UNIVERSITI TEKNIKAL MALAYSIA MELAKA

MINIMIZE WASTE AT PRODUCTION LINE BY IMPLEMENTING LEAN MANUFACTURING TOOLS

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

by

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Process and Technology) with Honours. The member of the supervisory is as follow:

.....

(MR. FARIDUDDIN BIN MOKHTAR)

ABSTRACT

Lean manufacturing is a method to eliminate and minimizes waste that occurs in production. It's a primary awareness to maximize customer value while minimizing waste. Basically, lean means creating more value for customers with less resource. Lean has various tools and one of them is Poka Yoke. This tool was introduced by Shigeo Shingo in year 1960 to manufacturing process to prevent human error. This research has been conduct at Chai Sheng Food Industries Sdn. Bhd. to minimize non-value added at their production by implement Poka Yoke tool. PDCA cycle is a method that been used from the beginning of improvement process until the end of it. After analysing mistake and defects data, a method to prevent mistake was created and a suggestion for minimize defects also done. Checklist for housekeeping was done to prevent operator skip a work before and after in production. A mistake that occur in production was completely eliminates by using Poka Yoke tool and also PDCA cycle. Defects for waste even reduce if use automatic packaging to prevent poor handling by operator. A labelling was introduce in this production as Poka Yoke tool and the suggestion were done for improvement process such as have warning signal at machine to get operator attention. This Poka Yoke implement shows it's successfully improved and it should be implement in this production line.

ABSTRAK

Pembuatan ‘Lean’ adalah satu kaedah untuk menghapuskan dan mengurangkan pembaziran yang berlaku dalam pengeluaran. Ia adalah satu kesedaran utama untuk memaksimumkan nilai pelanggan sambil meminimumkan pembaziran. Pada asasnya, ‘lean’ bermaksud mewujudkan lebih nilai untuk pelanggan dengan sumber kurang. ‘Lean’ mempunyai pelbagai alat dan salah seorang daripadanya adalah Poka Yoke. Alat ini telah diperkenalkan oleh Shigeo Shingo pada tahun 1960 untuk proses pembuatan untuk mengelakkan kesilapan manusia. Kajian ini telah dikendalikan di kilang mi Batu Berendam untuk mengurangkan ‘non-value added’ pada pengeluaran dengan menggunakan alat Poka Yoke. PDCA Cycle adalah kaedah yang juga telah digunakan dari awal proses penambahbaikan sehingga akhir. Selepas menganalisis kesilapan dan kecacatan data, kaedah untuk mengelakkan kesilapan telah dicipta dan cadangan untuk mengurangkan kecacatan juga dilakukan. Senarai Semak untuk pengemasan dilakukan untuk menghalang pekerja melangkau kerja sebelum dan selepas dalam pengeluaran. Kesilapan yang berlaku dalam pengeluaran dihapuskan sepenuhnya dengan menggunakan alat Poka Yoke dan juga PDCA Cycle. Kecacatan untuk sisa juga akan kurang jika ada pembungkusan automatik untuk mengelakkan pengendalian pembungkusan yang kasar dari pekerja. Label diperkenalkan dalam pengeluaran ini sebagai alat Poka Yoke dan cadangan telah dilakukan untuk proses penambahbaikan seperti meletakkan isyarat amaran di mesin untuk mendapatkan perhatian operator. Poka Yoke dilaksanakan dan ia berjaya menunjukkan peningkatan dan ia perlu terus laksanakan dalam pengeluaran ini.

DEDICATION

Special dedication to my beloved family especially to my parents, Md Liza Kolop and Hayati Senin that give support and encourage.

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Thanks to Allah S.W.T for His Blessing that put ability and given me the power to complete this research. Infinitely thank to Mr. Fariduddin bin Mokhtar as my supervisor of this research who guide and help me a lot in preparing and complete this research.

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Throughout this period when I prepared this research; I met many people who helped me by providing tutoring, sharing knowledge and experience in this field. In addition, they also provide much needed help me to prepare for this research. Therefore, I would like to take this opportunity to thank them all. Thank you also to my family for help and give encouragement and advice until I was finally able to complete this research. And finally, I hope my research is useful as reference in the future.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

LM	-	Lean Manufacturing
TPS	-	Toyota Production System
JIT	-	Just-In-Time
TPM	-	Total Productive Maintenance
TQM	-	Total Quality Management
QC	-	Quality Control
QI	-	Quality Improvement
VSM	-	Value stream mapping
WIP	-	Work in Progress
MRP	-	Material Requirement Planning
SMED	-	Single Minutes Exchange of Die
PDCA	-	Plan, Do, Check, Act

CHAPTER 1

INTRODUCTION

1.0 Introduction

Manufacturing is a main activity to support economic growing and development. Nowadays, rapid globalization and related changes must place companies under increasing pressure to improve competitiveness and struggle to reach excellence. That's why manufacturing industries tends to create a good products for people because a better product almethods success in market place. It will growth reputation, increase product loyalty and retain business sustainable in the long run when favoring quality over quantity.

Quality is most important than quantity on production to give customer satisfaction. When a quantity is the key focus in production, so numerous products has several rejection because of defect or no quality. Quality interpreted in various methods depending on the person. From a manufacturing industry perspective, it's simply said "quality drives productivity". From American Standard of Quality means the quality meeting the necessities and potentials in product or service. Improving the quality not right without productivity, so the result clearly will influence the productivity improvement in manufacturing once quality improves.

Productivity helps raising living standards and competitiveness industry; in the production process it represents the relationships between inputs and outputs.

Productivity does not reflect how much we value the output; it only measures how efficiently to produces product. Improving productivity through quality can produce all the preferred results such as greater productivity, better quality, less rework, price elasticity, improved customer satisfaction, lower unit cost, larger profit and more jobs. This progress provides improvement methods to accelerate the process of improving quality and productivity that support the industries growth. Lean manufacturing system was chosen to encounter the business's quality and performance (productivity).

The industries that applied lean manufacturing in the production already get impact in improvement of performance. Lean is systematic method to improving the efficiency of operations by eliminating and reducing wastes. When wastes are eliminating, the production quality improved and lead time with cost are decreased.

1.1 Research Background

Lean implementation develops in Japan at Toyota Production System (TPS) in early 1950 originally theoretical by Taiichui Ohno. According to Ohno, TPS is cost reduction (waste elimination); it can be achieved through quantity control, quality assurance and respect for humanity. It's recommends manufacturing only the kind of units required at the time required and in the quantities required. The main aim of TPS was to increase productivity as well as to cut the cost by reducing waste or non-value added activities.

In lean manufacturing, there are many techniques or a tool that helps to minimize manufacturing waste such as 5S, Just-In-Time (JIT), Kaizen, Total Productive Maintenance (TPM), Poka-Yoke, One-Piece Flow, Standardized Work, Jidoka, Kanban, Heijunka and many more. This tool also supports the continuous improvement of developments, reduce manufacturing lead time, improved quality and total production cost.

The introductory philosophy behind lean manufacturing is to eliminate waste or can call as 'MUDA'. It's a Japanese word meaning wasteful, unusable or ineffectiveness. There are seven 'MUDA' or seven kinds of waste that can be found in a manufacturing process. Hence, all of these wastes have a through effect on costs, they are all non-value adding jobs, process that customer unwilling to pay for and add no value to the service or product that company provided.

1.2 Problem Statement

Most production has been facing a lot of problem such as producing a lot of waste. This will cause a lot of costs connected with problem solving such as materials, increased lead times, rework, setups, rescheduling materials, paperwork, transport, and possibly lost customer of satisfaction if delivery not accomplish it on time. Waste can be caused by several dissimilar complications, many that should be preventable with a slight thought when designing products, process and equipment. It's caused by incorrect method due to non-standard procedures, differences in the way that processes are undertaken by different operators on different shifts.

For manufacturing quality products to satisfy customer, the improvement methodologies have been developed to eliminate this non value added activities. Industries implementing lean manufacturing technique to eliminate and minimize the waste occur on production process line. It's also to help industries to keep their competitiveness over their competitors by improving the manufacturing system's quality and productivity enhancement of the product.

1.3 Research Objective

Objective for this research are to:

i. To mapping the flow of production line.
ii. To analyse data and identify the non-value added activity occur in production line.
iii. To implement lean manufacturing tools and minimize the non-value added activity that occurs in production line.

1.4 Work Scope

This research presents the case study at the Noodles Factory Batu Berendam. It will focus on eliminate the waste that occur on production depends on the company problem. This company makes variety of noodles and this research focus only two types of noodles. This study will focus on defect waste which is some of the seven wastes of lean manufacturing. To find root of causes a mistake in the process that increased the error in production.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter focuses about Lean Manufacturing (LM), waste in production also tools and technique in Lean Manufacturing. Quality and productivity product is important and consider when implement LM in industries. The importance of this chapter is to give more explanation on definitions, as well as theoretical that related to this project research. Literature review will help to identifying data sources for how to implement in project towards successful.

2.1 Quality

Quality interpreted in various methods depending on the person itself. From a manufacturing industry perspective its simply say ‘quality drives productivity’. Previously, Genichi Taguchi (1992) mentioned that definitions defined quality is ‘Uniformity around a target value’. Preserve the range of results to a convinced number of standard deviations, with unusual exemptions to lower the standard deviation in outcome.

David Garvin in 1987 defined that there had eight dimension of quality that show at Table 2.1.

Table 2.1 Dimension of Quality [David A. Garvin (1987)]

Dimension of Quality	Description
Performance	Measure the quality of performance a product that frequently impacts reputation or profitability. Deliverables are not adequately defined within terms while performance is source of contention between customers and suppliers.
Features	Performance specifications rarely describe the features necessary in a product while the measurement may seem understandable. Suppliers designing product from performance specifications are regular to intend uses and maintain close relationships.
Reliability	For a long period, it will advantage to product of reliability and trustworthiness. Without disruption or breaking down, it will work.
Conformance	The grade to which the product imitates to pre-established qualifications. All value products are predictable to meet the necessity standards.
Durability	Replacement becomes required after measured the length of time product performs.
Serviceability	When the product breakdowns and sent for maintenances it refers of serviceability.
Aesthetics	The product need creatively attractive for addition of well-designed quality.
Perceived Quality	Perception the quality of product in the thoughts of the consumer are equally important dimension of quality

There are some features of product quality must have such as reliable, useable and repairable. Providing this quality product is important to meet customer requiredment. Although these definitions are different, some common ideas run through them.

