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ISYS90081 BPM Assignment 2

Business Process Analysis and Redesign

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EXECUTIVE SUMMARY

Northwestern Memorial Hospital (NMH), a leading academic medical center in Chicago, is facing significant challenges within its supply chain operations. Building upon earlier process discovery efforts, a comprehensive process analysis of the current dock-to-stock process has been conducted. Through simulation, waste, and value-added analysis of the as-is model, two major issues are identified: Firstly, late package delivery at floors, attributed to long processing times and subsequent supply shortages, resulting in an overstock cost of US$10,280,550. Secondly, inaccurate inventory records derive from the lack of a systematic tracking system, particularly for packages stored outside designated locations. This inconsistency has led to missing packages and uncertainty of the hospital's stock level, with items in temporary locations of US$5,000,000.

Following the issue identification, the team proposed three changes to mitigate their impacts. Each change was analysed using simulation to compare cycle time and Key Performance Indicators with the current as-is model. The first change aims to address long processing times by eliminating redundant activities, consolidating tasks under a single team, and optimizing resource allocation. The anticipated outcomes include a remarkable 66% improvement in process cycle time, a substantial 50% reduction in complaints, and an estimated overstock cost saving of $3,375,000. The second change involves adopting a semi-continuous approach, empowering teams to process packages upon actual factors without waiting for a full pallet. This method not only reduces cycle time to one day but also enhances operational efficiency and employee productivity. Lastly, implementing tracking technology signifies a strategic investment in future-proofing supply chain. This change ensures accurate package records, improves customer satisfaction, and facilitates total stock value calculation. Based on the pick-chart analysis, Change 1 was identified as the top priority for redesign due to its combination of high impact and ease of implementation, followed by Changes 2 and 3 because of their complexity in implementation.

Ultimately, the conducted analysis represents a strategic initiative for NMH to address its supply chain operations challenges, enhance operational effectiveness, reduce costs, and stimulate business growth.

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1. INTRODUCTION

As NMH suffers from bottlenecks and inefficiencies in its operation, this report aims to thoroughly conduct a process analysis to get a comprehensive understanding of NMH's current performance and root causes of the issues. In addition, it will propose several process redesigns for improving the operational efficiency of the hospital.

To achieve these objectives, the report will start by running an as-is process simulation to gather performance data. Based on the calculated statistics, both qualitative (value-added analysis) and quantitative (waste analysis) techniques are applied to gain deep insights into the current process. Subsequently, two major issues will be identified along with a cause-effect diagram to examine the most significant issue. Afterwards, three changes and their respective models will be presented. Finally, the feasibility and impacts of these changes will be assessed and prioritized for implementation using a pick-chart methodology.

