



REORGANIZING DISPATCHING LAYOUT TO MINIMIZE DISPATCHING TIME AT APPAREL INDUSTRY

NOR ASMAA ALYAA BINTI NOR AZLAN

MASTER OF MANUFACTURING ENGINEERING (INDUSTRIAL ENGINEERING)

2014



Faculty of Manufacturing Engineering

**REORGANIZING DISPATCHING LAYOUT
TO MINIMIZE DISPATCHING TIME AT
APPAREL INDUSTRY**

Nor Asmaa Alyaa binti Nor Azlan

Master of Manufacturing Engineering (Industrial Engineering)

2014

**REORGANIZING DISPATCHING LAYOUT TO MINIMIZE DISPATCHING TIME
AT APPAREL INDUSTRY**

NOR ASMAA ALYAA BINTI NOR AZLAN

**A report submitted in fulfilment of the requirement for the degree of Master of
Manufacturing Engineering (Industrial Engineering)**

Faculty of Manufacturing Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2014

DECLARATION

I declare that this project entitled “Reorganizing Dispatching Layout to Minimize Dispatching Time at Apparel Industry” is the result of my own work except as cited in the references. The project has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

Name : Nor Asmaa Alyaa binti Nor Azlan

Date :

APPROVAL

I hereby declare that I have read this report and in my opinion this report is sufficient in terms of scope and quality as a partial fulfillment of Master of Manufacturing Engineering (Industrial Engineering).

Signature :
Supervisor Name : Professor Dr. Adi Saptari
Date :

DEDICATION

To my beloved family because of all the wonderful things they do for me and always supporting me in my studies.

A special thanks to my supervisor, Professor Dr. Adi Saptari for giving me guidance through all the accomplishment of this project.

A big appreciation to Mr. Prakash, for helping me during conducting my physical works and assisting in collecting information for the project.

A loving dedication to my colleague, Muhammad Hazwan bin Arzmi for supporting and accompanying me through the thick and thin of this studies.

ABSTRACT

Reorganizing a layout entails a massive adjustment to current layout and because of that reason, thorough planning is essential before a new layout implementation. This project is to reorganize current layout at dispatching area of a manufacturing industry which produces apparel products. Current arrangement at the dispatching area of the company shows an interrupted flow path of activities and scattered of queued cartons at some area of activities in the dispatching line which brought to other issues such as operator takes time to search due to no storage identification and classification. As for that, this project aims on to identify problem in current arrangement of dispatching department layout, then analyze the dispatching department layout problem using simulation and propose an alternative layout of dispatching department that reduces current dispatching time. The project methodology consists of three divisions namely, carrying out data collection, analyzing data and performing Witness simulation study and developing alternative arrangement. Based on the findings, total dispatching time of current layout consumes 30.77 minutes to complete one dispatching job with distance travel of 162.83 meters. Alternative is developed with three steps whereby first is arranging the layout according to sequence of activities. Then, determining space requirement and lastly conducting storage planning. By reorganizing the arrangement of the layout, the dispatching time has reduced by 32.79%, which the alternative layout consumes only 20.68 minutes to complete one dispatching job with shorter distance travel of 109.44 meters.

ABSTRAK

Menyusun semula susun atur adalah melibatkan penggubalan secara besar-besaran terhadap susun atur semasa dan oleh kerana itu, perancangan yang rapi sangat penting sebelum pelaksanaan susun atur baru. Projek ini adalah untuk menyusun semula susun atur semasa di dalam bidang industri pembuatan yang menghasilkan produk pakaian di mana entiti yang akan disusun semula adalah susunan karton. Susunan semasa di bahagian penghantaran menunjukkan laluan aktiviti yang terganggu dan kotak beratur bertaburan di beberapa kawasan aktiviti di bahagian penghantaran yang membawa kepada isu-isu lain seperti pengendali mengambil masa untuk mencari kerana tiada pengenalan penyimpanan dan pengelasan. Oleh itu, projek ini adalah bertujuan untuk mengenal pasti susunan semasa di jabatan penghantaran karton di kilang dan melaksanakan pengumpulan data, menganalisis data yang dikumpul dan menjalankan kajian simulasi pada jabatan penghantaran .dan pada masa yang sama menghasilkan dan mencadangkan satu alternatif susun atur pada jabatan penghantaran karton di kilang. Metodologi projek ini akan terdiri daripada tiga bahagian iaitu menjalankan pengumpulan data, menganalisis data dan melaksanakan kajian “Witness” simulasi dan penghasilan alternatif susun atur. Berdasarkan kajian ini, jumlah masa penghantaran susun atur semasa memakan masa sebanyak 30.77 minit untuk menyelesaikan satu pekerjaan penghantaran dengan jarak perjalanan sebanyak 162.83 meter. Alternatif dijalankan dengan tiga langkah iaitu pertama mengatur susun atur mengikut urutan aktiviti. Kemudian, menentukan keperluan ruang dan akhir sekali menjalankan perancangan simpanan. Dengan menyusun semula susunan susun atur, masa penghantaran dapat dikurangkan sebanyak 32.79%, yang mana susun atur alternatif menggunakan hanya 20.68 minit untuk menyelesaikan kerja dengan jarak perjalanan yang lebih pendek iaitu 109.44 meter.

