



**Faculty of Manufacturing Engineering**

**LAYOUT IMPROVEMENT AT SMALL AND MEDIUM INDUSTRY:  
A CASE STUDY**

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**Master of Manufacturing Engineering (Industrial Engineering)**

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A CASE STUDY**

**NAZAHIAH BINTI SALLEH**

**A thesis submitted  
in fulfilment of the requirements for the degree of Master of  
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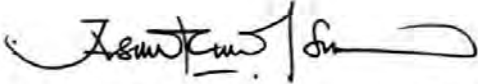
## DECLARATION

I declare that this thesis entitled “Layout Improvement at Small and Medium Industry: A Case Study” is the result of my own research except as cited in the references. The thesis has not been accepted for any master degree and is not concurrently submitted in candidature of any other master degree.

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## APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Master of Manufacturing Engineering (Industrial Engineering).

Signature   
Supervisor Name : Ir. Dr.-Ing. Azrul Azwan Bin Abdul Rahman  
Date : 7. 9. 2018

## DEDICATION

This thesis is dedicated to my beloved parents and parents in law:

Salleh Bin Satar, Normala Binti Ahmad, Azmi Bin Abd Rahman and Azizah Bte Mohd

Yasin for their great support, pray, love and care.

Secondly, for my husband, Mohd Azreen Bin Azmi for his support, love, care and pray.

Thirdly, my lovely daughters and son:

Auni Fathiah Binti Mohd Azreen, Muhammad Akmal Imran Bin Mohd Azreen and

Aisyah Zulaikha Binti Mohd Azreen

Fourthly, for my family:

Nur Farahiyah Binti Salleh, Nur Sarah Binti Salleh, Nur Fadhlina Binti Salleh,

Nur Ashikin Binti Salleh, Fakhrul Anuar Binti Salleh, Siddiq Binti Salleh,

Luqman Hafiz Binti Salleh and Mohd Fakharuddin Binti Salleh.

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The last for my friends and all people who shared their words of advice, encouragement ideas, support and care from the beginning until the last during my thesis writing.

## ABSTRACT

A study on facility layout helps to improve the existence facility layout. The efficiency of production depends on the number of production line, workers and machines available in the factory. This study is about the facility layout in *Keropok Lekor's* factory, Zazihan Enterprise. All the existing layout in the factory is based on the owner's experience in the *keropok lekor's* production process. The owner planned to modify the layout of the factory in order to facilitate the production process and also want to expand their market into the supermarket and hypermarket in the southern regions. To fulfil the market demand, this factory is looking forward to improve the existing efficiency in the production by space utilization and efficiency. The objectives of this study are to propose new layout improvement using 11 steps in systematic layout planning and to evaluate the proposed alternatives of layouts using Siemens PLM Software and some analysis. By improving the layout of the facilities, the production flow can be shortened and will be more effective and practical. Any constraints in the production flow will be considered in order to design the best layout which directly increases the productivity and quality of the process. The result of this study for the total distance for *keropok lekor's* production process, before and after the simulation are 48.8 m and 22.3 m. By improving the facility layout, almost 26.5 m from the total distance of the production process has been eliminated. Opportunity for improvement for weighing and shaping process is necessary because it needs the competent workers to increase the rate of production. The use of machine in weighing and shaping process is really helping in fulfilling the demand of *keropok lekor's* production for the company.

## ABSTRAK

Kajian mengenai susunatur kemudahan membantu peningkatan dalam susunatur kemudahan sedia ada. Kecekapan pengeluaran bergantung kepada berapa banyak kemudahan pengeluaran, kemudahan pekerja dan mesin yang terletak di kilang. Kajian ini mengenai susunatur kemudahan di kilang keropok lekor iaitu Zazihan Entreprises. Semua susunatur yang ada di kilang ini berdasarkan pengalaman pemilik dalam proses produksi keropok lekor. Pemiliknya merancang untuk mengubah susunatur kilang untuk memudahkan proses pengeluaran dan ingin memperluaskan pasaran mereka ke pasar raya dan pasar raya besar di wilayah selatan. Untuk memenuhi permintaan pasaran, kilang ini berusaha untuk meningkatkan kecekapan sedia ada dalam pengeluaran melalui penggunaan dan kecekapan ruang. Objektif kajian ini adalah untuk mencadangkan penambahbaikan susunatur baru menggunakan 11 langkah dalam perancangan susunatur sistematik dan untuk menilai alternatif susunatur yang dicadangkan menggunakan perisian simulasi Siemens PLM dan beberapa analisis. Dengan memperbaiki susunatur kemudahan, aliran pengeluaran dapat dipendekkan dan akan lebih efektif dan praktikal. Apa-apa kekangan dalam aliran pengeluaran akan diambil kira untuk merangka susunatur terbaik yang secara langsung meningkatkan produktiviti dan kualiti proses. Hasil daripada kajian ini dan simulasi yang dilakukan jarak bagi keseluruhan proses pembuatan keropok lekor sebelum dan selepas penambahbaikan adalah 48.8 m dan 22.3 m. Susunatur kemudahan semula dapat mengurangkan 26.5 m jarak bagi keseluruhan proses pembuatan keropok lekor. Selain itu juga ruang untuk penambahbaikan bagi proses menimbang dan membentuk keropok lekor perlu kerana memerlukan kecekapan pekerja untuk meningkatkan kadar pengeluaran. Penggunaan mesin bagi proses menimbang dan membentuk sangat membantu untuk memenuhi pengeluaran keropok lekor.

