REDESIGN WAREHOUSE STORAGE AND RETRIEVAL SYSTEM AT APPAREL INDUSTRY

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This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering Manufacturing Management (Hons.)

by

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DECLARATION

I hereby, declared this report entitled "Redesign Warehouse Storage and Retrieval System at Apparel Industry" is the results of my own research except as cited in the references.

Signature   :   ………………….....

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Management) (Hons.). The member of the supervisory is as follow:

……………………………………

(Professor Dr. Adi Saptari)

ABSTRAK

Sistem penyimpanan dan perolehan di sebuah gudang akan menjejaskan rantaian bekalan sesebuah syarikat. Oleh itu, sistem penyimpanan dan perolehan yang cekap adalah amat dituntut oleh sesebuah syarikat. Tujuan kajian ini adalah untuk mengakses sistem penyimpanan dan perolehan sebuah gudang pembungkusan industri pakaian. Susun atur kemudahan gudang pembungkusan dan prosedur pekerja semasa proses penyimpanan dan perolehan telah diperhati dan dianalisis. Melalui data yang dikumpul, masalah yang wujud dalam gudang dapat dikenalpastikan. Dasar tugasan penyimpanan, perancangan susun atur penyimpanan, dasar memetik, dasar routing, peralatan pengendalian bahan dan dasar pengisian semula adalah beberapa faktor yang dapat memberi kesan kepada kecekapan sesebuah gudang. Ruang yang diduduki dan ruang yang diberikan kepada barang-barang dalam gudang pembungkusan telah diukur untuk mendapatkan purata penggunaan ruang. Kajian ini mendapati bahawa hanya 32.39% ruang dipenuhi oleh barang-barang. Kajian masa dan gerakan telah dijalankan ke atas proses perolehan untuk menilai kecekapan system tersebut. Semua pergerakan yang terlibat dalam proses perolehan dikategorikan dalam aktiviti nilai tambah atau bukan nilai tambah. Melalui data yang dikumpul, purata kecekapan perolehan telah dikira sebanyak 50.47%. Satu penyelesaian alternatif, metodologi 5S telah dicadangkan kepada gudang ini untuk membawa nilai organisasi, kekemasan, pembersihan, piawaian dan disiplin ke dalam persekitaran kerja. Akhir sekali, ramalan telah dibuat untuk masa perolehan dengan andaian bahawa 5S telah dilaksanakan di gudang. Masa perolehan dijangka akan dikurangkan sebanyak 60.26%. Selain itu, anggaran pengurangan kos buruh telah diperolehi dengan menggunakan anggaran pengurangan masa perolehan itu. Pengurangan sebanyak RM 1700,00 setahun bagi seorang pekerja telah didapati.

ABSTRACT

The storage and retrieval system in a warehouse able to affect the supply chain of the company. Thus, an efficient storage and retrieval system are highly demanded by the company. The aim of this study is to assess the storage and retrieval system of the packaging warehouse of an apparel industry. The facility layout of the packaging warehouse and the working procedures of the workers during the storing and retrieving process were observed and analyzed to determine the problem. Through survey and interview with workers, the problems exist in the warehouse were determined. The storage assignment policies, storage layout planning, picking policies, routing policies, material handling equipment and replenishment policies are some of the factors that are able to affect the efficiency of the warehouse. Measurements were done on the space occupied and space provided to the items in the packaging warehouse in order to get the average space utilization. This study has found out that only 32.39% of the space was utilized by the items. Time and motion study was conducted on the retrieving process to evaluate the retrieval efficiency of the system. All the motions involved in the retrieving process were categorized into value added or non-value added activity. Through the data analyzed, the average retrieval efficiency was 50.47%. An alternative solution, 5S methodology was suggested to this warehouse in order to bring the values of organization, neatness, cleaning, standardization and discipline into the working environment. Lastly, the retrieving process was predicted assuming that the 5S was implemented in the packaging warehouse. The retrieving time was expected to be reduced by 60.26%. Besides, the estimated reduction in the labor cost was obtained using the estimated reduction in the retrieving time. Reduction of RM 1700.00 per year for a worker was found for the labor cost.