ACKNOWLEDGEMENTS

First and foremost, I would like to take this opportunity to express my sincere acknowledgement to my supervisor Professor Dr. Adi Saptari from the Faculty of Manufacturing Engineering, Universiti Teknikal Malaysia Melaka (UTeM) for his essential supervision, support and encouragement towards the completion of this project.

I would also like to express my greatest gratitude to Mr. Prakash, the industry's person-in-charge of this project for his advice and suggestions in evaluation of alternative layout development.

Particularly, I would also like to express my deepest gratitude to the technicians from dispatching department of case studied company for their assistance and efforts in all the data and analysis works.

Special thanks to my longest beloved parents, Nor Azlan bin Abdul Rahim and Maznah binti Yahya, and to all my peers, especially Muhammad Hazwan bin Arzmi, for their moral support in completing this master's degree. Lastly, thank you to everyone who had been to the crucial parts of realization of this project.

TABLE OF CONTENTS

	PAGE
DECLARATION	
APPROVAL	
DEDICATION	
ABSTRACT	i
ABSTRAK	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	vii
LIST OF FIGURES	vii
LIST OF APPENDICES	x
LIST ABBREVIATIONS	xi
CHAPTER	
1. INTRODUCTION	
1.1 Background of Study	1
1.2 Background of Company	2
1.3 Problem statement	2
1.4 Objective	3
1.5 Scope of Study	3
1.6 Organization of Study	4
2. LITERATURE REVIEW	
2.1 Layout Planning	5
2.1.1 Problem in Layout Planning	6
2.1.2 Factor Consideration	8
2.1.3 Significance of Layout Planning	9
2.1.4 Objective of Layout Planning	11
2.2 Types of Layout	14
2.6.1 Fixed Product Layout	14
2.6.2 Process Layout	14

2.6.3	Product Layout	15
2.6.4	Cellular Layout	15
2.6.5	Hybrid Cellular Layout	16
2.6.6	Job Shop Layout	16
2.6.7	Assembly Line or Flow Shop Layout	17
2.6.8	Group Technology Layout	17
2.3	Layout Planning Process and Applications	18
2.4	Factor of Reorganizing Layout	19
2.5	Tools and Approaches towards Assessing Layout Problem	21
2.6	Simulation Technique	24
3.	METHODOLOGY	
3.1	Flow Process of Project	27
3.1.1	Problem Formulation	27
3.1.2	Simulation Study	28
3.1.3	Experimental Design	31
4.	MODEL DEVELOPEMENT	
4.1	Dispatching Line of the Case Company	33
4.2	System Model	37
4.3	Conceptual Modeling of Dispatching Line	37
4.3.1	Input and Output of Conceptual Modeling	38
4.3.2	Model of Content of Conceptual Modeling	38
4.3.3	Assumption and Simplification	39
4.4	Data Collection	40
4.4.1	Carton Pickup	40
4.4.2	Palletizing, Wrapping and Storing	42
4.4.3	Data Collection on Processing Time	45
4.5	Model Translation	47
4.6	Verification	49
4.7	Validation	50
4.7.1	Statistical Description	50
4.7.2	Distribution Identification	51

