



BUSINESS PROCESS REENGINEERING TO EXCELLENCE WAREHOUSE MANAGEMENT SYSTEM: A CASE STUDY OF RETAIL INDUSTRY

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Abstract:

Company X is a modern Indonesian retail company that faces stock inaccuracies continuously and the variances exceeds the limit set by the company that reduce its profits continuously. Variances are difficult to identify since the stock recording in company X is not separated between stock in the warehouse and the store and not using warehouse management system. Business process re-engineering will be carried out by proposed two alternatives using traceability technology for the warehouse management system. Standard operating procedures will also be developed and used as a guide in implementing the system. This study uses qualitative method from a semi-structured interview with the management team, observation, and focus group discussion. The data were analyzed with gap analysis, cause mapping, and analytical hierarchy process to select the proposed alternatives using QR Code and RFID. The results from data processing is show that the company select QR Code as the technology used.

Keywords: Business Process Reengineering; Warehouse Management System; Retail Industry; Stock Inaccuracies; Analytical Hierarchy Process.

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INTRODUCTION

Warehousing is a concept in organizing and controlling everything in the warehouse to optimize the performance of every process (Kamali, 2019); (J. C. Chen et al., 2013). Since the warehouse and its inventory are assets owned by the company, it should be properly maintained to maximize efficiency and profitability (Richards, 2021); (Ozcelik, 2010). However, it is difficult to maximize efficiency and profitability when companies still rely on traditional

warehousing. According to (Kamali, 2019) taking cases of traditional warehouses in Bahrain, it was found that there are several areas in which the company is probably losing their money, such as excessive material handling, inefficient operations and bottlenecks in their workflow, material damage, inefficient space management, and inefficient material handling equipment (Liu et al., 2014). Other than that, inaccuracy of inventory data is a major problem in the retail industry (Raman et al., 2001). Companies are beginning to implement and adopt technologies to their warehouses. As stated by (Alicke et al., 2017), using new technologies in warehousing reduced the operations costs to 30% in the next few years and reduced loss in inventories up to 75%, to enhance the operations through more agile and efficient. For instance, Alibaba and Amazon have invested in automated material-handling technology to improve warehouse operations (Budiono & Loice, 2012); (Sun et al., 2020).

This paper will discuss a warehouse from company X in the retail industry. Company X is a modern Indonesian retail company with the format of supermarket and department store and has other strategic business units such as food courts, fashion, and their home brands. This company faces stock inaccuracy after stock take that exceeds the set limit and happens constantly. Stock taking is performed to calculate the accuracy of a warehouse or retailer's inventory to determine if there is an inventory shortage that may be caused by an error, damaged or obsolete goods (M. Chen, 1999). The variances generated from this stock take will be a loss to the company and continuously reduce their profit. Meanwhile, in company X, there is no system that records the movement of goods, so there is no clear information about the stock of goods in the warehouse and transactions of the movement of goods. In addition, if an error occurs in the warehouse, it will be more difficult to be tracked since the company does not have historical data (Fera et al., 2017); (Wambua et al., 2015).

The objective of this research is to (1) Find the core problem on the operational section, (2) develop Company X's warehouse operation system, and to (3) develop Company X's Standard Operating Procedures for the warehouse management system. Business process re-engineering will be carried out by using traceability technology for the warehouse management system to record the movement of goods. Standard operating procedures for the warehouse will also be developed and used as a guide in implementing the system. This study provides insight into a re-engineered business process that will be implemented to reduce stock inaccuracy in the warehouse of the retail industry.

METHODS

In this study, the author used qualitative methods (Sugiyono, 2018). These method used primary data and secondary data. In order to gain better insight into the business process and warehousing conditions of company X, semi-structured interviews were conducted with 8 management team. From this interview, the author can also dig deeper into the problems that arise in the warehouse. In addition, the author also made observations through internship

activities for 2 months. Meanwhile, secondary data was gathered from journals, articles, and books.

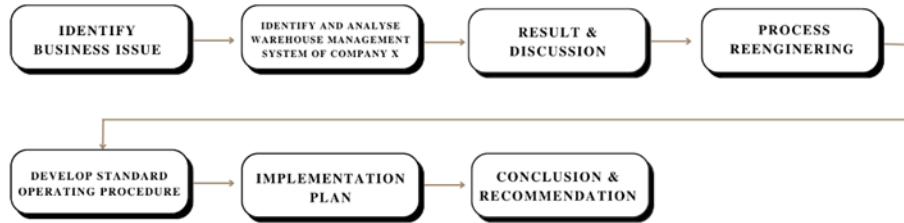


Figure 1. Research Design

This research began by identifying issues that happen in the business process. Through the interview and observation process, it can be identified that the problems that occur were in the warehousing section. Based on the data collection, gap analysis will be carried out to identify the actions that need to be taken to reduce the gap in achieving the expected conditions in the future. During the proposed solution stage, As-is Process, a business process modelling is carried out on inbound and outbound transaction activities in the warehouse to describe the current condition of the business process and the division of responsibilities. From As-Is Process Modelling, the author analysed what activities should be removed and added. Next, redesigning the alternatives for business process (To-Be Process) in the warehouse. Then, the alternatives are evaluated and selected with the Analytical Hierarchy Process using Super Decision software. The author also developed SOP which will be used for every activity carried out in the warehouse and the user interface of the proposed warehouse management system.