2.2 Quality Management

Quality management is systematized product or service that methods stable. Quality management turns to achieve for better quality in product and service. It has four key modules, quality planning, quality control, quality assurance and quality improvement. Quality Management has several techniques that are Total Quality Management (TQM), Continuous Quality Improvement, Lean Manufacturing, Six Sigma, Taguchi Methods and etc. These methods are all means to get the same thing which is: Improvement.

Quality management is significant part of management philosophy that particularly in new enterprises characterized by source cable. This quality is some strategy of methods and tool for productivity and quality management improvement in manufacturing and service organizations.

2.2.1 Quality Planning

Within a detailed timeframe, a measurable objective and lay down a arrangement of stages quality interpret into systematic development. It's a critical part of any project that needs to agree with customer for quality target. Quality planning helps to control and monitor quality manufactured by project to guarantee to meet the quality objectives. Constructing a quality plan is important to provide the customer with confidence to create solution that meets their necessary. The quality plan required totally required to confirm solution of quality.

2.2.2 Quality Assurance

A technique of avoiding problems and avoiding errors or faults in mass-produced products when providing solutions or services to customers; which ISO 9000 defines as "part of quality management focused on provided that confidence that quality desires will be achieved". To evade or at least reduce the problems which led to the defects in the first place it initiative quality assurance tries to expand and become stable production (and associated processes).

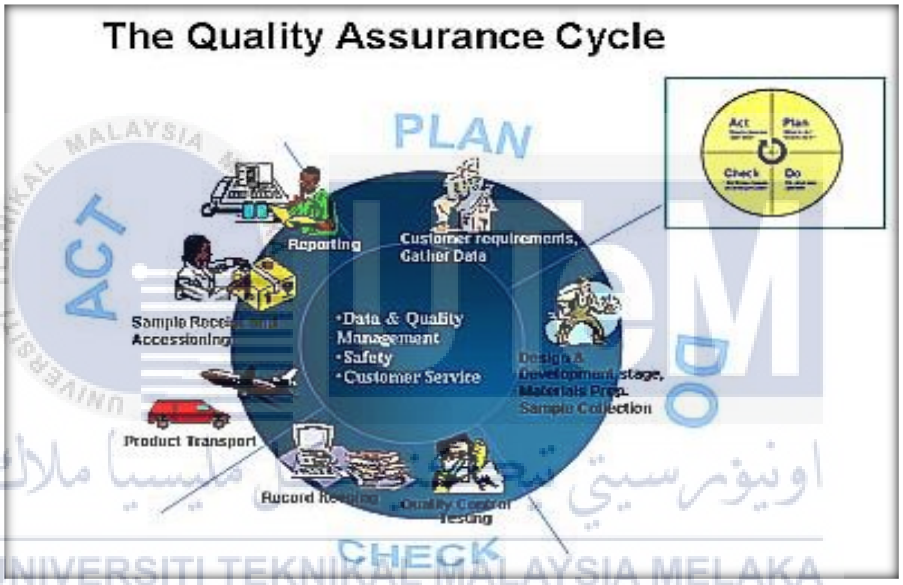

Figure 2.1 The Quality Assurance Cycle [ISO 9000]

2.2.3 Quality Control

Quality control (QC) is a method that anticipated ensuring of manufactured product or done service observes to meets the necessary or defined set of quality standards of the customer. QC also a method by which units evaluate the quality of all aspects tangled in manufacture. ISO 9000 : 2005 describes quality control as "A part of

quality management attentive on fulfilling quality necessary". Quality control emphasizes testing of products to find flaws and reporting to organization who make the resolution to disagree or allow product release.

2.2.4 Quality Improvement

Quality improvement (QI) contains both prospective and retrospective evaluations. It is intended at improvement; measuring where you are, and figuring out methods to make things well. It definitely attempts to avoid attributing fault, and to make systems to prevent errors from happening. Quality improvement is the effective manufacture of the quality that the market anticipates. Costs drop and productivity goes up as perfection of quality is accomplished by better organization of design, engineering, testing and by development of progressions (Deming, 1986 & 1988).

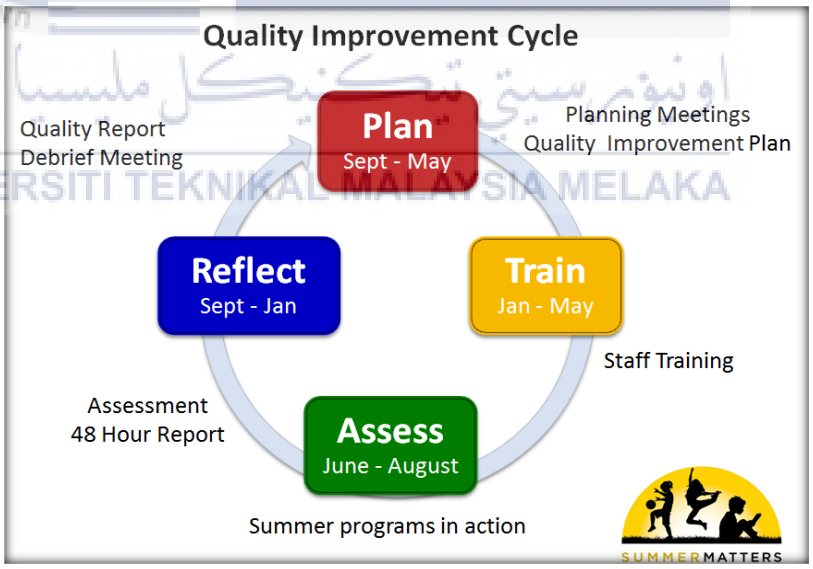

Figure 2.2 The Quality Improvement Cycle [Deming, 1986 & 1988]

2.3 Productivity

Productivity has become an important matter in industry organization nowadays because high productivity means greater profit margin. Productivity is the average measure of the effectiveness of production; it can be stated as the ratio of output to inputs used in the manufacture progression.

Productivity = Output / Input

Productivity is one of the main anxieties of business management and engineering. Basically all companies have established procedures for accumulating, analyzing and reporting the essential data. Usually the accounting department has generally responsibility for gathering and organizing and keeping the data, but some data usually initiates in the various departments. Productivity data are used to consider the effect of product and labor market protocols on economic performance.

2.4 Relationship between Quality and Productivity

Organizations want to growth profits; it must increase productivity as well as quality (Park et al., 2005). Without improving quality, increasing the productivity may not be right. But improving quality will effects in improved productivity (Deming, 1986). Several benefits result:

i. Quality increases
ii. Productivity growths
iii. Cost per good unit drop. (price can be cut)
iv. Employee's confidence recovers since they are not seen as the problematic.

Improving productivity through quality can produce the entire anticipated outcome: better quality, more productivity, lower unit cost, fewer rework, price elasticity, improved customer satisfactions, greater profits and more jobs. After all, customers get high quality at a low price, dealers get expectable long-term sources of business and investors get profits, a 'win-win' state for everyone. (Shanmugaraja & Nataraj, 2011)

2.5 Lean Manufacturing

Lean Manufacturing is an operational plan using their tools and methods to drive down the manufacturing cost and succeeding the shortest possible cycle time by eliminating wastes. LM was established by Toyota which is one of the Japanese automotive industries to improve the Japanese economy after World War II. After that, lean has happening and spread over to other industries such as aerospace and general manufacturing, consumer electronics, construction and healthcare, (Perumal, P. A., 2014).

There are many tools in lean manufacturing such as 5S, Standardized Work, Total Productive Maintenance (TPM), Value Stream Mapping (VSM), Kanban, Takt time, Kaizen, Poka-yoke and Just-in-time (JIT) and more. All these tools not only can be used to eliminate waste, but it is also suitable to increase quality, decrease manufacturing lead time and total manufacture cost (Singh J. and Singh H., 2009).

The benefits of lean manufacturing are acknowledged in factories all around the world. Moreover, the company testified that a quality of better products, decrease lead time, reduction in cycle time, improve delivery on time, inventory reduction, increase flexibility, increase net income, improve labor utilization, increased levels of higher production, organization work better, better use of space, a decrease in equipment

investment, the use of better technology and a strong focus on improvement the skills of a better job (Earley, 2015).

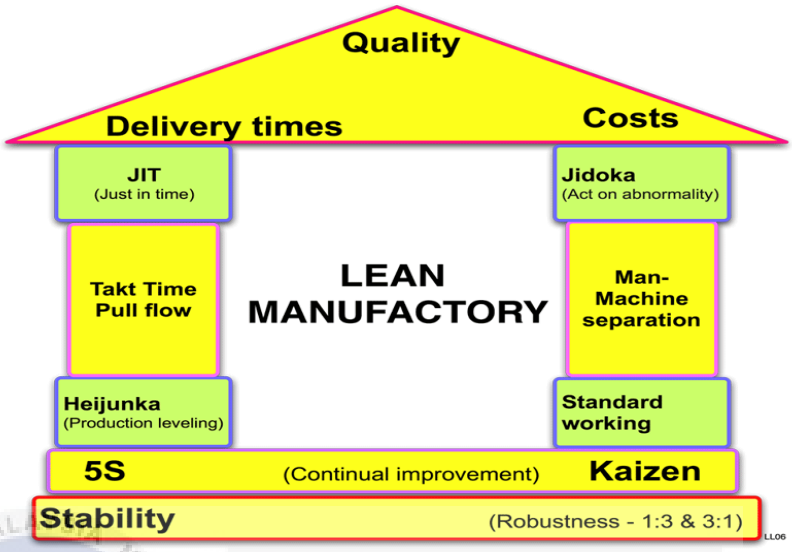

Figure 2.3 Lean Manufacturing Overview [Earley, 2015]

Lean manufacturing can lead to many positive improvements in the business when it done in the right way. Apart from these benefits, lean manufacturing also has many secreted benefits that play a vital role in the achievement of the industry. However, the implementation is not an easy task as it is defined in many aspects that need the integration of principles, tools and methods that can be seen to give more value in the business process flow (Suhartini et al, 2012).