DEDICATION

Dedicated to my beloved family

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

AGV	-	Automated Guided Vehicle
AS/RS	-	Automated Storage and Retrieval System
AVS/RS	-	Autonomous Vehicle Storage and Retrieval System
CIM	-	Computer Integrated Manufacturing
I/O	-	Input / Output
LSM	-	Linear Synchronous Motor
MC	-	Machine Centers
MHEs	-	Material Handling Equipment
OP	-	Order Picking
SKUs	-	Stock Keeping Units
SLAP	-	Storage Location Assignment Problem
SMED	-	Single Minute Exchange of Die
TPS	-	Toyota Production System
VLM	-	Vertical Lift Modules

CHAPTER 1

INTRODUCTION

1.1   Background

In this era of competitive world, warehouse and distribution system constitute highly complex nodes within the value-added chain and have to meet a variety of requirement with regards to time, costs and quality. This system emerges as an essential and sometimes a major part in any modern organization. It plays its importance in the development of the trade and commerce by providing several of services to the organization such as receiving goods, storing of goods, picking items from certain location and delivering goods to particular destination.

The warehouse plays a critical role in supporting a company's supply chain success. The mission of a warehouse is to effectively transfer products in any configuration to the next step in the supply chain without damaging or altering the product's basic form. In order to make the warehouse operation more effective, the information technology and physical distribution have to play a significant role. Tompkins *et al.* (2010) stated that all warehousing opportunities, including order picking, cross-docking, productivity, space utilization, and value-added service allow the warehouse to process and ship orders more effectively.

Generally there is a time gap between the storage of raw material and the production of products. Raw materials required for production can be brought domestically and delivered directly to be preserved in warehouses. According to Tompkins *et al*. (2010), a company's supply chain will suffer if the warehouse cannot process orders quickly, effectively, and accurately. A good warehouse management

has a systematic storage location for the goods. Thus, the time needed to search for the raw materials will be reduced. Some warehouse of the industries has a poor management and facility planning is able to affect the lead time for the whole production of the product.

A warehouse with good storing facility to keep all the raw materials for production is able to make the production flow more consistently. Therefore, for some industries having storage problem, it might cause a huge impact on the storage of the raw materials. Due to the storage problem, some raw materials might be put at a random location and causes the time to be wasted in the searching process of the need materials. Therefore a warehouse that cannot perform its function properly will affect the productivity of the manufacturing processes.

This study is about the packaging warehouse of an apparel industry and providing an alternative solution to increase the storage utilization and retrieving efficiency of the warehouse in a more effective way. This industry is located in Melaka and is a multinational manufacturing company with worldwide operation. It is a subsidiary company of Germany and engaged in manufacturing and distribution of sewing notions, garments accessories and craft accessories.

This company manufactures a variety of clothing accessories such as safety pin, straight pin, sew-on press fasteners, pearl headed pins, ball pins, concorder pins, bra back extenders and braided elastics for snap fasteners tape. It also supplies sewing notions, needlecraft and knitting accessories for garment industry and household use. In the packaging warehouse, all the packaging materials will be stored at the storage racks provided. When an order is placed by the customer, worker will retrieve the required packaging material and send to the kitting area to be collected by the packing department and packed together with the accessories manufactured.

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1.2   Problem Statement

This study is carried out in an apparel industry which is located at Tanjung Kling Free Trade Zone, Malacca. Recently, the warehouse of this industry is facing problem to keep the packaging stocks. There is inadequate space to store the packaging materials which they are ordered from suppliers. The packaging materials are used to pack variety of products manufactured by this industry. There are many types of packaging materials used for the packing purpose such as carton, outer, blister, card and so on. In this warehouse, different sizes of storage racks are used to keep the packaging materials with different packing purposes.

By referring to the interview conducted with the warehouse supervisor, the inadequacy of the space for storing the packaging materials has affected the efficiency of the functional activities in the warehouse. This is because when the stock arrives at the warehouse and there is no vacancy in the rack, the stock will be placed on the floor which is the temporary storing place for the stock. The temporary storing place is illustrated in Figure 1.1. In some cases, the stock has been put at somewhere else other than the storing rack or the temporary storing floor. This has caused difficulties to the workers to search for the required packaging materials.

Figure 1.1: The Temporary Storing Floor.

Besides, the current storage system has impact on the efficiency of the retrieval system of the warehouse. The storage assignment and layout planning have resulted to low efficiency in the retrieval system. Moreover, the low retrieval

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efficiency also due to the unsystematic retrieving process carried out by the workers. The storage and retrieval problem have decreased the efficiency and seriously affected the productivity of the industry.