Conceptual Framework

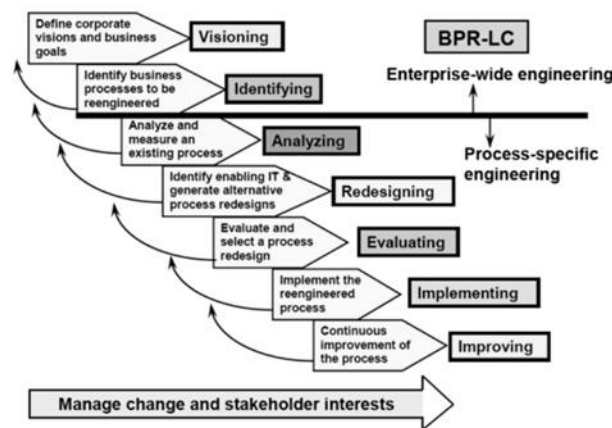


Figure 2. Conceptual Framework

Conceptual framework is taken from Business Process Reengineering Life Cycle (BPR-LC) that was constructed by Chen (1993). He created this framework based on the existing BPR methodologies and used by consulting companies. BPR-LC consists of 7 stages, 1. Visioning: Visioning is required for an enterprise-wide effort in achieving goals for reengineering business processes. 2. Identifying: This stage will identify and select processes to be reengineered. 3. Analyzing: After determining which processes will be reengineered, it is needed to conduct a preliminary study, develop as-is process models of the existing processes, and measure critical processes. 4. Redesigning: Create ideas for changes, identify technologies enablers that suit the process, identify core sub-processes and design alternative new processes. 5. Evaluating: Evaluate the redesigned alternative process models using Analytical Hierarchy Process (AHP) with Super Decision software and select a design alternative to use in the implementation phase. 6. Implementing: Implement the reengineered process. 7. Improving: Measure the process with a performance indicator to evaluate the impacts of BPR and try to improve the process continuously.

RESULTS AND DISCUSSION

A. Business Solution

1. Visioning

Everyone in the company should have the same vision to achieve a successful change. In this case, we need to focus to have vision on, improving operational in the warehouse by reengineering business processes in the warehouse and improving stock accuracy with warehouse management system.

2. Identifying

Based on semi-structured interview and observation at company X, their business process consists of Ordering, Receiving, Warehousing, Displaying, and Selling.



Figure 3. Business Process in Company X

Source: Company X

Currently, the goods movement in Company X's retail is still done manually, which makes it more difficult to identify the variances amount of stocktake. This is due to the absence of recording the inbound and outbound of goods in the warehouse. Business processes carried out are still a combination of computerization and manual. In the process of ordering, receiving and selling, the company used software that was built in-house and integrated with each other. Meanwhile, the process that occurs in the

warehousing is still done manually, there is no system for recording the movement of goods. This makes more difficult to know the real-time amount of stock in the warehouse since the recording of stock is still calculated entirely (combination of Warehouse and store). In addition, there is no supervision from the supervisor, while crews and sales instore can pick and put back goods into the warehouse, and this opportunity tends to be used by them to do things that are unproductive in the warehouse.

In 2016, Company X had implemented a warehouse system, but it lasted for only 2 months. This was due to the notion of warehouse management system’s implementation as an inhibitor to the warehousing process. At that time, the warehouse system required a long process of receiving and dispatching items. The workload that must be carried out by the Warehouse Service Crew was heavy and the number of crews was also limited, hence the warehouse system is not used anymore. It is found that there are several causes for this problem to appear (Figure 4): limited human resources, SOP Warehouse need to be improved, no supervision in the warehouse and not using a Warehouse Management System.

