



**Faculty of Manufacturing Engineering**

**MULTI-ITEM REPLINESHMENT MODEL OF INVENTORY  
MANAGEMENT IN SMALL MEDIUM ENTERPRISES IN  
MALAYSIA**



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**Master of Science**

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IN SMALL MEDIUM ENTERPRISES IN MALAYSIA**

**Irfan Ur Rahman**



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2022**

## DECLARATION

I declare that this thesis, titled "Multi-item Replenishment Model of Inventory Management in Small Medium Enterprises in Malaysia," is the product of my own research and study, as noted in the sources. The thesis has not been accepted for any degree and is not currently being submitted for any other degree.

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## APPROVAL

I hereby declare that I have checked this thesis and in my opinion this thesis is adequate in terms of scope and quality for the award the degree of Master of Science in Manufacturing Engineering.

Signature : .....

Supervisor Name: Professor Dr. Mohd Rizal Bin Salleh

Date : .....



## DEDICATION

This thesis is dedicated to my missed late brother Ali Rahman. Ya Allah I beg for your mercy on their soul and grant him a place in Jannah. Ameen.

I am thankful to my parents, my brothers as well as my family members for their everlasting support and prayers throughout my research journey.



## ABSTRACT

In the international context, small and medium businesses are rapidly expanding, but they have received little attention, especially in Malaysia. Many previous studies have concentrated on the degree of issues and challenges that SMEs face, and to a lesser extent, on the maximum potential that SMEs in this country possess. The most common issue that manufacturing SMEs in Malaysia face is poor inventory management and a lack of proper lean manufacturing tool, both of which have an impact on the organization's efficiency. Manufacturing SMEs have been found to be unable to compete effectively in the manufacturing sectors due to a lack of inventory management skills. According to the SME annual report 2017/2018, there is a substantial annual increase of 20% in the operation cost of the manufacturing SMEs recorded in a quarterly survey conducted from the third quarter of 2015 to third quarter of 2017. For this purpose, the objectives of the research are to find the barriers of Kanban system in local SMEs in Malaysia for Kanban framework, to propose a multi-item inventory model in Malaysia's SMEs and to validate the applications of the developed inventory model at selected SMEs. The study investigated barriers in the implementation of Kanban system in Malaysia's SMEs and provided a framework that will enable SMEs to implement Kanban system successfully. The research methodology is designed to distribute questionnaire survey to the local SMEs to collect data for the development of Kanban framework. As per objective of the study framework was developed accordingly by SPSS analysis. The research has also developed Economic order quantities in objective 2, for a multi-item inventory model with financial and storage constraints for SMEs. The findings of this research have shown that the model has reduced the order quantities for Akhtar Munir Manufacturing Sdn. Bhd. by 22.27%, Al Taj food marketing and services by 32.93% and Dusaf Musa Maju by 15.97% in order to satisfy the given condition of financial and storage resources.

