

THE EFFECTIVENESS OF INVENTORY CONTROL SYSTEMS IN PUBLIC FOOD LOGISTICS: EVIDENCE FROM INDONESIA



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Abstract

This study examines the effectiveness of a rice inventory control system in supporting the sustainability and stability of the national food supply. It evaluates key indicators, including planning accuracy, recording accuracy, compliance with standard operating procedures, stock availability and control, and the system's ability to mitigate the risk of inventory damage. A descriptive qualitative approach with a case study design was employed, using both primary and secondary data. Primary data were collected through interviews with personnel directly involved in inventory management, while secondary data were obtained from document reviews such as SOPs, organizational structures, and inventory records. Data analysis involved data reduction, presentation, and conclusion drawing. The findings reveal that the inventory control system operates in a structured and integrated manner through the use of an ERP system, periodic stocktaking, and preventive as well as corrective quality control measures. However, increased absorption volume driven by government assignments poses challenges to warehouse capacity management. Overall, the system is considered effective in maintaining rice supply stability.

Keywords: Inventory Control System, Effectiveness, Rice, ERP System, Stock Control, Food Supply Stability, Warehouse Capacity Management

INTRODUCTION

Food security remains a critical issue in national development, particularly in developing countries where ensuring stable access to staple food is essential for economic and social stability. Among staple commodities, rice plays a strategic role in Indonesia, not only as the primary food source for the majority of the population but also as a key determinant of inflation and public welfare (Tangkudung et al., 2016). Consequently, maintaining the availability and stability of rice supply has become a central concern for policymakers and public institutions.

In this context, a state-owned logistics agency is entrusted with a strategic mandate to manage government rice reserves, stabilize prices, and ensure equitable distribution across regions. Its responsibilities include procurement from farmers, storage management, and nationwide distribution under both normal and emergency conditions. As government interventions intensify to strengthen food self-sufficiency, the operational complexity of inventory management within such institutions has increased significantly.

Recent policy developments further highlight this challenge. As of May 2025, government rice reserves reached approximately 3.5 million tons, reflecting a substantial increase in procurement volume driven by national food security programs. While this achievement demonstrates successful policy implementation, it simultaneously introduces new operational risks, particularly in inventory control, including warehouse overcapacity, potential quality deterioration, and increased pressure on logistics coordination. Tennis et al. (2023) argue that a well-designed control system can enhance operational effectiveness and support the achievement of strategic objectives, particularly in the food sector, which is highly vulnerable to supply fluctuations. These conditions emphasize the importance of an effective inventory control system capable of managing both the quantity and quality of stock in a dynamic operational environment.

Previous studies on inventory control have primarily focused on quantitative optimization models, such as Economic Order Quantity (EOQ), and traditional stock management approaches. Although these studies provide valuable insights into cost efficiency and stock optimization, they often overlook the complexity of real-world implementation in public sector organizations, particularly those operating under policy-driven mandates and large-scale logistics systems. Furthermore, limited attention has been given to the role of integrated digital systems, such as Enterprise Resource Planning (ERP), in enhancing transparency, accuracy, and coordination in inventory management.

In addition, existing literature tends to examine inventory control effectiveness from a purely operational perspective, with insufficient consideration of contextual factors such as government intervention, fluctuating procurement targets, and infrastructure constraints. As a result, there remains a research gap in understanding how inventory control systems function in practice within state-owned logistics institutions, especially in balancing administrative control, operational efficiency, and policy-driven objectives.

To address this gap, this study aims to analyze the effectiveness of a rice inventory control system within a state-owned logistics agency using a qualitative case study approach. The analysis focuses on five key indicators: inventory planning accuracy, recording accuracy, compliance with standard operating procedures (SOPs), stock availability and control, and the system's ability to mitigate the risk of inventory deterioration. By examining

these dimensions, the study seeks to provide a comprehensive understanding of how inventory control systems operate in a complex and policy-driven environment.

This research contributes to the literature in several ways. First, it extends existing studies on inventory control by incorporating a qualitative perspective that captures real operational dynamics and organizational practices. Second, it highlights the role of integrated digital systems in supporting inventory management effectiveness within the public sector. Third, it provides practical insights for policymakers and logistics managers in improving inventory control systems, particularly in managing large-scale food reserves and ensuring supply stability.

