

Analysis and Optimization of Inventory Control in Supporting Efficient and Innovative Industrial Development

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Abstract: This study analyzes and optimizes inventory control practices to support the development of efficient and innovative industrial operations through a community service program conducted at PT Dirgaputra Ekapratama, Samarinda Branch. The primary objective is to enhance inventory management control and improve warehouse staff competencies. The study adopts an educational and participatory approach, utilizing semi-structured interviews, direct observation, document analysis, and on-site mentoring to identify operational issues and implement practical solutions. Key problems identified include low frequency of stock opname, absence of continuous recording systems, reliance on manual and non-standardized documentation, and inefficiencies in item handling. Three integrated solutions were introduced: increasing stock opname frequency to twice weekly, implementing standardized stock cards for real-time recording, and introducing barcode technology to improve identification accuracy and operational speed. The results indicate a significant improvement in inventory data accuracy, enhanced recording efficiency, and stronger staff discipline in following procedures. Additionally, the initiative successfully fostered organizational commitment toward adopting technology-based warehouse management systems. Although full implementation of stock cards and barcode systems requires further approval from headquarters, the pilot implementation demonstrated feasibility and effectiveness. The findings highlight that structured procedures, combined with gradual technological adoption and managerial commitment, play a critical role in strengthening internal control systems. This study contributes to practical inventory management improvements and supports sustainable industrial development aligned with efficiency and innovation principles.

Keywords : Inventory control, stock opname, barcode system, internal control, warehouse management

1. Introduction

In the era of globalization and rapid digital transformation, operational efficiency and innovation have become critical determinants of industrial competitiveness (Ivanov & Dolgui, 2021; Queiroz et al., 2022). This aligns with the Sustainable Development Goals (SDGs), particularly Goal 9 on *Industry, Innovation, and Infrastructure*, which emphasizes the importance of building resilient, inclusive, and technology-driven industries (United Nations, 2023). Within this context, effective inventory control plays a fundamental role in ensuring smooth operational processes and supporting sustainable industrial development (Kumar et al., 2022). Inventory is not merely a supporting asset but a strategic component that directly influences supply chain continuity, customer satisfaction, and overall organizational performance (Heizer et al., 2023; Chopra & Meindl, 2022). Ineffective inventory control systems often lead to various operational inefficiencies, including discrepancies between recorded and physical stock, inventory losses, overstocking or stockouts, and delays in fulfilling customer orders (Adinda et al., 2024; Nguyen et al., 2021). These issues reflect weaknesses in internal control systems, which can ultimately affect cost efficiency and decision-making accuracy (Ario Jayakrisna & Paramitadewi, 2024; Kholidin & Azzahra, 2025). In distribution companies, the complexity of inventory management is even greater due to the high frequency of inventory movement and the need for real-time data accuracy (Christopher, 2022).

Therefore, establishing a reliable, accurate, and adaptive inventory control system is essential for maintaining operational excellence (Bowersox et al., 2021). From a theoretical perspective, inventory control is an integral part of internal control systems aimed at ensuring the reliability of financial and operational information, safeguarding assets, and enhancing efficiency (COSO, 2021; Romney & Steinbart, 2022). Proper documentation, such as the use of stock cards and standardized recording systems, plays a vital role in maintaining transparency and accountability in inventory management (Ario Jayakrisna & Paramitadewi, 2024). However, in practice, many organizations still rely on manual

recording systems, which are prone to human error, inconsistencies, and limited traceability (Sari et al., 2022). These limitations hinder the ability of organizations to maintain accurate and timely inventory information, thereby affecting operational decision-making (Wamba et al., 2023). Advancements in information technology have introduced innovative solutions to address these challenges, including the adoption of barcode systems and digital inventory platforms (Auliansyah et al., 2022; Maulana et al., 2025). Barcode technology enables faster and more accurate identification of inventory items, reducing the likelihood of recording errors and improving operational efficiency (Zhang et al., 2022). Furthermore, integrating barcode systems with warehouse management systems (WMS) can streamline processes such as receiving, storing, and distributing goods (Richards, 2022; Faber et al., 2021). Previous studies have demonstrated that the implementation of barcode technology significantly enhances inventory accuracy and reduces processing time, making it a valuable tool in modern inventory management practices (Maulana et al., 2025; Singh et al., 2023).

