Jurnal Darma Agung
Volume: 31, Nomor: 5, (2023), Oktober: 485 - 498
https://dx.doi.org.10.46930/ojsuda.v31i5.3743

P-ISSN:0852-7296
E-ISSN:2654-3915

ANALYZING THE EFFICIENT EXECUTION OF IN-STORE REPLENISHMENT PROCESS BY USING LEAN SIX SIGMA FRAMEWORK IN RETAIL BUSINESS

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Abstrak

Peretail memanfaatkan rak untuk memamerkan produk mereka kepada pelanggan, memerlukan keputusan tentang cara mengalokasikan ruang penjualan untuk setiap item. Karena produk di rak secara bertahap habis melalui pembelian pelanggan, pengecer harus mengisi kembali rak secara teratur. "Sistem Pengisian Ulang" memainkan peran penting dalam memenuhi harapan pelanggan dengan memastikan barang yang diproduksi tersedia. Dengan rangkaian produk yang luas dan permintaan pelanggan yang terus meningkat, mengelola ruang penyimpanan yang tersedia menjadi faktor penting dalam menjaga efisiensi pengisian ulang secara keseluruhan. Penelitian ini bertujuan untuk mengidentifikasi proses pengisian ulang di dalam toko yang relevan dan biaya terkait untuk Bisnis Ritel. Dengan memanfaatkan metode lean six-sigma yang dikenal sebagai Define-Measure-Analyze-Improve-Control (DMAIC) untuk mengidentifikasi proses pengisian ulang, penelitian ini menggunakan kombinasi pendekatan kualitatif dan kuantitatif. Temuan penelitian ini digunakan untuk mengembangkan proses optimalisasi yang secara bersamaan meningkatkan manajemen ruang penjualan dan proses pengisian ulang di dalam toko.

Kata Kunci: Retail; Sistem Pengisian Ulang, Manajemen Ruang Penjualan, Lean Six Sigma, DMAIC

Abstract

Retailers utilize shelves to showcase their products to customers, requiring decisions about how to allocate selling space for each item. Because products on shelves are gradually depleted through customer purchases, retailers must restock shelves on a regular basis. "The Replenishment System" plays a vital role in meeting customer expectations by ensuring the goods produced are in stock. With a broad product range and ever-increasing customer demands, managing available sales space is becoming a critical factor in maintaining overall replenishment efficiency. This study aims to identify relevant in-store refill processes and associated costs for Retail Businesses. By utilizing the lean six-sigma method known as Define-Measure-Analyze-Improve-Control (DMAIC) to identify the replenishment process, this research uses a combination of qualitative and quantitative approaches. The findings of this study were used to develop optimization processes that simultaneously improve salesroom management and in-store replenishment processes.

Keywords: Retail, Replenishment System, Sales Space Management, Lean Six Sigma, DMAIC

INTRODUCTION

History:
Received : 25 Februari 2023
Revised : 10 Oktober 2023
Accepted: 23 Oktober 2023
Published: 31 Oktober 2023

Publisher: LPPM Universitas Darma Agung

Retailers utilize shelves to present their products to customers. By doing this, they face the task of determining the appropriate allocation of shelf space for each item. The primary objective is to maximize the utilization of retail selling space within stores to enhance sales opportunities (Rushton et al., 2010). As customers make purchases, the quantities of items assigned to retail shelves gradually diminish, necessitating regular replenishment and reordering by retailers. The process of reordering directly affects the replenishment procedures. When reorders arrive at the store, the respective items are transferred to the showroom for restocking, a process known as direct replenishment. As a result, each order triggers the direct replenishment process. This approach to replenishment is aligned with agile supply chain management principles, which aim to establish a responsive structure and process that can effectively meet customer demand in a dynamic market (Rushton et al., 2010).

The limited availability of shelf space presents a challenge for retailers as the number of products they offer continues to increase. This places pressure on retailers to effectively manage profitability within narrow margins while maximizing space productivity (Gutgeld et al., 2009). Shelf space is often considered the most scarce resource for retailers (Lim et al., 2004; Irion et al., 2012; Geismar et al., 2015; Bianchi-Aguiar et al., 2015). Changes in shelf space allocation have a direct impact on customer demand, as increased visibility of items influences their desirability (Eisend, 2014). To clarify, as the demand for a specific item increases, it becomes necessary to allocate more space on the shelves to accommodate it. Additionally, the costs associated with in-store replenishment are significant, comprising up to 50% of the overall expenses in the retail supply chain (Kotzab and Teller, 2005; Broekmeulen et al., 2006; Reiner et al., 2013; Kuhn and Sternbeck, 2013). Consequently, when planning the allocation of shelf space, shelf-space planners need to consider not only factors like product profitability and demand impact but also various aspects such as shelf arrangement options, the frequency and cost of in-store replenishment, and the availability of a backroom for replenishment (Hübner & Schaal, 2017).

