source triangulation was applied. This involved comparing information obtained from different interviewees with field observations to reduce bias and confirm the reliability of the data. This method is particularly suitable in qualitative research to cross-verify patterns and deepen contextual understanding, as suggested by Miles *et al*., (2014).

2.4 Data Validation

The research employed a qualitative descriptive approach to analyze how NSCOM contributes to operational effectiveness in warehouse management. Data were analyzed inductively through a continuous cycle of organizing, interpreting, and synthesizing. Following the interactive model proposed by Miles *et al*. (2014), the process involved collecting relevant data, reducing it to highlight essential themes, displaying it in visual formats for clarity, and drawing conclusions that align with the research objectives. The focus was to uncover patterns, operational insights, and improvement opportunities grounded in actual field conditions.

3. Results and Discussion

3.1 Results

3.1.1 Key Findings from Field Observation

This research aimed to evaluate the effectiveness and optimization of the NSCOM (Nippon Seiki Control Stock System) in managing inventory operations at PT Indonesia Nippon Seiki's Warehouse Electric division. Over four months of internship, the researcher directly observed and participated in several core warehouse processes, including Acceptance, Stock In, Stock Out, Inventory Transfer, and Stock Taking, all conducted through the NSCOM system. The integration of Handy Terminal (HT) devices further enabled real-time tracking and verification of stock movement, thus improving operational efficiency. Each major warehouse process was systematically documented and analyzed. Below is a brief summary of each:

1) Acceptance: Involves verification of incoming goods through NSCOM, matching shipment documents, printing and applying system-generated labels, and final confirmation via HT.
2) Stock In: Registers incoming materials into the warehouse inventory. This process ensures synchronization between physical goods and the digital inventory.
3) Stock Out: Manages the release of materials to production lines. It includes stock request registration, HT scanning during picking, and real-time confirmation to prevent discrepancies.
4) Inventory Transfer: Enables internal movement of goods between locations. Through HT and NSCOM integration, the process maintains data accuracy and traceability.
5) Stock Taking (Inventory): Conducted periodically to reconcile physical stock with system records. NSCOM's inventory module, supported by HT scanning and automated difference reports, streamlines this process.

3.1.2 Triangulation of Data: Interview & Observation Integration

To validate and enrich the observational data, the study employed source triangulation by integrating findings from interviews with four key informants warehouse leader and staff directly involved in NSCOM operations. The interviews confirmed key patterns observed during fieldwork and offered additional

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perspectives on the system's strengths and weaknesses. For instance, RS, WH Electric Leader, emphasized:

> *"When using NSCOM with the Handy Terminal, the accuracy of material movement improves significantly. It reduces our dependence on manual recording, which often caused mismatches in the past."* RS, WH Electric Lead

TI, a warehouse staff member, added:

> *"We use the system every day for almost every activity—from acceptance to stock taking. It helps us speed up the process, especially when barcode scanning is used."*, TI, Warehouse Electric Staff

Challenges also emerged during interviews. MRS explained:

> *"Sometimes we face problems when the network is unstable or when the barcode isn't recognized properly. It interrupts the flow and needs manual adjustment."* MRS, WH Electric Staff

Meanwhile, SL noted the issue of limited access for trainees:

> *"Not all employees, especially interns, are granted full access to NSCOM. This makes training a bit difficult because they cannot fully engage with the process."* SL, WH Electric Staff

These responses triangulated with direct field observations, reinforcing the study's credibility. Themes such as real-time control, system reliability, user constraints, and procedural integration were consistently noted across both data sources.

3.2 Discussion

The findings of this study reinforce and elaborate on several established theoretical perspectives in the fields of warehouse operations, inventory management, and digital transformation in manufacturing. First, the NSCOM system functions in alignment with the operational management concepts presented by Heizer *et al*. (2024), particularly in the context of globalized supply chains. In a complex and interconnected manufacturing environment, real-time inventory tracking, standardization of processes, and system reliability are not just operational needs they are strategic imperatives. NSCOM responds to this by enabling traceability, visibility, and data integration, which are critical for maintaining consistent service levels and responding quickly to production demands. Second, the observed use of NSCOM reflects the core tenets of lean manufacturing as defined by Womack and Jones (2003), which emphasize waste elimination and continuous process improvement. The automation of material flow through NSCOM, the minimization of manual intervention, and the synchronization with production schedules embody lean practices in a digital context. This represents a transition from traditional lean systems toward what recent scholars have termed "digital lean" or "Lean 4.0", integrating lean principles with smart technologies.