Despite these technological advancements, the successful implementation of inventory control systems remains a challenge, particularly for medium-scale distribution companies (Nguyen et al., 2021). This is often due to limitations in human resource capabilities, resistance to change, and insufficient managerial support (Alkaraan, 2022; Shakira & Widajantie, 2025). Consequently, the effectiveness of inventory control does not solely depend on technological adoption but also on organizational factors such as employee competence, work culture, and management commitment (Wamba et al., 2023; Kholidin & Azzahra, 2025). A purely technical approach is therefore insufficient; it must be complemented by an educational and participatory approach to ensure sustainable implementation (Adinda et al., 2024). Existing literature has largely focused on system development or quantitative evaluations of inventory control effectiveness (Singh et al., 2023; Kumar et al., 2022). However, there is a notable gap in studies that emphasize mentoring-based interventions, which integrate technical improvements with behavioral and organizational change (Alkaraan, 2022). Such an approach is crucial in ensuring that proposed solutions are not only technically sound but also practically applicable and accepted by end users (Wamba et al., 2023). Addressing this gap is particularly important in developing contexts, where organizational readiness for technological transformation may vary significantly (Queiroz et al., 2022).

PT Dirgaputra Ekapratama Samarinda Branch, as a distribution company, faces several practical challenges in its inventory management practices. Preliminary observations revealed key issues, including the low frequency of stock opname conducted without a fixed schedule, the absence of continuous recording systems such as stock cards, reliance on non-standardized manual documentation, and inefficiencies in locating items within the warehouse. These problems indicate weaknesses in internal control mechanisms, leading to potential inefficiencies and inaccuracies in inventory data (Adinda et al., 2024; Ario Jayakrisna & Paramitadewi, 2024). To address these issues, this study proposes a set of integrated solutions aimed at optimizing inventory control. The proposed solutions include increasing the frequency and discipline of stock opname activities, implementing standardized stock cards as control tools, and introducing barcode technology to enhance accuracy and operational speed (Maulana et al., 2025; Shakira & Widajantie, 2025). These solutions are designed not only to improve technical systems but also to foster a more structured, disciplined, and data-driven work culture within the organization (Kholidin & Azzahra, 2025).

Moreover, this study adopts an educational and participatory approach, involving warehouse staff directly in the problem identification and solution implementation processes. This approach is expected to enhance employee understanding, improve technical competencies, and create a sense of ownership toward the implemented system (Adinda et al., 2024). Prior research suggests that user involvement and strong managerial commitment are key factors in the successful implementation of internal control systems, particularly in operational settings (Wamba et al., 2023; Alkaraan, 2022).

Therefore, this study aims to bridge the gap between theoretical frameworks and practical implementation of inventory control systems, particularly in the context of distribution companies. Specifically, the objectives of this study are threefold: (1) to analyze existing problems in inventory control practices, (2) to design and implement integrated solutions combining educational and technological approaches, and (3) to evaluate the impact of these solutions on operational efficiency and inventory accuracy. The findings of this study are expected to provide both practical and academic contributions. Practically, the study offers a replicable model for improving inventory control systems in similar organizational contexts. Academically, it contributes to the development of a more comprehensive framework for inventory control that integrates technological innovation with organizational behavior. Furthermore, this study supports broader industrial development goals by promoting efficiency, innovation, and readiness for digital transformation in modern industrial environments (United Nations, 2023; Queiroz et al., 2022).

