JAIIT (Journal of Advances in Information and Industrial Technology)
Vol. 7, No. 2 Nov 2025, ISSN 2716-1935, E-ISSN 2716-1927

Exploring Logistics Process Improvement Possibility with SCOR Digital Standard and Lean Waste Analysis

Adhie Prayogo[*1)], Curie Habiba[2)], M. Mujiya Ulkhaq[3)], Dina Tauhida[4)], Fachri Rizky Sitompul[5)]

[1, 4)]Department of Industrial Engineering, Universitas Muria Kudus, Kudus, Indonesia
[2)]Department of Informatics Engineering, Universitas Muria Kudus, Kudus, Indonesia
[3)]Department of Industrial Engineering, Diponegoro University, Semarang, Indonesia
[5)]Doctoral School of Economics and Regional Sciences, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary

[1*]adhie.prayogo@umk.ac.id, [2]curie.habiba@umk.ac.id, [3]ulkhaq@live.undip.ac.id , [4]dina.tauhida@umk.ac.id, [5]Sitompul.Fachri.Rizky@phd.uni-mate.hu

ARTICLE INFO

Article history:
Received 27 October 2025
Revised 8 November 2025
Accepted 21 November 2025
Available online 26 November 2025

Keywords:
Business Process Modelling
Lean Waste Analysis
Logistics
Process Improvement
SCOR Digital Standard

ABSTRACT

Inbound logistics, including receiving goods, quality and physical checking, item inquiry, and stock-level checking are essential aspects within supply chain management in which the unresponsive operation may lead to inefficiency. This study aims to observed the ongoing operations in a mid-sized paper manufacturer using a combination of Business Process Modelling to map the current flow process, Lean Waste Analysis to identify possible wastes, and SCOR Digital Standard to offer improvement opportunities. The results show that waiting, motion, overprocessing, and inventory wastes are identified across the three logistics main processes. Additional waste, human skill, is observed in the stock-level checking procedure. Subsequently, SCOR DS recommends the firm to escalate the human skills of lean manufacturing, bar code handling & RFID, ERP system, automation tool, time management, and collaboration, to support the performance improvement. Finally, the study proposed metrics within four dimensions to validate the solution impact on the performance, including the responsiveness, reliability, asset management, and people.

1. Introduction

Inbound logistics is essential to supply chain management, highlighting the efficient movement of incoming goods from suppliers to manufacturing facilities [1]. It encompasses a range of actions, including receiving goods, quality and physical checking, and keeping in the storage area to support the subsequent manufacturing processes [2]. Many industries focus on ensuring supply availability, minimizing delays, and preventing disruptions, while maintaining operational efficiency. Several distinctive yet advanced technologies assisted businesses in achieving the aforementioned purposes, including GPS for real-time tracking and visibility [3], [4], machine learning for predictive analytics [5], [6], GIS and Simulation for demonstrations [7]. In addition, lean management, process optimization, and benchmarking are profound improvement strategies or methods [8]–[10].

Lean management constitutes an integrative framework for process optimization, highlighting the waste elimination and value creation enhancement across various businesses [11], [12]. With its typical focus on waste reduction through identification and elimination, and on continuous improvement through detection and minimizing inefficiencies, lean management becomes an imperative strategy for logistics performance escalation [13], [14]. Swimlane diagrams may serve as a visual tool for business processes or workflow representation by several actors. Clearly delineating responsibilities and interactions between stakeholders facilitates workflow optimization, becoming a complementary tool for lean strategy in mapping out current and desired workflow [15], [16].

The concept of technology implementation into the inbound logistics process may refer to the SCOR DS (Digital Standard). SCOR DS offers a comprehensive framework for improving supply chain efficiency and effectiveness through better integration of technologies. The model incorporates a range of digital tools, namely Enterprise Resources Planning (ERP), Warehouse Management System (WMS), and Radio Frequency Identification (RFID) systems, to enable real-time visibility, and emphasizes metrics for its performance measurement [17], [18]. Its functionality complements the combination of business process modelling and lean management in offering a technological solution for the problems.

Limited studies have utilized SCOR DS to measure the supply chain. A research by [19] use SCOR DS to identify and categorize performance indicators of waste management site in Sleman, Yogyakarta, according to the six core processes, namely plan, order, source, transform, fulfil and return. Another study by [20] utilizes SCOR DS as a framework, with quantitative approach, for identifying the performance gaps and its targeted improvements. The study then subsequently implements 5-Why Analysis to observe the factors causing the low performance scores. A similar research by [21] aims to evaluate the current performance of Cijurey Dam Package 1 Project by measuring baseline performance using SCOR DS approach. Afterwards, the 5-Why Analysis and fishbone diagram is deployed to identify the problem causal. Despite of the limited existing studies, SCOR DS incorporates existing capabilities, such as automation, digital connectivity, which the traditional frameworks may not fully address.

This study proposed a combination of Business Process Modelling, SCOR DS, and Lean Concept, using qualitative approach, to evaluate the inbound logistics process in a spare-part warehouse of a mid-sized paper manufacturer in Indonesia. Unlike the previous studies, this research uses business process modelling to map the current workflow in the observed area, specifically a swim lane diagram to facilitate the process flow and connection mapping between stakeholders. In addition, the study uses lean concept to identify possible unnecessary processes or areas for further improvement. Finally, SCOR DS presents possible solutions and performance evaluation metrics for each distinctive process.

The paper is structured as follows. Section 2 describes the proposed methods, presenting a swim lane diagram, lean concept, and SCOR DS. Section 3 presents the case study, including the data collection, results, and analysis. Section 4 emphasizes the conclusions and future research studies.