Japanese corporations talk about waste, they usually talk about the three M; Mura, Muri and Muda. Most people who have had contact with lean manufacturing will have been made aware of the seven wastes and Muda that not been presented to Muri and Mura. These wastes are significant to tackle than Muda and often are the underlying causes of the Muda that you perceive within your progressions. While Muda is the non-value adding activities within your progressions; Muri is to overstrain or be irrational while Mura is unevenness.

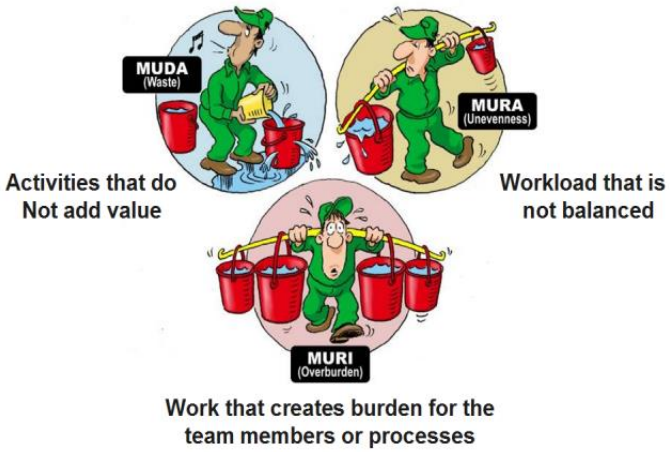

Figure 2.4 Waste categorize in Lean Manufacturing [Liker, 2004]

2.5.1 Lean Principles

Lean today mostly been efficiently used by countless companies regardless of the manufacturing services. It is known as a multi-dimensional approach with a set of principles, tools and methods to decrease production costs by identifying and eliminating waste in the manufacturing sector such as inventory, defects, transportation, inappropriate processing and waiting.

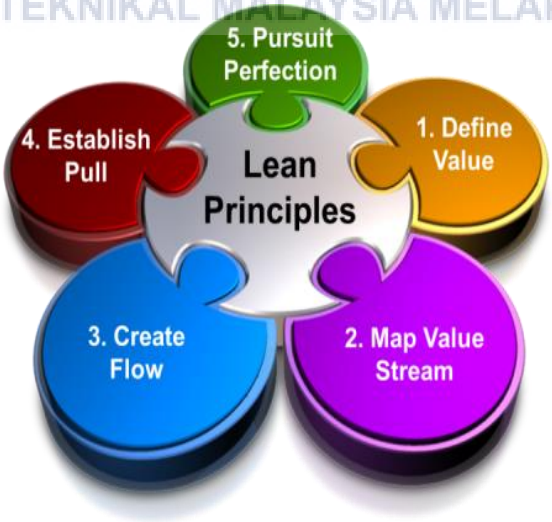

Figure 2.5 Lean Principles steps [John Krafcik, 1988]

In the book of "The Machine That Changed the World" Womack and Jones state five principles of lean manufacturing. These lean principles describe the philosophy of lean and can be used at any lean system. The five of lean principles stage thought process to guide the implementation of lean techniques. However, it's easy to remember, but not easy to accomplish.

Table 2.2 Lean Principles [John Krafcik, 1988]

LEAN PRINCIPLE	DESCRIPTION
Define Value	Define value from the customer's viewpoint and express value in terms of a detailed product or service.
Map Value Stream	Map all of the steps, value added and non-value added that carry a product or service to the customer.
Create Flow	The constant flow of products, services and information from end to end through the progression.
Establish pull	Nothing is done by the upstream procedure until the downstream customer signals the requiredment; actual demand pulls product or service through the value stream.
Pursuit Perfection	The complete removal of waste so all actions create value for the customer by breakthrough and continuous improvement missions.

2.5.2 Value Activities

Value is a measurement of the worth of a product, or service, by a customer based on its convenience in satisfying a customer need. An action, process or operation that changes the product from one form to another in order to get it closer to the customer's specifications. It is something that the customer is agreeable to pay for.

Many studies have shown that we only add value to a product for less than 5% of the time, the rest of the time is wasted.

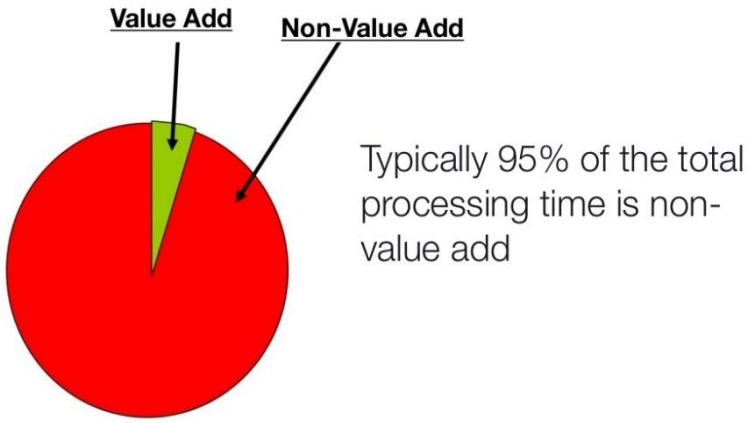

Figure 2.6 Value activities statistic [Hay 1988]

Value-added activities are actions that change the form, fit, or function of the part and the customer is agreeable to pay for them. Non-value-added activities are actions that do not change the form, fit, or function of the part and activities the customer does not want to pay for.

2.6 Waste (MUDA)

The goal of lean manufacturing approach is on cost drop by eliminating the wastes or non-value added activities. The Main importance in lean manufacturing is to decrease waste streams and intelligent automation (Nakamura et al., 1998). Although waste elimination should not be the focus of any initiative lean it will absolutely be something that can be succeeded while trying to implement the principles of lean manufacturing.

The method of waste elimination, quality can be improved while production time and cost can be reduced, but there must be something the company is run regularly. Taichi Ohno believed by finding and removing all waste is the key to raising productivity and becoming competitive (Peter L. King, 2009). Therefore, the principles of lean manufacturing can be used together with the lean tools to get the benefits of lean manufacturing and driving in seven waste decreases. Ohno's is the one who knowledgeable at Toyota that has categories the seven wastes as shown in figure 2.7.

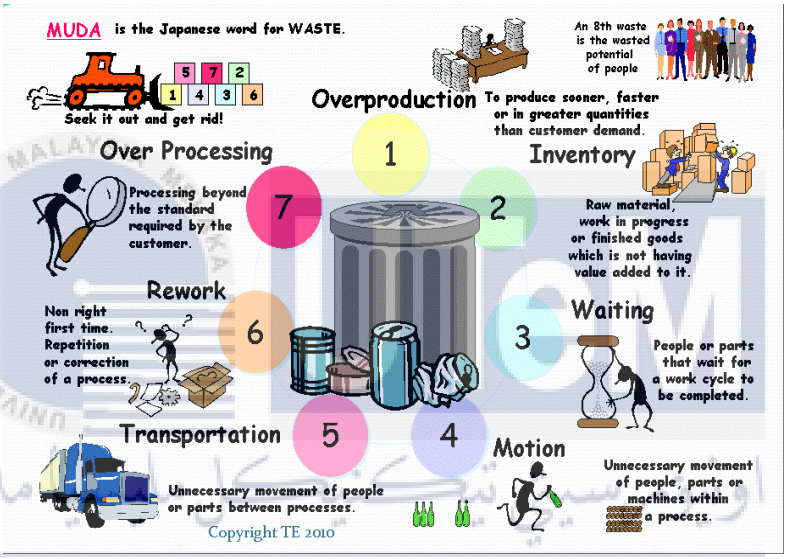

Figure 2.7 Waste in Lean Manufacturing (Peter L. King, 2009).

2.6.1 Over Production

Over production means manufacture what is unnecessary, when it is unnecessary, and in unnecessary quantity. It occurred when making a product without no detailed customer and orders (Ed., 2002). This is a mostly serious form of waste because it may leads to excess inventory that is frequently used to mask other causal complications and ineffectiveness. The example symptoms of this problem are; the extent of warehouse space required and used the development and production of

organization unevenness and an ever changing process. Usually this problematic happen due to large lot production, anticipatory production which means manufacturing product in advance of request, making enough stock to replace the number of faulty parts produced and machines used turn out parts too rapidly.

There are many methods to overcome this problem such as; using a pull system to control how much is manufactured which is also called as Kanban, cut setup times so that smaller batches can be economically manufactured, and pace production so the rate of manufacturing matches the rate of customer demand. Benefits gained from eliminating this waste are; the company will saves money to produce product, prevent manufacturing from possibility ahead of customer, and discovers the real problem occur in manufacturing areas

Figure 2.8 Overproduction Waste [Earley, T. (2014)]

2.6.2 Inventory

Inventory is the raw materials, work in progress (WIP) and finished goods stock that is detained, we often hold far more than is necessary to produce goods and services when the customer wants them using Just in Time (JIT) principles. The common causes this problem happen due to; produce more product than need, poor equipment layout of manufacturing process, long changeover times and mismatched production speed. To identify this problem happen in production area, there will be large buffer stocks within a manufacturing facility and also large warehouse on the site.

Figure 2.9 Inventory Waste [Ed., 2002]

The methods to overcome this problem are; bring raw materials in only as they are requiredd, reduce or eliminate buffers between steps in production, and using pull production using Kanban. The benefits by eliminating this problem are; less material handling and transportation happen, less floor space for storage equipment that the balance space gained can be used for another work and less money tied up (Perumal, P. A., 2014).