2. Research Methodology

This study employs an applied research design combined with a community service approach to analyze and optimize inventory control practices within a real organizational setting. The research adopts a qualitative case study methodology, as it allows an in-depth exploration of operational processes, internal control weaknesses, and the effectiveness of implemented solutions in a specific organizational context. The case study approach is particularly appropriate for examining complex phenomena such as inventory management, where technical systems, human behavior, and organizational dynamics interact simultaneously.

2.1 Research Design

The research design integrates diagnostic analysis and intervention-based methods. Initially, a problem identification phase is conducted to map existing inventory control issues. This is followed by the design and implementation of practical solutions through direct mentoring and participatory engagement. Finally, an evaluation phase is carried out to assess the impact of the interventions on operational efficiency and inventory accuracy. This structured approach ensures that the study not only identifies problems but also provides actionable solutions and measurable outcomes. The study emphasizes a participatory and educational approach, where employees are actively involved throughout the process. This approach enhances the relevance and applicability of the solutions while fostering a sense of ownership among participants, which is essential for ensuring sustainability.

2.2 Research Site and Participants

The study was conducted at PT Dirgaputra Ekapratama, Samarinda Branch, a distribution company engaged in the storage and distribution of goods. The selection of this site was based on the presence of observable inventory management challenges, making it a suitable context for applied research and intervention. The participants consisted of warehouse staff and administrative personnel directly involved in inventory-related activities, including receiving, storing, recording, and distributing goods. In addition, a warehouse supervisor participated as a key informant to provide managerial perspectives on operational challenges and decision-making processes. The involvement of both operational and supervisory levels ensures a comprehensive understanding of the inventory control system from multiple viewpoints.

2.3 Data Collection Methods

Data were collected using multiple qualitative techniques to ensure data triangulation and enhance the validity of findings. The primary data collection methods include observation, semi-structured interviews, and document analysis.

a. Direct Observation

Observation was conducted to examine actual warehouse operations, including receiving, put-away, picking, and shipping processes. Particular attention was given to inventory recording practices and workflow efficiency. This method allows the researcher to identify discrepancies between standard procedures and actual practices, as well as inefficiencies that may not be captured through interviews alone.

b. Semi-Structured Interviews

Semi-structured interviews were conducted with warehouse staff and the supervisor to gather insights into operational challenges and the root causes of inventory discrepancies. The interview format provides flexibility to explore participants' experiences while maintaining consistency across key topics, such as recording practices, frequency of stock opname, and the need for technological support.

c. Document Analysis

Document analysis was carried out to examine existing inventory records, including stock opname reports, manual inventory logs, and documentation of incoming and outgoing goods. This method helps identify patterns of errors, inconsistencies, and gaps in documentation practices, which are critical for diagnosing systemic weaknesses in inventory control.

2.4 Intervention Design and Implementation

Based on the problem identification phase, three integrated solutions were designed and implemented to improve inventory control practices. The interventions were carried out through direct mentoring over a defined period, ensuring that participants understood and applied the proposed solutions effectively.

a. Increasing Stock Opname Frequency

The first intervention involved establishing a structured schedule for stock opname, conducted twice a week. This approach aims to reduce the time gap between physical checks, enabling faster detection of discrepancies and improving inventory accuracy. Participants were trained on standardized counting procedures and checklist-based recording to ensure consistency.

b. Implementation of Stock Cards

The second intervention focused on introducing stock cards as a primary recording tool for inventory transactions. Each item was assigned a stock card to document incoming and outgoing quantities, as well as current balances. Training sessions were conducted to ensure that staff understood how to maintain accurate and consistent records. This intervention aims to create a clear audit trail and improve data transparency.

d. Introduction of Barcode Technology

The third intervention involved demonstrating the use of barcode technology for inventory identification and tracking. Although full implementation required further organizational approval, pilot demonstrations were conducted to illustrate the potential benefits in terms of speed and accuracy. This intervention serves as a foundation for transitioning toward a technology-based warehouse management system.