# **MODEL PENGISIAN SEMULA BERBILANG ITEM BAGI PENGURUSAN INVENTORI DALAM PERUSAHAAN KECIL SEDERHANA DI MALAYSIA**

## **ABSTRAK**

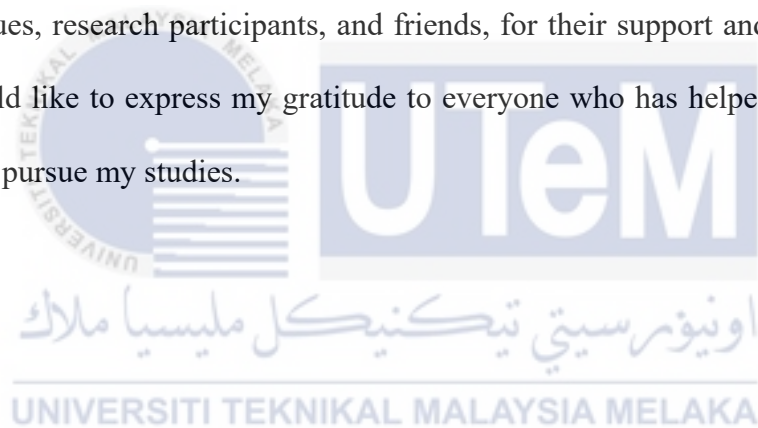
*Dalam konteks antarabangsa, perniagaan kecil dan sederhana berkembang pesat, tetapi mereka kurang mendapat perhatian terutamanya di Malaysia. Banyak kajian yang lalu telah menumpukan pada tahap isu dan cabaran yang dihadapi oleh PKS, dan pada tahap yang lebih rendah, pada potensi maksimum yang dimiliki oleh PKS di negara ini. Isu paling biasa yang dihadapi oleh PKS pembuatan di Malaysia ialah pengurusan inventori yang lemah dan kekurangan alat pembuatan kejut yang betul, yang kedua-duanya memberi kesan kepada kecekapan organisasi. PKS pembuatan didapati tidak dapat bersaing secara berkesan dalam sektor pembuatan kerana kekurangan kemahiran pengurusan inventori. Menurut laporan tahunan PKS 2017/2018, terdapat peningkatan tahunan yang ketara sebanyak 20% dalam kos operasi PKS pembuatan yang direkodkan dalam tinjauan suku tahunan yang dijalankan dari suku ketiga 2015 hingga suku ketiga 2017. Bagi tujuan ini, objektif penyelidikan adalah untuk mencari halangan sistem Kanban dalam PKS tempatan di Malaysia bagi rangka kerja Kanban, kepada mencadangkan model inventori berbilang item dalam PKS Malaysia dan mengesahkan aplikasi model inventori yang dibangunkan di PKS terpilih. Metodologi penyelidikan direka bentuk dengan mengedarkan tinjauan soal selidik kepada PKS tempatan bagi mengumpul data untuk pembangunan rangka kerja Kanban. Kajian itu mengkaji halangan dalam pelaksanaan sistem Kanban di PKS Malaysia dan menyediakan rangka kerja yang membolehkan PKS melaksanakan sistem Kanban dengan jayanya. Mengikut objektif rangka kerja kajian, sistem Kanban dibangunkan dengan sewajarnya melalui analisis SPSS terhadap tujuh faktor penghalang. Penyelidikan ini juga telah membangunkan kuantiti pesanan Ekonomi dalam objektif 2, untuk model inventori berbilang item dengan kekangan kewangan dan penyimpanan untuk PKS. Dapatan kajian ini telah menunjukkan bahawa model tersebut telah mengurangkan kuantiti pesanan bagi Akhtar Munir Manufacturing Sdn. Bhd. sebanyak 22.27%, pemasaran dan perkhidmatan makanan Al Taj sebanyak 32.93% dan Dusaf Musa Maju sebanyak 15.97% untuk memenuhi syarat kewangan dan sumber simpanan yang diberikan.*

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## LIST OF SYMBOLS AND ABBREVIATIONS

SMEs	- Small Medium Enterprises
FDI	- Foreign Direct Investment
LM	- Lean Manufacturing
CONWIP	- Constant Work in Process
GDP	- Gross Domestic Product
RM	- Malaysian Ringgit
%	- Percentage
Sdn Bhd	- Sendirian Berhad
MIDA	- Malaysian Investment Development Authority
WEF	- World Economic Forum
APEC	- Asian Pacific Cooperation



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# CHAPTER 1

## INTRODUCTION

### 1.1 Research Background

The existence of SMEs has an important role to bring Malaysia's manufacturing businesses to the level that comparable to the other developed countries in the world. The Malaysian economy is no stranger to foreign direct investment (FDI). Due to the advent of foreign FDI into Malaysia, GDP growth rate has grown annually for the previous three decades. Malaysia has received a large percentage of FDI inflows from developing countries, which has aided the country's growth (Hill, 2009). According to MIDA, (2016), it can be seen through the increasing investment of foreign companies in Malaysia Foreign Direct Investment (FDI) which rose to US\$2.4 billion in 2016 as compared to many developed countries like Japan and Netherland etc., which shows the FDI inflow down. Therefore, to remain competitive, SMEs must actively look for an opportunity to further improve their performance through the adoption of Lean tools in production floor.

There is a real problem facing by industry in deciding how to distribute buffer space to reach or maintain throughput, yet reduce the work-in-process (WIP) and flow time. One has to decide on the trade-of between these factors. Traditionally this has been done by using WIP inventory holding costs and lost order costs (Nistane and Viswanath, 2013) . Many traditional inventory models focus on single-item models. Single-item inventory models are less realistic than multi-item inventory models. Using the traditional single item paradigm to evaluate an inventory with several things is problematic. Furthermore, in the multi-item instance, the primary goal is to save money by ordering multiple things in bulk. When using

single-item models for multiple item inventories, one item waits until a particular cost-saving order quantity for another item is reached, and all items have a fixed order time. The majority of developed or published models and software focuses on single-item inventory control. Retailers, on the other hand, are accountable for thousands of goods in their inventory, and single-item models do not help them handle such a vast number of items (Balkhi and Foul, 2009). A Kanban can be a card, a cart, or simply a marked space. The goal is to improve flow, create pull, and reduce inventory in all cases. It's a crucial weapon in the fight against overproduction (Apreutesei et al., 2010). The Kanban method for inventory stock management is a well-known lean technique that sends out a signal for product development based on actual consumer demand. Kanban's main goal in lean manufacturing is to keep inventory to a minimum and cut costs. In the event of a line interruption, steps are taken to ensure that each workstation produces only enough components to fill the container before stopping. Kanban also serves as an authorization to generate more inventory, limiting the amount of inventory in the process. Because Kanban is a chain process in which orders move from one operation to the next, production or delivery of components is pulled through the production line rather than pushed, as in the traditional forecast-oriented system (Nistane and Viswanath, 2013). SME manufacturing capabilities are important because they contribute significantly to a country's Gross Domestic Product (GDP). In comparison studies of Kanban principles implementation in large organisations, the number of studies on SMEs is relatively limited, and many important issues and areas remain largely unexplored in academic research.