REVIEW OF LITERATURE

Concept and Function of Control in Management

Management control is widely recognized as a fundamental function in ensuring that organizational activities align with predetermined goals. Rather than merely serving as a monitoring mechanism, contemporary perspectives emphasize control as a dynamic process that integrates planning, coordination, and performance evaluation across organizational units. Laoli & Ndraha (2022) argue that management control ensures the effective utilization of human, technological, and physical resources, while Vasilev & Akhmetshin (2014) highlight its embeddedness in both individual behavior and organizational systems.

In the context of operations management, control plays a strategic role in managing the transformation of inputs into outputs, ensuring efficiency, quality, and timeliness (Heizer et al., 2017). However, prior studies tend to conceptualize control as a relatively stable and internally driven process. This perspective may be limited when applied to public sector organizations, where control systems must also respond to external pressures such as government policies, fluctuating demand, and socio-economic objectives. Therefore, understanding management control in such contexts requires a broader perspective that incorporates both internal mechanisms and external institutional influences.

Inventory Control Systems: From Traditional Models to Integrated Systems

Inventory control systems are essential for balancing supply and demand, minimizing costs, and ensuring operational continuity. Traditional approaches to inventory management, such as Economic Order Quantity (EOQ), primarily focus on optimizing order quantities and reducing holding and ordering costs. While these models offer analytical clarity, they often rely on assumptions of demand stability and predictable supply conditions, which may not reflect the complexities of real-world operations.

Prior studies by Sari et al. (2023) found that inventory control practices relying mainly on manual stock management and physical quality inspections often create inefficiencies, particularly when organizations face demand fluctuations and complex distribution processes. This highlights the need for integrated information systems to improve real-time monitoring, operational efficiency, and administrative accuracy. Recent studies have further emphasized technology-driven inventory systems, where effective control requires alignment between operational activities and long-term organizational goals, supported by accurate data recording and integrated information systems to ensure efficient inventory management (Ayomide et al., 2024; Fauzan, 2024).

Despite these advancements, empirical research indicates that many organizations, particularly in the public sector, still rely on hybrid systems that combine manual processes with digital tools. Such conditions may lead to inconsistencies, delays, and reduced system effectiveness, especially in large-scale operations involving multiple stakeholders and complex logistics networks. Furthermore, existing studies often focus on technical efficiency, with limited exploration of how digital systems interact with organizational practices, human resources, and institutional constraints.

Effectiveness of Inventory Control Systems

Effective inventory control is essential for achieving organizational objectives, including maintaining optimal stock levels, reducing costs, and ensuring timely demand fulfillment. Pasaribu (2024) states that effective inventory management requires a strong understanding of demand patterns and the ability to adapt to changing market conditions. Likewise, Lugina and Myamba (2025) highlight inventory turnover as a key performance indicator, where higher turnover reflects more efficient stock utilization and stronger system performance.

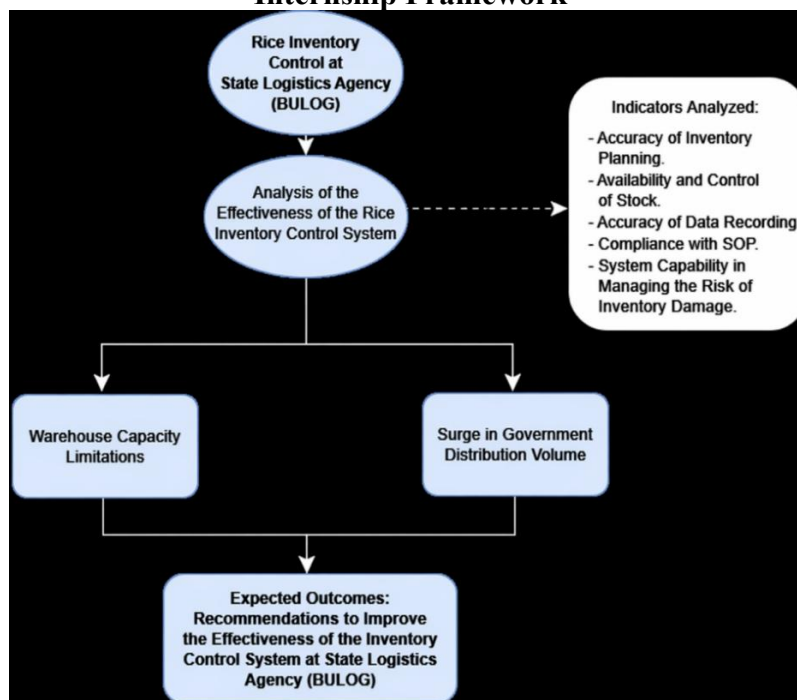
However, measuring effectiveness solely through quantitative indicators may provide an incomplete understanding, especially in public sector organizations where inventory management also supports policy implementation, supply stability, and risk mitigation. Previous studies often focus on system design outcomes while giving limited attention to implementation processes and contextual challenges, such as SOP compliance, administrative accuracy, infrastructure capacity, and risk management, despite their significant influence on actual system performance.