Third, this evolution corresponds with the framework of Industry 4.0, which envisions interconnected, sensor-driven, and data-centric production systems. As argued by Kagermann *et al*. (2013) and further by Buer, Strandhagen, and Chan (2018), digitalization acts as a catalyst for operational agility and strategic responsiveness. NSCOM with its integration of Handy Terminal (HT), barcode scanning, and real-time system updates illustrates the convergence between digital infrastructure and operational routines. It supports not only efficiency and error reduction, but also knowledge transparency and data-based decision-making, as theorized in smart manufacturing ecosystems. Moreover, the modular structure and inventory intelligence of NSCOM reflect characteristics of Enterprise Resource Planning (ERP) systems, particularly in how subsystems can interoperate to form a cohesive digital nervous system for a company. This mirrors insights from Umble *et al*. (2003) and Tarigan *et al*. (2021), who argue that ERP subsystems enhance cross-functional integration, allowing inventory data to inform broader planning, procurement, and performance monitoring processes. By connecting empirical observations with these theories, the study not only validates the functionality of NSCOM within PT Indonesia Nippon Seiki but also positions the system as a real-world case of digital operational excellence in mid-scale manufacturing environments.

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The case illustrates how theoretical concepts like lean digitalization, ERP modularity, and smart warehousing are not only feasible but highly applicable in practice.

4. Conclusion

This study explored the optimization of the NSCOM (Nippon Seiki Control Stock System) in supporting inventory operations within the Warehouse Electric division at PT Indonesia Nippon Seiki. By employing a qualitative approach grounded in direct observation, document analysis, and triangulated interviews, the research found that NSCOM significantly enhances the accuracy, speed, and reliability of warehouse activities, particularly in stock recording, inventory transfer, and real-time data validation through Handy Terminal integration. The findings demonstrate that NSCOM functions not only as a stock control mechanism but as a vital component of digital transformation in manufacturing operations. Its role in enabling lean, standardized, and real-time inventory management positions it as an effective subsystem for broader ERP and smart warehouse integration. The observed improvements in traceability, reduction in manual error, and improved coordination between warehouse and production units further underscore its operational relevance. Practically, the study provides several actionable insights. For practitioners, investing in continuous training, ensuring broader access to system functions, and expanding NSCOM to cover all material types including local parts are crucial steps to further enhance system performance. Moreover, aligning internal SOPs more closely with NSCOM features will help standardize workflows and support data-driven decision-making.

Despite its contributions, the study is not without limitations. It is confined to a single company division and relies heavily on internship-based observation, which may limit generalizability. Access to system data and participation in decision-making processes was also restricted for the researcher. These factors should be considered when interpreting the findings. Future research should examine NSCOM's scalability in other departments or companies within the same industry. Comparative case studies could also provide broader insights into how similar digital inventory systems perform across different organizational contexts. Additionally, integrating quantitative performance metrics such as error reduction percentages or time savings would help substantiate the qualitative claims made in this study. In sum, the study successfully addressed its original research questions by revealing how NSCOM contributes to operational efficiency, identifying the barriers faced in practice, and offering strategic recommendations for system improvement. It also contributes to the academic conversation on digital manufacturing by illustrating how targeted technological tools can be embedded into existing operational frameworks to foster efficiency and accuracy in supply chain execution

5. Acknowledgement

The author gratefully acknowledges the guidance and support of Dr. Dessy Isfianadewi, the academic advisor, whose insights and encouragement were invaluable throughout the research process. Sincere appreciation is also extended to Ms. Natasya Chairunnisa, the internship supervisor at PT Indonesia Nippon Seiki, for her mentorship and assistance during the internship period. The author also wishes to thank all respondents who participated in the interviews and shared their experiences, as well as the management and entire team at PT Indonesia Nippon Seiki for their kind cooperation and support, which greatly contributed to the successful completion of this study.

E-ISSN: 2579-5635 | P-ISSN: 2460-5891
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