2. Methods

This section presents methodology for spare-part warehouse possible improvement identification using a SCOR DS, which integrated with a swim lane diagram and lean concept within the framework. This study aims to present possible improvement ideas using qualitative approach, as a reference or guidance for further measurement. Firstly, the diagram will present the current process flow of receiving goods, user inquiry, and stock checking, enabling easier understanding of the existing process condition. Secondly, this visualization was then used as a reference for lean concept approach in identifying possible wastes. Finally, SCOR DS offers possible solutions for each observed issue with various strategies, technologies, and required skills. This integration facilitates a more structured problem-solving for effective strategies. Those approaches are consolidated within SCOR DS steps, as follows:

a. Step 1: Engage

   This step enables stakeholders' identification by collecting information through documentation, a structured face-to-face interview, and direct 30 days observation. The expected results are detail information of existing process flow and its stakeholders.

b. Step 2: Define

   This phase prioritizes strategic organizational issues, including primary goals definition and boundary analysis setting. This study uses the swim lane diagram to visualize existing processes with their stakeholders, enabling easier waste detection in the next step. Three primary activities, including receiving goods, user inquiry, and stock checking, were prioritize to evaluate, expecting ideas for better inbound logistics processes.

DOI: https://doi.org/10.52435/jaiit.v7i2.723

c. Step 3: Analyze
The third step attempts to analyze the existing process flow using lean approach. Lean idea aims to detect possible waste, including time, inventory, movement, warehouse, overproduction, overprocessing, and defects across activities.

d. Step 4: Plan
The fourth step assists in defining solutions for observed issues by referring to the SCOR DS framework. Its framework offers several business practices as guidelines, metrics for improvement measurement, and a list of related skills, technologies, and experiences as references in driving successful improvement ideas to minimize waste.

e. Step 5: Launch
The last step is launch, aiming to execute the proposed idea for waste minimization. In this study, prioritized projects were presented as references for further measurement, execution, and control.

3. Results and Discussions

3.1. Step 1: Engage

A structured face-to-face interview with the head of the spare-part warehouse was conducted to obtain comprehensive information on the actual procedure for receiving, storing, issuing, and periodic inventory checking. A literature review and direct observation, within around 30 days, of the existing processes were conducted to enrich the gathered data. These findings were subsequently used as a fundamental consideration for process analysis and improvement in tackling the observed challenges.

3.2. Step 2: Define

Referring to the interview results, three specific process mappings were constructed. Figure 1 depicts the incoming goods procedure. Once the shipment is received, the purchasing manager coordinates with the quality control department for product receiving. The quality control department then collected the goods for quality and physical checking. The purchasing manager coordinated with the supplier for the return policy once goods failed the standards; otherwise, the quality control department issued a Quality Inspection Report. Further, according to the stock card and delivery note, the staff forwarded the goods and documents to the spare part warehouse for reassessment.

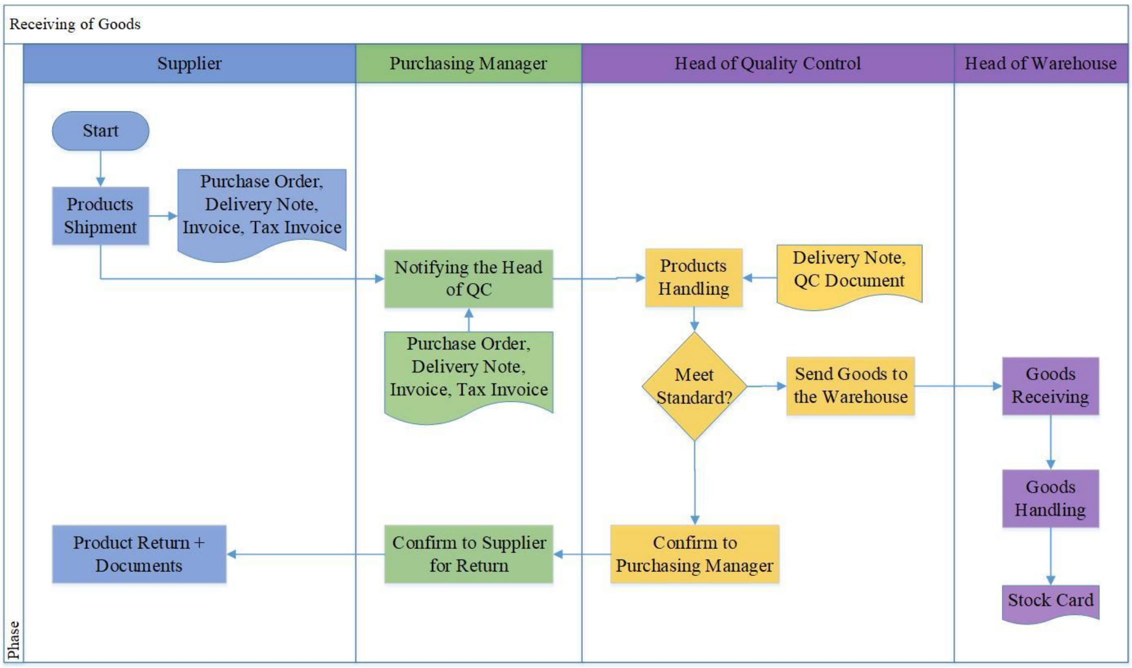

Figure 1. Receiving Goods

For any item request, shown in Figure 2, the users must issue and submit an inquiry to the spare part warehouse using a "template paper". Following the requests, the warehouse staff prepares, hands over the items, and updates the stock card. The user then confirms receipt of the goods, while the staff records the released goods on the "Warehouse Outbound Log" before they are archived. Subsequently, the staff inputs the stock record into the system. A monthly stocktaking is performed by checking the physical products to validate the system data, shown in Figure 3. If a discrepancy is found, a causal analysis is conducted, which the documents then saved and archived by warehouse staff.

