IMPACT OF MANUAL INBOUND INVENTORY MANAGEMENT ON OPERATIONAL EFFICIENCY AT THE L3 LEVEL IN SRI KANNAPIRAN MILLS LIMITED, COIMBATORE

Swathi

Sri Ramakrishna College of Arts and Science (Autonomous)

ABSTRACT

In today's globally competitive manufacturing landscape, operational efficiency has become a decisive factor in determining organizational performance, profitability, and sustainability. Inventory management—particularly inbound inventory operations—plays a central role in ensuring timely material flow and production continuity. This study investigates the impact of manual inbound inventory management on operational efficiency at the L3 level in Sri Kannapiran Mills Limited, a prominent textile manufacturer in Coimbatore, Tamil Nadu. Relying on a descriptive and exploratory research design and supported by secondary data and employee survey analysis, the research identifies the key challenges associated with manual inbound inventory systems, including data delays, entry inaccuracies, and lack of real-time visibility. The study applies statistical tools such as chi-square tests, regression, and ANOVA to evaluate the relationships between inventory accuracy, decision-making delays, and overall operational performance. The findings highlight the inefficiencies caused by manual documentation and underscore the potential of digital transformation through ERP integration, barcode systems, and real-time tracking. The paper concludes with strategic recommendations for process automation, employee training, and system modernization to enhance accuracy, responsiveness, and sustainability in textile operations.

Keywords: Inventory Management, Operational Efficiency, Manual Inbound System, ERP Integration, Textile Industry, Digital Transformation, Sri Kannapiran M

1. INTRODUCTION

Manufacturing organizations face constant pressure to optimize operational efficiency, minimize waste, and enhance responsiveness to market demands. Among the many determinants of operational performance, **inventory management**—especially inbound logistics—plays a vital role. Inbound inventory management refers to the receipt, verification, documentation, and storage of raw materials entering the production process. Any delay or inaccuracy at this stage can disrupt production planning, increase costs, and reduce customer satisfaction.

In the context of the textile industry, the inbound process is particularly significant due to the high volume and value of materials such as cotton, packing materials, and spares. At **Sri Kannapiran Mills Limited (SKML)**, inbound inventory at the **L3 level** is managed manually through registers, spreadsheets, and physical documentation. While manual systems provide direct human control, they are vulnerable to data entry errors, time delays, and lack of real-time visibility. These inefficiencies directly affect the company's ability to plan production and maintain delivery schedules.

This study aims to assess the impact of manual inbound inventory management on operational efficiency at SKML. It also explores how digital transformation—such as integrating ERP, barcode, or RFID technologies—could improve accuracy, visibility, and performance at the L3 operational level.

2. REVIEW OF LITERATURE

Inventory management has long been recognized as a strategic function within manufacturing systems. Zhao and Tu (2021) emphasized that effective inventory control is central to ensuring smooth material flow and minimizing resource waste. Similarly, Teplicka and Culkova (2020) highlighted that optimization methods like EOQ models improve cost efficiency and stock management accuracy.

Jonas (2022) explored the transition from manual to smart warehousing, demonstrating that automation tools such as barcode scanners and RFID systems significantly reduce human error and operational delays. Srikanth Yerra (2025) further reinforced this finding by showing that real-time data dashboards enable predictive decision-making, enhancing agility across supply chains.

Within the textile industry, Lorente-Leyva et al. (2024) and Castellucci et al. (2024) noted that manual inbound systems cause data mismatches, hinder sustainability efforts, and reduce material traceability. Their studies suggested that digital synchronization between departments can reduce lead time and waste.

In the Indian context, Hamed and Ramesh (2024) emphasized that digital transformation enhances coordination across production and logistics functions. Likewise, Thenarasu (2023) observed that modernization in yarn manufacturing could strengthen India's textile competitiveness globally. Collectively, these studies indicate that automation supports both operational excellence and sustainable manufacturing—two key imperatives for the textile sector.

3. RESEARCH METHODOLOGY

This research adopts a **descriptive and exploratory design**, aiming to understand existing manual inbound inventory practices and their operational consequences.

3.1 DATA COLLECTION

The study relies on both **secondary data** (company records, operational manuals, industry reports) and **primary data** collected from 46 employees directly involved in L3 inbound operations. Data were analyzed using SPSS software to examine relationships between process delays, discrepancies, and efficiency.

3.2 SAMPLING

A **purposive sampling method** was adopted, targeting employees with direct exposure to inbound inventory handling.