Replenishment involves the transfer of goods from reserve stock or goods-in areas to the picking face, where items are selected for customer orders (Tien et al., 2019). The efficiency and accuracy of the picking process greatly depend on the effectiveness of the replenishment operation. If the picking stock is not replenished promptly, it can lead to incomplete orders and customer dissatisfaction. In such cases, pickers may have to make unnecessary trips to pick slots or return to the slot once replenishment is completed. Additionally, if goods are replenished to the wrong pick slot, there is a higher likelihood of customers receiving incorrect products. The effectiveness of checking procedures plays a crucial role in ensuring accurate replenishment and minimizing errors (Rushton et al., 2010).

While the growth of PT XYZ's as a retail business creates opportunities for cost-efficient in-store replenishment, it also presents challenges related to its process. In the

actual replenishment process, there is an item that has a frequency of replenishments requested almost every day in one sales period. The index of auto-replenishment process is still low, only 48% in 2022. From the index, 31% of the articles are accepted and 17% of articles are rejected. From the auto-replenishment trend, the average ratio between accepted and rejected items is 3:2. It can be assumed that for every 5 items in the proposal, only 3 of them will be continued to replenishment process, and the rest will be rejected. This causes a continuous effect where each rejected item will generate a manual request. Manual replenishment requested can reach 50% of the replenishment list every day.

In this case, the replenishment team, especially the operator, must take a small quantity of one article from the buffer storage using a forklift or Mobile Handling Equipment (MHE) repeatedly (Richards, 2017). This has the potential to cause high operational costs due to the inaccurate use of MHE. In addition, activities that are carried out repeatedly with a small quantity make the lead time of a process longer.

In-store operational inefficiencies can present management challenges and impact the overall efficiency of the store. Some common examples include:

- Unnecessary early or late deliveries: Inefficient scheduling of deliveries can result in additional in-store handling, such as moving products around or storing them temporarily. This can lead to wasted time and effort.
- Non-aligned resource use: If the staff planning is inflexible and not optimized according to the workload, there may be mismatches between the available resources and the tasks at hand. This can result in inefficient resource utilization and potentially increased costs.
- Inefficient lead time of daily replenishment process: If the process of replenishing products on a daily basis takes longer than necessary, it can lead to delays and disruptions in the availability of products for customers. This can impact customer satisfaction and potentially lead to lost sales.
- Human error in manual replenishment process: In a manual replenishment process, there is a higher likelihood of human error, such as picking the wrong products or misplacing items. These errors can result in inefficiencies, as they may require additional time and effort to correct

The analysis revealed that the current internal process results in unnecessary in-store handling and inefficient utilization of storage space. It was concluded that there is potential for improvement in in-store replenishment through flexible staff planning and reducing operational disruptions, such as minimizing idle times and reducing the time items remain on hand.

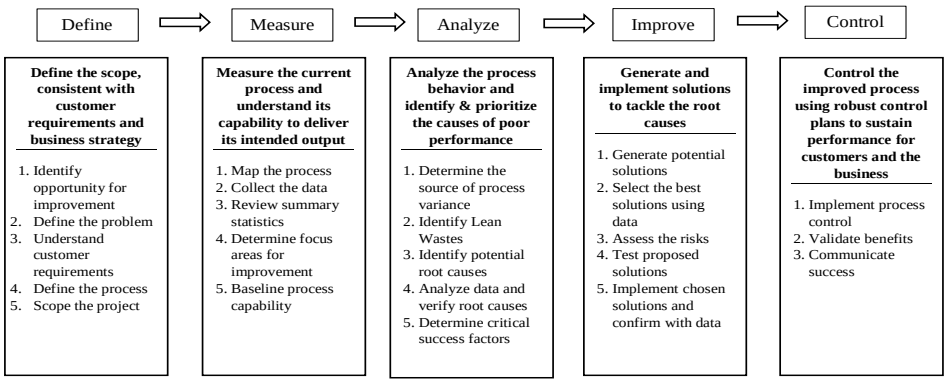
RESEARCH METHODS

The research employs a mixed methods approach as its design, which integrates qualitative and quantitative research data, techniques, and methods within a unified