4.7.3	Normality Test	52
5.	MODEL EXPERIMENTATION, RESULTS AND DISCUSSION	
5.1	Model Experimentation	54
5.2	Comparison of Current and Alternative Layout	61
5.2.1	Distance Travel	61
5.2.2	Space Utilization	64
6.	CONCLUSION AND RECOMMENDATIONS	
6.1	Conclusion	66
6.2	Recommendation	67
	REFERENCES	68
	APPENDICES	
A	Gantt Chart Master Project I & II	75
B	Turnitin Report	76

LIST OF TABLES

TABLE	TITLE	PAGE
2.1	Study on facility planning	22
2.1	Study on facility planning	23
2.2	Structural component	25
2.3	Steps in performing simulation	26
3.1	Data collection	28
4.1	Profile of activities areas in dispatching system of case company	34
4.2	System model and their components	37
4.3	Input and output of conceptual modeling	38
4.4	Scope of simulation for dispatching line	39
4.5	Level of detail of simulation for dispatching line	39
4.6	Data of processing time for each activity at dispatching line	46
4.7	Summary result of replication of average total processing time of dispatching line	48
4.8	Comparison of number of queued pallet at areas of activities	50
4.9	Statistic average processing time of dispatching	51
5.1	Summary result of space requirement of involved area	57
5.2	Summary result of annual total dispatch (carton)	59
5.3	Summary result of percentage of annual total dispatch	60
5.4	Summary result of ABC inventory classification	61
5.5	Comparison of current and alternative layout for distance travel and time consume	64
5.6	Comparison of current and alternative layout for area of each activity	65

LIST OF FIGURES

FIGURE	TITLE	PAGE
2.1	Facilities planning process	19
3.1	Steps in a simulation study	29
3.2	Logic flow of validation technique	31
4.1	Current dispatching line layout of case company	34
4.2	Activities in dispatching system of case company	35
4.3	Process flow diagram of dispatching system in case company	36
4.4	Pickup bay at dispatching line	40
4.5a	Carton size of 44.7x34.6x41.1cm	41
4.5b	Carton size of 22.6x19.5x31.3cm	41
4.5c	Carton size of 35.1x27.5x28.3cm	41
4.5d	Carton size of 28.5x9.6x15.0cm	41
4.5e	Carton size of 44.6x35.1x41.0cm	41
4.6a	Forklift	42
4.6b	Stepless pallet truck	42
4.6c	Electric forklift truck	42
4.7a	Block style	43
4.7b	Stringer style	43
4.8	Arrangement of cartons on a pallet	43
4.9	Wrapping machine	44
4.10	Wrapped palletized cartons	44
4.11	Storing wrapped palletized cartons	44
4.12	Model formulation of the dispatching line	48
4.13	Simulation model of the dispatching line.	49
4.14	Statistic description for the average processing time of dispatching	51
4.15	Distribution of the average total processing time of dispatching line	52

4.16	Result of distribution identification the of average total processing time of dispatching line	52
4.17	Normality test for average total processing time of dispatching line	53
4.18	T-test for average total processing time of dispatching line	53
5.1	Sequence of activities involved in dispatching system	55
5.2	Reorganization of dispatching layout according to its sequence of activities	56
5.3	Current dispatching layout	62
5.4	Alternative dispatching layout	63

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Gantt chart Master Project I & II	74
B	Turnitin Report	75

LIST OF ABBREVIATIONS

UTeM	-	Universiti Teknikal Malaysia Melaka
WIP	-	Work-In-Process
EDP	-	Engineering Design Process
AHP	-	Analytic Hierarchy Process
PROMETHEE	-	Preference Ranking Organization Methods for Enrichment Evaluations
DEA	-	Data Envelopment Analysis

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Layout of production facilities is the basic integration phase in designing a productive system. According to Khoshnevisan *et al.* (2003), layout can be described as an arrangement of elements included within a manufacturing plant such as machineries and materials flows from one machine or department to another. The arrangement appears to minimize costs that may related to the plant for instance cost of material handling with regards to the limitation that may encounter due to the plant layout arrangement. In addition to that, such arrangement is related to design of processes, layout of the location, and workers' adjustment into the work area as well as machines and systems activities in the physical space environment.