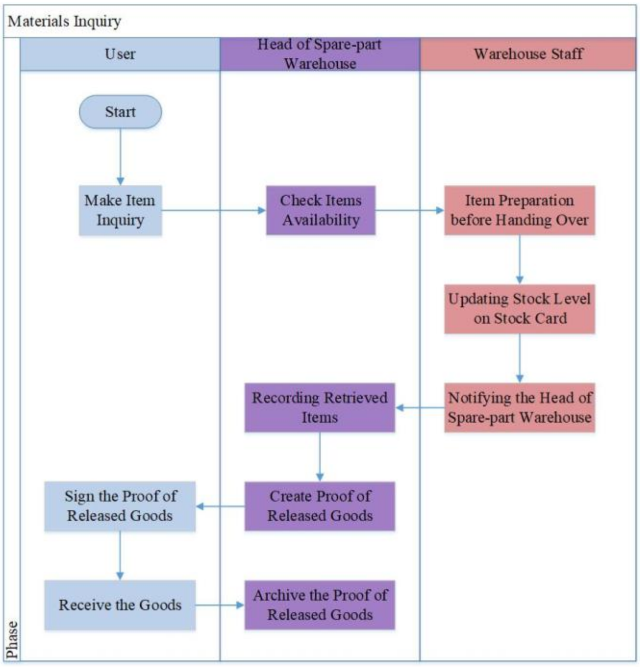

Figure 2. User Request

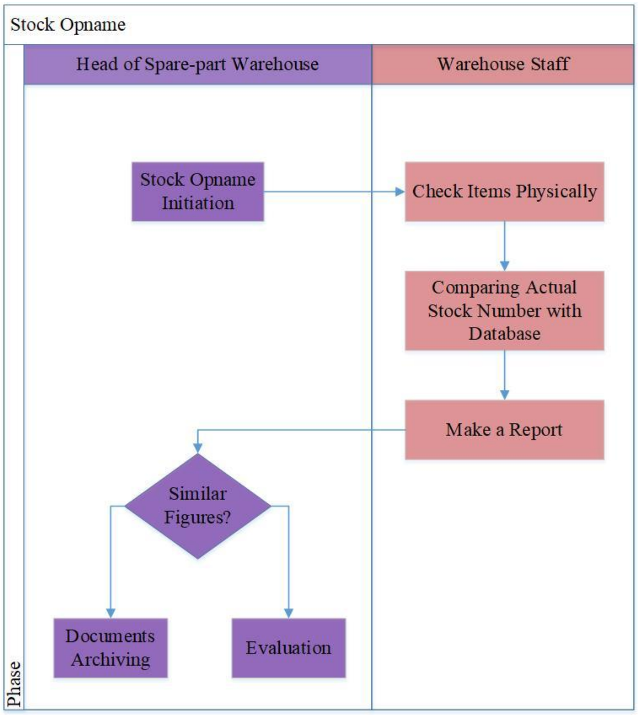

Figure 3. Stock Opname

3.3. Step 3: Analyze

An operation analysis is conducted to discover possible alternatives to solving the issues. First, exploring suitable technology applications could resolve the lack of valid real-time stock visibility.

 DOI: https://doi.org/10.52435/jaiit.v7i2.723

Second, longer waiting and processing times within the inbound logistics flow could be optimized by applying a lean approach to investigating and minimizing waste.

a. Receiving Goods from Supplier

According to the process map shown in Figure 1, the procedure operates reactively. The head of the warehouse was informed regarding the incoming products after quality check approval, resulting in the warehouse facility being unready to process. Consequently, it could lead to a longer processing time since the warehouse is unprepared. Furthermore, the staff might experience more physical and mental workload as they must deal with unexpected incoming goods. Comprehensive details about the returning process for rejected items are needed. Otherwise, its presence would accumulate holding costs. Documentations were primarily performed manually, which could result in human error, lost files, and no real-time visibility. Especially during the goods receiving after QC acceptance, the warehouse team was asked to input the data into the system manually. In summary, several observed wastes are shown in Table 1.

Table 1. Identified Waste in the Receiving Goods Flow Process

No	Type of Waste	Details
1	Waiting	• Receiving process waits for the readiness of the warehouse due to late information. • Quality checking by documents cause a late result of the quality inspection report.
2	Motion	• Documents are passed physically between several parties, leading to unnecessary movement.
3.	Overprocessing	• Excessive documentation processes since the warehouse team needs to read the label and input product details to the system manually.
4.	Inventory	• Products that cannot meet QC standards but remain in the warehouse waiting for return increase non-value-adding inventory.

b. User Inquiry

The process flow lacks information on the stock-out scenario. Besides, the request form is manually created and distributed, increasing time spent on a simple request, especially during a long queue. Furthermore, manual inventory checks and preparation by the staff prolong the waiting time. Then, the released goods were recorded on the Stock Card with no real-time visibility on the system. After updating the system, they experienced overprocessing as the items were again recorded on the “Proof of Released Goods”. Observed wastes during the user inquiry process are described in Table 2.

Table 2. Identified Waste in the User Inquiry Flow Process

No	Type of Waste	Details
1	Waiting	• The user needs to wait for the warehouse staff to process the inquiry.
2	Motion	• Manual distribution of the item inquiry card • The warehouse staff performs manual inventory checking
3.	Overprocessing	• The goods recording process is performed repetitively.
4.	Inventory	• Too much paperwork increases the physical administrative work.