research framework. By utilizing this approach to collect and analyze data, it is expected to enhance the credibility and dependability of the research findings (Muhammad & Kabir, 2016). The research uses a type of data answers to "how and why" questions and mostly covers data regarding feelings, perceptions, and emotions using unstructured approaches such as interviews for data collection. Qualitative methods encompass three main categories including observations, document reviews, and in-depth interviews (Taherdoost, 2021). Quantitative data refers to numerical information that is mathematically generated and computed. Additionally, the findings from quantitative research can be easily summarized, generalized, and compared, allowing for straightforward analysis and interpretation (Taherdoost, 2021). The research primarily utilizes primary data, which refers to information that has not been published yet and is obtained directly from original sources.

A conceptual framework refers to a collection of concepts, assumptions, expectations, beliefs, and theories that underpin and guide research. In this study, the main concept being employed is the Lean Six Sigma DMAIC tools, which merges the principles of Lean thinking and Six Sigma. Lean principles focus on generating value for customers by reducing or eliminating activities that do not contribute to the overall process. On the other hand, Six Sigma aims to enhance processes in alignment with what is crucial to the customer. These two strategies complement and reinforce each other, resulting in a combination of methodologies that systematically employ tools to achieve improved process outcomes and deliver superior results. The conceptual framework of this research is shown below:

Figure 1. Lean Six Sigma DMAIC Conceptual Framework

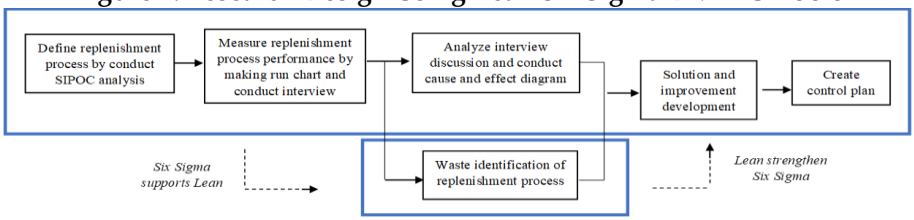


Source: Internal Data Collection

The author examined relevant literature to investigate which tools and methodologies would assist in accomplishing this research. Subsequently, data and analysis were gathered to enhance the efficiency and efficacy of the replenishment process, as well as to acquire any necessary information for the study's completion. The collected data and information, which disclosed certain findings, were analyzed

utilizing Lean Six Sigma DMAIC tools. These tools were employed to enhance effectiveness, generate solutions, and establish the implementation plan for continuous improvement within the organization.

Figure 2. Research Design Using Lean Six Sigma DMAIC Tools



Source: Internal Data Collection

RESULTS AND DISCUSSION

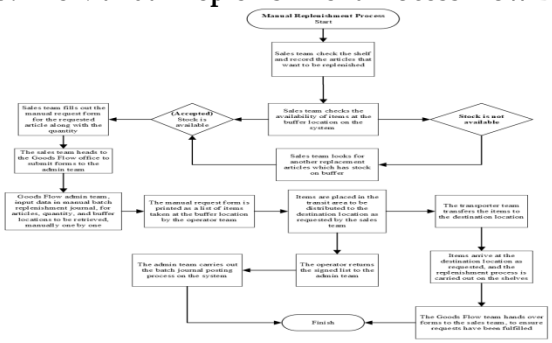
A. Define Phase

1. Manual Replenishment Process

Manual replenishment is purely a replenishment process based on manual requests by the Sales team not based on the calculations of the system used. This process uses more estimates from the sales team for out-of-stock items on the shelves. This can happen when the parameters in the system do not match the actual conditions in the field. The stages in the manual replenishment process include:

a. The sales team checks the condition of the sales rack
b. The sales team sees a shelf that looks empty
c. The sales team records the article, inputs it into the request form, and submits it to The Logistics Team for the replenishment process