Research Gap and Conceptual Framework

Based on the review of existing literature, several gaps can be identified. First, prior studies predominantly adopt quantitative approaches and focus on cost efficiency and optimization models, with limited attention to qualitative insights into real-world implementation. Second, there is insufficient exploration of inventory control systems within public sector organizations, particularly those operating under policy-driven mandates and large-scale logistics operations. Third, the role of integrated digital systems, such as ERP, in shaping both administrative control and operational practices remain underexamined.

To address these gaps, this study adopts a qualitative case study approach to analyse the effectiveness of an inventory control system within a state-owned logistics agency. The analysis is based on five key indicators: (1) inventory planning accuracy, (2) accuracy of inventory recording, (3) compliance with standard operating procedures, (4) stock availability and control, and (5) risk control of inventory deterioration. These indicators are used to evaluate not only the technical performance of the system but also its practical implementation in a complex organizational and policy environment. The research framework can be seen in Figure 1.

Figure 1.
Internship Framework



Source: Processed Research Data, 2026

RESEARCH METHOD

This study employs a qualitative approach with a descriptive case study design to examine the effectiveness of a rice inventory control system within a state-owned enterprise in Indonesia. A case study was selected to enable an in-depth understanding of real-world practices and system performance. Data were collected through semi-structured interviews and document analysis, including organizational structures, SOPs, and internal policies. Informants were selected using purposive sampling based on their expertise and direct involvement in inventory control processes, including personnel from the Government Food Reserve, Logistics Management, and Quality Management divisions. To maintain confidentiality, the organization and respondents were anonymized. Data analysis was conducted using thematic analysis, involving data reduction, data display, and conclusion drawing to ensure credible and systematic findings.

RESULTS AND DISCUSSION

Data Description

The data were analyzed using thematic analysis based on in-depth interviews with personnel involved in rice inventory management within a state-owned enterprise. Manual coding was applied through open and selective categorization to identify key ideas related to the effectiveness of the inventory control system. This process generated five main codes representing the study indicators (shown in Table 1). The coding procedure was

systematically directed to address the three research questions concerning the effectiveness of the rice inventory control system.

Table 1.
List of Main Codes in Thematic Analysis

Informant Code	Position
K_PP	Represents the rice inventory planning process to ensure stock availability aligns with distribution needs.
K_AP	Describes the accuracy of rice inventory recording through warehouse administrative systems, including stock recording and verification activities.
K_SOP	Illustrates the implementation of Standard Operating Procedures (SOPs) in receiving, storing, and distributing rice in the warehouse.
K_KSP	Represents stock availability and inventory control in maintaining the stability of quantity and quality during storage.
K_PM	Describes monitoring and maintenance activities to preserve rice quality during storage and prevent damage or quality deterioration.

Source: Data Processed (2026).

This section discusses the research findings based on key themes in the research framework, which reflect the effectiveness of rice inventory control in a state-owned enterprise. Each theme connects practical implementation with theoretical concepts, illustrating how the inventory control system is applied and addressing the research questions outlined in Chapter One.

Informant Description

Interviews were conducted with informants involved in rice inventory management in a state-owned enterprise (Table 2), focusing on procurement planning, recording, storage, and quality control. The study also examined SOPs, ERP systems, and internal controls, as well as challenges such as warehouse capacity limits, policy demands, and quality risks.

Table 2.
Informant Description.

Description	Informant 1	Informant 2	Informant 3
Code	W1	W2	W3
Position/Unit	Subdivision of Domestic Government Rice Reserve Procurement, Government Food Reserve Division	System Manager for Other Food Commodities	Assistant Manager of Quality Maintenance, Quality Management Division
Data Collection	Direct interview with the researcher	Direct interview with the researcher	Direct interview with the researcher

Source: Data Processed (2026).