2.6.3 Waiting

Waiting or also known as idle time is a time when WIP is waiting for the next step in manufacture where there is no value is being added (Ed, 2002). It is the act of doing nothing or working gradually that can be refers to human and machine waiting for next progressions. Unstable processes are a reason for this problem are; the huge quantity of work in progress held up in the manufacturing process that can be seen frequently on the balance sheet, piles of inventory around the workplace. This occurred due to; poor equipment layout of the production line, imbalances volumes, barricade flow of processes and having trouble at the upstream process.

Figure 2.10 Waiting Waste [Ed., 2002]

There are many methods to overcome this problem such as; applying mistake proofing or also known as Poka-yoke at any areas that may require, design process so that the flow is continuous so that there are least or no buffers between each process in production, and use standardized work guidelines to ensure that a dependable process and consistent times are used for every phase of production. Perumal, P. A. (2014), describe, the benefits attained from reducing this waste are; there will be fully utilize of operator time and equipment when working process is happening, and less interest happen among operator occur.

2.6.4 Motion

Motion is a movement of equipment or people that is not really necessary to perform a process and does not add value to the product (Ed., 2002). While they are in motion, the processing of the product cannot be support. It also can be defines as excessive movement of data, judgments and information. This problem can be seen if data entry being seen as problem within Material Requirement Planning (MRP) systems and large teams of operators are moving to and from the manufacturing unit but less activity essentially within the unit. It is happened due to; shared tools among workers, poor workstation layout, operation who doing process lack of training, and operators searching for tools, materials or information while working.

Figure 2.11 Motion Waste [Earley, T. (2014)]

The methods to overcome this problem are; provide plenty equipment for operator to do their process, ensure the work areas are reasonably organized, consider alternative arrangements of equipment that decrease motion, provide training for operator before they perform work at the production line, arrange all the tools so that there is no need to search the necessary tools, and growth operator alertness about their movement during an operation. The benefits by disregarding this problem is; better workspace environment for operator, less work related to injuries and absence, and more productive work environment (Perumal, P. A., 2014).

2.6.5 Transportation

Transportation is needless movement of raw materials, WIP or finished goods. The product is in motion but there is no progression happens and does not add value to the product. It can be seen when there is a large warehouse and frequent movement of intermediate material on and off site slightly than final product and movements of pallets of intermediate product around a site or between sites. This problem occurred due to; poor layout of production (excessive distance between operation), moving things around for any intention, additional inventory, and single skill concentrated operation.

The methods to overcome this problem are; design developments so that the flow is continuous and there are slight or no buffers between stages in production, use

uniform work guidelines to certify that a reliable method and reliable times are used for each step of manufacture, train operators to be a multi-skilled so that they are able to perform extra task. The benefits by eliminating this problem is; there will be cost decrease in handling equipment, less traffic in gang methods, and reduced threat of handling damage. All these waste can be eliminate by using Kaizen techniques (Perumal, P. A., 2014).

Figure 2.12 Transportation Waste [Perumal, P. A., 2014]

2.6.6 Defect (Rework)

Defects as an errors that happens when a product produced fails to meet requirement that has been decided or do not conform to customers anticipation that may lead to customer dissatisfaction (Perumal, P. A., 2014). The defects product need rework process or additional work to ensure that the product produce in good quality and meet customer expectation. The eliminate defects, the root cause must be found. The indications of this problem are; missed or late order, excessive overtime, and bigger operating costs. This problem occurred because of; emphasis on downstream examination where uncertain material is easily passed to another process without double checking, unsuitable material handling during the process and lack of standard work used.

There are several methods to overcome this problem such as; design developments so they are less possible to produce defects, design processes to notice any abnormalities so they can be instantly adjusted, look for the singles greatest common defect and define why it occurs, create work guidelines that provide a reliable technique of manufacturing the part, build mistake proofing devices. Benefits from eliminating this problem are; increase customer fulfillment, lower costs required and less overtime happen (Perumal, P. A., 2014).

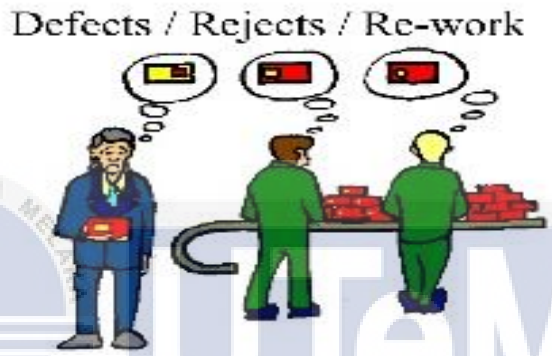

Figure 2.13 Defect Waste [Earley, T. (2014)]

2.6.7 Over Processing

Over processing is needless progression or process such as rework, reprocessing, and overproduction (Perumal, P. A., 2014). It occurs when a specific procedure phase does not add value to the product. This activity will increase the time taken for each step to be complete. It can be see if these happen; the response phase is typically complete within minutes but the process still continue for hours or days, process control that never shows a failure and the delay of documents to accompany finished product. It happened due to; lack of standard work or processes, over designed equipment, lack of effective problem solving, doing more than it needs to produce an excellently effective product.

Figure 2.14 Overprocessing Waste [Perumal, P. A., 2014]

The methods to overcome this problem are; compare customer desires to manufacturing conditions, look for possible simplifications to the manufacturing process, use more suitable process design and review over the recent processes. The benefits by eliminating this problem are; avoidable processes cost will be eliminate, developed flow through lines or cells at production line, and increase availability of machinery (Perumal, P. A., 2014).

2.7 Tools and Techniques

Companies need to state the waste occur in production line, then lean tool will implementation and guide the companies through corrective arrangements to eliminate waste.

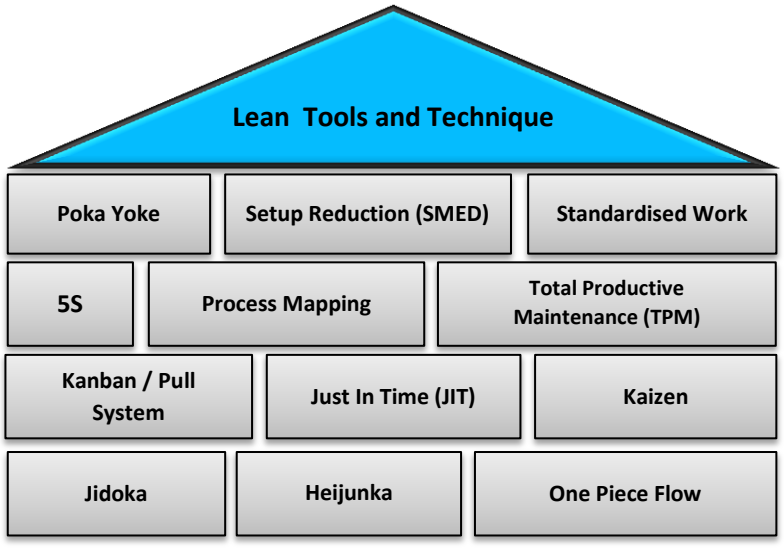

Figure 2.15 Some of Lean Manufacturing tool and technique

2.7.1 Just-In-Time (JIT)

JIT is a method develops by Taichi Ohno and his fellow workers at Toyota (Ballard et. al., 1995). The main aims of JIT are constantly decreasing and eliminate all types of wastes (Kumar et. al., 2007). The core target of JIT is to achieve zero inventories, not just within the limitations of a single organization, but eventually throughout the whole supply chain (Hutchins D., 1999). JIT is a manufacturing approach that allows a company to fabricate the product by what customer need, when, and in what quantity (Ed., 1998). Meanwhile Javadian Kootanaee, A. et al (2013), describe JIT as having the right things of the right quality and quantity in the right place and the right time.

JIT manufacturing is important because it helps companies to become more competitive by manufacture the anticipated variety while maintaining low cost and waste, high quality, least lead time, and increase in productivity and efficiency. Other than that, it will help companies to find out manufacturing volume that was concealed in waste. Other that giving benefits to the companies, JIT manufacturing also benefits the company employee because by applying JIT, it will decreasing transport and unnecessary handling of work in process, rapidity up machine setups and eliminating the clutter of additional work in process inventory.

2.7.2 Process Mapping

Process Mapping is also known as Process Charting or Flow Charting is the oldest, simplest and most valuable methods for streamlining work. This needs skilled implementers for best results. Several benefits of Process Charting (Mapping) are:

i. Focuses on waste
ii. Streamlines work progressions

iii. Describes and regulates

iv. Helps deep thoughtful

v. Forms agreement

A process map visually shows the arrangement of events to form a product or produce an outcome. It may include additional information such as inventory, cycle time, and equipment information.