Table 3. Identified Waste in Stock Checking Flow Process

No	Type of Waste	Details
1	Waiting	• Staff are waiting for the related parties to be ready for stock checking
2	Motion	• Staff physically roam the facility area to assess the stock.
3.	Overprocessing	• Staff need to record the item with books, which are input into the system.
4.	Inventory	• Too much paperwork increases the physical administrative work.
5.	Skills	• The staff was mainly burdened with counting and checking items physically and manually because they were not equipped with technology. • The related staff were not urged to develop technology.

c. Stock Checking

Coordination with other departments was not initiated during the process, disrupting production or other related processes. Besides, the process was executed manually, as the staff had books or notes for manual item counting and recording. These practices obviously required a longer time and were prone to human error. Table 3 presents several observed wastes.

3.4. Step 4: Plan

The SCOR Digital Standard model is deployed to guide the flow into a more digitalized procedure. SCOR Digital Standard comprises seven primary domains: the Orchestrate, Plan, Order, Source, Transform, Fulfill, and Return. In this case, not all domains were included, but only those highly associated with the three procedures: the Orchestrate, Source, and Transform. Four distinctive waste groups were identified during the receiving procedure, presented in Table 4.

First waste, waiting, occurred because of poor synchronization between the storage area readiness with inbound deliveries. This problem reflects performance gaps in *SCOR Process S2.4 Receive Product*. Referring to the *BP.069 Raw Materials Receiving Process*, an advanced shipping notification would enable the storage location readiness in advance, resulting in a streamlined process. The impact could be analyzed with metrics *RS.3.107 Receiving Product Cycle Time* for detailed delay-time calculation. A shorter cycle time is expected to confirm the application success; otherwise, further analysis is required. Addressing the waste requires skills in *HS.0211 Collaboration* and *HS.0213 Time Management* since coordination with other parties for storage location preparation and priority decisions are imperative. Waiting waste also occurred during the issuance process of the quality inspection report by the QC staff, because the usage of physical documents. This issue reflects gap performance in *SCOR Process S2.5 Inspect and Verify*. Possible strategy could refer to the *BP.147 Receiving Goods Inspection*, implementing technology for quicker checking process, particularly in looking for standards or storing obtained information or evidence. *RL.2.11 Correct Documentation* may act as a metric to measure the process punctuality. In driving the idea's success, the staff requires discrepancy reporting and resolution skills through several indispensable training courses, such as *HT.008 Automation Tool, HT.0045 Enabling Technology,* and *HT.0052 ERP System Training*.

The second waste, motion, occurred when the documents were handed over to several parties, belongs to the *S2 Direct Procure*. Possible solution may refer to *BP.166 Document Management System* and *BP.305 Digital Invoice and Payments Processing*, digital documents to replace the physical version for convenience and quickness in storing, transferring, tracking, and validation. Besides, the digital practice also accommodates the company and its suppliers to digitalize the invoice process, including issuance, handing over, storing, or checking, for a more streamlined invoice process. To substantiate the idea application, the staff must master *HS.0098 Product Information Management*, the ability to operate software or other tools for capturing and maintaining information about products and services. *HS.0094 Procurement* is indispensable for acquiring goods and services, with its imperative documentation.

Third waste, overprocessing, happened once the staff again checked the goods by reading the labels and inputting them manually within the system upon storing the items, belongs to *S2.5 Inspect and Verify*. By applying the *BP.166 Document Management System* and *BP.152 Automated Data Capture (ADC)*, the process can be streamlined using a Barcode Scanner to identify which items belong to which supplier and its shipment date, especially if there are several distinctive suppliers for similar items. This tool enables integrated data capture with the RFID System for further strategy, replacing unnecessary manual input. To support the implementation, *HS.0098 Product Information Management (Product Data Management (PDM))* skill is required to operate software or other tools in capturing and maintaining product information, along with *HS.0164 Automation* to understand machines procedure.

Fourth, waste inventory occurred due to the rejected incoming goods appeared in the warehouse. The longer the presence, the greater the accumulated wastage would be. This process depicts gaps in *SCOR S4.4 Schedule Product Shipment*. Considering the adoption of *BP.112 Return Shipping*

 DOI: https://doi.org/10.52435/jaiit.v7i2.723

Consolidation, the rejected items should be routed to the defined location, which could be central facilities or a third-party logistics provider. This practice may lower the handling cost with its associated risks, enabling the area for other purposes and minimizing mobility disturbance. The impact could be measured by calculating how much energy is consumed and the amount of generated waste. To perform this item well, the staff must have *HE0067 Defective product handling experience.*

Table 4. SCOR Digital Standard Applications Receiving Goods

Waste	Details	Process	Practice	Performance/ Metrics	People
Waiting	The receiving and transferring process waits for the readiness of the warehouse area, specifically the storage location, due to late information upon the goods' arrival.	Source – Direct Source S2.4 Receive Product	BP.069 Raw Materials Receiving Process	RS.3.107 Receiving Product Cycle Time	HS.0211 Collaboration HS.0213 Time Management
	The Quality Checking performed by the inspector uses physical documents, which leads to a late result in the Quality Inspection Report due to manual input into the system before issuance.	S2.5 Inspect and Verify	BP.147 Receiving Goods Inspection	RL.2.11 Correct Documentation	HS.0034 Discrepancy Reporting and Resolution HT. 0008 Automation Tool HT.0045 Enabling Technology HT.0052 ERP Systems Training
Motion	Documents, such as delivery notes and invoices, are physically passed between several parties, leading to unnecessary movement.	S2 Direct Procure	BP.166 Document Management System BP.305 Digital Invoice & Payments Processing	RL.1.1 Perfect Customer Order Fulfillment	HS.0098 Product Information Management (Product Data Management (PDM)) HS.0094 Procurement
Over-processing	Excessive documentation processes since the warehouse team needs to read the label and input product details to the system manually before storing the goods.	Inspect and Verify	BP.166 Document Management System BP.152 Automated Data Capture (ADC)		HS.0098 Product Information Management (Product Data Management (PDM)) HS.0164 Automation
Inventory	Products that fail QC standards but remain in the warehouse waiting for return increase non-value-adding inventory.	S4.4 Schedule Product Shipment	BP.112 Return Shipping Consolidation	EV.1.2 Energy Consumed EV.1.5 Waste Generated	HS.0222 Sustainability Standards and Frameworks HE.0067 Defective Product Handling