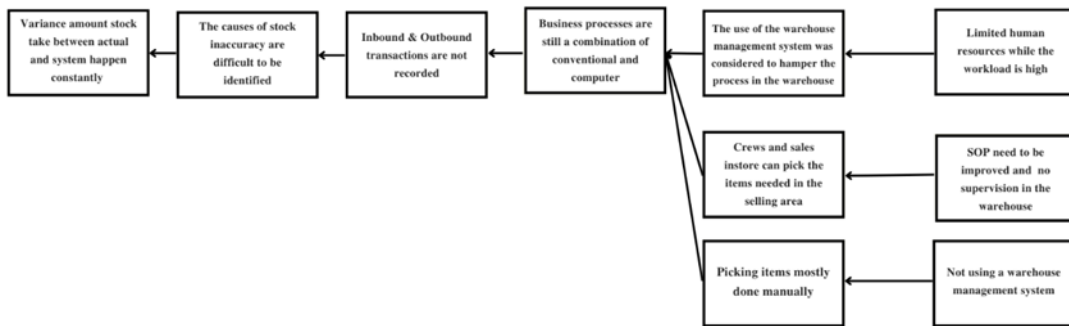


Figure 4. Cause Mapping of Company X’s Warehouse System

Gap analysis (Table 1) was also carried out to identify and reduce the gap that occurs between the current state and the desired state in the future by determining the actions that need to be taken to achieve the desired state in the future. The following is an analysis by defining the focus area, current state, future desired state, gaps, and actions to be taken to address the gaps that occur. Focus area is defined from key focus area to audit warehouse generally (Miebach Consulting, 2020).

Table 1. Gap Analysis

Focus Area	Current State	Future Desired State	Gap	Action
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Stock Inaccuracy	Above 2.5% of monthly turnover	Allowable inaccuracies from stock taking only 2,5% of monthly turnover	Inaccuracies is higher than allowed number	Reduce inaccuracies that occurs every time stock taking are done by recording stock accurately
Labor Productivity	There are many crews who do other things besides the activity that should be done in the warehouse	There is supervision as it is done in other business processes	There is no supervisor that stays in the warehouse so the crews feels free to do anything in the warehouse	Warehouse should be supervised so it will help to implement WMS and SOP properly
IT Systems	Stock recording is not integrated between business processes	Company should have warehouse management system	There is no warehouse management system	Implement warehouse management system
	It is difficult to identify if there is any discrepancies while stock taking since stock of goods are recorded globally	Stock recording in the warehouse and selling area separated	There is no stock recording in the warehouse	
Material Handling Processes	Picking items can be done by crews and sales instore, some of them are not tidying up back and left the items that have been scattered by themselves.	There is a SOP that regulates all activities in the warehouse, that only allow Warehouse Crew to do every activities in the warehouse and train them to have awareness to keep the warehouse tidy under any	SOP Warehouse need to be improved	Develop and implement SOPs in the warehouse

circumstances

3. Analyzing

In this warehouse, the process of entering and releasing goods is manually done. Incoming goods to the warehouse comes from two areas: the receiving area (Figure 5), where goods are delivered from suppliers or distribution centers, and the selling area (Figure 6), where the display of the selling area changes. Inbound goods process is only carried out by the Warehouse Crew. Even though there is a warehouse layout, but many company X's employees and sales instore are involved in picking goods and don't put the goods back in their places, it is piled up on other goods and make it difficult for the Warehouse Crew in preparing the area. Warehouse Crew must sort the goods at its location. Once the space are available, Warehouse Crew brings goods into the warehouse. Items are stored based on their categories.