Malaysian SMEs make a significant contribution to the Malaysian economy, accounting for 65 percent of total labour market jobs and 40 percent of GDP (MIDA, 2016). The manufacturing sectors in Malaysia underwent with a great transformation from last two years and have shown efficiency in different fields. It has been recognized that one of the

ways to achieve development and progress is through industrialization (MIDA, 2017). From Table 1.1 the manufacturing sector has shown an increasing contribution to GDP in 2017 as compare to 2016, similarly total export from manufacturing sector also increased in the same year. According to the Department of statistic, Malaysia 2017, sales value from manufacturing sector showed a strong growth of 16.3 percent, rising to RM 65.1 billion as compared to RM 55.9 billion reported in 2016 and total employees engaged in manufacturing sector have shown an increase of 2.6 percent in 2017 as compared to 2016.

Table 1.1: Performance of manufacturing sector from 2013 - 2017  
(Department of Statistic Malaysia, 2017)

Year	2013	2014	2015	2016	2017
GDP (%)	21.6	22.9	23.0	22.7	23.2
Total export (%)	41.5	46.6	44.1	44.6	44.7
Sales value (RM billion)	55.1	55.3	55.6	55.9	65.1
Employees	1,018,383	1,031,226	1,027,044	1,028,091	1,054,482

## 1.2 Problem statement

Problem is identified through existing literatures that most of SMEs in Malaysia have poor inventory management (Sapry et al., 2019). Chan et al., (2017) have also investigated that the SMEs in Malaysia are facing issues regarding inventory like overproduction, underproduction and shortage of stocks. As the lack of an effective inventory management will lead to SMEs inability to their customer's demand. Ahmad and Zabri, (2016), added

that there is a shortage of knowledge on inventory management activities in the SMEs sector in Malaysia's retailing industry. The problem can be exemplified by the data in Table 1.2, which is taken from Hicom Honda (M) Sdn Bhd's Stock Take Variation Report for December 2012 (Mahidin, et al., 2014).

Table 1.2: The variance between recorded stock and actual stock

Item Group	Recorded Stock	Actual Stock	Variance	Variance Percent
CKD Thailand	1,318,832	1,121,535	-197,297	-15%
CKD Japan	760,197	650,259	-109,938	-14%
CKD Vietnam	1,609,674	1,230,967	-378,707	-24%
Multi Source	761,467	719,082	-42,385	-6%
Local Part	1,734,925	1,869,903	134,978	8%

The SME survey conducted by SME Corporation Malaysia, which attracted 1,469 respondents in the third quarter of 2017, was organized to evaluate recent SME business growth and outlook, as well as identify SME challenges. Figure 1.1 shows that more than 69.4 percent of all respondents recorded an average annual increase of 20% in their operating costs, which is higher than in previous quarters. Manufacturing and construction workers, as well as small businesses, were the most affected.

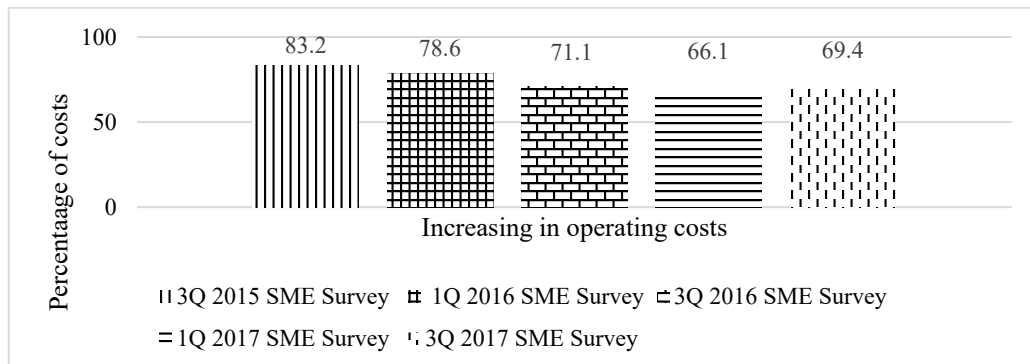


Figure 1.1: Increasing of operation cost in the manufacturing (SME annual report 2017/18)

Moreover, Rahman et al., (2013) the Kanban method has been highlighted as one of the manufacturing strategies for lean production with minimal inventory and lower costs. In Malaysia, however, the Kanban method not commonly used by manufacturing firms. SMEs in Malaysia are facing problem to implement Kanban system. There are numbers of factors exist which hinder these SMEs to introduce Kanban system for their survival and better reputation.