Table 5 presents the wastes related to the user inquiry. As with the manual process, much paperwork may confuse prioritizing the order, resulting in a late response in material supply. Therefore, under the *Transform, T3.6 Issue Raw Material or Components or Subassemblies*, a *BP.009* Kanban is applied. Though kanban is usually known for its physical cards, current enterprise resource planning systems can replace it with electronic signals or a dashboard. The digital version of item inquiry enables process prioritization and quicker inventory checking, as manual input of any information on the system is unnecessary. Further, the system may analyze how long the inquiry process for one item could be, thus the bottleneck may be revealed. Once applied, the metric *RS.3.14 Issue Material Cycle Time* indicated whether the method improved the process. *HS.0065 Lean Manufacturing* skill is essential to drive the success, as the staff will emphasize their orientation on process efficiency and waste reduction.

Table 5. SCOR Digital Standard Applications User Request

Waste	Details	Process	Practice	Performance/ Metrics	People
Waiting	The user must wait for the warehouse staff to process the item inquiry.	T3.6 Issue Raw Material, Components, or Subassemblies	BP.009 Kanban	RS.3.14 Issue Material Cycle Time	HS.0065 Lean Manufacturing
Motion	Manual distribution of the item inquiry card	T3.6 Issue Raw Material, Components, or Subassemblies	BP.009 Kanban	RS.3.14 Issue Material Cycle Time	HS.0065 Lean Manufacturing
	Manual inventory checking in the storage area is done by the warehouse staff.	T3.6 Issue Raw Material, Components, or Subassemblies	BP.198 Real-Time Location System	RS.3.14 Issue Material Cycle Time	HS.0213 Time Management
Over-processing	The warehouse staff perform the goods recording process repetitively, within the system, and on the card.	T1.3 Issue Raw Material or Components	BP.012 Lot Tracking	RL.2.11 Correct Documentation	HS.0009 Bar Code Handling and Radio Frequency Identification (RFID) HS.0046 Enterprise Resources Planning (ERP) Systems
Inventory	Too much paperwork increases the physical administrative work.	T1.3 Issue Raw Material or Components	BP.012 Lot Tracking	RL.2.11 Correct Documentation.	HS.0009 Bar Code Handling and Radio Frequency Identification (RFID) HS.0046 Enterprise Resources Planning (ERP) Systems

Staff mobility while distributing the item inquiry is considered mobility waste, belonging to the *Transform Process, T3.6 Issue Raw Material or Components or Subassemblies*. Implementing the

 DOI: https://doi.org/10.52435/jaiit.v7i2.723

BP.009 Kanban improves the process through online submission. *RS3.14 Issue Material Cycle Time* serves as an indicator to assess the quickness of item inquiry. Similarly, *HS.0065 Lean Manufacturing* skill drives the staff to realize that what they perform may lead to waste and inefficiency. Motion waste also occurred when the warehouse staff roamed the storage area to search for the requested items. This process again belongs to the Transform, *T3.6 Issue Raw Material or Components or Subassemblies*. To overcome the issue, *BP.198 Real-Time Location System* with its RFID tool facilitates quicker object location tracking for a faster item picking process, compared to a static inventory system which is still inaccurate. The *RS.3.14 Issue Material Cycle Time* indicates how fast or slow the item picking process could be. To support this, *HS.0213 Time Management* is indispensable in prioritizing which item should be picked first.

The next waste, overprocessing, occurred when items released from the warehouse were recorded repetitively, reflecting gap in Transform, *T1.3 Issue Raw Material or Components*. Using the *BP.012 Lot Tracking*, technology such as RFID tags or bar coding enables lot recording automation, facilitating better documentation for historical information. The impact can be measured by *RL.2.11 Correct Documentation*. Human skills in *bar code handling, radio frequency identification (HS.0009),* and *Enterprise Resource Planning (ERP)* systems are obligatory. Inventory waste occurred primarily due to excessive reliance on paperwork in the material issuance process. Implementing *BP.012 Lot Tracking* will result in a quicker and better material movement report, along with more reliable for historical verification than manual document review.