Basically, when designing a facility layout it is associates with organizing, searching and locating equipments as well as manufacturing support departments to achieve an optimum overall production time, maximize operational flexibility and arrangements, maximizing revenue and maximizing the work in factory output in line with the production schedule. Yet, the significant of planning is a very obvious in the manufacturing whereby it is for the sake of their impact on achieving efficient product flow. Moreover, by putting an appropriate experimentation and analysis when designing facility layout, it possibly leads to production performance with reduction of congestion, reduce material handling costs, reduce idle time, and increase the efficiency and utilization of labor, equipment and space.

The department layout that has following features such as using less manufacturing lead time, aiding in increase the throughput and yet increase overall productivity and efficiency of the plant can be called as effective layout arrangement. In order to decide the arrangement of layout, the way parts move from one department to another department is needed to be considered. Still, the way of arranging department layout is affected by a number of machines, space availability and correspondence of production process as well as employment of material handling system. This project is about to plan a layout of the organization at dispatching department of a manufacturing company using Witness simulation.

1.2 Background of Company

The study is conducted is one of apparel industry in Malacca which having high volume of components and specialized item of clothing accessories to be manufactured. The company's main business activities are manufacturing and supplying of apparel accessories such as safety pins, cover buttons, straight pins and may more for various customers around the world. The production is dependently in accordance with demand by having high volume as well as a high variety of products. Thus, this makes the company having a mixed of the batch and job shop type of layout profile. The dispatching department is deals with managing the dispatch of the product which comes with a variety of carton volumes to be dispatched out, different of carton sizes to be used, different regions where the cartons to be dispatched out and different schedule time of the cartons to be dispatched out.

1.3 Problem Statement

The company is currently facing a problem of organizing the arrangement of area of activities that exists in the dispatching department. The area of activities in the dispatching department involved are carton picking area, palletizing area, wrapping area and storage area. The unorganized areas of activities' arrangement has influenced the dispatching process job whereby the operator having difficulties in searching cartons. Yet, this unorganized layout results high distance travel by the operator to move from one area to another and again consuming more time to travel. Due to this arrangement, it caused the cartons to be scattered

around the area without proper practice or method of arrangement. This can expose to wrong order mistakes since there is no classification for identification. Therefore, by finding the appropriate arrangement of the layout it is wish to achieve the optimize results in minimizing the current dispatching process time.

1.4 Objectives

In order to complete this project, there are three objectives to be achieved as follows:

- i. To define the problem in current arrangement of dispatching department layout.
- ii. To analyze the dispatching department layout problem using simulation.
- iii. To propose an alternative layout of dispatching department that reduces current dispatching time.

1.5 Scope of Study

The study is concentrated on the dispatching department of the apparel industry to reduce dispatching time. Area of activities of the dispatching department that involved in dispatching time are carton picking area, palletizing area, wrapping area and storage area. Witness simulation is only used to depicts the current arrangement of the activities and visualize the scattered of queued cartons. Approach to developed alternative is first by arranging the layout according to sequence of activities, determining space requirement and conducting storage layout planning. The steps of alternative are developed based on the problems which are interrupted flow path of activities and scattered of queued cartons at some area of activities which brought issues such as operator takes time to search since there is no storage identification and classification.

1.6 Organization of Study

Chapter 1: Introduction

This chapter describes the background of method, objective of the study, problem statement, scope and organization of the study.

Chapter 2: Literature review

This chapter summaries the theory, information opinion, and also finding from sources such as journal, book, internet, and articles.

Chapter 3: Methodology

This chapter explains the sequence of method that used from collecting data to analyzing the data using selected approach.

Chapter 4: Model Development

This chapter provides a collection of extracted data and information, steps of working procedure that carried out.

Chapter 5: Model Experimentation, Result and Discussion

This chapter is primarily described step by step on performing model experimentation to develop alternative of arrangement of the simulation model and along with reasoning of result obtained from the project.

Chapter 6: Conclusion and Recommendation

This chapter provides a summary of the whole project done and few recommendation in order to improve the project in future.

CHAPTER 2

LITERATURE REVIEW

This chapter is a summary of journal, articles or other education paper that relates to the study of the project. It also comprises all the theories and current information regarding on the facility layout planning by reviewing several related papers or journals. Yet, approach or method that going to be used in the study and the application of it regarding on planning the layout of manufacturing facility are to discussed in this part of report.