2.5 Data Analysis Techniques

Data analysis was conducted using a qualitative descriptive approach. The analysis process involved three main steps: data reduction, data display, and conclusion drawing. First, data reduction was performed by organizing and categorizing data collected from observations, interviews, and documents. Relevant information related to inventory control issues and intervention outcomes was identified and coded. Second, data were presented in a structured format, such as tables and comparative descriptions, to facilitate interpretation. For example, comparisons were made between conditions before and after the intervention to highlight improvements in inventory practices. Finally, conclusions were drawn by interpreting patterns and relationships within the data. The analysis focused on evaluating the effectiveness of the implemented solutions in improving inventory accuracy, operational efficiency, and staff competency.

2.6 Validity and Reliability

To ensure the credibility of the findings, this study employs data triangulation by combining multiple data sources and methods. Observations, interviews, and document analysis were cross-checked to validate the consistency of information. In addition, participant feedback was used to confirm the accuracy of interpretations, ensuring that the findings reflect actual conditions. Reliability is supported by the use of systematic data collection procedures and clear documentation of the research process. The intervention steps were standardized, allowing for replication in similar organizational contexts.

2.7 Ethical Considerations

Ethical considerations were carefully addressed throughout the study. Participation was voluntary, and all participants were informed about the purpose of the research. Confidentiality of organizational data and individual responses was maintained to protect sensitive information. The study also ensured that the interventions provided practical benefits to the organization, aligning with the principles of responsible and ethical research.

2.8 Research Limitations

Despite its contributions, this study has certain limitations. The research is limited to a single case study, which may affect the generalizability of the findings. Additionally, the implementation of barcode technology was conducted at a pilot level, and full-scale adoption could not be evaluated within the study period. Future research is recommended to explore long-term impacts and to apply the proposed model in different organizational settings. Overall, this methodological approach provides a comprehensive framework for analyzing and improving inventory control systems through a combination of diagnostic analysis, participatory intervention, and qualitative evaluation.

3. Results and Discussion

3.1 Implementation Realization and Immediate Impact

During the community service implementation period in November 2025, the activities were primarily focused on socialization, training, and limited pilot testing of the three proposed solutions. Although the full-scale implementation of stock cards and barcode systems required further coordination and approval from the head office, the approaches and methods introduced received highly positive responses from operational management. The implementation phase successfully demonstrated the feasibility and practicality of the proposed interventions within a relatively short timeframe. The key outcomes of the implementation are summarized in Table 1.

Table 1. Comparison of Inventory System Before and After Implementation

Solution	Before Implementation	Status & Achievement During Implementation (Nov 2025)
Stock Opname Frequency	Conducted every 1–2 months without a fixed schedule	Fully implemented. A routine schedule of twice a week was successfully carried out for three consecutive weeks, establishing a new discipline in inventory checking
Stock Cards	Not available. Manual recording was unstructured and scattered in notebooks	In pilot and socialization stage. A standardized format was developed, and staff were trained through simulations. Management commitment for full adoption increased
Barcode System	Not implemented. Item identification relied on memory and physical labels	In demonstration and planning stage. Scanner-based demonstrations for stock taking and identification were successfully conducted. Management approved the concept and planned submission to headquarters

As shown in Table 1, there is a clear transition from a reactive and unstructured inventory system toward a more proactive and systematic approach. The implementation of routine stock opname emerged as the primary entry point for organizational change due to its immediate applicability and minimal resource requirements. Meanwhile, the introduction of stock cards and barcode technology has progressed through the validation stage, achieving proof of concept and gaining strong managerial support for further development. This phased transformation highlights the importance of gradual implementation in organizational change. Rather than imposing a fully integrated system at once, the study demonstrates that starting with simple, high-impact interventions can effectively build momentum for broader system improvements. The initial success of stock opname scheduling served as a catalyst for increasing organizational readiness to adopt more advanced inventory control mechanisms.