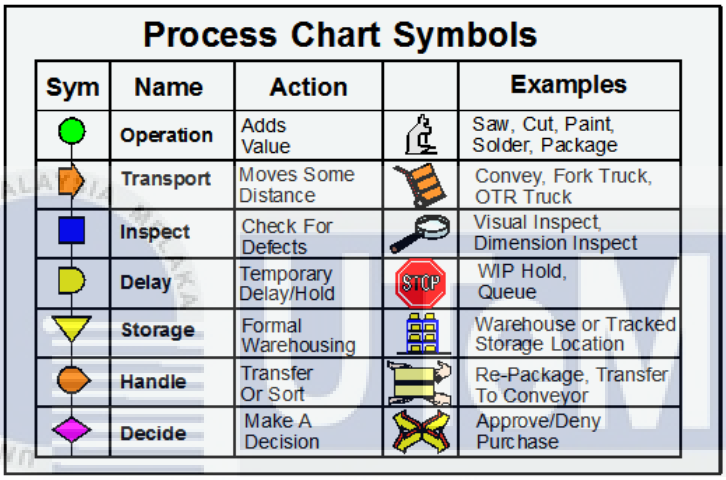

Figure 2.16 Process chart symbols (Ed., 1998)

2.7.3 Poka - Yoke

Poka-Yoke or mistake proofing is a simple method that developed out of the Toyota Production system through Jidoka and Automation. It is normally a simple and frequently economical device that avoids defects from being made or highlights a defect so that it is not approved to the next process. It is a design processes so they are less likely to produce defects. The ineffectiveness of inspection can be overcome through the use of automatic devices called Poka-Yoke; these pursue to do three things;

i. Refuse a defect for the process

ii. Not Produce a Defect

iii. Not let a Defect to be passed to the next process

A control type Poka-Yoke is one that physically discards an underweight product on a conveyor whilst a warning Poka-Yoke is one that sounds an alarm such as the one that sounds when you unintentionally leave your lights on in the car when you remove the ignition key (Earley, 2015). There are two methods to implementation of Poka-yoke method; warning method and control method as shown in Table 2.3 (Dudek-Burlikowska, M. and Szewieczek, D. 2009).

Table 2.3 Approaches of Poka Yoke method
[Dudek-Burlikowska, M., and Szewieczek, D. (2009)]

POKA YOKE METHOD	DESCRIPTION
Control Method	Senses a problem and ends a line or process, so that corrective action can take place instantly, thus escaping serial defect generation.
Warning Method	Method that signals the incidence of a deviation or trend of deviations through an escalating series of buzzers, lights or other warning tools.

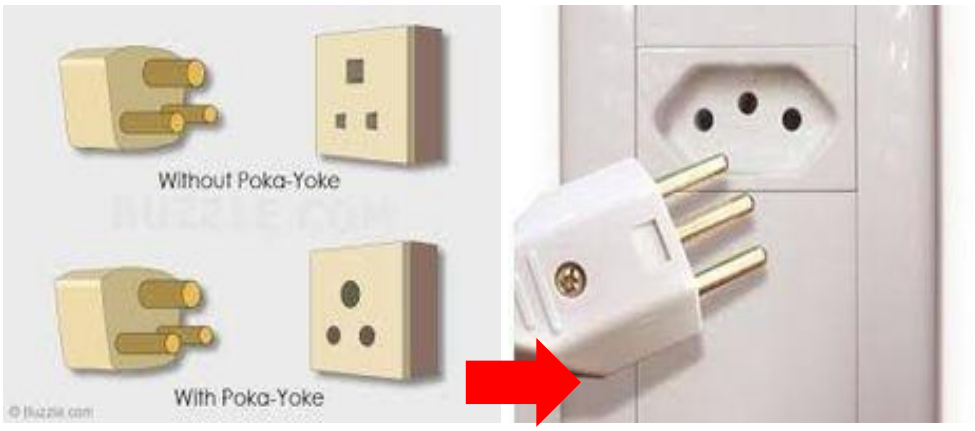

Figure 2.17 Poka Yoke application [free-logistics, (2015)]

2.7.4 Standardized Work

While improving the process, it is important to standardize the way work is done. In a pull system, later processes count on the capability of earlier processes to make or supply a certain quantity of parts at a certain time. To establish this expectedness in processing cycles, each process determines its standard work. Standardized work instructions is use to ensure that a constant method and constant times are used for each stage of production and create work instructions that provide a reliable method of manufacturing the part. Table 2.4 show the components of standardized work.

Table 2.4 Component of Standardized Work [Perumal, P. A. (2014)]

Standardized Work	Description
1. Standard cycle time	The genuine time necessary to process one part. Process cycle time defines whether the process is capable of manufacturing the amount necessary by next process at the required time. The time necessary of each process are eventually controlled by takt time for the finishing process. If a process makes parts quicker than required, excess inventory will be formed except production is strictly controlled by kanban or other means. It is better to remain idle; idleness is a graphic pointer of excess volumes that could be used another way. On the other hand, if the cycle time is slower than required, shortages will delay the next process. Process improvements may be required to avoid delays, or additional people or machines may be used to ensure a smooth process.
2. Standard work sequence	It is not possible to have a stable work cycle time without a constant work sequence and method.

		Documenting the stages carried out by the people and machines helps ensure that works is finished the same best way each time. This adjustment is also important for top quality products and a safe workplace.
3.	Standard in-process inventory (WIP)	To standardize the work that takes place in a process, the minimum quantity of parts or materials to complete one processing cycle and allow the cycle to continue. The objective to aim for is one- piece flow of work pieces through the process. This means that individual pieces of WIP move straight from one operation to the next rather than piling up between operations.

2.7.5 One-Piece-Flow

One-Piece-Flow is one of the most significant principles of lean manufacturing. One-Piece-Flow is tools that will assist a manufacturer achieve true just-in-time manufacturing. That is, the right parts can be made in the right amount at the right time. In the simplest of terms, One-Piece-Flow means that parts are moved through operations from step-to-step with no WIP in between whichever one piece at a time or a small batch at a time. This arrangement works best in combination with a cellular layout in which all necessary equipment is located within a usually U-shaped cell in the sequence in which it is used.

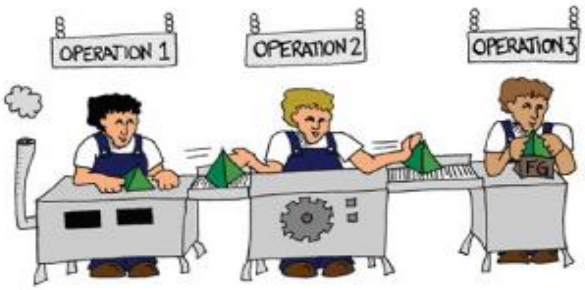

Figure 2.18 One Piece Flow [Ed., 1998]

2.7.6 Kaizen

Kaizen is well-defined as continuous improvement in minor stages (Womack et al., 1990). Organizations typically use Kaizen procedures to emphasis on improving a detailed process. Look for possible simplifications to the manufacturing process. Continuous improvement or Kaizen means to start from a standard lean organization (With supermarkets, delivery trains and flow racks already implemented) and to improve it with continuous decrease of the outstanding wastes. The Kaizen attitude required a willingness to accommodate everlasting adjustment. This means a daily pursuit to disregard Muda and a willingness to increase within the outline of a 3-stage process: Identify the Muda, isolate it and eliminate it. Continuous improvement means generating a standard work reference and then improving it constantly.

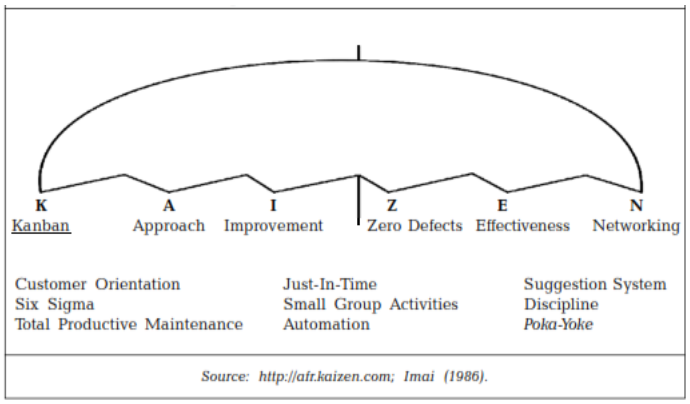

Figure 2.19 Kaizen Umbrella Technique [Singh, J., and Singh, H. (2009)]

2.7.7 5S

In current years, 5S is often practiced among the Japanese organizations in order to improve human proficiency and productivity (Rahman et. al., 2010). It is supposed that by implement the 5S methods, the environmental performance in production line including housekeeping, health, safety and more could be greatly growth. The 5S is the short form of five Japanese words which stands for Seiri, Seiton, Seiso, Seiketsu and Shitsuke (Perumal, P. A.,2014), each "S" has their own practice.

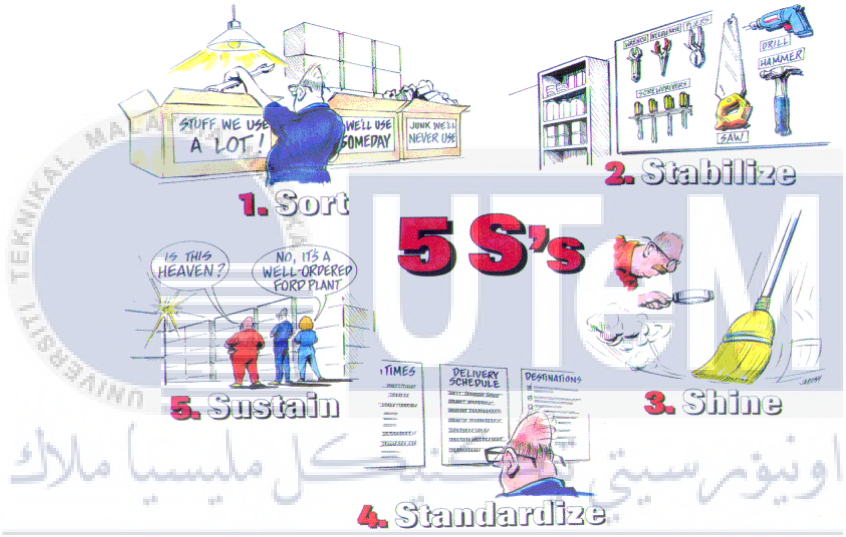

Figure 2.20 5S Method [Singh, J., and Singh, H. (2009)]

There are numerous benefits by implementing 5S in the work areas such as; reducing cost, better utilize of the working area, prevention of losing tools, elimination of the causes of accident, increase safety and decrease of the manufacturing effluence (Perumal, P. A., 2014).