2. PROCESS ANALYSIS

2.1 Cycle Time Analysis

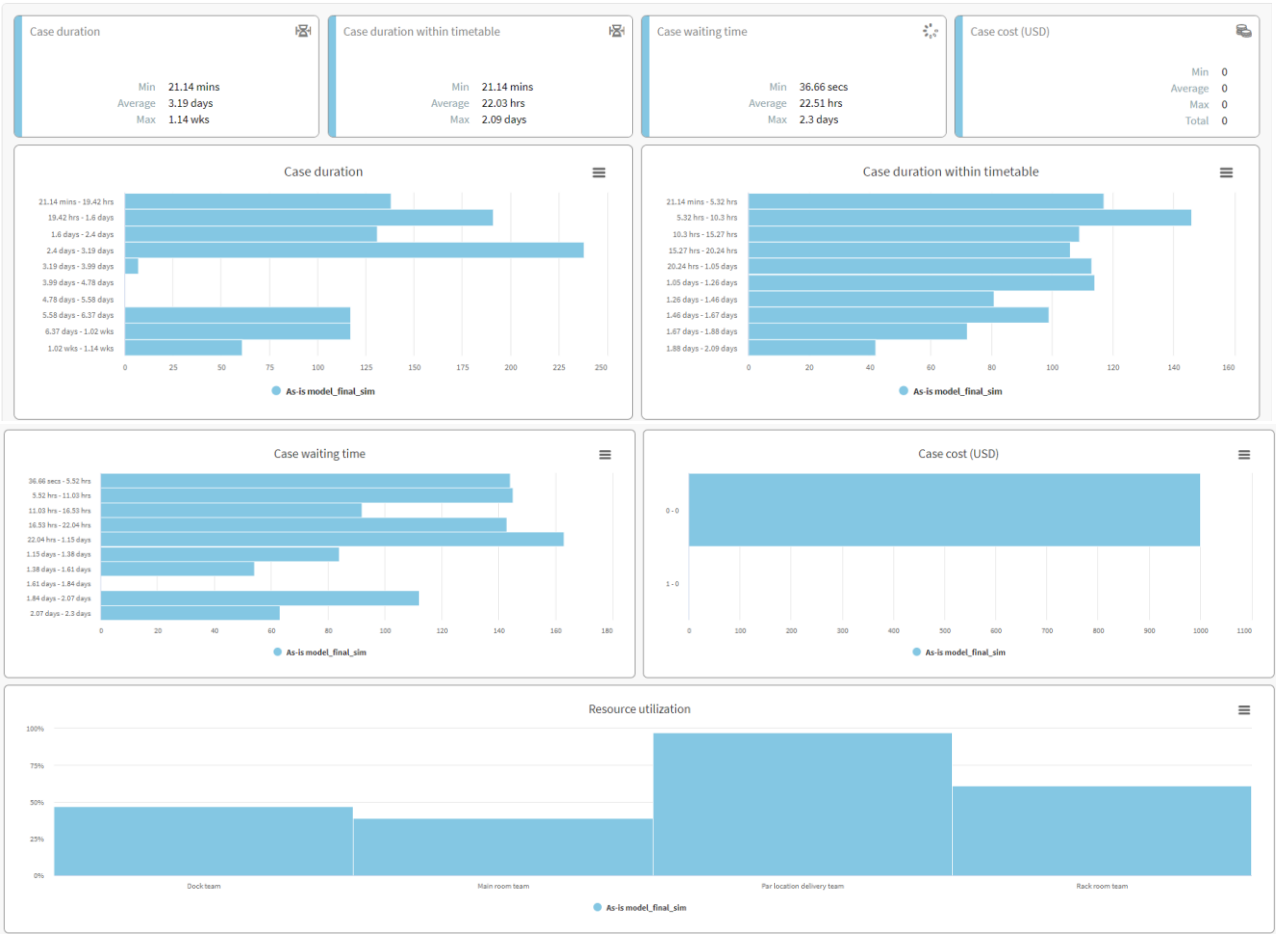


Figure 1. Simulation of as-is model.

The average cycle time of dock-to-stock process is about three days with most cases taking more than one day to complete. The average waiting time is around one day, and the par location team is overloaded.

2.2 Value-added and Waste Analysis

The following table summarizes the value-added and waste analysis for all activities in the as-is model.

VALUE-ADDED ANALYSIS					WASTE ANALYSIS
No.	**Activity**	**Step**	**Performer**	**Classification**	**Waste Type**
1	Unload Package				
1.1		Prepare necessary equipment (e.g. pallets)	Dock-Team	NVA	Motion
1.2		Unload package from trucks		NVA *While this step is crucial for logistics, it is a backend activity, meaning it does not directly enhance the product's value from the customers' perspective and does not contribute directly to business growth.*	Motion, Inventory *At any given time, there are several packages waiting to be unloaded (Inventory)*
2	Move to Pallet				
2.1		Pick up package	Dock-Team	NVA	Motion
2.2		Move package onto pallet		NVA	Motion, Inventory *At any given time, there are several packages waiting to be moved (Inventory)*
3	Move to receiving room				
3.1		Move pallet to receiving room	Dock-Team	NVA	Motion
3.2		Handover to the main room team		NVA	Transport

4	Move to workstation				
4.1		Wait for package to be delivered	Main-Room-Team	NVA	Wait
4.2		Find available workstation		NVA	Motion *The team must move around to search for available workstations for packages.*
4.3		Place packages into workstation		NVA	Motion, Inventory
5	Determine destination				
5.1	Check destination				
5.1.1		Unload the package from workstation	Main-Room-Team	NVA	Motion, Inventory
5.1.2		Open and pull-out package information		NVA	Motion
5.1.3		Check package information for PO number		BVA *This step relates to how the hospital internally manages and stores package information.*	Inventory *At any given time, there are several packages waiting to be checked.*
5.1.4		Open ERP system		NVA	
5.1.5		Enter PO number into the system		NVA	
5.1.6		Check destination details		VA *This step adds value to the customer by ensuring accurate delivery of packages to them.*	Inventory

5.2	Register package into ERP		Main-Room-Team	BVA *This step relates to how the hospital internally manages and stores package information.*	Inventory *At any given time, there are several packages waiting to be input information into the system.*
5.3	Write details on package			NVA	Over-processing *This step is unnecessary because the package details are already on the package information.*
5.4	Print delivery form			NVA	Move, Over-Processing, Inventory *Employees need to move to the printer to complete the task (Move). This step is unnecessary because the package details are already written on the package (Over-processing).*
5.5	Secure form in plastic packet			NVA	Over-Processing, Inventory *This step is unnecessary because the package details are already written on the package (Over-processing).*
5.6	Tape plastic packet to package			NVA	Over-Processing, Inventory
5.7	Set as unknown				
5.7.1		Enter details into ERP system	Main-Room-Team	BVA *This step relates to how the hospital internally manages and stores package information.*	Over-production *15% of packages will not be delivered to customers due to missing information, which brings no value to them upon completion.*

6	Place in temporary location				
6.1		Find available space	Main-Room-Team	NVA	Motion
6.2		Place package at available space		BVA *This step involves how the hospital handles unknown packages internally to prevent losses by placing them in available spaces instead of discarding them.*	Motion, Inventory, Over-production
7	Move package to pallet				
7.1		Place package on pallet	Main-Room-Team	NVA	Motion, Inventory
7.3		Check number of package on pallet (process in batch of 8)		BVA *This step relates to how the hospital internally processes package.*	Inventory
8	Move to rack room				
		Move pallet to rack room	Main-Room-Team	NVA	Motion
		Handover to the rack room team		NVA	Transport
9	Move to rack				
9.1		Wait for package to be delivered	Rack-Room-Team	NVA	Wait
9.2		Unload package from pallet		NVA	Motion, Inventory
9.3		Place package on rack		NVA	*The main room team performs multiple movements (bending, reaching, stretching, walking) to place packages on racks.* *At any given time, there are several packages on the pallet waiting to be placed on rack (Inventory).*

10	Sort package				
10.1		Read the package information	Rack-Room-Team	NVA	Inventory *At a given time, there are several packages waiting to be read.*
10.2		Classify packages based on designated par locations		VA *This step ensures the package will be delivered to customers accurately.*	Inventory *At a given time, there are several packages waiting to be classified.*
11	Load package to designated pallet				
11.1		Arrange pallet	Rack-Room-Team		Motion
11.2		Stack package on pallet			Motion, Inventory
12	Deliver to designated par location				
12.1		Move to par location	Rack-Room-Team	NVA	Motion
12.2		Handover to par location delivery team		NVA	Transportation
13	Unload package from pallet				
13.1		Wait for package to be delivered	Par-Location-Delivery-Team	NVA	Wait
13.2		Unload package		NVA	Motion
13.3		Move package to available place		NVA	Motion
14	Scan package		Par-Location-Delivery-Team	BVA *This step relates to how the hospital manages packages.*	Inventory
15	Discard package				