Table 6 presents the observed wastes in stock checking procedure, including waiting which emerged when auditor teams were delayed waiting for other parties prepared for the task. This issue can be tackled using *BP.084 Inventory Cycle Counting* under the *OE3 Performance and Continuous Improvement*, a way to check the physical inventory number on a defined cyclic schedule and compare it with the database. To minimize the waste, *HS.0211 collaboration* is required for better cooperation with other departments, along with advance notifications for earlier preparation. Furthermore, *HS.0213 Time Management* are crucial in managing the sequence as the inventory were scattered around the plant

Staff encountered difficulty in manually recording items, especially if the items were located too high or too deep in the aisle, out of reach unless more effort was given. This process again belongs to the *BP.084 Inventory Cycle Counting* and *BP.030 Inventory Record Accuracy* under the *OE3 Performance and Continuous Improvement*. Bar code handling or RFID reader may assist the staff in minimizing motion and enable easier physical inventory checking. Going inside a difficult yet narrow aisle, or unnecessary hand movement while identifying goods, is no longer needed. Furthermore, the auditor used a checklist paper or books for item recording, which was then input into the system. This process may lead to overprocessing waste. Barcode handling and RFID for item identification and inputting the data within the System may overcome the double-processing issues while simultaneously let another team to compare and analyze the data immediately, rather than waiting for the whole item to be finished. Moreover, this combination results in more free space by removing unwanted administrative papers. To validate its benefit compared to the printed version, *RL.2.11 Correct Documentation, HS.0195 Data Analytics, and HS.0213 Time Management* metrics can be used.

In terms of wasted skills, the staff was burdened with many manual processes that could take longer than they would when equipped with technology, which the time may be used for other valuable activities related to creativity, such as idea generation or improvement. Implementing *BP.084 Inventory Cycle Counting*, specifically with *HS.0009 bar code handling and radio frequency identification* integrated with *HS.0192 WMS*, could shorten the inventory checking time. This unchanged work habits may discourage the staff from developing technology. Thus, the unused creativity can be hindered by conducting training on *HS.0042 enabling technology* to support more knowledge and encouragement in improving their current work, resulting in continuous improvement driven by the staff's creative ideas.

Table 6. SCOR Digital Standard Applications Inventory Checking

Waste	Details	Process	Practice	Performance/ Metrics	People
Waiting	The stock checking functionary waited for the related units, such as the manufacturing floor and the work-in-process warehouse, to be ready for stock checking.	OE3 Performance and Continuous Improvement	BP.084 Inventory Cycle Counting	RL.3.28. Percentage of Item Location Accuracy	HS.0211 Collaboration HS.0213 Time Management
Motion	Staff physically roam the facility area to calculate the stock.	OE3 Performance and Continuous Improvement	BP.084 Inventory Cycle Counting	Custom Metrics: Distance traveled.	HS.0009 Bar Code Handling and Radio Frequency Identification (RFID)
Overprocessing	Staff need to record the item with books, which are input into the system.	F3.3 Pick Product OE3 Performance and Continuous Improvement	BP.030 Inventory Record Accuracy BP.084 Inventory Cycle Counting	RL.2.11 Correct Documentation HS.0195 Data Analytics HS.0213 Time Management HS.0211 Collaboration	HS.0009 Bar Code Handling and Radio Frequency Identification (RFID) HS.0192 Warehouse Management Systems (WMS)
Inventory	Too much paperwork increases the physical administrative burden.	OE3 Performance and Continuous Improvement	BP.084 Inventory Cycle Counting	RL.2.11 Correct Documentation HS.0195 Data Analytics HS.0213 Time Management	HS.0009 Bar Code Handling and Radio Frequency Identification (RFID) HS.0192 Warehouse Management Systems (WMS)
Skills	The staff was mainly burdened with counting and checking items physically and manually because they were not equipped with technology.	OE3 Performance and Continuous Improvement	BP.084 Inventory Cycle Counting	RL.2.11 Correct Documentation HS.0195 Data Analytics HS.0213 Time Management	HS.0009 Bar Code Handling and Radio Frequency Identification (RFID) HS.0192 Warehouse Management Systems (WMS)
	The related staff were not urged to develop technology	OE3 Performance and Continuous Improvement	BP.084 Inventory Cycle Counting		HS.0042 Enabling Technology HT.0045 Enabling Technology

DOI: https://doi.org/10.52435/jaiit.v7i2.723

All previously identified wastes are summarized in Table 7, highlighting that the most frequent wastes are waiting and motion with 4 frequencies each, followed by overprocessing and inventory with 3 items each and skills with 2. Interestingly, the proposed solution of all identified waste could be achieved by increasing the human skills, as the most dominant dimensions with 83.33%, followed by the human training and experience with 13.33% and 3.33% respectively, as shown in Table 8.

Table 7. Summarized SCOR Digital Standard

Identified Waste	Frequency
Waiting	4
Motion	4
Overprocessing	3
Inventory	3
Skills	2

Table 8. Summarized SCOR Digital Standard

Dimensions	Total Mentions	Percentage
Human Skills	25	83.33 %
Human Training	4	13.33 %
Human Experience	1	3.33 %

Considering the limitation of industry in implementing ideas, including the time, investment, human, and other related resources, a steady improvement plan would beneficial for the industry. A pareto diagram serves as a useful tool in ranking the proposed solution for implementation prioritization. According to the Table 9, the top four solutions for improvements are including the skills of barcode handling & RFID, Time Management, Warehouse Management System and Enabling Technology, account for approximately 50 percent of all improvement actions. While, the pareto diagram in Figure 4 suggests that the first eight solutions account for nearly 80 percent of interventions. Those two groups may inform the industry of which area should be focus more.