Interview Results

This study involved three informants directly engaged in rice inventory management within a state-owned enterprise, representing procurement, inventory operations, and quality control functions. Primary data were collected through semi-structured, face-to-face

interviews to gain in-depth insights into daily inventory control practices. The interviews focused on the implementation of inventory control systems, including procurement planning, ERP-based recording and monitoring, warehouse storage management, and quality supervision during storage. This aligns with prior findings that ERP enhances internal control effectiveness but depends heavily on user discipline and continuous training (Pangaribuan et al., 2025). Additionally, operational challenges such as warehouse capacity limitations, government assignment dynamics, and risks of quality deterioration were explored to provide a comprehensive understanding of system effectiveness.

Based on informants' responses, the rice inventory control system within a state-owned enterprise has been implemented in a structured manner, supporting procurement, recording, and stock monitoring processes. Procurement is conducted through farmers and milling partners to meet targets and maintain supply stability. Inventory management is supported by digital systems that enable systematic recording and monitoring, complemented by periodic stock opname to ensure consistency between system data and physical stock.

SOPs are consistently applied in storage and inventory handling, with regular quality inspections to maintain standards and minimize deterioration. However, challenges remain, including warehouse capacity constraints during high procurement periods and the limited storage life of harvested dry paddy (GKP), which requires rapid processing. Overall, the system enhances organized stock management, although further optimization is needed to improve effectiveness.

Field Observation Results

During the internship at a state-owned enterprise, the researcher observed rice inventory management processes aimed at maintaining stock availability and supporting food supply stability. The system facilitates administrative processes and stock monitoring through structured recording of inflows, outflows, and stock levels, improving coordination across units and minimizing recording errors. The integrated system strengthens operational control through standardized procedures and accurate data sharing. However, challenges were identified, including warehouse capacity limitations during high procurement periods and the perishable nature of harvested dry paddy (GKP), which requires rapid processing. Therefore, optimizing warehouse capacity and improving operational coordination are necessary to enhance inventory control effectiveness.

Discussion

The findings of this study indicate that the rice inventory control system within the state-owned logistics agency operates through a structured and integrated mechanism encompassing planning, recording, monitoring, and quality control. However, beyond this procedural structure, the analysis reveals that the effectiveness of the system is not solely determined by its design, but by the interaction between digital infrastructure, operational practices, and external policy pressures.

Integration of Digital Systems and Operational Control

One key finding is the important role of digital systems, particularly ERP, in enhancing inventory accuracy and transparency. The integration of ERP with supporting applications enables real-time data recording, multi-layer verification, and improved coordination across units. This finding aligns with previous studies suggesting that digital systems contribute to improved operational efficiency and data reliability in inventory management (Holloway, 2024). However, this study extends existing literature by demonstrating that digital

integration alone is insufficient to guarantee system effectiveness. In practice, the effectiveness of ERP is contingent upon system stability, accessibility, and user readiness. Disruptions in system availability and limitations in field access indicate that technological infrastructure remains a critical constraint (Sudarmi & Sunaryo, 2024). It supports the argument that the success of digital transformation in inventory control is not purely technical but also organizational, requiring alignment between technology, users, and operational conditions.

Inventory Planning in a Policy-Driven Environment

The study also highlights that inventory planning within the organization is largely driven by government assignments rather than purely demand-based forecasting. It distinguishes public sector inventory systems from private sector models, which typically prioritize cost efficiency and demand optimization. While top-down planning enables the organization to maintain national food reserves and respond to policy objectives, it also introduces operational rigidity and uncertainty. Fluctuations in procurement targets require continuous adjustments in storage capacity, logistics coordination, and stock management (Monczka et al., 2016). This finding challenges conventional inventory theories that assume relatively stable demand patterns and reinforces the need for adaptive planning mechanisms in policy-driven environments. Thus, inventory planning effectiveness in this context should not be evaluated solely based on forecasting accuracy but also on the system's ability to respond to dynamic and externally imposed changes.

SOP Compliance and Organizational Discipline

Another important finding is the consistent implementation of standard operating procedures (SOPs) in inventory handling processes, including procurement, storage, and distribution. SOP compliance contributes to standardization, reduces procedural errors, and enhances coordination among units. This finding supports prior research emphasizing the importance of formal control mechanisms in maintaining operational consistency. However, this study further reveals that SOP effectiveness depends on organizational discipline and continuous monitoring. Internal audits and supervision play a crucial role in ensuring that procedures are not only formally established but also practically implemented. In this regard, SOPs function not merely as administrative guidelines but as instruments of organizational control that bridge the gap between system design and real-world execution.