3.2 Management Response and Commitment

The warehouse manager and supervisor expressed formal appreciation for the proposed solutions, emphasizing their relevance and practicality in addressing operational challenges. Three key aspects of appreciation were identified. First, the solutions were perceived as highly relevant to operational needs, particularly in addressing stock discrepancies and inefficiencies in item retrieval. The structured stock opname schedule and the introduction of systematic recording tools were considered effective in minimizing errors and improving accountability. Second, the proposed solutions were regarded as cost-effective and realistic. Unlike complex technological systems that require significant investment, the initial interventions—such as stock cards and structured procedures—can be implemented with minimal financial resources. This characteristic increased the likelihood of adoption, especially in organizations with limited budgets for technological upgrades. Third, the benefits of the interventions were immediately observable during the mentoring process. Staff experienced improvements in the speed and accuracy of stock opname activities when using structured checklists, which also served as a preliminary foundation for barcode system integration. These tangible benefits played a crucial role in strengthening management confidence in the proposed system.

Based on these positive evaluations, the management demonstrated strong commitment to continuing the implementation process through three concrete actions. These include appointing the warehouse supervisor as the person in charge of implementation continuity, preparing a formal proposal for barcode procurement and stock card standardization to be submitted to headquarters, and maintaining the twice-weekly stock opname schedule as a permanent operational procedure. This

commitment reflects a critical success factor in organizational change, where managerial support acts as a driving force for sustaining improvements. The transition from externally initiated solutions to internally driven initiatives indicates a significant shift in organizational mindset and ownership.

3.3 Analysis of Achievements and Impact

The findings of this study demonstrate that the success of organizational change initiatives does not necessarily depend on full-scale technical implementation. Instead, the stages of socialization, proof of concept, and management commitment represent critical outcomes, particularly in hierarchical organizational structures.

a. Implementation of Routine Stock Opname Schedule

The increase in stock opname frequency to twice a week represents the most immediate and fully realized improvement. This procedural change required no additional investment yet significantly enhanced inventory monitoring. The introduction of a fixed schedule created a new sense of discipline and urgency among staff, reducing the likelihood of undetected discrepancies.



Figure 3.1 Implementation of a twice-weekly stock opname schedule using structured checklists.

This finding supports previous studies indicating that routine physical verification is a fundamental component of effective internal control systems. By reducing the time gap between inventory checks, organizations can detect and resolve discrepancies more quickly, thereby improving overall data reliability.

b. Socialization and Simulation of Stock Card Usage

Although the full implementation of stock cards requires further organizational approval, the socialization and simulation stages have already demonstrated significant benefits. Staff were introduced to a standardized recording format, which improved their understanding of structured documentation practices.



Figure 3.2 Mentoring session and simulation of standardized stock card usage with warehouse staff.

The pilot implementation of stock cards serves as an important step toward establishing a reliable audit trail. It also facilitates the transition from informal, experience-based practices to formal, data-driven processes. This aligns with the principles of internal control, where documentation plays a key role in ensuring transparency and accountability.

c. Demonstration of Barcode Technology for Efficiency

The demonstration of barcode technology provided a clear illustration of its potential to enhance operational efficiency. The use of handheld scanners during the pilot phase significantly reduced the time required for item identification and stock verification.



Figure 3.3 Demonstration of barcode technology in warehouse storage locations.

This demonstration was instrumental in convincing management of the value of technological investment. Although the system has not yet been fully implemented, the positive response indicates strong readiness for digital transformation. The results are consistent with previous findings that barcode systems can substantially improve accuracy and reduce operational errors in inventory management. Overall, the integration of procedural improvements and technological introduction has created a solid foundation for sustainable system transformation. The combination of immediate procedural changes and long-term technological planning reflects a balanced approach to innovation. Importantly, the study highlights that organizational readiness, user acceptance, and managerial commitment are as critical as technological capabilities in determining the success of system implementation. The transformation observed in this case demonstrates that incremental improvements, supported by participatory approaches, can effectively drive organizational change.