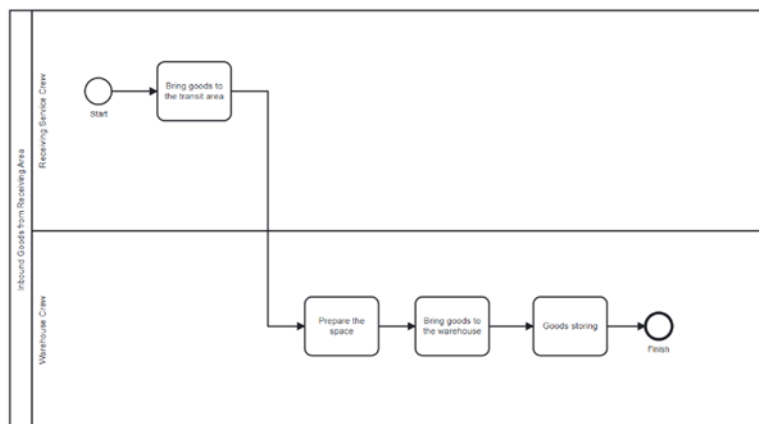


Figure 5. As-Is Process of Inbound Goods from Receiving Area

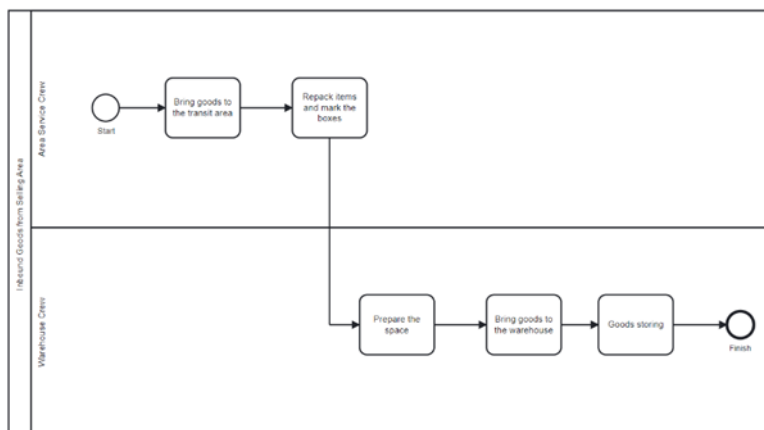


Figure 6. As-Is Process of Inbound Goods from Selling Area

Outbound goods process (Figure 7) begins with replenishment requested by the Area Service Crew through the mobile application by scanning the product barcode and entering the required quantity. Warehouse Crews then pick goods based on the picking list and the schedule. After the warehouse staff picks up the goods, it will be sent to the display area immediately. Requests for goods are not immediately picked by the Warehouse Crew after the Area Service Crew makes a replenishment request, Area Service Crew need to wait until the scheduled time. In these situations, Area Service Crew often pick the goods directly into the warehouse without using the mobile application.

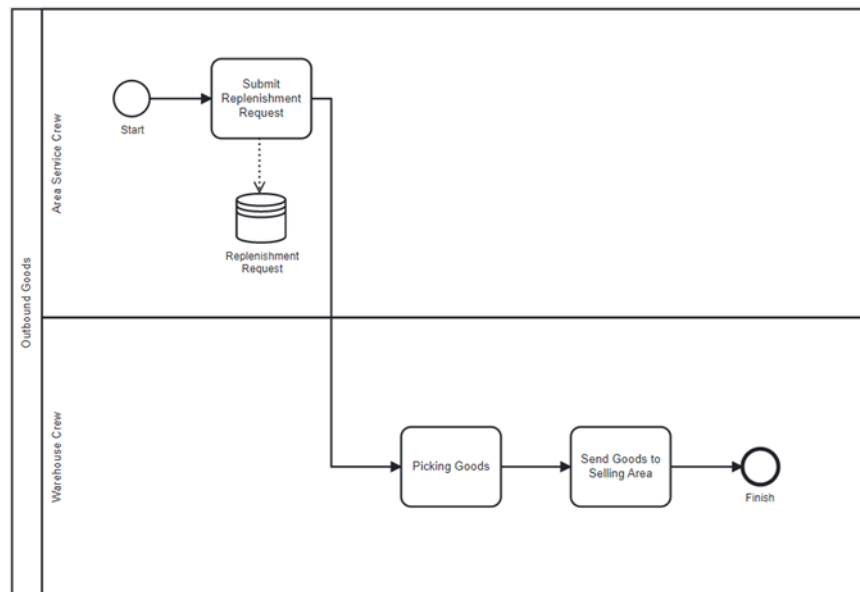


Figure 7. As-Is Process of Outbound Goods

4. Redesigning

In this redesigning process, several alternative redesign processes are made. Among these several alternatives, one of the most applicable with the industry's characteristics and needs will be selected.

a. To-be Process (Alternative 1)

Incoming goods to the warehouse comes from two areas: the receiving area, where goods are delivered from suppliers or distribution centers, and the selling area, where the display of the selling area changes. If the goods come from the Receiving Area, the inbound goods process will begin with the process of printing and attaching the QR code to the batch of goods by Receiving Service Crew. This is done to make it easier to check when receiving goods and check the list directly (Figure 8) without having to scan the product barcodes one by one.

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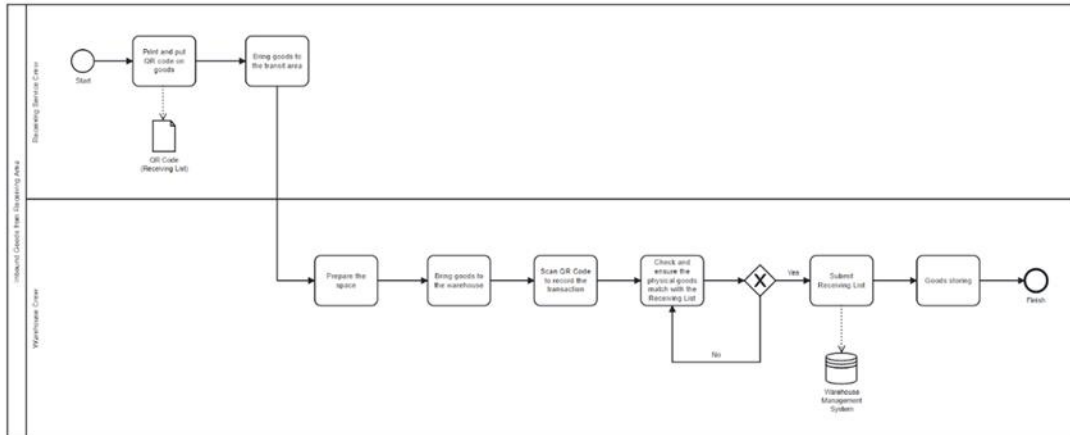


Figure 8. To-Be Process of Inbound Goods from Receiving Area (Alternative 1)

If the item comes from the Selling Area (Figure 9), the Area Service Crew brings the goods to the transit area and repacked into the box and mark the box with item name and quantity. Then, goods will be processed to be received by the Warehouse Crew.