1.3 Objectives

a) To determine the current storage and retrieval problem at the apparel industry.
b) To evaluate the performance of the current storage and retrieval system.
c) To propose an alternative solution to increase the performance.

1.4 Scope

This research was carried out in an apparel industry which is a manufacturing factory that provides sewing and needlework accessories. The manufacturing process starts from the operation to manufacture the product from raw material until the product is packed and ready to be delivered. This research was focused on the storage and retrieval system of the packaging materials in the warehouse. The manufacturing process, packaging process, and the warehouse of the finished product were not covered in this research.

In order to solve the problems faced by the industry, facility planning theory and lean tool were applied in this research. Facility planning at the warehouse was investigated so that the storage system of the packaging materials can be improved. For the retrieval system, all the activities carried out by the workers were analyzed to identify the value added and non-value added activities so that solution can be suggested to improve the retrieval system.

1.5   Significance of Study

There are some potential benefits that can be gained by the company after the completion of this study.

a) The efficiency of the storage and retrieval system will be increased by adopting the alternative solution suggested to the company.

b) The labor cost of the company becomes lower since the time consumed by the worker during the storing and retrieving process is reduced. The working time of the worker is not wasted in the non-value added activities.

1.6   Organization

a) Chapter 1 : Introduction

This chapter discusses about the project which includes background of the study, problem statement, objectives, scope of the project, and significance of study. The problems are identified through interview and observation conducted by using checklist and questionnaires. This is followed by the objectives to be achieved throughout the study and the scope which narrows down the area of the study.

b) Chapter 2 : Literature Review

This chapter discusses on previous researches or studies on the warehouse system as well as the methods used to solve the problems for this project. The activities in the warehouse are explained. The principles and planning for storage design and retrieval system are also included. Lastly, an alternative solution suggested solving the problem in the storage and retrieval system is described.

c) Chapter 3 : Methodology

This chapter discusses about the methods used to complete the project throughout the semester. Problems regarding current storage and retrieval system are identified. Measurements of space occupied and space provided to the items are obtained in order to calculate the space utilization. Each step in the

retrieving process is categorized into value added or non-value added activity. The relevant study on the storage principles and lean management are applied in the proposed alternative.

d) Chapter 4 : Results and Discussion

This chapter compiles and analyzes the outcomes through the data collected from the warehouse system. Analysis and interpretation are carried out on the results obtained. An alternative solution which comprises the storage principles and lean management is proposed for the warehouse.

e) Chapter 5 : Conclusion and Recommendations

This chapter discusses about the summary of the study completed. Some recommendations for this study are included.

CHAPTER 2
LITERATURE REVIEW

2.1   Functions of Warehouse

In the procedure of getting the material into and out of the warehouse, there are many activities that occur as part of it. A supply chain can be considered as a system of individual component that are collectively responsible for procurement, manufacturing, warehousing and transportation activities (Onut *et al.,* 2008). Suppliers, manufacturers, distributors and customers in the supply chain system can be connected through the warehouses. Kirill and Vera (2013) stated that warehousing is one of the operations entering into logistic activity which on the organization of a material stream as a requirement.

Warehousing is described as "management of spatial movement of stocks". The main function of the warehousing systems is to receive products, to store materials until they are requested, to extract products from inventory and ship them in response to the customers' orders (Accorsi *et al.,* 2014). Specifically, the customer needs in terms of the order accuracy and response time, order frequency, order quantity and order size have dramatically changed with the global economy and new demand trends. The role of warehouses as places of storage for materials is transformed to understanding of warehousing as an innovative logistic system. Kirill and Vera (2013) pointed out that warehouse logistics represents the key competence (activity) which provides all functional areas of commercial logistics includes of supply, production and sale. The basic requirements in warehouse operations are to receive Stock Keeping Units (SKUs) from suppliers, store the SKUs, receive orders

from customers, retrieve SKUs and assemble them for shipment, and ship the completed orders to customers (Gu *et al.,* 2007).