15.1		Check expiry date	Par-Location-Delivery-Team	VA *This step ensures that customers will not get the spoiled packages.*	Inventory *At a given time, there are several packages waiting to be checked.*
15.2		Note down expired package		BVA *This step relates how the hospital manages expired packages.*	Inventory
15.3		Discard expired package		VA *This step ensures that customers will not get the spoiled packages.*	Motion, Overprocessing, Overproduction *This task can be avoided by doing the expiry date check earlier in the process. This process instance also brings no value upon completion.*
16	Stock package				
16.1		Input package into systems	Par-Location-Delivery-Team	BVA *This step relates to how the hospital manages packages.*	Motion, Inventory
16.2		Place package at available space		VA *This step refers to stocking successful deliveries for customers, which brings value to them, and they are willing to pay for.*	
17	Notify requester				

17.1		Write notification email	Par-Location-Delivery-Team	BVA *This step refers to the communication method that the hospital chooses to notify the customers.*	
17.2		Send notification email		VA *This step helps to notify the customers of their delivery, which adds value to them.*	Transportation
18	Return to receiving room				
18.1		Move pallet to the elevator area	Par-Location-Delivery-Team	NVA	Motion
18.2		Wait for the elevator		NVA	Wait
18.3		Return pallets to receiving room		BVA *This step relates how the hospital handles failed deliveries to prevent losses.*	Motion, Defects, Transportation, Over-processing *If delivery fails due to no space at par locations, the team must return pallet, handover it to the receiving room and reprocess the package.*
18.4		Wait to be reloaded		NVA	Wait

Table 1. Value-added and Waste Analysis

2.3 Issue Registers

Based on the above analysis, two major issues are identified. The following sections summarize each individual issue and provide an impact analysis, with their potential impacts.

Issue Name	**Late package delivery at floors**
Priority	1
Description	Packages often arrive at the floors later than needed because of the long lead time in processing packages.
Assumptions	Since the frequency of late packages is 'often', it is assumed that 40% of the packages fall in this category.
Qualitative Impact	- Customers cannot get the orders on time and have supply shortages. - Customers tend to over-order to secure their inventory, which causes high overstock.
Quantitative Impact	- Customers have to wait for **three days** on average to get their packages delivered after arrival at the receiving area. - Number of late deliveries per day: 500*0.4 = **200 packages**. - The amount of overstock hospital-wide is estimated at **30%**. - Overstock cost estimate: 34,269,500*0.3 = **US$ 10,280,550** *(Assuming 30% overstock has already considered the value of US$ 5million, so it is excluded here.)*

Table 2. Issue 1

Issue Name	**Inaccurate inventory records**
Priority	2
Description	Inventory records are inaccurate because packages stored outside par locations are not entered into the systems. Moreover, there is no systematic way to track packages.
Assumptions	Since the frequency of no space for new items at par locations is 'often', it is assumed that 40% of the packages fall in this category.
Qualitative Impact	- Customers are not able to receive their packages and make complaints. - Customers have to call for missing products and go to the receiving area to search for packages. - Customers who urgently need the items but cannot find them have to reorder. - The hospital cannot fully calculate the actual stock value.
Quantitative Impact	- **32 occurrences daily** related to lost, missing or reorder products and package searches, which take receiving area staff **2 hours 5 minutes per day** to solve the issues. - **200 delivered items per day** that bypass the receiving area and go unrecorded in the system. - Items held in temporary locations with no record is worth **US$5,000,000**.

Table 3. Issue 2

Timely package delivery is crucial because of its immediate and direct impact on internal customers and operational processes. When orders are delivered on time, it ensures smooth daily operations and high internal customer satisfaction. Efficient delivery management also reduces overstock, optimizing storage use and minimizing storage costs. Furthermore, with fewer packages held in temporary locations, tracking becomes more manageable, reducing errors in record-keeping. On the other hand, issues with inaccurate inventory records usually accumulate over time, showing less instantly disruptive impacts than those of delivery delays. Therefore, while both issues are important for operational efficiency, the immediate consequences of late deliveries make it a higher priority.

2.4 Cause-effect Diagram

As late delivery is identified as higher priority, this cause-effect diagram aims to analyse the root causes of this issue.