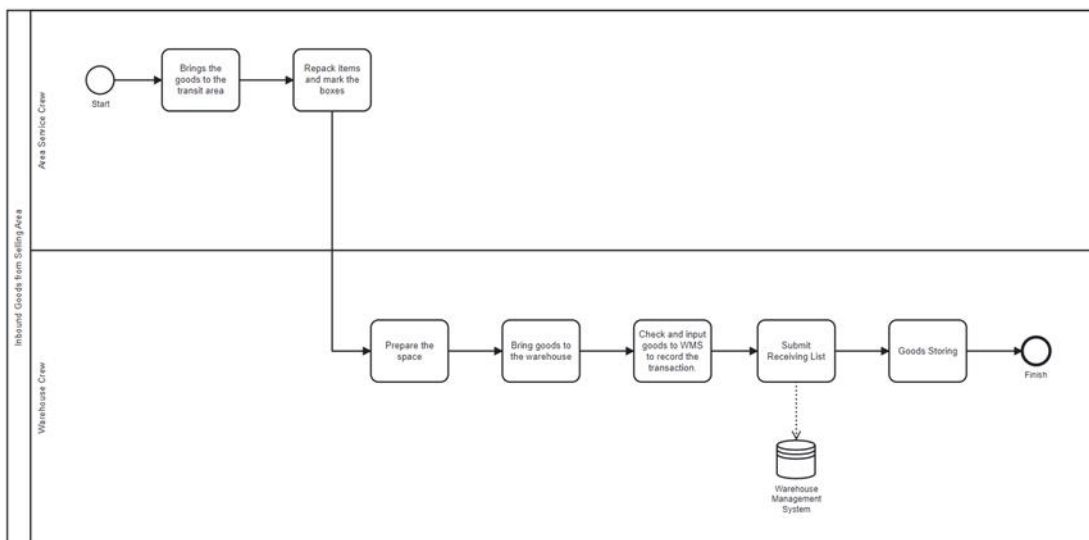


Figure 9. To-Be Process of Inbound Goods from Selling Area (Alternative 1)

Warehouse Crew prepares a place for storing goods in the warehouse. After that, Warehouse Crew will bring the goods to be received before entering the warehouse. Warehouse Crew scans the available QR Code to record the transaction. Based on the QR Code, Warehouse Crew checks and ensures whether the item is in accordance with the Receiving List. If the goods received match with the Receiving List, the Receiving List will be submitted and the Warehouse Crew will store goods at the place that has been prepared before.

While in the outbound goods process (Figure 10), the Area Service Crew submits replenishment requests first. Replenishment requests will be accepted as a Picking List by the Warehouse Crew. Then, the Warehouse Crew will proceed and print the QR Code of Picking List. If picking goods is already done, the Warehouse Crew will scan the QR Code again to record the transaction. Warehouse Crew scans the QR Code and checks the picked items. Warehouse Crew will input the actual quantity of outgoing items on the WMS. After the actual quantities of all items to be issued have been recorded, Warehouse Crew submits the Picking List and Warehouse Crew sends goods to the Selling Area. If there are items with different expiry dates, the Warehouse Crew can add items and input items with different expiry dates, so each item can still record its expiry date.

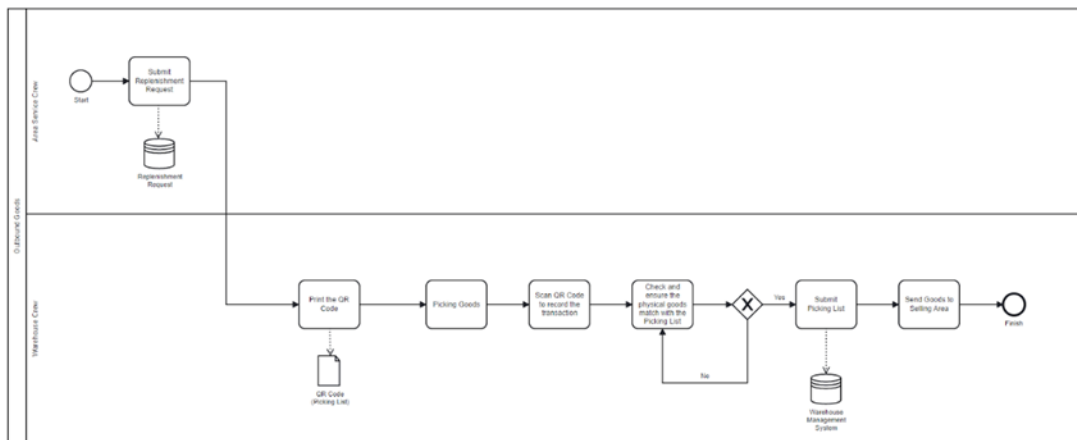


Figure 10. To-Be Process of Outbound Goods (Alternative 1)