Table 2.5 5S Overview [Perumal, P. A. (2014)]

5S	DESCRIPTION
Seiri (Sort)	Set into preparation of sorting through all the tools, things in the work area and keeping only necessary items. By working sorting, it will disregard waste materials, nonconforming products, and damaged tools. In addition, it helps to sustain the clean workspace and increases effectiveness of searching and getting things.
Seiton (Stabilize)	Means set in order or place of everything. It is a method that focuses on proficiency with goal to arrange tools, equipment, and parts. All the tools, equipment, and materials must be systematically organized for the easiest and most proficient access.
Seiso (Shine)	It means custody the workplace clean and neat. It must be made as a regular routine between workers and it will let they know what goes where and have sureness that the whole thing where it needs to be.
Seiketsu (standardize)	It means persistent place for things, rules of organization, storage, and custody cleanliness. It is mentioning to work out and implemented standards in the form of processes as well as instructions permit to keep the order on the workplaces. The standard should be clear and easy to understand.
Shitsuke (Sustain)	This practice is to sustain high principles and review those values. It is a technique where people or procedure necessity to focus on this system of working and not acceptable to slip back to old habits.

2.7.8 Jidoka

Jidoka is a design development to detect irregularities so they can be instantly corrected. The Jidoka is often labeled "stop and react to every irregularity". This is obviously much more than having a machine shut down. Toyota refers to every process, whether human or automatic, being allowed or empowered to autonomously notice abnormal conditions and stop. The team member pulling an andon cable on the assembly line is Jidoka as much as an automatic machine. Sometimes at the company, it can be defined as a four-step process that engages when abnormalities occur (Mark, 2002).

i. Detect the irregularity.
ii. Stop.
iii. Repair or correct the abrupt condition.
iv. Examine the root cause and set up a countermeasure.

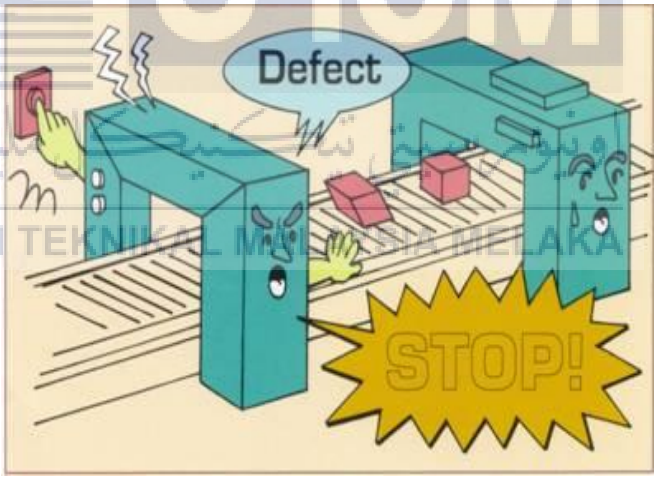

Figure 2.21 Jidoka [Mark, 2002]

The purpose of this concept is to allow equipment from the requirement of persistent human attention, separate people from machines and allow workers to staff multiple operations. Since the loom stopped when a problem arise, no faulty products were manufactured. This meant that a single operator could supervise many machines

without risk of producing large quantities of defective material. Jidoka is very important for lean thinkers because Lean manufacturing dramatically increases the importance of building things right the first time. With very low levels of inventory, there is no buffer to fall back on in case there is a quality problem (Qualiti Amo, 2015).

2.7.9 Total Productive Maintenance (TPM)

Total Productive Maintenance (TPM) is the technology comparable of Total Quality Management (TQM) and involves everyone in the organization in focusing on disregarding the six big losses through the use of a performance measure known as overall equipment effectiveness (OEE).

TPM builds on preventative maintenance and predictive maintenance programs and implicates the operators through autonomous maintenance. This is another substance stone of Lean manufacturing which ensures that the company or industry not only have reliable processes by disregarding failures but also standardizes their processes, decreases and develops setups and increases product quality.

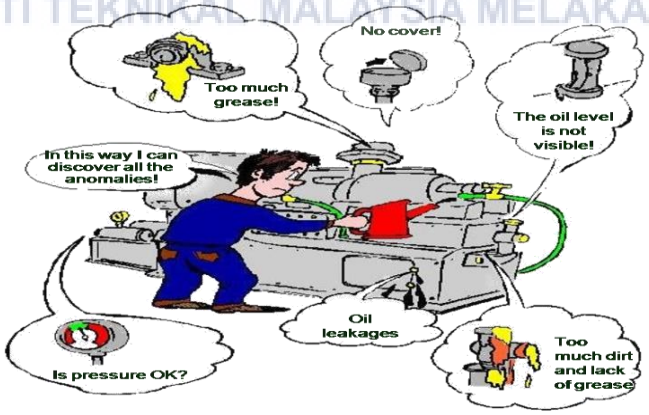

Figure 2.22 Maintenance in Production [PDT, 1998]

Workers carry out regular equipment maintenance to detect any irregularities. The focus is changed from fixing failures to avoiding them. Since operators are the closest to the machines, they are included in maintenance and monitoring activities in order to avoid and deliver warning of malfunctions (The Productivity Development Team, 1998).

2.7.10 Kanban

This tool is a signalling system for implementing JIT production. Use a pull system to control how much is manufactured. Kanban (literally signboard or billboard in Japanese) is a scheduling system for lean and just-in-time (JIT) production. Kanban is a system to control the logistical chain from a production point of view, and is an inventory control system. Kanban was established by Taiichi Ohno, an industrial engineer at Toyota, as a system to increase and keep a high level of production. Kanban is one method to achieve JIT.

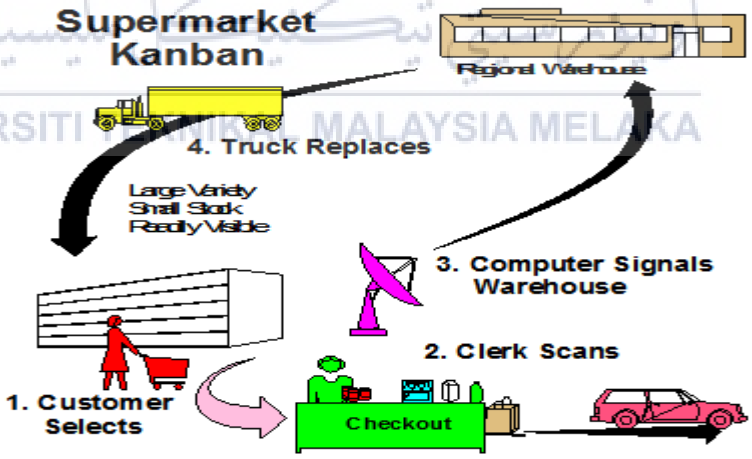

Figure 2.23 Kanban Signal in Production [PDT, 1998]

Kanban became an effective tool to support running a production system as a whole, and an excellent way to promote improvement. Problematic areas are highlighted by decreasing the number of Kanban in circulation. One of the main benefits of Kanban

is to create higher limit to the work in progress inventory, avoiding overloading of the manufacturing system (The Productivity Development Team, 1998).

2.7.11 Heijunka

Heijunka means which in English is interpreted as "Levelized Production", is the process of "dampening" variations from production schedule. The objective of Heijunka is to absorb unexpected fluctuations in market demand by manufacturing some different models in small batches on the same line. The practice of Heijunka also allows waste to be disregarded by making it easier to standardize work. That even spreading is what we call Heijunka sequential planning. Heijunka means distributing volume and specifications evenly over the span of the production. We do that to make effective use of the basic aspects of manufacture: our people and our equipment.

On a production line, as in any progression, variations in performance increase waste. This is because equipment, workers, inventory and all other elements required for production must be arranged for peak production. This is a cost of flexibility. If a later progression varies its removal of parts in terms of timing and quality, the range of these variations will growth as they move up the line towards the earlier processes. This is known as demand amplification.

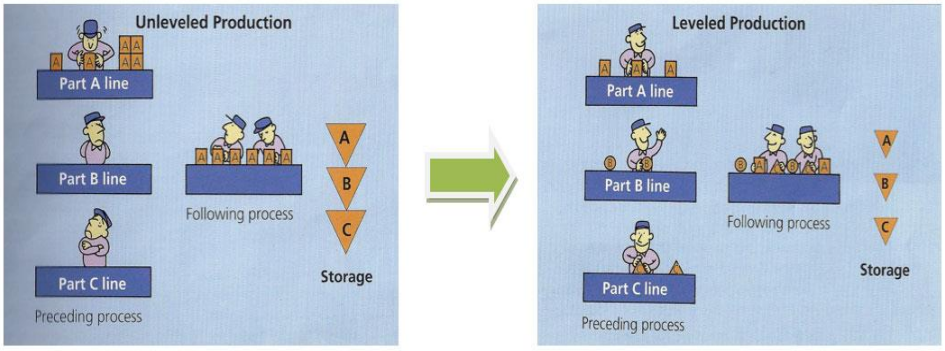

Figure 2.24 Heijunka Leveled Production [PDT, 1998]

2.7.12 Setup Reduction (SMED)

One of the numerous lean production methods for reducing waste in a manufacturing process. It provides a quick and effective way of converting a manufacturing process from running the current product to running the next product. This rapid changeover is key to reducing production lot sizes and thereby improving flow (Mura).

Setup reduction also call Single Minutes Exchange of Die (SMED); the catchphrase "single minute" does not mean that all changeovers and startups should take only one minute, but they would take fewer than 10 minutes (in other words, "single-digit minute").

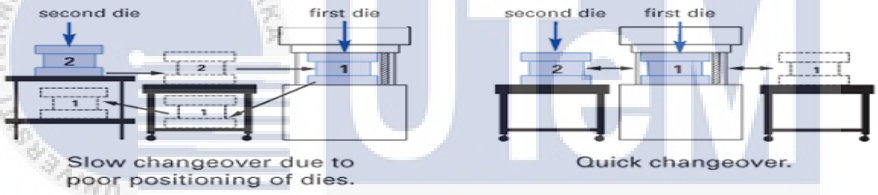

Figure 2.25 Single Minute Change of Die (SMED) [PDT, 1998]

2.8 Conclusion

Quality is most essential than quantity on manufacture to give customer satisfaction. Improving productivity through quality can produce all the preferred results such as better quality, less rework, greater productivity, lower unit cost, price elasticity, improved customer satisfaction, larger profit and more. Industries implement Lean Manufacturing to eliminating the seven wastes in production line to enhance quality and productivity. There are many tools and techniques available in lean manufacturing that are focuses on eliminating seven waste. Many techniques such as Poka-yoke, Kanban, Just-in-time (JIT), Total Productive Maintenance (TPM) and many more that can be used as a counter measure for problems arise at the production line.