Table 9. Pareto Frequency Table

Rank	Solution	Frequency	Cumulative Frequency	Cumulative
1	RFID (Bar Code Handling & RFID)	6	6	20 %
2	Time Management	3	9	30 %
3	WMS (Warehouse Management Systems)	3	12	40 %
4	Enabling Technology	3	15	50 %
5	Collaboration	2	17	56.7 %
6	Lean Manufacturing	2	19	63.3 %
7	PDM (Product Data Management)	2	21	70 %
8	ERP (Enterprise Resource Planning)	2	23	76.7 %
9	Discrepancy Reporting & Resolution	1	24	80 %
10	Automation Tool	1	25	83.3 %
11	ERP Systems Training	1	26	86.7 %
12	Procurement	1	27	90 %
13	Automation	1	28	93.3 %
14	Sustainability Standards & Frameworks	1	29	96.7 %
15	Defective Product Handling	1	30	100 %

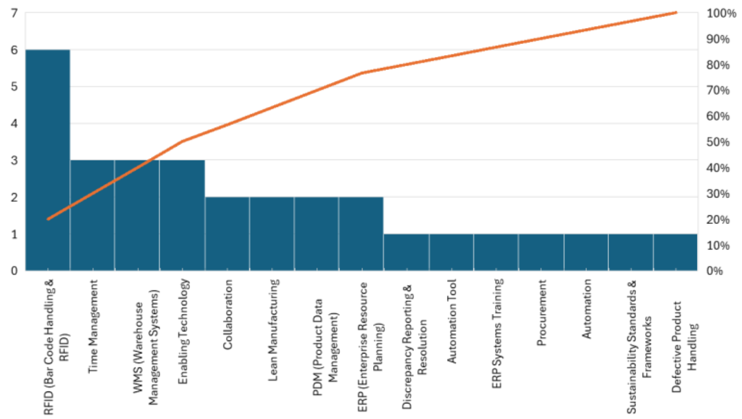

Figure 4. Pareto Diagram

3.5. Step 5: Launch

Implementing alternative solution is expected to drive improvements on diverse dimensions, but simultaneously requires a range of investments. Therefore, cost benefit analysis should also be addressed by the industry to consider the solution installation, as shown in Table 10. Although not yet quantified, those criteria serve as guidance for policy makers to consider the alternative decisions. Afterwards, Table 11 presents metrics for further guidance in analysing the actual performance throughout the solution adoption. The importance rate of the possible solutions should refer to the main issues, no valid real-time inventory data, and long waiting time.

Table 10. Cost Benefit Analysis Criteria

No	Solutions	Cost	Description	Benefit	Description
1	RFID & Barcode Handling	Initial Investment	Hardware, Software, Infrastructure Setup	Cycle time reduction	Faster process, real-time data capture
		Process Integration	System configuration, data migration, API setup	Error Reduction	Less errors in data input, data accuracy improvement
	Warehouse Management System	Maintenance and Support	Annual technical support and software updates	Labor efficiency	Reduced unnecessary movement
	Enabling Technology	Transition Cost	Efficiency loss during the transition	Visibility	Better information for decision making
2	Time Management	Training	Employee training, standardization	Employee Capability	Increased ability to digital technology, work procedures, and enabling technology
		Productivity Downtime	Downtime during employee training		

Table 11. Expected Improvement

No	Dimensions	Future State	Metrics
1	Responsiveness	No delays in receiving goods	(Minutes delayed)/ (total receiving time) × 100%
		Shorter response time for item inquiries	Minutes/inquiry
		Quicker auditing process and evaluation	Hours/audit
2	Reliability	Zero errors in documentation	(Correct Documents)/ (Total Documents) × 100%
		Real-time inventory visibility	(Matched items)/ (total items) × 100% (System downtime)/ (total hours) × 100%
3	Asset Management	Optimal warehouse space utilization	(Used space)/ (total space) × 100%
4	People	Active, innovative solutions from employees	New ideas per month
		Periodic training	Training hours/employee Additional skill/employee/time

4. Conclusion

The integration of SCOR Digital Standard with Business Process Modelling and Lean Waste Approach provides valuable inbound-logistic improvement ideas for the mid-sized paper manufacturer in Indonesia. Four wastes were always observed within each procedure, namely waiting, motion, inventory, and overprocessing, while the skill waste was found in stock checking. The study recommends to prioritize Barcode Handling & RFID, time management, warehouse management system and enabling technology skills for improving the logistics performance. For further

 DOI: https://doi.org/10.52435/jaiit.v7i2.723

consideration, the study also highlights the possible incurred costs, including the initial investment, process integration, maintenance and support, transition cost, training, and productivity downtime, despite of its benefits, ranging from the cycle time reduction, error reduction, labor efficiency, visibility, and employee capability. Several quantifiable metrics within four dimensions, namely responsiveness, reliability, asset management, and people, are presented for impact validation guidance.

This integrated approach contributes to the enrichment of existing literature of how SCOR DS could be used in logistics improvement scenario, especially for the goods receiving, user request, and stock checking procedure. The usage of business process modelling and lean approach offers new perspective that differs to the available studies. Despite the contributions, the study has limitation as it only emphasizes the possible solutions generation without actual implementation yet. Future studies could incorporate measurable data to assess the performance outcome before and after implementation, enabling calculation of impact metrics for the validation.

Acknowledgement

The authors would like to thank the logistics expert team whose active participation and professional insights greatly contributed to this study.

References

[1] T. Kučera, "Calculation of Logistics Costs in Inbound Logistics," 2018, doi: 10.5593/SGEMSOCIAL2018/1.5/S05.015.

[2] F. H. D. O. Costa, A. L. Da Silva, C. R. Pereira, S. C. F. Pereira, and F. J. Gómez Paredes, "Achieving organisational resilience through inbound logistics effort," *Br. Food J.*, vol. 122, no. 2, pp. 432–447, 2019, doi: 10.1108/BFJ-04-2019-0250.

[3] N. Santos *et al.*, "iFloW: An Integrated Logistics Software System for Inbound Supply Chain Traceability," in *Enterprise Interoperability VII*, 2016, pp. 187–197.