The use of the QR Code in this process does not provide significant results in terms of time-saving. However, at almost the same time, there was an additional activity: recording the transactions with the QR Code. Time-saving also arises from several activities due to efficiency from unproductive activity carried out by Crew in the As-Is Process.

b. To-be Process (Alternative 2)

In this alternative, RFID as another traceability technology is used. Even though it will take longer time to label goods with an RFID label and with a higher initial cost, RFID will minimize human touch in the next process by ensuring that the movement of each item is recorded properly. The use of RFID requires RFID labels, printers, and RFID reader. Receiving Service Crew prints and puts an RFID label on each carton (Figure 11). Warehouse Crew will prepare the space and bring goods to the warehouse through the RFID reader. This reader will immediately record the goods that enter the

warehouse. If goods come from the selling area (Figure 12), Warehouse Crew will attach the RFID labels to the box to be stored in the warehouse.

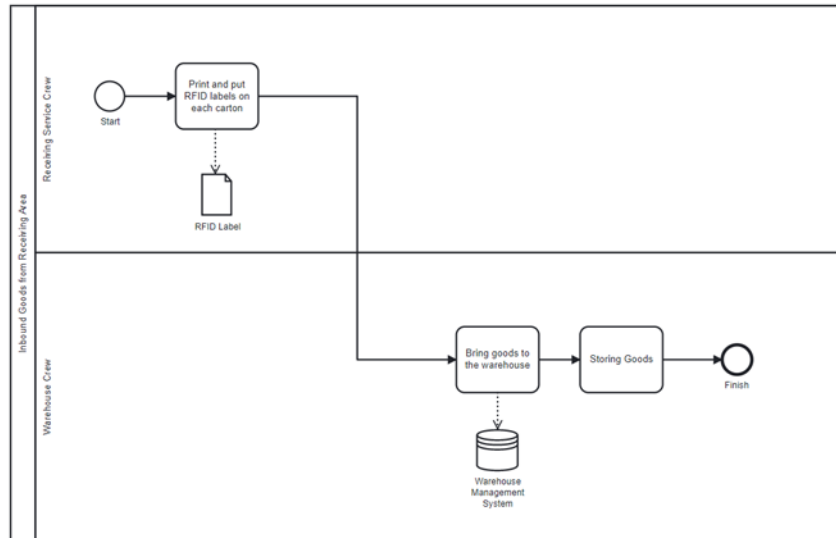


Figure 11. To-Be Process of Inbound Goods from Receiving Area (Alternative 2)

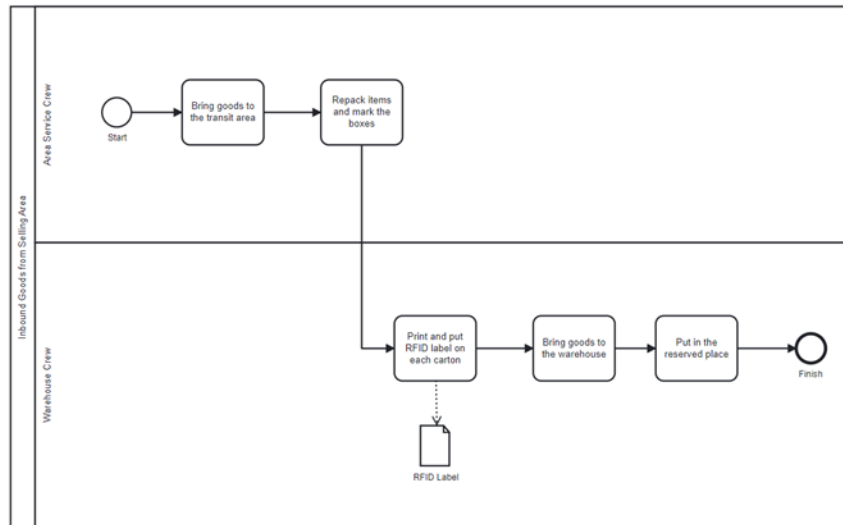


Figure 12. To-Be Process of Inbound Goods from Selling Area (Alternative 2)

Warehouse Crew does not need to check goods with a picking list at the exit from the warehouse (Figure 13). Warehouse Crew will pick up goods in cartons, then immediately bring them to the Selling Area through the RFID reader. Every item dispatched will be recorded automatically with the presence of an RFID label on the item.