CHAPTER 3
METHODOLOGY

3.0 Introduction

This chapter discusses the methodology and flow charts to achieve the objectives of this study were the qualities that have been evaluated to select the appropriate method. Planning process for this study case should be framed because it important to identify the problems faced by industries. The project methodology of this project will be explained from the start of project until the end of the project after the result had been acquired and the objectives stated before were fulfilled and achieved. This project only focused on one types of waste. If the election of waste is not compatible with the goals of this project, one of the other wastes will be selected with appropriate lean tools. Research framework shows the flow charts of this project in the way to achieve the objectives and scope that are provided.

3.1 Project Planning

This research used a case study method to enable the student to gain the experience of realistic investigation and intensive analysis of real- life situation. This is because, the case study is suitable to answer the ‘how’ and ‘why’ question to find the explanation of a business process and a specific phenomenon under investigation. This case study is planned to be carried out in manufacturing area as it is related to lean

manufacturing. It was conducted at Likom Caseworks Sdn. Bhd. This company is situated at Kawasan Perindustrian Cheng, Fasa III, Mukim Cheng, Daerah Melaka Tengah, Melaka, Malaysia.

3.2 Research Framework

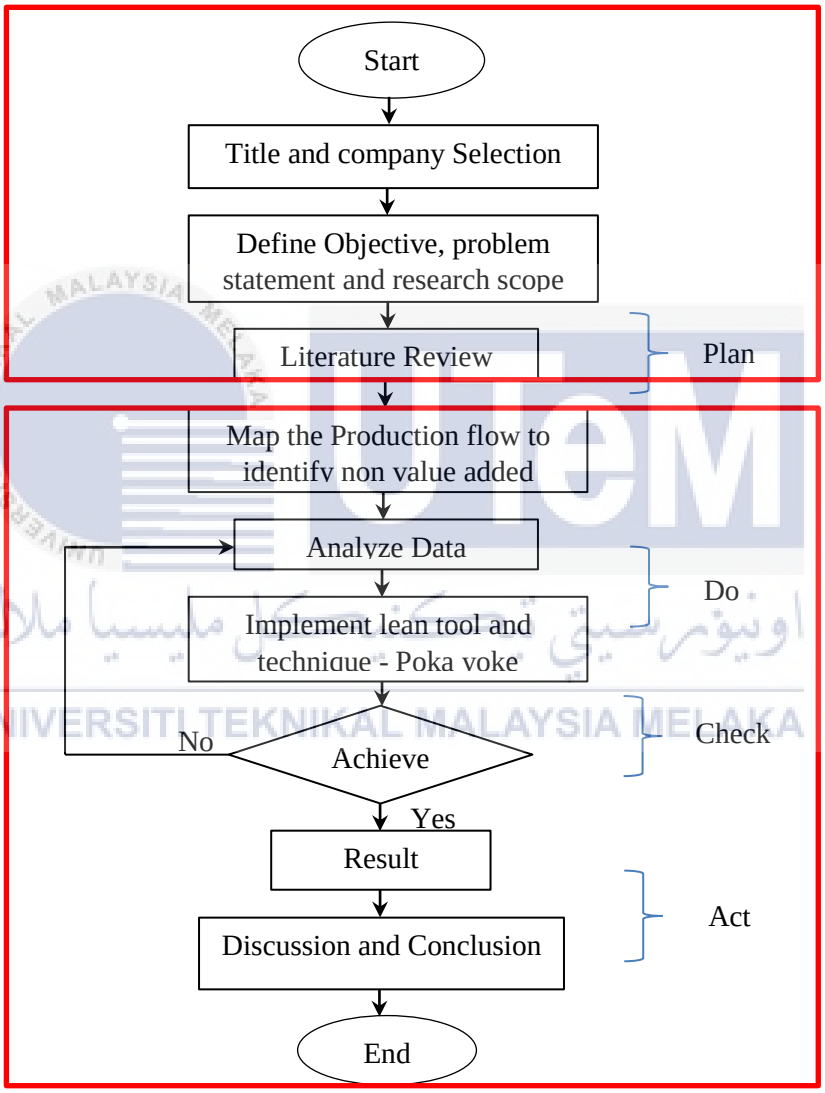

Figure 3.1 Project Flow Chart

3.3 Poka Yoke Techniques

When defect occur in the product, Poka-yoke techniques has been applied to encounter the problem. Before making a Poka-Yoke, SPT is things that need to have. SPT is a set all the documents, standards, instructions and guidance when making a process. When there is lack in process, Poka-Yoke can be applied. A Poka-Yoke device was created and according to the problem occurs. The process must be full monitor to ensure the new implementation been used.

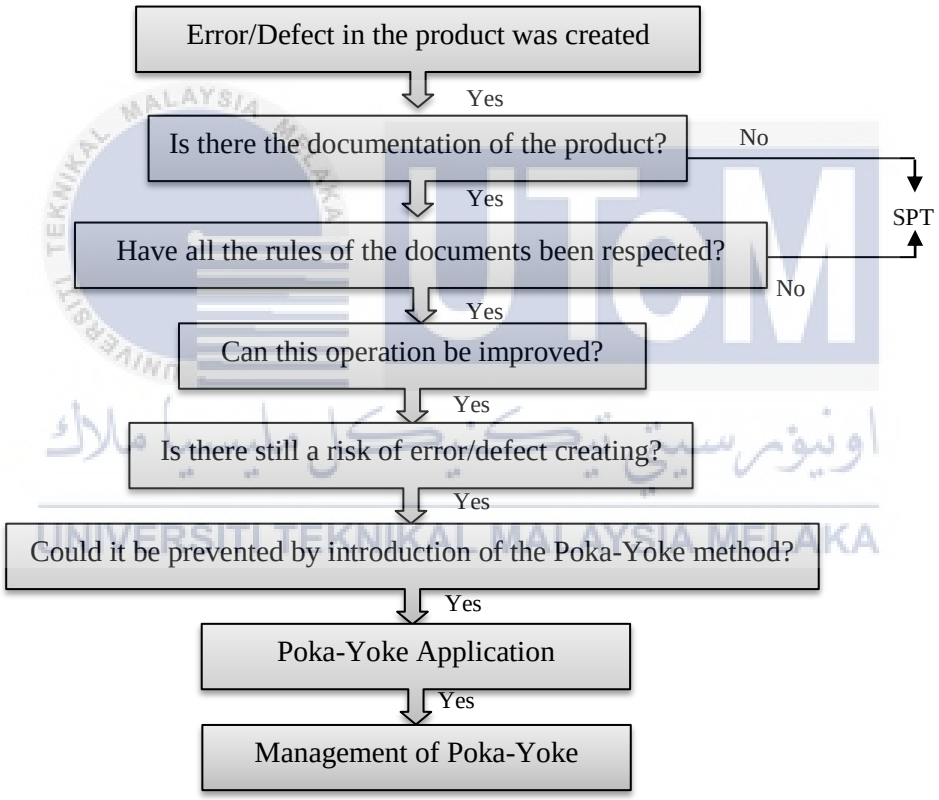

Figure 3.2 Steps Implement Poka -Yoke Technique

3.4 PDCA Techniques

3.4.1 Plan

In the beginning, the process of understanding and familiarity with arrangement of processes in the production line will be done. Walk around and do the observations on each line to find out which process is methods face overproduction problems. This observation will be focused on the line that causes bottlenecks and overflow into their process. Monitoring the process by referring to existing Standard of Procedure (SOP) and identify the delay caused by the operators.

3.4.2 Do

After done identifying overproduction at the production line, the data need to be collect; such as detail of the process in each workstation, current cycle time, normal time, standard time and come out with data analysis. The line balancing will be made to balance the standard time of each process. Before the line balancing is made, the Takt Time (one of lean tools) of the process need to be done first to precisely match production with demand. Then, the current work instructions will be revised and at this stage lean tools will be proposed which is new Standardized Work then One Piece Flow or Kanban.

3.4.3 Check

At this stage, the effectiveness lean tools should be checked whether it could be able to bring improvement or not. Compare the standard time, output per hour before

and after the implementation of lean tools into the process. If the implementation of lean tools is not achieved find another lean tool to solve the problem.

3.4.4 Act

The discussions were made based on the finding and the result attained. The discussions were made about the effectiveness of the methods applied; the problems arise during the completion of the project and the new findings. Lastly, the conclusions of the project were made. The conclusions also reflect whether the objectives of this project had been achieved and the problem statements that stated before are resolved after this project completed.

3.5 Conclusion

In PSM 1, the project selected must be understand and know the outcome that will be obtain when making the project. By referring from the Figure 3.1, it shows the activities that had been done throughout PSM 1. After making decisions on the title of project, objectives, problems and scope was define during making a project proposal. Next, literature review was done by referring to Lean Manufacturing tools and technique to focus on Poka Yoke Technique and other techniques that related to it.

CHAPTER 4

RESULT AND DISCUSSION

4.0 Introduction

This chapter is confer detail information about the result from the improvement that has been implemented at the production line from beginning where learning process is run, analysed the defects data, making an improvement and implemented. Method used in as a guideline while conducting the improvement process is a PDCA Cycle. PDCA Cycle is one of Kaizen tools that always seek for new improvement. In this implementation, Poka Yoke method has been used in Plan-Do-Check-Act (PDCA Cycle) which is done under Do step. Poka Yoke act as a mistake proof to ensure there is no defects happen during the running of mass production. All of these methods of improvement made just to make and produce a product with a good quality to ensure customer satisfaction.