Stock Control and Infrastructure Constraints

Despite the presence of structured control mechanisms, the study identifies warehouse capacity limitations as a major challenge affecting system effectiveness. Increased procurement volumes, driven by government policies, often exceed available storage capacity, leading to overcapacity conditions and the need for external storage solutions. This finding highlights a critical limitation in existing inventory control frameworks, which tend to emphasize administrative and technological aspects while underestimating the role of physical infrastructure. The results suggest that effective inventory control requires a balance between digital systems and physical capacity. Moreover, stock control in this context extends beyond quantity management to include quality preservation. Practices such as FIFO implementation, moisture control, and stock rotation indicate that inventory management is multidimensional, involving both logistical and quality considerations.

Prior studies support these findings, showing that the effectiveness of digital systems in the public sector depends on the quality of technological infrastructure and user readiness.

Weak infrastructure, limited flexibility, and low technology adoption reduce system efficiency, while coordination problems and inconsistent SOP implementation across units further create operational inefficiencies (Argianti & Kartini, 2025; Nchabeleng & Ncube, 2025). Therefore, improving digital systems requires technical enhancement, stronger organizational coordination and better-prepared human resources.

Risk Management and Quality Control

Risk control emerges as a central component of inventory effectiveness, particularly in managing the perishable nature of rice. The study finds that both preventive and corrective measures are implemented, including routine inspections, spraying, drying, and reprocessing. This finding reinforces the argument that inventory control in food logistics differs from other sectors due to the inherent risk of product deterioration. Therefore, effectiveness must be assessed not only in terms of stock availability but also in the system's ability to maintain product quality over time. In addition, the need for rapid processing of harvested dry paddy (GKP) highlights the importance of time-sensitive operations in reducing quality risks. This indicates that inventory control systems must integrate operational speed with quality assurance mechanisms, particularly in high-volume and high-risk environments.

Implications for Inventory Control Theory

The findings of this study contribute to the development of inventory control theory in several ways. First, they demonstrate that effectiveness is context-dependent and cannot be fully explained by traditional models focused on cost efficiency and optimization. Second, the study highlights the importance of integrating digital systems with organizational practices and infrastructure capacity. Third, it underscores the role of external factors, particularly government policies, in shaping inventory control processes in public sector organizations. These insights suggest that inventory control should be conceptualized as a socio-technical system, where technology, human factors, organizational processes, and external environments interact dynamically. Such a perspective provides a more comprehensive understanding of inventory control effectiveness, particularly in complex and policy-driven contexts.

CONCLUSION

This study examines the effectiveness of a rice inventory control system within a state-owned logistics agency operating under a policy-driven environment. The findings indicate that the system has been implemented through structured and integrated processes, including inventory planning, digital recording, stock monitoring, and quality control. The use of ERP and supporting digital applications has enhanced data accuracy, transparency, and coordination across organizational units, contributing to more reliable inventory management practices.

However, the results also demonstrate that system effectiveness is not determined solely by the presence of formal procedures and digital infrastructure. Instead, it is shaped by the interaction between technological systems, organizational practices, and external policy pressures. In particular, inventory planning is largely driven by government assignments, requiring the organization to continuously adapt to fluctuating procurement targets and operational demands. This condition differentiates public sector inventory management from conventional models that rely on stable demand forecasting and cost optimization.

Furthermore, this study identifies several critical challenges affecting system effectiveness. These include limitations in warehouse capacity during periods of high procurement, dependence on system stability and accessibility, and the need to manage quality risks associated with perishable inventory. Such challenges highlight that effective inventory control requires not only administrative accuracy but also adequate physical infrastructure and responsive operational coordination.

From a theoretical perspective, this study contributes to the inventory control literature by emphasizing the importance of a socio-technical approach, in which system effectiveness is understood as the result of interactions between digital technology, human factors, organizational processes, and external institutional environments. This perspective extends beyond traditional efficiency-oriented models and provides a more comprehensive understanding of inventory management in complex and policy-driven contexts.

Practically, the findings suggest that improving inventory control effectiveness requires a holistic approach. Organizations should strengthen digital system integration, enhance infrastructure capacity, and improve inter-unit coordination to better manage fluctuations in inventory volume. In addition, continuous monitoring, employee training, and adaptive planning mechanisms are essential to ensure both stock availability and quality stability.

Despite its contributions, this study has several limitations. The research is based on a single case study, which may limit the generalizability of the findings to other organizational contexts. In addition, the qualitative approach focuses on in-depth understanding rather than quantitative measurement of performance outcomes. Therefore, future research is recommended to adopt comparative or mixed-method approaches to further examine inventory control effectiveness across different sectors and operational settings.

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