Figure 3. The Manual Replenishment Process Flow Diagram



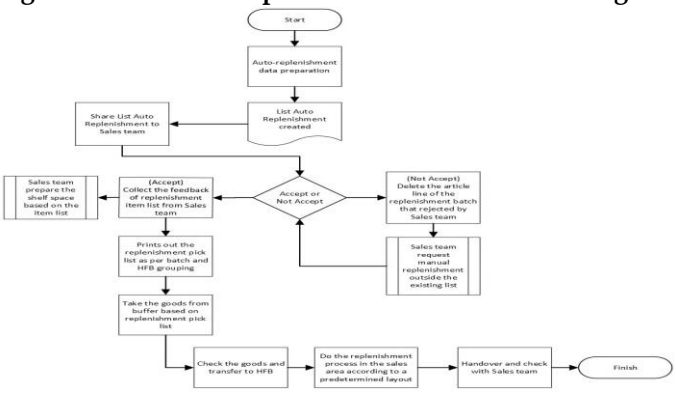
Source: Primary Sources Within The Organization, 2023

2. Auto-Replenishment Process

Auto-replenishment is a replenishment process that is carried out accurately based on system calculations. When the article has touched the replenishment point, the system triggers or creates a replenishment batch automatically. This happens because there are goods sold so that the stock on the shelf is reduced from the amount of sales space that has been determined and registered in the system. Auto-replenishment is

processed by the system to calculate, process and print batch replenishment for each Home Furnishing Business grouping. The Logistics Team will execute the created batch.

Figure 4. The Auto Replenisment Process Flow Diagram



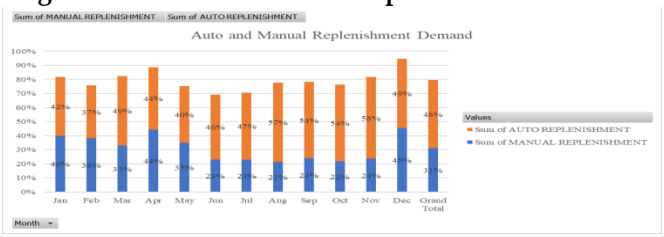
Source: Primary Sources Within The Organization, 2023

The potential waste from the initial process is small auto-replenishment accuracy due to many manual requests that can cause extra processing to revise the replenishment batch. It happened because of the unmatched replenishment parameter. The parameter input process is not based on the actual condition in the sales area so it can cause extra processing and inventory waste in the replenishment process. An inaccurate batch of replenishment can also cause a waste of motion and transportation regarding the high goods movement demand. High demand for replenishment and goods movement also impact the manpower allocation and its cost. The high demand for replenishment can also cause by the unmatched sales layout and space management to make the stock look low. The understanding of Sales Space Management that is not evenly distributed to co-workers also can cause errors (defects) and waste of waiting, because the co-worker's knowledge is still unready. The internal process that has not been appropriately implemented due to the manual process implementation can also potentially make waste of waiting and defects.

B. Measure Phase

In accordance to the replenishment process, if the item stock quantity reaches the replenishment point, the system will automatically create a replenishment batch. And ideally, every item that is inputted on the auto-replenishment list at night after the store closes, can be processed for replenishment in the morning before the store opens. However, due to reviews from the Sales team regarding the condition of the sales area, missing Sales parameter, or other strategies, the auto-replenishment list proposal may be rejected. The data on figure below the trend of replenishment demand, accepted and rejected items in the auto-replenishment list proposal in the period of January to December 2022.

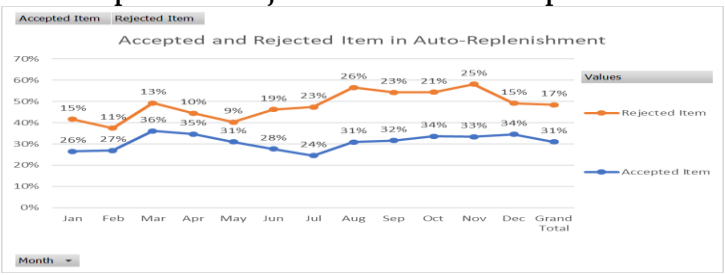
Figure 5. Auto And Manual Replenishment Demand



Source: Primary Sources Within The Organization, 2023

The index of the auto-replenishment process in PT XYZ is still low only 48% in 2022. From the auto-replenishment trend, the average ratio between accepted and rejected items is 3:2. It can be assumed that for every 5 items in the proposal, only 3 of them will be continued to replenishment process, and the rest will be rejected. This causes a continuous effect where each rejected item will generate a manual request. Manual replenishment requested can reach 50% of the replenishment list every day. This can potentially cause high operational costs.