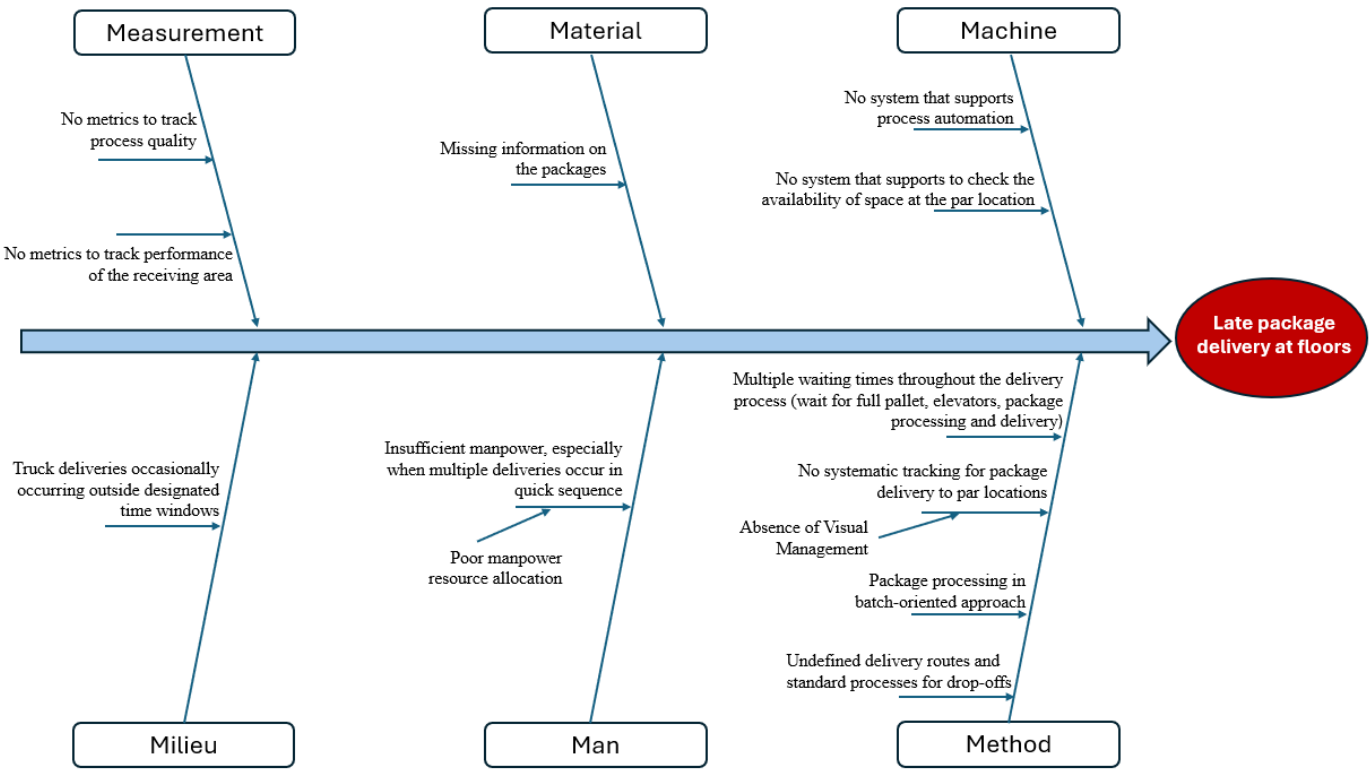


Figure 2. Cause-effect Diagram

3. PROCESS REDESIGN

3.1 Process Change

Three following tables outline the proposed changes to the as-is process, with the issues identified in the section above.

Change No.	1
Issue addressed	**Late package delivery at floors**
Description	**H1: Activity Elimination**

	Main room team only write details on package after checking the package destination to easily access to the destination information. Other activities running in parallel such as "print delivery form", "secure form in plastic packet" and "tape plastic packet to package" can be eliminated, and redundant over-processing, inventory and motion waste can be avoided. **H2: Activity Composition** The main room team will load packages onto designated pallets immediately upon identifying their destination and deliver them to the par location in batches of 8 packages. Activities such as "move package to pallet", "move to rack room", "move to rack", "sort package" and "load package to designated pallet" will be merged into one activity performed by the main room team. **H7: Resource Optimization** With the consolidation, three members from the rack room team would be freed up. Additionally, it is noted that the par location team is overloaded with 100% resource utilization, which would result in a drastic increase in waiting time. Therefore, this change involves allocating one of the three freed-up rack room team members to assist the main room team, as the new process assigns them more activities, and two members can assist the par location team.
Impact on performance	1. 66% improvement in cycle time for package delivery to the par location, with the average cycle time reduced to from 3.19 days to 1.09 days. 2. Enhance customer satisfaction by reducing the number of customer complaints by 50% through faster delivery *(Assuming the number of customer complaints decreases from 2 to 1 per day)*. *3.* Decrease the need for reordering items by 30%, resulting in cost savings from overstocking *(Assuming that the improvement in late supplies at floors, which sometimes resulted in shortages, resolves the shortages - with 'sometimes' equivalent to 30% of the occurrences).* Cost savings resulting from a reduction in overstock: US$10,280,550* 30% = US**$3,084,165** *(Note: US$10,280,550 is the estimated overstock value)*
Heuristic or BPR principles used	H1: Activity Elimination H2: Activity Composition H7: Resource Optimization

Table 4. Change 1

Change No.	2
Issue addressed	**Late package delivery at floors**
Description	**BPR1: One source of truth** The ERP system will be used for inventory management, replacing the current use of two systems (ERP and Inventory management), to create a single source of truth for all stakeholders. By scanning the package barcode or RFID, the ERP system automatically records the details and updates the packages' location. Consequently, all the manual activities will be eliminated, leading to a significant reduction in cycle time. It will also give the visual management for stakeholders to reduce both the return rate at par location and reorder. **BPR4: Put the decision point where the work is performed, and build control into the process**

	Both the dock team and main room team are empowered to make decisions about moving pallets with a continuous- or batch-processing approach, called semi-continuous approach. Specifically, decision-making is decentralized to let staff process packages based on actual factors, such as the number of packages waiting for process and the package priority level. To control the quality of process, two rules are implemented. 1. The waiting time at the dock will be up to 13 minutes *(66 seconds – maximum duration to unload and move one package at dock, multiplied by 12 packages of a pallet)* before moving to the receiving room area. The waiting time in the main room will only be 25 minutes maximum to move the pallet to the rack room.
Impact on performance	1. Reduce the average cycle time process to around 1 days (Appendix 2) 2. Enhance employee productivity by optimizing the workflow and ensure consistent quality (Timberg, 2024) 3. Improve customer satisfaction by delivering packages closer to their needed timing (Kinematics, 2019) 4. Reduce the overstock rate through visual management resulted in a 25% reduction in scrap (Stiles, 2020), leading to a significant decrease in the return rate to 5% at the par location.
Heuristic or BPR principles used	BPR: Principle 1 BPR: Principle 4