[4] R. Kalaiarasan, T. K. Agrawal, J. Olhager, M. Wiktorsson, and J. B. Hauge, "Supply chain visibility for improving inbound logistics: a design science approach," *Int. J. Prod. Res.*, vol. 61, no. 15, pp. 5228–5243, 2023, doi: 10.1080/00207543.2022.2099321.

[5] A. Albadrani, M. A. Zohdy, and R. Olawoyin, "An Approach to Optimize Future Inbound Logistics Processes Using Machine Learning Algorithms," in *2020 IEEE International Conference on Electro Information Technology (EIT)*, 2020, pp. 402–406, doi: 10.1109/EIT48999.2020.9208238.

[6] A. Albadrani, F. Alghayadh, M. A. Zohdy, E. Aloufi, and R. Olawoyin, "Performance and Predicting of Inbound Logistics Processes Using Machine Learning," in *2021 IEEE 11th Annual Computing and Communication Workshop and Conference (CCWC)*, 2021, pp. 790–795, doi: 10.1109/CCWC51732.2021.9376171.

[7] X. Hu, W. Wang, H. Li, J. Li, L. Zhu, and B. Gao, "A research on warehouse logistics guided inbound and outbound operations simulation technology based on GIS," in *2023 11th International Conference on Information Technology: IoT and Smart City (ITIoTSC)*, 2023, pp. 256–261, doi: 10.1109/ITIoTSC60379.2023.00053.

[8] N. Pawlak and N. Gibus, "Improving Logistics Processes Using Lean Management Concept: A Case Study," *Commun. Int. Proc.*, 2024, doi: 10.5171/2024.4340124.

[9] I. Petryk, "Streamlining business processes based on logistics concepts of improvement," *Sci. J. Bielsk. Sch. Financ. Law*, vol. 25, no. 2, pp. 11–17, 2021, doi: 10.19192/wsfip.sj2.2021.2.

[10] J. Y. Suh and Y. J. Kim, "Logistics lean integration strategies: case study of Samsung Electronics LCD inbound logistics," *J. Int. Logist. Trade*, vol. 7, no. 1, pp. 107–116, 2009, doi: 10.24006/jilt.2009.7.1.107.

[11] M. Helmold, "Basics in Lean Management," in *Lean Management and Kaizen: Fundamentals from*

Cases and Examples in Operations and Supply Chain Management, Cham: Springer International Publishing, 2020, pp. 1–14.

[12] Melović, Boban, Mitrović, Slavica, Zhuravlev, Andrey, and Braila, Natalia, "The role of the concept of LEAN management in modern business," *MATEC Web Conf.*, vol. 86, p. 5029, 2016, doi: 10.1051/matecconf/20168605029.

[13] H. Hastono, A. Affandi, and D. Sunarsi, "Implementation of Lean Management Principles for Operational Efficiency," *Implikasi J. Manaj. Sumber Daya Mns.*, vol. 2, no. 2, p. 145~148, 2024, doi: 10.56457/implikasi.v2i2.458.

[14] E. Vetoshko, "The use of Lean management to optimize business processes in the enterprise," *Int. J. Sci. Res. Arch.*, vol. 13, no. 2, pp. 180–185, 2024, doi: 10.30574/ijsra.2024.13.2.2106.

[15] A. Jeyaraj and V. L. Sauter, "Validation of Business Process Models Using Swimlane Diagrams," *J. Inf. Technol. Manag.*, vol. 24, no. 4, pp. 27–37, 2014.

[16] A. Ibom, S. Ozuomba, C. Kalu, and A. I. Nigeria, "Development Of Swim Lane Workflow Process Map For Enterprise Workflow Management Information System (WFMIS): A Case Study Of Comsystem Computer And Telecommunication Ltd (CCTL) Eket," 2015, [Online]. Available: https://api.semanticscholar.org/CorpusID:32375190.

[17] E. Shevtshenko, R. Maas, L. Murumaa, T. Karaulova, I. Oluwole Raji, and J. Popell, "Digitalisation of Supply Chain Management System for Customer Quality Service Improvement.," *J. Mach. Eng.*, vol. 22, no. 3, pp. 78–90, 2022, doi: 10.36897/jme/147803.

[18] M. N. Sholeh, A. Nurdiana, B. Dharmo, and Suharjono, "Implementation of construction supply chain flow based on SCOR 12.0 performance standards," *J. Phys. Conf. Ser.*, vol. 1833, no. 1, p. 12012, Mar. 2021, doi: 10.1088/1742-6596/1833/1/012012.

[19] K. Naziro, Y. R. Perdana, and D. Kristanto, "Supply Chain Performance Measurement and Determination of Improvement Priorities Using the Supply Chain Operations Reference Digital Standard (SCOR DS) and Analytic Network Process (ANP) Methods," *J. Ind. Eng. Halal Ind.*, vol. 6, no. 1, pp. 81–88, 2025, doi: https://doi.org/10.14421/jiehis.4637.

[20] J. O. Tetelepta, U. Pristiana, and E. H. Prastiwi, "Improving Supply Chain Performance Using The Supply Chain Operation Reference Digital Standard (SCOR DS) V14.0 Racetrack Model At Pt Cipta Krida Bahari Kalimantan Area," *Int. J. Econ.*, vol. 4, no. 2, pp. 834–846, 2025, doi: https://doi.org/10.55299/ijec.v4i2.1444.

[21] T. Apriyadi, O. Patra, H. Suryana, and E. Nugraha, "Implementation of the SCOR Digital Standard Method in the Cijurey Dam Package 1 Project," *J. Res. Soc. Sci. Econ. Manag.*, vol. 5, no. 3, pp. 3547–3560, 2025, doi: https://doi.org/10.59141/jrssem.v5i3.1084.