3.3 STATISTICAL TOOLS

- **Chi-square Test:** To determine associations between work shifts and data entry delays.
- **Regression Analysis:** To examine relationships between outdated data and inventory discrepancies.
- **ANOVA:** To identify significant differences between groups regarding delay frequency and production disruptions.
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3.4 SCOPE

The scope is limited to inbound inventory operations at the L3 level within SKML, focusing on process efficiency, accuracy, and system responsiveness.

4. DATA ANALYSIS AND FINDINGS

The analysis revealed several critical insights into manual inbound inventory management at SKML:

1. **Time Delay in Data Entry:**

The average time lag between goods arrival and system entry ranges from **3 to 6 hours**, extending to over **18 hours** in some cases. These delays hinder real-time visibility and affect downstream planning.

2. **Error Frequency:**

Manual entry methods resulted in quantity mismatches of **3–10%**, primarily due to human counting errors and duplicate documentation across registers and Excel files.

3. **Chi-square Analysis:**

A significant relationship was found between shift timings and data entry delays ($\chi^2 = 86.12$, $p < 0.001$), indicating that evening and night shifts experience longer lag times.

4. **Regression Findings:**

A strong positive correlation ($r = 0.689$, $p < 0.001$) was identified between decision-making delays and inventory discrepancies. This suggests that outdated information directly contributes to operational inefficiencies.

5. **ANOVA Results:**

Significant differences ($p < 0.001$) were observed across process stages, confirming that delay-prone activities—such as documentation and verification—substantially affect production timing.

6. **Employee Perspectives:**

Most employees expressed that **real-time inventory updates** would drastically improve workflow efficiency. The regression model confirmed this perception with a strong positive correlation ($r = 0.847$, $p < 0.001$).

Overall, the findings reveal that manual processes slow decision-making, increase rework, and reduce transparency. The lack of integrated systems also limits traceability and audit readiness.

5. DISCUSSION

The results align with global research that identifies manual inbound processes as key bottlenecks in supply chain performance. At SKML, manual recording practices, while familiar and controllable, no longer meet the speed and accuracy demands of modern textile operations.

The study underscores that **human dependency** in documentation leads to data fragmentation and delayed communication between departments. Moreover, the absence of ERP integration prevents seamless synchronization across purchase, stores, and production functions.

Automation technologies such as **barcode scanning**, **RFID tagging**, and **IoT-based monitoring** can address these limitations by providing real-time visibility and reducing error rates. The implementation of digital dashboards and analytics tools would also enable proactive decision-making and improved resource utilization.

6. RECOMMENDATIONS

6.1 PROCESS IMPROVEMENTS

- Implement **barcode or RFID systems** for faster and more accurate material tracking.
- Develop a **semi-automated data entry interface** at the L3 level, linked directly with ERP.
- Establish **standard turnaround times** (e.g., material entry within two hours).
- Assign **inbound process supervisors** to monitor compliance and minimize delays.

6.2 TECHNOLOGICAL INTEGRATION

- Integrate **ERP systems** across inbound, production, and finance departments.
- Deploy **digital dashboards** for real-time monitoring of inbound status and stock levels.
- Introduce **IoT-based sensors** for condition monitoring of cotton bales and sensitive materials.
- Use **cloud-based storage** for accessible and secure data retrieval.

6.3 HUMAN RESOURCE DEVELOPMENT

- Conduct **training sessions** for staff on ERP usage and digital entry procedures.
- Introduce **performance indicators (KPIs)** for accuracy and response time.
- Offer **incentives** for employees maintaining high data accuracy and compliance.
- Foster **cross-departmental communication workshops** to improve coordination.

6.4 STRATEGIC ACTIONS

- Begin with a **pilot automation phase** at one inbound unit before full-scale implementation.
- Establish a **Digital Transformation Committee** to oversee process integration and policy formulation.
- Monitor **sustainability metrics** (paper reduction, energy efficiency, process time savings) to assess long-term benefits.

7. CONCLUSION

The study concludes that manual inbound inventory management at the L3 level significantly affects operational efficiency in Sri Kannapiran Mills Limited. While manual verification ensures control, it introduces substantial delays, inaccuracies, and data visibility issues. Statistical analysis confirmed that these inefficiencies correlate strongly with production delays and decision-making bottlenecks.

Transitioning to a **digitally integrated inbound system**—through ERP, barcode, or RFID technologies—can provide real-time synchronization, minimize human errors, and improve responsiveness. Implementing automation will not only enhance productivity and data accuracy but also support sustainability goals by reducing paper dependency and waste.

Therefore, modernization of inbound inventory management is not merely an operational upgrade but a **strategic necessity** for sustaining competitiveness in the Indian textile industry. By embracing automation and digital transformation, SKML can achieve agile, transparent, and sustainable operational excellence.

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