Table 5. Change 2

Change No.	3
Issue addressed	**Inaccurate inventory records**
Description	Tracking technology will be deployed for all types of packages at every stage to ensure accurate hospital-wide inventory records. After being moved to workstations, every package will have its destination checked and be registered into the ERP system through scanning, whether it reached the floors or not. Staff will just scan the barcode or RFID and the technology will then automatically store details into the ERP system. As packages move through different teams, they will be scanned for check-ins and status updates. Consequently, activities handling physical forms can be eliminated. This will allow all teams to share the same data view in one central system and minimize human errors in working with data.
Impact on performance	1. Enable customers to track inventory from the beginning to the end (Nash, 2010), improving customer satisfaction. 2. Improved real-time inventory control and tracking (Tiwari and Roy, 2022). 3. Greater inventory accuracy (Nash, 2010), facilitating the calculation of stock value. 4. Achieve accurate ordering rate (Tiwari and Roy, 2022). 5. 30% reduction in labour costs (Tiwari and Roy, 2022).
Heuristic or BPR principles used	BPR: Principle 1

Table 6. Change 3

3.2 Pick Chart

Prioritization of the three proposed changes has been performed using the pick chart in Figure 3.

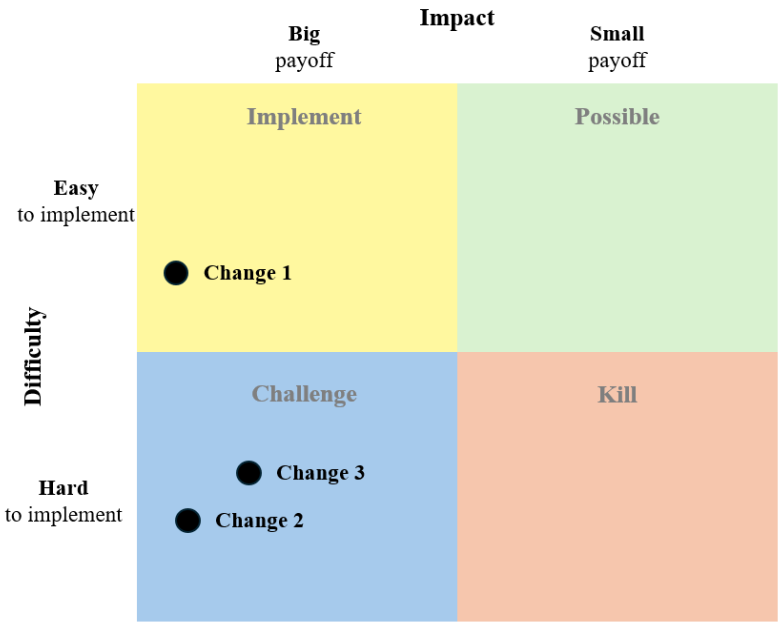


Figure 3. Pick Chart

CHANGE 1

Easy to implement: This change is positioned as 'easy to implement' because it involves straightforward modifications. However, considering change management factors, such as employee resistance to change, especially when they learn new job scopes, efforts are needed to ensure employees accept the changes. Training and learning will be necessary for the change's implementation, thus placing it at a lower position in the quadrant.

Big payoff: The numerical impact is undoubtedly significant, as stated earlier. This change greatly enhances operational and resource allocation efficiency by streamlining package delivery processes, resulting in smoother overall operations, and bringing a significant impact into the business.

CHANGE 2

Hard to implement: This change requires a modification to the standard operating procedures of the company; thus, training sessions for employees are necessary to help them adapt to new processes. Consequently, the substantial investment consisting of time and fees will play important roles in ensuring the effective implementation.

Big payoff: This change will have positive impacts on multiple aspects of the dock-to-stock process. It will significantly improve the process's waiting time and minimize the return rate and reorder instances, which leads to more space available for newly coming items.

CHANGE 3

Hard to implement: The high cost and complexity of implementing barcode and RFID hospital-wide pose substantial challenges. Specifically, it includes integrating and testing hardware, software, and systems, and conducting user training and change management for the whole new operations. Therefore, the implementation is complex and resource intensive.

Big payoff: As stated, the widespread adoption of tracking technology would greatly advance inventory management by enabling efficient package tracking and control. This would bring significant improvements to the hospital's inventory accuracy, calculation of stock value and internal customer satisfaction.

3.3 To-be Process Model

This section presents screenshots of the to-be models based on the proposed changes.