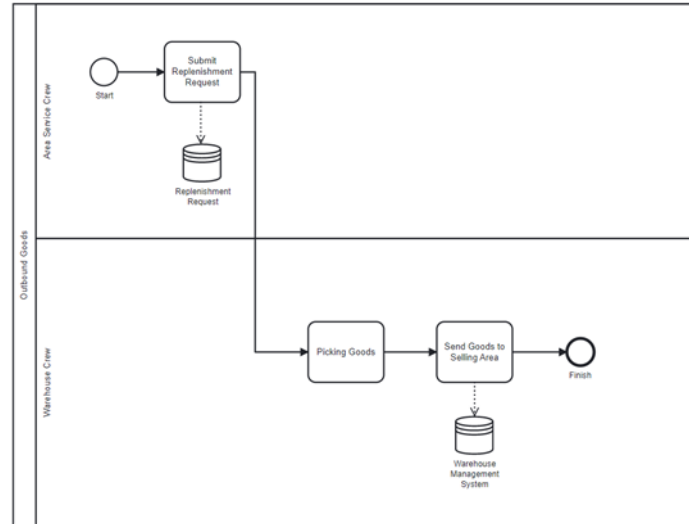


Figure 13. To-Be Process of Outbound Goods (Alternative 2)

Using the RFID system as the traceability technology, there is additional activity during the receiving process of goods in which an RFID label must be printed and attached to each box. However, the process of preparing space for storing goods is not repeated since RFID can provide information about the location of goods in real-time. The system can immediately detect where the goods must be placed and also save time when picking up goods so the Warehouse Crew can immediately get information where the goods are placed.

5. Evaluating

This section will evaluate and selects between QR Code and RFID using Analytical Hierarchy Process based on four criteria (Figure 14): Cost (the costs of software, hardware, training, operating costs, and future development of the system), Functionality (the system functions that speed up by integrated with other systems), Performance (The usage of systems that increase performance in data entrance to the system), IT Readiness (Technological readiness is considered based on capability from IT skills companies and even partnering with competent technology providers (Sharma & Hannafin, 2007).

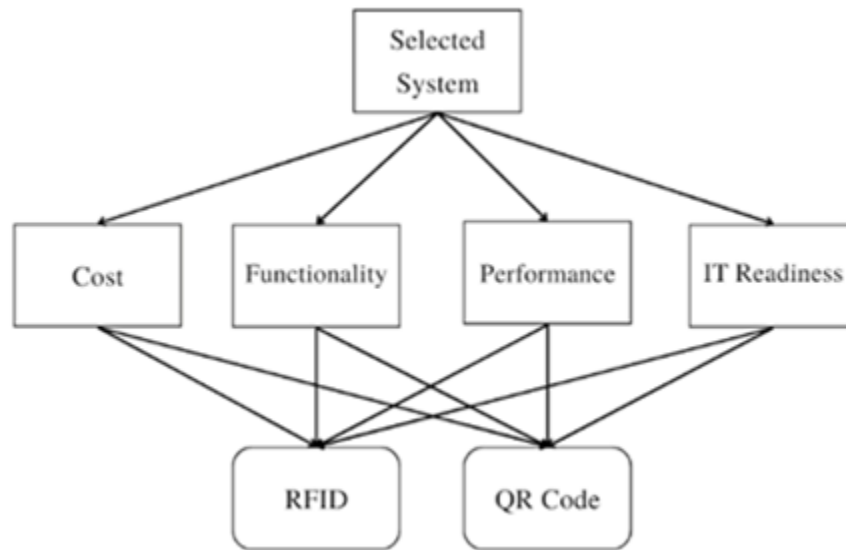


Figure 14. Hierarchical Structure

There are several measurement scales that could be used to quantify managerial judgments. This study uses Saaty’s fundamental scale (Table 4) of comparison for parameter of pairwise comparison.

Domination (Rank)	Determination	Meaning
1	Equal importance	Both elements have the same impact
3	Moderate importance	One element has slight advantage over the other
5	Strong importance	Strong advantage of one element over the other
7	Very strong or demonstrated importance	Very strong advantage of one element over the other
9	Extreme importance	Extreme (full) advantage of one element over the other
2,4,6,8	In-between	Applied when the evaluation with a set of odd numbers is not possible
Reciprocal	If element i has one of the above numbers assigned to it when compared with the element j then j has reciprocal value when compared to element i	

Figure 15. Saaty’s fundamental scale of comparison

Source: (Saaty, 2001)

Selecting the system between QR Code and RFID is executed using the Analytical Hierarchy Process where the parameters of the pairwise comparison (Table 5, table 6) are the results of the Focus Group Discussion with the management team of company X.

Criteria	Cost	Functionality	Performance	IT Readiness
Cost	1	5	3	5
Functionality	1/5	1	7	9
Performance	1/3	1	1	1/9
IT Readiness	1/5	1/9	9	1

Figure 16. Pairwise Comparison Matrix Between Criteria

Table 2. Pairwise comparison matrix between alternatives

Cost	QR Code	RFID	Functionality	QR Code	RFID
QR Code	1	5	QR Code	1	1/3
RFID	1/5	1	RFID	3	1
Performance	QR Code	RFID	IT Readiness	QR Code	RFID
QR Code	1	1/5	QR Code	1	5
RFID	5	1	RFID	1/5	1

Data is processed using Super Decision software. Based on data processing performed on the software, it can be found that QR Code gives higher results than RFID, which is 0.61 (when RFID is 0.39). Therefore, the selected system for this warehouse is using QR Code.