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## **LIST OF ABBREVIATIONS**

MHS	Material handling system
SLP	Systematic Layout Planning
SME	Small and medium enterprises
FPL	Fixed Position Layout

# CHAPTER 1

## INTRODUCTION

### 1.1 Background of Study

Plant layout refers to the arrangement of physical facilities such as machinery, equipment furniture etc. within the factory building in such manner so as to have quickest flow of material at the lowest cost and with the least amount of handling in processing the product from the receipt of material to the shipment of the finished product (Tak and Yadav, 2012). The arrangement of the workers, materials location and material handling is also considered in order to ease the production processes. A plant layout is designed to obtain a physical arrangement of different entities of a facility that most economically meets the required output, in terms of both quantity and quality (Daf and Zanwar, 2013). An optimum and good arrangement can make the flow of the material free from any interruption and will increase the productivity.

Material handling system (MHS) is a vital component in production systems which facilitate the ideal delivery process in terms of material usage, right place and right time at the lowest cost (Raman *et al.*, 2009). According to Mirhosseyni and Webb (2009), MHS is responsible to lift a material at the workstation with the minimum constraints. With minimum constraints, the time needed to complete the process can be reduced and contributes to the smoothness of the production flow. It uses multiple functions that work together in the factory and very important in the production system because it represent 30% - 75% of total cost of the product (Sujono and Lashkari, 2007).

The simulation of production processes is a technique used for solving problems occurring during the manufacturing processes. It is based on virtual models (Klos and Patalas-Maliszewska, 2016). Simulation is one of the tools that can be used to solve problems regarding to size and complexity. It can forecast any complex manufacturing system behaviour by analysing the movement and interactions between components in the systems. It helps in designing a complex layout and allows the user to evaluate several alternatives and inspect the design flexibility without any massive modification or section closing.

Simulation and modelling is the path to optimal manufacturing facility planning and design. It brings key decision makers into alignment quickly so that the project can move ahead. Seeing is believing and a fact-based virtual animation of the planned facility functioning as intended encourages swift, intelligent group making (Verdier and Zhang, 2016). It is risky to use a traditional means because without the quantitative rigor and validation that simulation and modelling brings to the facilities planning process, overbuilding and underbuilding are both distinct possibilities, each giving rise to its own negative consequences. It also has an easy scalability where the impact on productivity and cost of any proposed changes in capacity plan can be analysed in real time before implementation.

Based on the facts above, it is clear that layout optimization and simulation plays a vital role in any facility planning and layout study (Grajo, 1995). It must be dealt in the earlier stage or otherwise it will cause a negative impact to the company's intralogistics implication.

This study is conducted at Zazihan Enterprise, a factory which produced a snack called *keropok lekor* for Johor and neighbouring regions market. This company is a small

and medium industry and looking to break through the market with hypermarket and supermarket in the southern regions as a target.

## 1.2 Problem statement

Zazihan Enterprise is a small and medium industry. All the layout existed in the factory is based on the owner's experience in the *keropok lekor's* production process. Improper positioning of the machines or production process in the shop floor with regard to the sequence of the operations. Current production floor, total travelling distance is 48.8 m which is time to complete overall process for manufacturing *keropok lekor*. The distance between processes must be minimized to reduce the time required, material handling and product processing costs.

Table 1.1: Current distance travelling distance to complete *keropok Lekor* production

<b>From / To</b>	<b>Current Distance</b>
From Store(Fish) to mixing area	31.2
From Store(Flour) to mixing area	2.1
From mixing area to assembly area	3.2
From assembly area to cooking area	7.0
From cooking area to cooling area	5.3
<b>Total travelling distance</b>	<b>48.8</b>

The owner planned to modify the layout of the factory in order to facilitate the production process and want to expand their market into the supermarket and hypermarket in the southern regions. To fulfil the market demand, this factory is looking forward to improve the efficiency in their production by space utilization and efficiency. Any suggestion of layout improvement must fulfil the needs of the factory in the long term.

### **1.3 Objectives of Study**

The objectives of this study are:

- i. To propose new layout improvement using a systematic layout planning procedures
- ii. To evaluate the proposed layout using simulation.

### **1.4 Scope and limitation**

This project will be conducted at Zazihan Enterprise in Masai, Johor. This is one of the small and medium industries at the area. This study will focus on improving facilities design of the production floor from receiving raw material to storage the finished product. The layout of the production is process oriented layout. This study will use systematic layout planning (SLP) that will arrange the workplace according to the relationship of every department to produce an alternative of better arrangement. This alternative layout will be evaluated using Siemens PLM Software and some analysis.

### **1.5 Significance of Study**

Ramlan and Malekin (2011) mentioned that small and medium enterprises (SMEs) play a vital role in the Malaysian economy and are considered as the backbone to industrial development in the country. The critical area need to be strongly looked into the SMEs is their ability to sustain their competencies in business.

By improving the layout of the facilities, the production flow can be shortened and will be more effective and practical. Any constraints in the production flow will be taken

into account in order to design the best layout which directly increases the productivity and quality of the process.

## **1.6 Project Report Organization**

The summary for each chapter of the report for this project are as follow:

### **a) Chapter I: Introduction**

This chapter consist a background of study and it comprises of introduction, problem statements, objectives of study, scope and limitation and project report organization.

### **b) Chapter II: Literature Review**

This chapter is based on literature reviews on related topics for this study. Mainly the literature reviews are from books, journals, articles and internet.

### **c) Chapter III: Research Methodology**

This chapter explain the methodologies used to carry out this study.

### **d) Chapter IV: Results**

This chapter is about data collected and the preliminary analysis on several data.

### **e) Chapter IV: Discussions**

This chapter focuses on analysing collected data and discussing the findings. Various suitable techniques and methodologies are used in analysing the data gathered appropriate with the information needed and the type data collected. Analysis and discussion in this chapter is carried out with regards to fulfilling the objectives of the research.