CHANGE 1

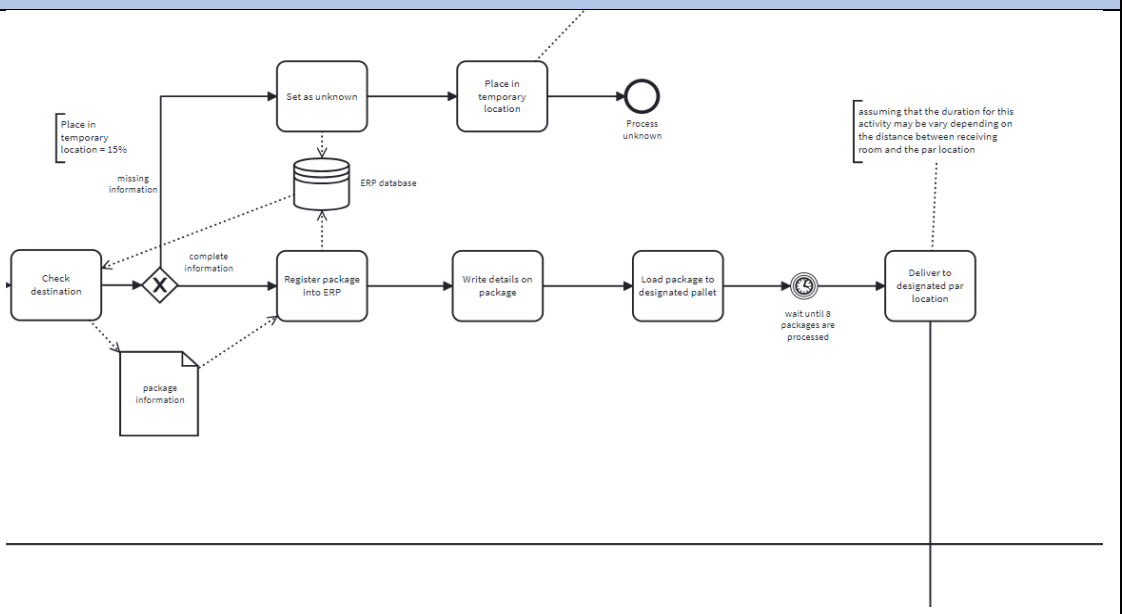
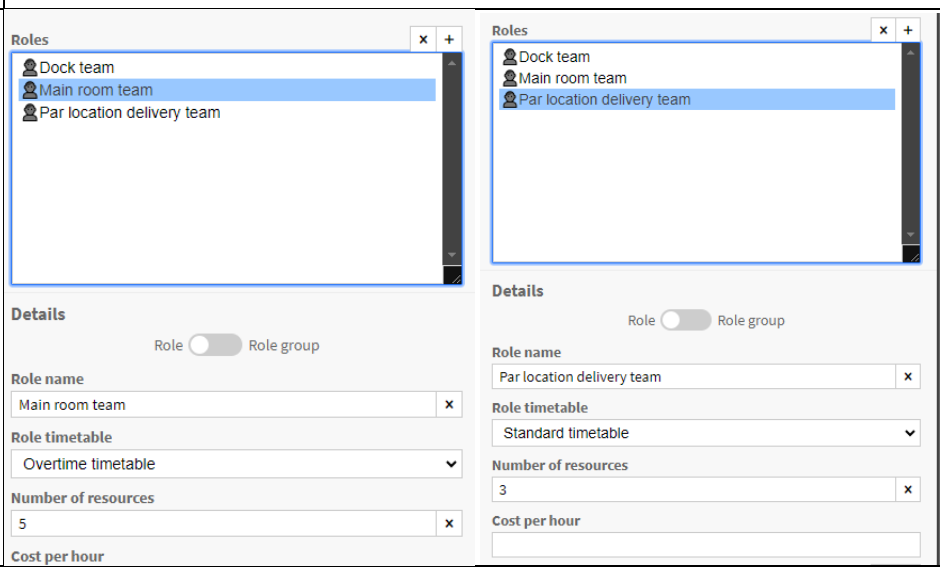
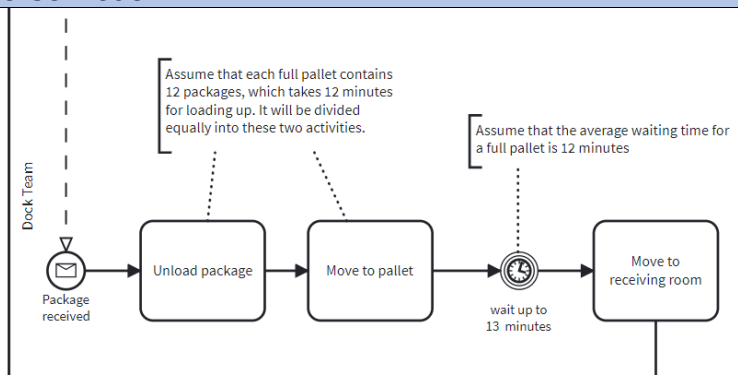
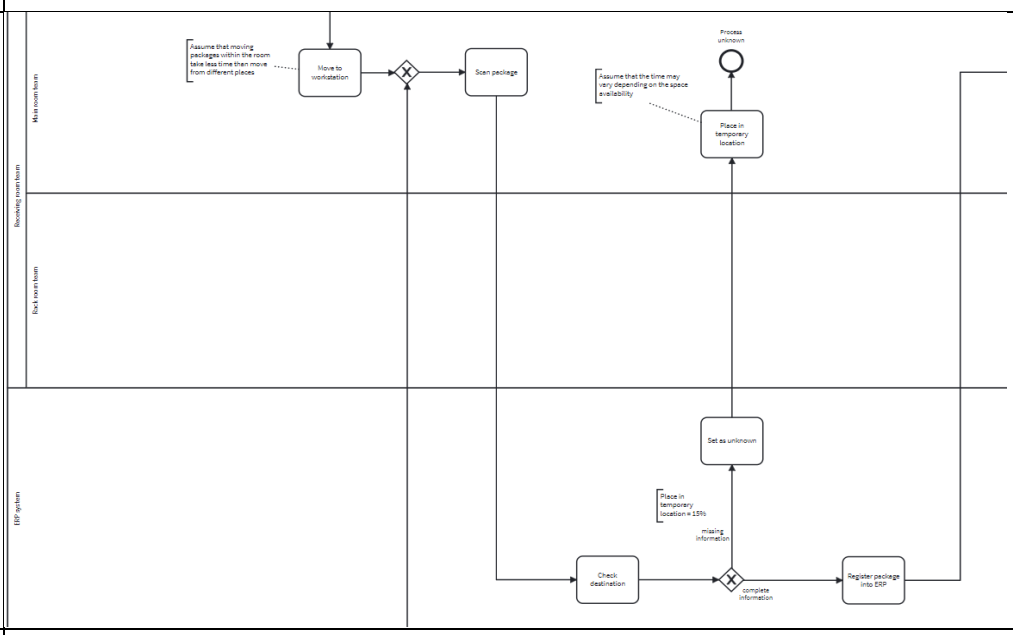
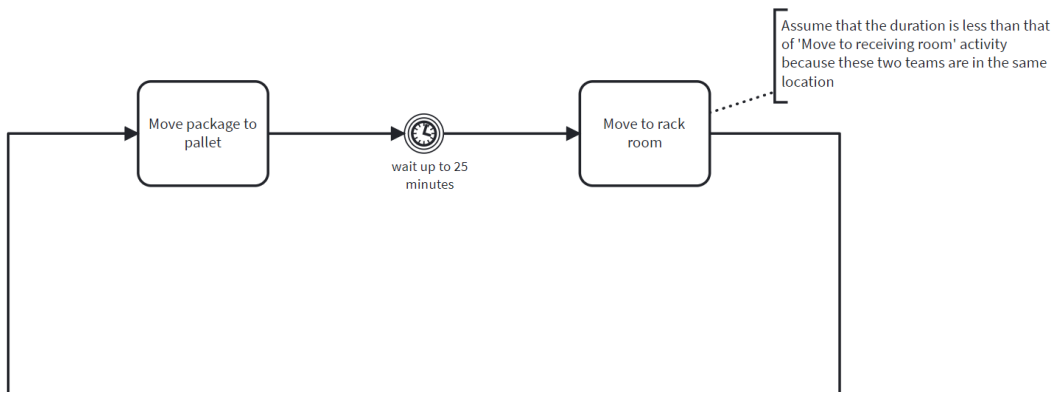
Description	To-be model
Only "Write details on package" is kept for easy access to destination details. "Load packages to designated pallet" and "Deliver to designated par location" are now assigned to the main room team.	
With the rack team being freed up, the main room team now has 5 staff, and the par location team has 3 staff.	