According to Kovacs (2011), "warehousing contributed to about 20% of the surveyed companies' logistics costs in 2003 (other activities distinguished are value added services, administration, inventory costs, transportation and transport packaging)". Warehouses apparently form an important part of a firm's logistics system (De Koster *et al*., 2007). Muppani and Adil (2008) emphasized that warehousing management is a vital and logistical activity that can affect supply chain costs. They are commonly used for storing or buffering products (raw materials, goods-in-process, finished products) at and between points of origin and points of consumption (De Koster *et al*., 2007).

All the activities in the warehouse in actual operation are visualized and shown in Figure 2.1. As illustrated in Figure 2.1, the major warehouse activities include receiving, transfer and put away, order picking/selection, accumulation/sortation, cross-docking, and shipping. The unloading of items from the transport carrier, updating the inventory documentation and inspection for the quantity or quality discrepancy are the receiving activity. Transfer and put away involves the shift of received items to storage locations. Repackaging and physical movements may involve in these activity. The main activity in most warehouses is order picking/selection. The exact amount of the right items for a set of customer orders is picked during this process. If the customer orders have been picked in batches, there is a need to carry out the accumulation/sortation of picked orders into individual (customer) orders. After the order picking process is completed, picked units have to be grouped by customer order. Besides, the orders often have to be packed and stacked on the right unit load such as a pallet. Cross-docking is performed when the received items are transferred directly to the shipping docks. Replenishment is carry out where the primary picking locations from reserve storage locations is replenished (De Koster *et al.,* 2007).
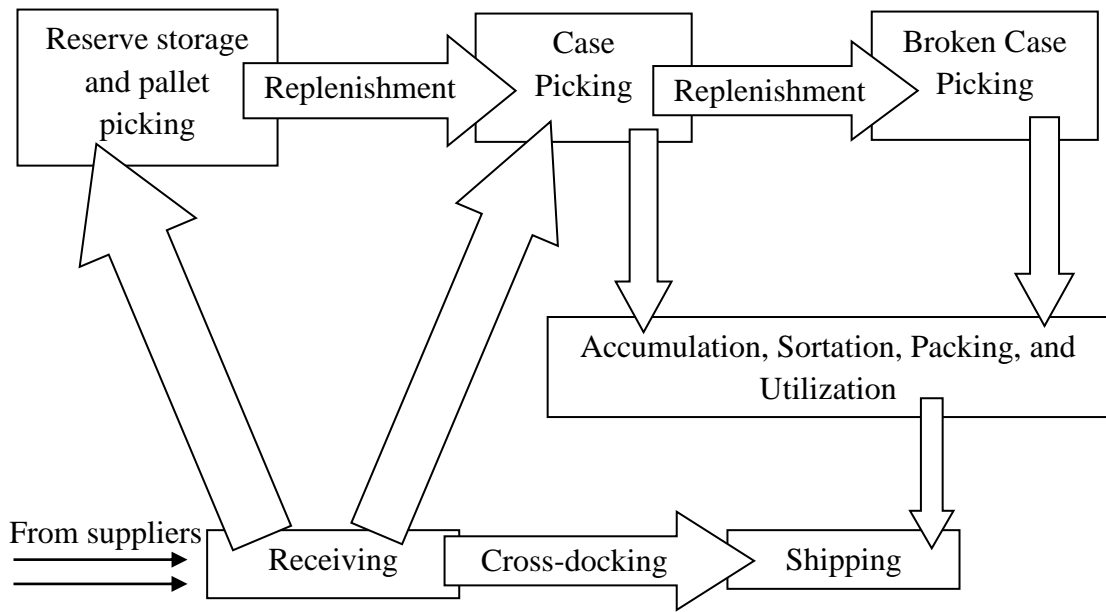
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Figure 2.1: Typical Warehouse Functions and Flows (Tompkins *et al.,* 2003).

There are three general types of inventories can be located into warehouse such as the raw materials, components, parts, work in process, and finished goods for distribution. Accorsi *et al*. (2014) emphasized that warehousing systems play a crucial role in providing efficiency and customer satisfaction. The warehouse design entails a wide set of decisions, which involve layout constraints and operative issues that seriously affect the performances and the overall logistics costs.

This warehousing provides management with information on the status, condition, and disposition of items being stored. There are certain key functions performed by the warehousing in the logistics chain, they are:

- Warehouses help provide a level of customer service at the lowest total cost. By storing goods they increase their availability to the customer.
- Warehouses are a bridge between the manufacturer and supplier, and between the manufacturer and customer.