Figure 6. Accepted And Rejected Item In Auto-Replenisment Process



Source: Primary Sources Within The Organization, 2023

C. Analyze Phase

The potential waste from the initial process is small auto-replenishment accuracy due to many manual requests that can cause extra processing to revise the replenishment batch. It happened because of the unmatched replenishment parameter. The parameter input process is not based on the actual condition in the sales area so it can cause extra processing and inventory waste in the replenishment process. An inaccurate batch of replenishment can also cause a waste of motion and transportation regarding the high goods movement demand. High demand for replenishment and goods movement also impact the manpower allocation and its cost. The high demand for replenishment can also cause by the unmatched sales layout and space management to make the stock look low. The understanding of Sales Space Management that is not evenly distributed to co-workers also can cause errors (defects) and waste of waiting, because the co-worker's knowledge is still unready. The internal process that has not been appropriately implemented due to the manual process implementation can also potentially make waste of waiting and defects.

The 5-why analysis is employed as a method for conducting a comprehensive investigation and uncovering the root causes of issues. The root cause is determined based on the insights gained from interviews and observations conducted earlier in the process. The root causes can be categorized into various groups, including:

Table 1. The Potential Waste In Replenishment Process

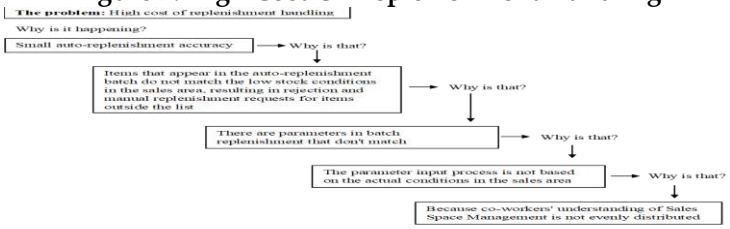
Process	Potential Waste	Classification
Auto-replenishment accuracy	Small auto-replenishment accuracy due to many manual requested	-Processing waste -Inventory waste
Input the parameter in replenishment batch	The parameter don't match due to the input process is not based on the actual condition in the sales area	-Processing waste -Inventory waste
Sales Space Management knowledge	The understanding of Sales Space Management is not evenly distributed	-Waste of waiting -Waste from product defects
The process of goods movement	Inaccurate batch replenishment affect the replenishment demand and goods movement	-Waste of motion -Transportation waste
Sales layout and sales space management	If the layout does not match the sales space management, it makes the stock look low	-Processing waste -Waste from product defects
Manpower allocation	High demand of replenishment affect the manpower allocation	-Waste of motion -Transportation waste
The Internal Process of Replenishment	The internal process has not been implemented properly due the manual process implementation	-Waste of waiting -Waste from product defects

Source: Primary Sources Within The Organization, 2023

D. High Cost of Replenishment Handling

In replenishment process, the high cost of handling is caused by the small auto-replenishment accuracy. It can be happened because the items that appear in the auto-replenishment batch list do not match the low stock conditions in the sales area. In result, the items will be rejected and Sales team will request the manual list outside the batch. Auto-replenishment rejection is affected by the correct replenishment parameter. Because of the understanding of Sales Space Management and its parameter are not evenly distributed to the co-worker, the process of input and maintain the parameter is not based on the actual conditions in the sales area. That is why the cost of handling increasing.

Figure 7. High Cost Of Replenishment Handling



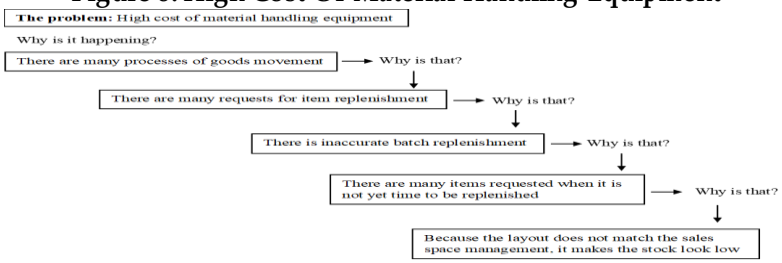
Source: Primary Sources Within The Organization, 2023

E. High Cost of Material Handling Equipment

The high cost of material handling equipment such as reach truck and power stacker, is because of the high frequency of goods movement. The high demand of

replenishment item is affected the goods movement. An inaccurate replenishment batch is the factor that can cause the high demand of manual replenishment. Manual replenishment can be happened if the items are requested when it is not yet time to be replenished. It usually happens because the stocks look low in the sales area. Unmatched sales layout and its space management should be maintained to decrease the demand of manual replenishment.