Table 7. Change 1 to-be model

CHANGE 2

Description	To-be model
The pallet at the dock team will wait up to 13 minutes instead of waiting until it is full.	
The systems will automate 'determine destination' activity, which eliminate writing and printing activities	
The package will wait for up to 25 minutes instead of waiting all 8 packages	

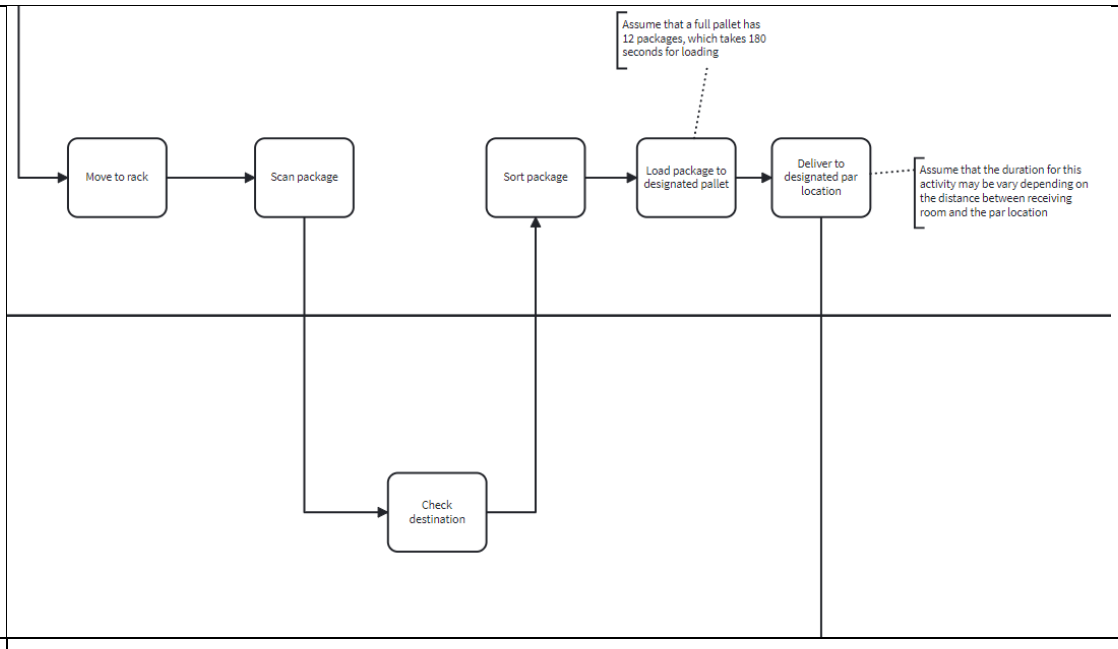
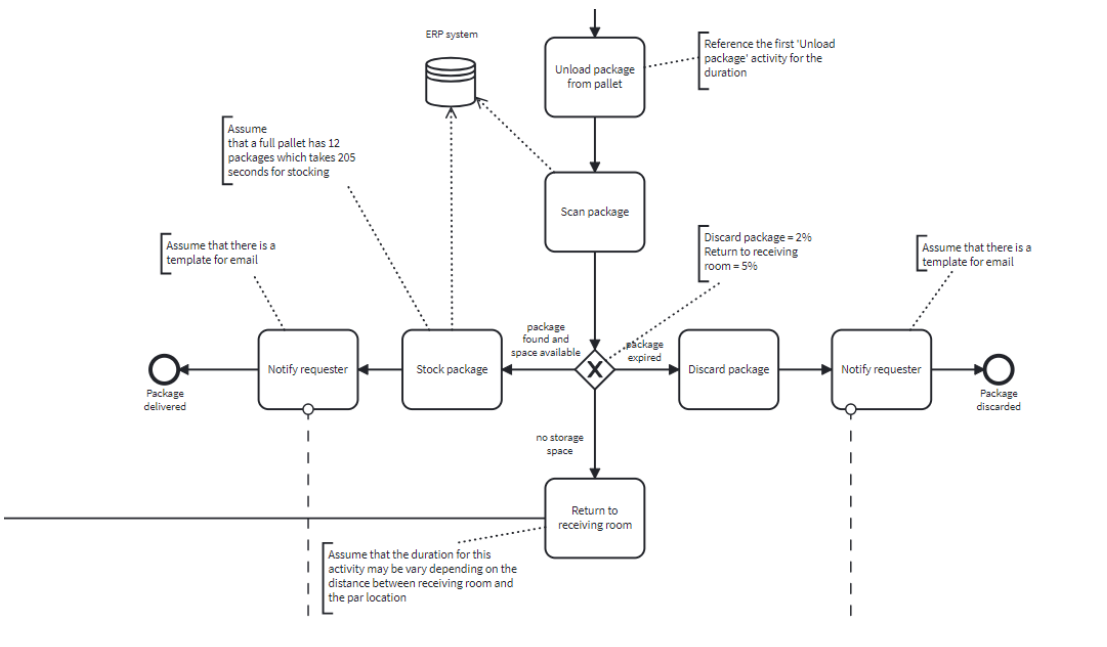
Rack room will scan package to check destination before sorting.	
The percentage of no available space case significantly decreased to 5%.	