### **1.3 Research objective**

The research objectives designed according to the scope. Which are below as;

- i. To investigate the adoption of Kanban System and its barriers among local SMEs in Malaysia and to prepare framework for Kanban implementation.
- ii. To propose a multi-item inventory model framework for Malaysia's SMEs.
- iii. To validate the application of developed multi-item inventory model at the selected SMEs.

### **1.4 Scope of the study**

The current research has looked at the manufacturing sector of SMEs in Malaysia, as well as the introduction of the Kanban System and inventory management. The current work has focused the integration of Kanban with multi-item inventory model and initiated to improve the inventory model with Kanban concept. For this purpose, the research has designed a questionnaire survey in order to find out potential barriers of Kanban system adoption in SMEs. The scope of this research is to highlight a best possible way to eliminate the barriers in the way of successful implementation of Kanban. The research also is focusing to develop a framework of multi-item inventory model with constraints of financial and space that will help the Malaysian SMEs to improve their manufacturing performance and

reduce the cost of inventory. Furthermore, few case studies should be approached, in order to evaluate the importance of multi-item inventory model at SMEs.

### **1.5 Significance of research**

This section is entirely dedicated to the importance of the research. Which will be provided the obstacles and barriers that hinder the implementation of Kanban system in SMEs. Kanban system is very helpful in reducing the idle time in the manufacturing organization. It also controls the inventories and reduces the defects in the production processes. Moreover, the research will also be given a developed framework of inventory system for Malaysian' SMEs, which helps the SMEs to reduce the total costs of inventory.



## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

SMEs in Malaysia are vital to the nation's economic growth and are regarded as the backbone of the country's industrial production (Musa and Chinniah, 2016). According to a 2018 report by the Malaysian Investment Development Authority, SMEs account for at least 40% of the country's GDP and employ nearly 65 percent of Malaysians (MIDA, 2016). They emphasised how important it is for SMEs to participate in the global value chain in order to succeed in the market. Malaysian SMEs in the manufacturing sector must incorporate and practise lean manufacturing to achieve manufacturing excellence (LM) (Norani et al., 2010). As a result, companies must design and manufacture high-quality goods and services, as well as enhance their manufacturing processes, in order to stay competitive in the global market and be able to manage market shifts. The use of lean manufacturing practises is one of the strategies for enhancing manufacturing operations (Rahman et al., 2013).

Implementing lean in any organization has become a significant challenge, especially for SMEs, which play a critical role in national economies. As a result, many of these companies have attempted to adopt lean, but only a handful have succeeded in achieving the desired results (Bhamu and Sangwan, 2014). Furthermore, according to Belhadi et al., (2016), most of these companies are still unsure how to successfully implement lean systems and complete their lean transition. There have been many literature reviews carried out on lean, suggesting different structures, but the majority of these are drawn from the experience of large organizations, making them improper for SMEs. Furthermore, SMEs are severely impacted by emerging technology and globalisation. SMEs are attempting to implement new

methodologies, approaches, and principles, such as Lean, in order to achieve consistent performance. Unfortunately, a considerable percentage of SMEs have not adopted the concept of Lean Manufacturing due to concerns about time, cost, and subsequent quality (Yusof and Aspinwall, 2000).

Many manufacturing firms have attempted to boost their performance in recent years (Tao et al., 2017). In the manufacturing sector, lean tools used to reap benefits; otherwise, they are not worth introducing. The Kanban method has a major effect on the manufacturing industry's processes and efficiency (Hiremath et al., 2018). Kanban used to manage the amount of buffer inventories in the manufacturing process, as well as to monitor output quantities in a more straightforward manner. The upstream machine is told to stop, when a buffer fills up, producing the part type in any condition. As a result, Kanban system used as a signal in the manufacturing environment to replenish item inventories (Rahman et al., 2013).

### **2.1.1 Overview of manufacturing sector**

Manufacturing has long been a crucial component of developed countries' economic development. Manufacturing benefits have been investigated, resulting in strengthened and expanding national economies as well as being a main sector that offers job opportunities. World Economic Forum WEF, (2012) investigated that the significant factor to the prosperity of nations is manufacturing “with over 70% of the income variations of 128 countries highlighted by differences only in the product export data of manufacturing”. Manufacturing has numerous impacts, being firmly associated with areas of the economy. According to Veugelers, (2013), Manufacturing can be connected to other sectors of the economy in two ways: "backwards" (as with mining or construction) or "forwards" (as with transportation) (such as with transportation, wholesale and retail trade and business). Many