Figure 8. High Cost Of Material Handling Equipment

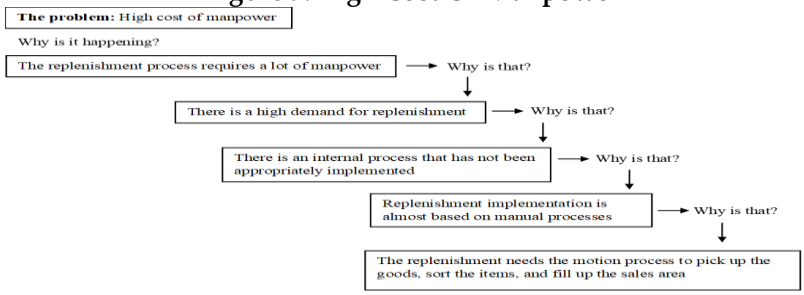


Source: Primary Sources Within The Organization, 2023

F. High cost of manpower

The high demand for replenishment also affects the high cost of manpower. It happens because the internal process of replenishment has not been appropriately implemented. The replenishment implementation is almost based on a manual process, starting from maintaining the batch list, picking up the goods from buffer storage, transporting the items to the sales area, and the process of filling up the shelves.

Figure 9. High Cost Of Manpower

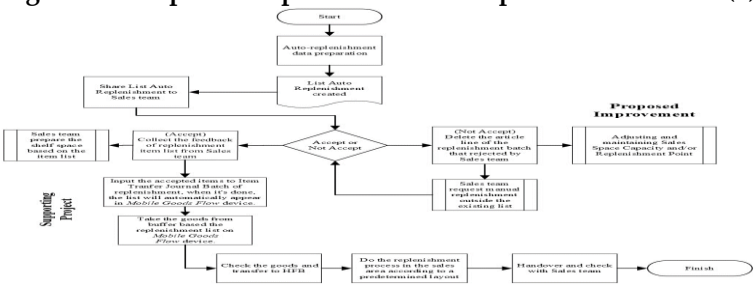


Source: Primary Sources Within The Organization, 2023

G. Improve Phase

The main purpose of replenishment is to make the goods available for the customers. It is the last part of a long supply chain from developing the products, sourcing raw materials, production, and transport from the supplier, until the sales location where it is sold. In order to create an efficient replenishment process, the previous procedure needs to be modified. Not to change all the systems, but to add some steps to maintain and adjust the sales space capacity and replenishment point.

Figure 10. Proposed Improvement For Replenishment Flow (a)

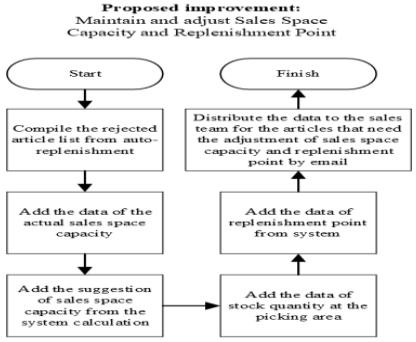


Source: Primary Sources Within The Organization, 2023

In the previous manual replenishment process, items that were rejected in batch auto-replenishment were not given any treatment. That is why manual requests repeatedly occur in the near period. The improvement in the current replenishment process is by asking for justification from the Sales team if there is a manual replenishment request. The justification is the reason why the Sales team needs the manual replenishment.

for items requested. Then the sales team will immediately review and adjust the sales space capacity for the rejected item. Coordination with The Logistics Team is also required in making replenishment point adjustments. That way, manual requests will be reduced and switch to automatic requests.

Figure 11. Proposed Improvement For Replenishment Flow (b)



Source: Primary Sources Within The Organization, 2023

H. Control Phase

Replenishment is the last task of making goods available to fulfill customer needs. It should be done carefully to secure high availability for all and an excellent customer shopping experience. The main activities of this task are:

- Fill up the sales locations in accordance with the internal service agreement.
- Secure high customer perceived availability, high findability and high-quality impression when the goods meet the customer.
- Secure high-volume impression to support low prices.