Table 8. Change 2 to-be model

CHANGE 3

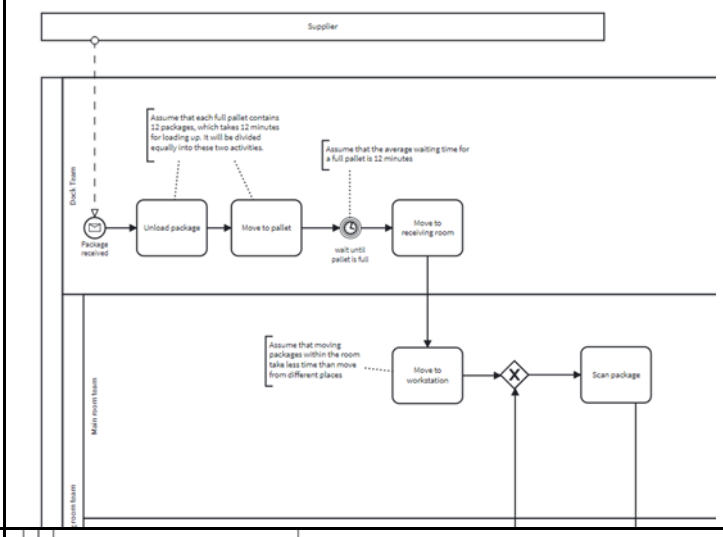
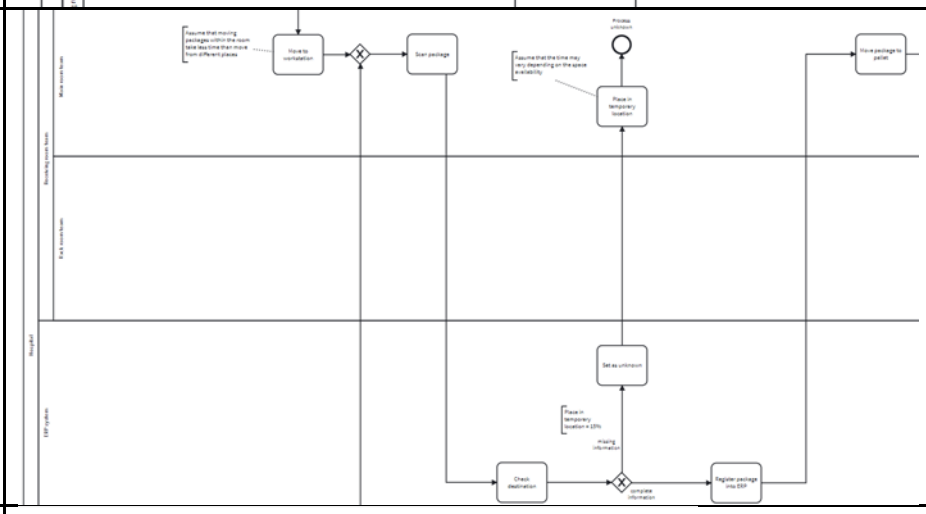
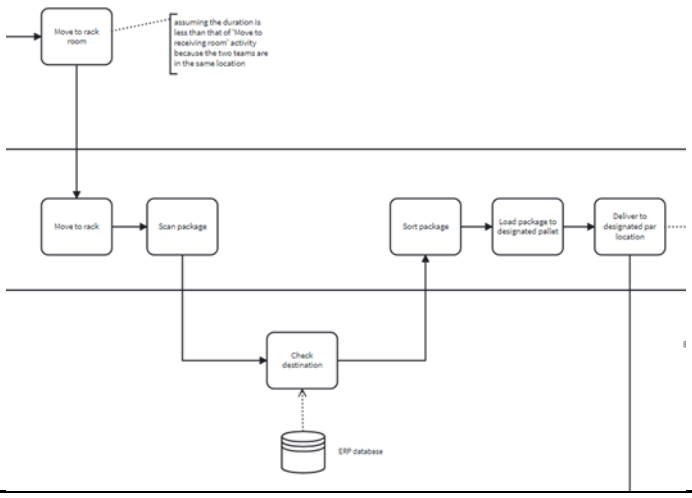
Description	To-be model
After moving to workstation, the main room team will scan the package.	
ERP system will handle three steps here.	
Three lanes here are Main room team, Rack room team and ERP system.	

Table 9. Change 3 to-be model

4. CONCLUSION

In conclusion, after conducting the process analysis for the as-is model, two significant issues are identified, comprising package delivery delays at floors, and inaccurate inventory records. To solve the problems, three proposed solutions offer opportunities for NMH to improve its business performance. By implementing these solutions, the potential benefits include reducing process cycle time by at least 11%, enhancing customer satisfaction by 50%, and refining inventory management practices. These improvements not only address the current NMH's issues but also establish smooth operations and improved outcomes for the organization and its stakeholders.

5. REFERENCE

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6. APPENDICES

Appendix 2: Change 2 simulation