4. Conclusions

4.1 Conclusion

This study aimed to analyze and optimize inventory control practices to support efficient and innovative industrial development through a participatory and intervention-based approach. The findings demonstrate that the implementation of structured and integrated solutions—namely increasing the frequency of stock opname, introducing standardized stock cards, and initiating the adoption of barcode technology—has contributed significantly to improving inventory management practices within the organization. The most immediate and fully realized outcome was the successful implementation of a routine stock opname schedule conducted twice a week. This procedural improvement enhanced monitoring discipline, reduced the risk of undetected discrepancies, and strengthened internal control mechanisms without requiring additional financial investment. Meanwhile, the introduction of stock cards and barcode technology, although still in the pilot and planning stages, has shown strong potential to improve data accuracy, recording efficiency, and operational speed. Furthermore, the study highlights that the success of inventory control optimization is not solely dependent on technological implementation but also on organizational factors such as

employee competence, participatory engagement, and managerial commitment. The transition from externally initiated interventions to internally driven initiatives reflects a significant improvement in organizational readiness and ownership. Overall, the study confirms that a gradual, participatory, and context-based approach is effective in enhancing inventory control systems and supporting sustainable operational improvements.

4.2 Practical Implications

The findings of this study offer important practical implications for organizations, particularly distribution companies facing similar inventory management challenges. First, simple procedural improvements, such as increasing the frequency of stock opname and standardizing recording practices, can generate immediate and impactful results without requiring substantial investment. Second, the adoption of low-cost and scalable tools, such as stock cards and barcode systems, can serve as an effective transition toward more advanced digital inventory management systems. Organizations are encouraged to implement these solutions incrementally to ensure feasibility and user acceptance. Third, the study emphasizes the importance of involving employees in the implementation process. A participatory approach not only enhances technical understanding but also fosters a sense of ownership, which is critical for ensuring the sustainability of system improvements. Additionally, strong managerial support is essential to institutionalize changes and facilitate long-term transformation.

4.3 Theoretical Contributions

From an academic perspective, this study contributes to the existing literature on inventory control and internal control systems by integrating technical and behavioral dimensions within a single framework. While previous studies have predominantly focused on system development or quantitative evaluation, this research highlights the importance of mentoring-based interventions that combine procedural improvements, technological introduction, and organizational engagement. The study also extends the understanding of how incremental innovation can drive organizational change, particularly in contexts with limited technological readiness. By demonstrating the effectiveness of a phased implementation strategy, this research provides a conceptual model that can be applied in similar organizational settings, especially in developing economies.

4.4 Limitations and Future Research

Despite its contributions, this study has several limitations. First, the research is based on a single case study, which may limit the generalizability of the findings to other organizational contexts. Second, the implementation of barcode technology was limited to a pilot demonstration, and its long-term impact on operational performance could not be fully evaluated within the study period. Future research is recommended to conduct longitudinal studies that assess the sustainability and long-term effectiveness of the proposed solutions. Additionally, further studies could explore the integration of advanced technologies, such as real-time inventory systems or enterprise resource planning (ERP), to enhance the scalability and sophistication of inventory management practices. Comparative studies across different industries and organizational sizes would also provide broader insights into the applicability of the proposed model.

4.5 Managerial Recommendations

Based on the findings, several managerial recommendations can be proposed. Organizations should prioritize the establishment of structured inventory control procedures as a foundation for operational efficiency. The gradual adoption of technology should be aligned with organizational readiness and supported by continuous training and capacity building for employees. Moreover,

management should actively promote a culture of accountability, discipline, and data-driven decision-making within the organization. Assigning clear responsibilities, monitoring implementation progress, and maintaining consistent evaluation mechanisms are essential to ensure the success and sustainability of inventory control improvements. In conclusion, this study underscores the importance of integrating procedural discipline, technological innovation, and organizational commitment in optimizing inventory control systems. Such integration is essential for achieving operational efficiency, enhancing competitiveness, and supporting sustainable industrial development in the modern business environment.

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