To ensure the replenishment task is designed effectively and does not hinder the

picking task, especially in high throughput operations, several methods can be employed. These methods, as suggested by Inter PT XYZ System B.V., (2012), include:

- Establishing distinct replenishment and picking aisles: This layout involves creating distinct aisles for replenishment and picking activities. For example, replenishers can fill carton-live storage from the rear while pickers retrieve items from the front. Alternatively, ground-level pallet-live storage can be utilized with separate areas for replenishment and picking.
- Timing the replenishment and picking tasks differently: By scheduling replenishment activities to occur before or after picking tasks, interference can be minimized. For example, when picking is scheduled in the evening for delivery the following day, a significant portion of the replenishment can be carried out prior to the commencement of the picking process. Similarly, in operations where narrow-aisle racking is used, it is advisable to avoid simultaneous low-level order picking and narrow-aisle truck putaway/replenishment tasks for safety reasons.
- Creating multiple locations for fast-moving goods: Allocating multiple locations for frequently picked items helps prevent replenishers and pickers from working at the same pick slot simultaneously. This ensures smoother operations and reduces the likelihood of interference between the two tasks.

It is important to emphasize that the success of order picking relies on the effectiveness and efficiency of the replenishment operation. By implementing these methods, companies can optimize their replenishment and picking processes, enhancing overall operational performance.

The replenishment process needs to be followed up regularly to ensure that it always works in the best possible way. The different ways to do the follow-up of the operation could refer to the short and long-term goals planning.

Short-term follow-ups measure the efficiency of routines. A daily routine check could be maintained as a short-term control phase for the category below:

- The replenishment process finished before the opening hour of the store.
- The replenishment process fulfills the store every criterion of Store In Shape As New
- Make sure the stock of In-Store Availability and On-Shelf Availability in sales picking area are maintained

On the other hand, the long-term evaluations indicate the level of In-store Logistics know-how and competence throughout the store. Key Performance Indicators could be the overview tools in measuring the In-store Logistics performance. The KPIs can act as a useful signal that all is not right. In the replenishment process, the parameters must be maintained to make the process efficient including parameters of damage handling, sales location management, and goods flow classification. In practice, the KPI results are the result of the Logistics and Sales team collaboration process. Therefore, the synergy between the two teams is needed to achieve the expected KPI goals.

CONCLUSION

The main purpose of replenishment is to make the goods available for the customers. It is the last part of a long supply chain from developing the products, sourcing raw materials, production, and transport from the supplier, until the sales location where it is sold. According to the business issue that occurs in the replenishment process, the root causes that generate the waste of replenishment process are as follow:

- The repeated requests of the same article in the certain period
- Small auto-replenishment accuracy due to many manual requests
- The parameter mismatch between the system and the actual sales location
- Uneven understanding of co-worker about the sales space management
- High demand of replenishment affects the manpower allocation
- Product damage caused by high movement

Establishing efficient replenishment routines has a number of advantages. They feed the PT XYZ mechanical sales system so the store can make the most of its volume advantage. Getting the products to the sales locations efficiently means sales locations are filled more quickly, and the store is ready for opening. Having the store replenished by opening time means that co-workers can fully concentrate on visitors in the store. When sales locations are well-stocked before the store opens it is unnecessary to use hand pallet jacks or mechanical equipment during store opening hours. This also helps keep product costs low.

In order to create an efficient replenishment process, the improvement should start form:

1. Evaluate and modify the replenishment procedure
2. Maintain and adjust the sales space management
3. Recalculate the replenishment level
4. Manage sales location and buffer storage mapping
5. Equalization of co-worker skills

PT XYZ actually have a system that is integrated with all its business process. However, in the actual implementation, it requires the role of co-worker to define the parameters and to make a smooth operational business process, as well as for the replenishment process.

Understanding of the logic of the replenishment process is lacking. It is impacted the unproper replenishment process. The mismatch parameters cause the repeated requests of the same article in the certain period. So, the number of the movement increased. With increasing of the movement, it impacted the cost. The small auto-replenishment accuracy causes an unefficient replenishment work flow. It is also impacted the manpower needs. Eventually resulting in high operational cost.

When In-store Logistics runs efficiently, it lowers operating costs and increase the store's profits. Every PT XYZ store has the capacity to make large volumes of products available from immediate take-away at the lowest possible cost. Customers benefit from

low prices and the PY XYZ retailer earns healthy profit.

THANK-YOU NOTE

Jika ada, ucapan terima kasih ditujukan kepada lembaga atau individu resmi yang telah memberikan dana atau telah memberikan kontribusi lain untuk penelitian ini. Ucapan terima kasih disertai dengan nomor kontrak penelitian.

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