B. Standard Operating Procedures (SOP)

The development of SOP in warehouse management produces several SOPs,

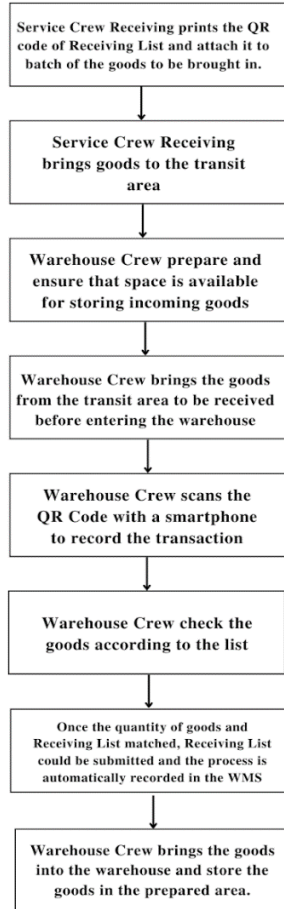
1. Receiving Goods

This SOP is designed to ensure that all incoming stock is stored in the warehouse and that items are accurately recorded. Goods that enter the warehouse come from the Receiving Area and Selling Area. The process of receiving goods involves several people, namely the Receiving Service Crew, Area Service Crew, Warehouse Supervisor, and Warehouse Crew.

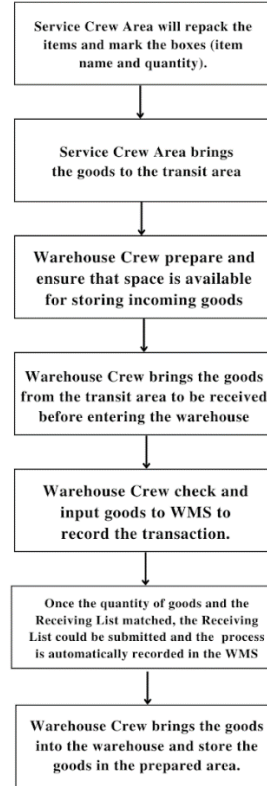
Process Receiving Goods

There are 2 types of sources of goods that enter the warehouse

A. From Receiving Area



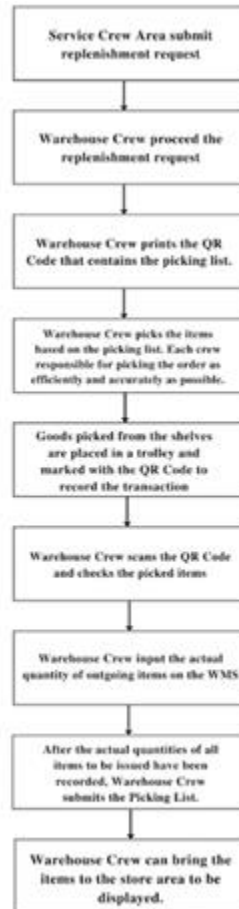
B. From Selling Area



2. Outbound Goods

In the outbound goods process, picking and distributing goods will be carried out. The purpose of establishing this SOP is to ensure the picking and distributing of goods carried out efficiently, on time, on the right amount and good quality.

Process Picking & Distributing Goods



3. Warehouse Maintenance

Warehouse also should be maintained to ensure all stock items are stored properly and can be easily located and picked up at all times, ensure the inventory is recorded accurately matches with the actual stock in the warehouse, minimize the amount of expired or shrinkage items in the warehouse, reduce expired items through better warehouse management and keep the warehouse facility secure and safe.

CONCLUSION

Stock inaccuracy is a major problem experienced by the retail industry, which also happens to company X as this research object of study. This company constantly experiences stock inaccuracy every time it does a stock take and can cause losses. All business processes of Company X are related one to another. If a transaction error occurs, other business processes will be affected. However, in the warehousing section there is still no system that records stock

and movement of goods from the warehouse. In addition, the recording of stock between the warehouse and the store is not separated. This makes it difficult to identify the cause of the inaccuracy. Based on this finding, this research proposed two alternatives of business process reengineering using QR Code and RFID. The RFID technology is indeed interesting to apply since it will minimize human contact and is faster in recording transactions, but has less flexibility than the QR Code. In addition, RFID will also be more suitable for use in distribution centers for a larger number of cartons and pallets.

The further research is suggested to provide another broader and compatible alternatives to fit the needs of the warehouse in the retail industry. In addition, the technologies can be implemented that will give information about the efficiency that can be achieved according to the characteristics of the company, the needs of the company, and the factors that support the implementation plan as a guidance for companies in the retail industry.

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