2.1 Layout Planning

Layout planning is one of the basic essential matters that must be considered in the decision of starting and setting up particular organization whereby its arrangement may be affected by or effected to company's objective. The problem areas may involve on determining the location and shape of various departments within a facility. As for that, an optimal solution to the problem will yield the most efficient layout based on the measures. Thus, facility planning is contributes to some extent of the profit and efficiency of company.

Layout is a map which illustrates the arrangement of facilities or working activities whereby these facilities are wish to be located within a particular area. According to Fernandez (2014), layout plan is the representation of the configuration and arrangement of different spatial elements in a building. In order to arrange these facilities into the area, a layout planning must be worked on. Layout planning is concerns with placing of the facilities such as machines and departments in the plant area to which certain objective must be met (Ertay & Ruan, 2006; Drira *et al.*, 2007). The objective to be met is involves by calculating the layout arrangement

as effective as possible with respect to the resources needed such as staff, equipment or materials by a company to carry out its production (Gomez & Quesada, 2000).

In order to do the layout planning, it is crucial to identify the factors that influence the construction of particular layout. This is because, without knowing the things that effecting the layout arrangement will resulted to some profit loss, regarding on cost or other resources. Liggett (2000) expressed that, layout planning is concerned with a set of criteria such that the allocation of activities to space, for example area requirements are met or some objective optimized which is usually some measure of communication costs. Hence, factor consideration in layout is vital when making layout planning.

2.1.1 Problem in Layout Planning

The facility layout problem can be subjected to such that departments with space requirements cannot be overlapped with each other and it must be located within the facility (Meller & Gau, 1996). Another is that the facility layout problem arises since there are several facilities that is not movable or must be in a specific area. Thus, it is fixed to a location. This is because, variety of production facilities for instance, service, way of communicating or due to the manufacturing facility layout itself. Problem in searching for a well planning of a layout as well as appropriate attempt in designing a plant is the thing to be sought since it helps to aid the production to be more efficiently (Ertay *et al.*, 2006). An assignment of the coordinates and an orientation of components that achieve most optimal in terms of cost and fulfill particular of demanded requisites is an issue to be sought.

In addition to that, inappropriate facility layout design not only can causes rearrangement of existing facilities and material handling system, but it will also undertake its resulting heavy costs (Hadi-Vencheh & Mohamadghasemi, 2012). Thus, it is necessary to determine the most critical criteria for evaluating facility layout planning. Criteria that can affect facility layout design problem are internal and external criteria. Internal criteria involve some important factors which describe characterizations within the organization's internal boundaries.

External criteria include the shape and location of road related to loading and unloading the raw material and items manufactured.

Another problem is that a making decision in layout planning currently attaining crucial study in that area as competitive attitude has becoming more vigorously with the highly invention of new technology (Bock & Hoberg, 2007). As for that fact, layout planning turns out to be among of interest field of study. Since facility layout planning evaluates details elements included in a plant manufacturing, thus, efficiency effect will be obviously affected by facility layout planning. The layout planning that ignored other important details of a manufacturing plant may be the root causes of issues that arise regarding on the productivity of the manufacturing system. As a result, this neglecting leads to the impact on the relationship interdependencies between one department to another within a facilities and produce inefficient layouts.

In spite of that, facilities factor within a manufacturing plant can gives a high influence to the manufacturing performance in terms of costs, on hold inventory, customer and manufacturing lead time and productivity (Drira *et al.*, 2007). Yet, these layout problems are highly depend on the specific characteristics of manufacturing systems such as the changing of product and volume, the selection of material handling system, the diverse route flows of parts, the space area where machines can be allocated, the facility provided space and the pickup and drop-off locations. Besides, the problem in layout design is to locate manufacturing available facilities to a location within a provided layout arrangement such that a target is to optimize performance (El-Baz, 2004).

According to Edis *et al.* (2011), the invention of new and high technology as well as differentiation in product leads to the changes of layout organization. Unfortunately, the machines are allocated randomly to the available are with no consideration on recheck again the compatibility of the current to the new machines. This is due to the differentiation in products makes a different product flow than the existed one. This also can cause the requirement of material handling system to be increased as to cope with the new products flow route. As a result, this contributes to the facility layout problem. Therefore, the design of a