Quality of product is a very important thing that needs to be care of when producing a product because consumer always wants a product or services that are in good quality and worth with the money they invested. Every consumer wants a good quality no matter whether in services or products that are offered by companies. Hence, it is important to always maintaining and increase the level of quality and services provide for customer.

4.1 Factory Visual

This factory categorizes in small and medium industries that has 32 workers. In this production have four production lines for yellow mee, kuew tiaw, Wantan Mee, Yee Mee, mee suah and many more. All production lines have 4-5 operators on entirely processing noodles machine.

Figure 3.3 Front factory viewing

This production using many type machines to produce many types of noodles such as; mixer, compress feed rolling, cutting, packaging and others. From the view of production, they facing pro and cons while processing noodles. This factory have good machine to produce product but facing problem such as mistake happen during product taken by customer and worker also waste happen when processing and packaging product.

4.2 Plan Do Check Act Implementation

PDCA Cycle represents the repeated and continuous nature of continuous improvement. It is always sought for new improvement in order to maintaining the level of quality product or services provide for customer satisfaction. The research focuses on after processing as shown in figure 4.1. From the ingredients preparation to freezer, worker often make mistake because all types of 'Wantan Mee' wrap in one type plastic bag. Waste happened during packaging product and production needs to minimize. Before any implementation been implemented in the production line, the countermeasure needs to be check whether it is effectively bringing an improvement for the product. If the new countermeasure has brought an improvement for the production line, then the improvement can be implemented to the production line.

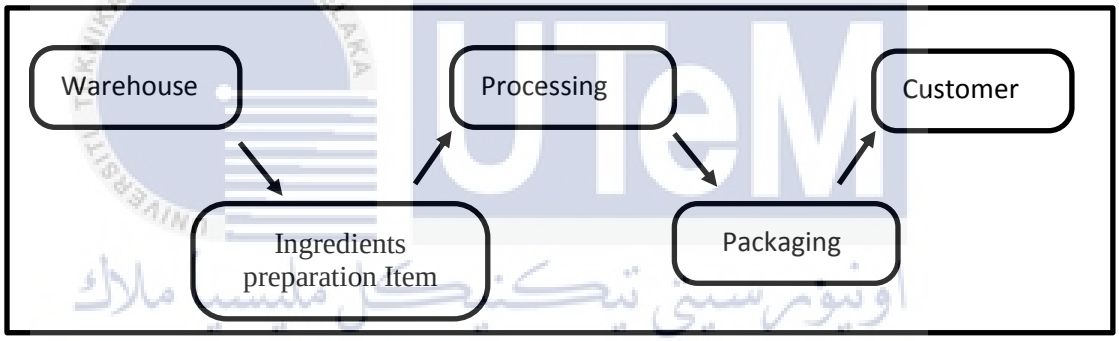

Figure 3.4 Wantan Mee processing flow

4.2.1 Plan Phase

Checklist need to be done to know process sequence for every station at the production processing. This production produce many type of noodles but, during this research the product is focussed on Wantan Mee and Yee Mee (additional process).

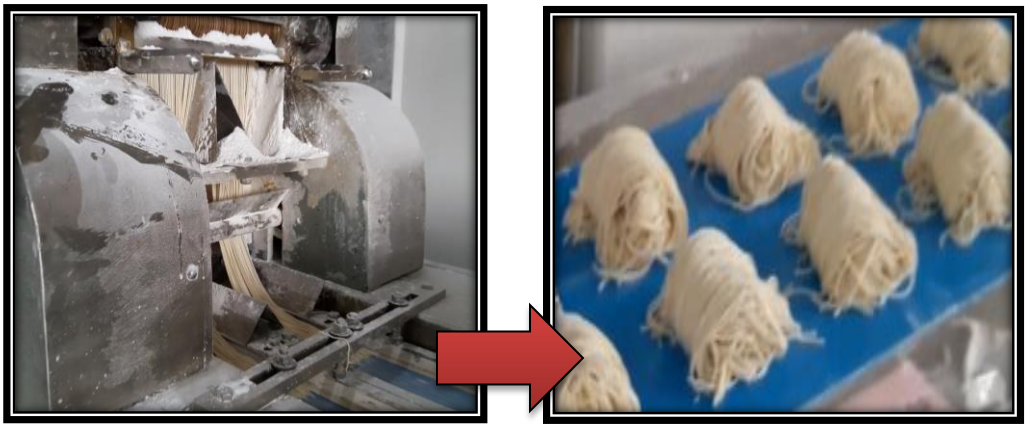

Figure 3.5 Wantan Mee Process

4.2.1.1 Checklist

The purpose of this checklist is to help conclude if opportunity for improvement would be addressed as a Lean Process Improvement. A Lean approach may be applicable if:

- There are bottlenecks in the process where worker are waiting.
- There are lots of steps and/or handoffs in the process.
- Faults or mistakes are being made. Work has to be ended.
- The work procedures are complex. The work is really tough to do.
- There are parts of the process that only one person knows how to do and do their own way.
- Safety is concern.

In this production, the checklist for operational has been done to determine the value added and non-value added in this production. Table shows a checklist in production to process noodles from customer until done making it and give to customer. This checklist answer is provided from a production supervisor.

Table 3.1 Operational Checklist

NO.	OPERATIONAL TASK	YES	NO
1.	Customer demanding greater varieties of product?	/	
2.	Under pressure to reduce the problem?		/
4.	Producing too much defects?	/	
5.	Are product changeovers a problem?		/
6.	Output unpredictable?		/
7.	Too much downtime?	/	
8.	Need more operators?		/
9.	Errors or mistakes are being made?	/	
10.	The process not all operator knows how to do?	/	

In this production, error/mistakes happened when customer and worker are confused due to same packaging (yellow plastic bag) and labelling just use marker pen. The process also not all operators know how to do it, like the preparation ingredients to put in mixer making noodles. Downtime that stands for overproduction also occur when production keep producing for just in situation for unclear customer requirement and producing to a forecast.

For this plan phase, production doesn't have daily production Status Tracking Board. So, this production needs to have this board for better visual management. This board are important to provide immediate updates, specify aim and goals and also to show results on that day. This board also help operator what they should do or process on that day, how much quantity and time to running machine.

Figure 3.6 Example of daily production status board [Internet source]

4.2.1.2 Process Flow Mapping

Process mapping is a workflow diagram to bring forth a clearer understanding of a process or series of parallel processes. The purpose of process mapping is to use

diagramming to understand the process. Picture below shows process mapping for Wantan Mee.

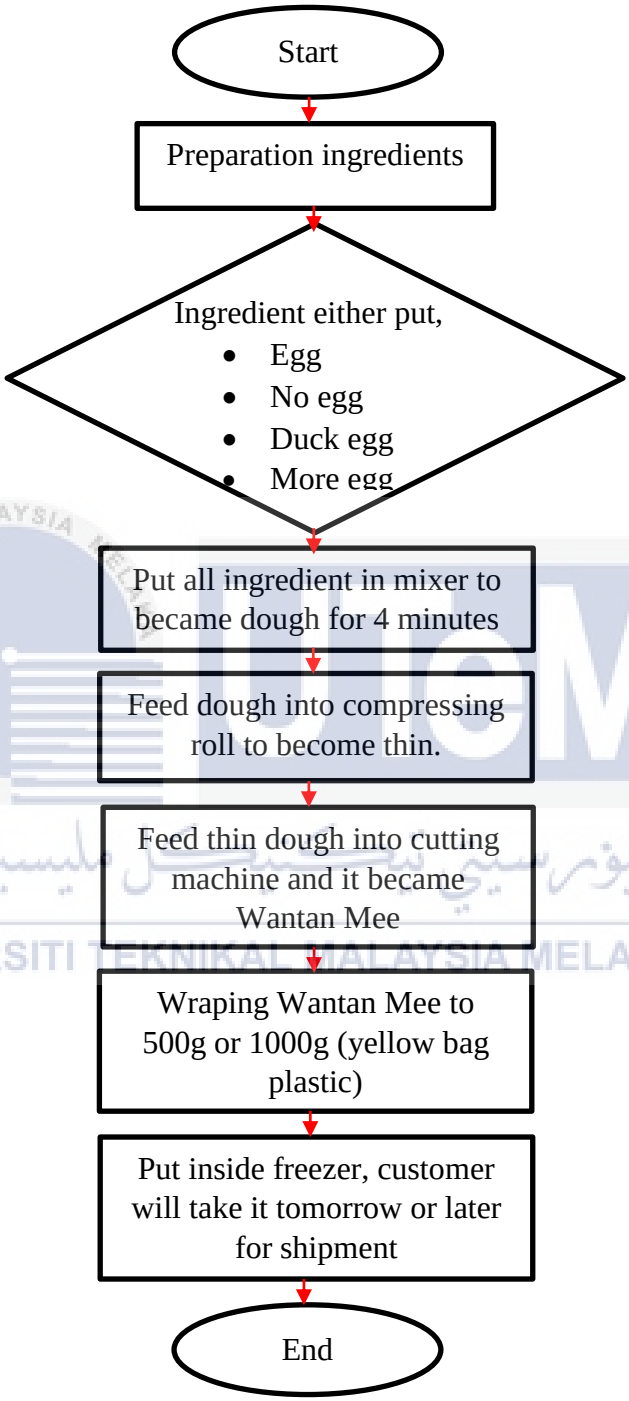

Figure 3.7 Wantan Mee process flow mapping

In this Wantan Mee production line, there are four workstation with manpower of five people. Figure shows the process layout for Wantan Mee process that shows where every operator located.

Every operator has their own works instruction as a guideline to follow when making the process. Figure below is a work instruction for every operator that shows every each of steps from preparation ingredients until it is ready to pass to another operator. To transfer the work process from one station to another station, this production line used compressing roller system to compress dough become thin.

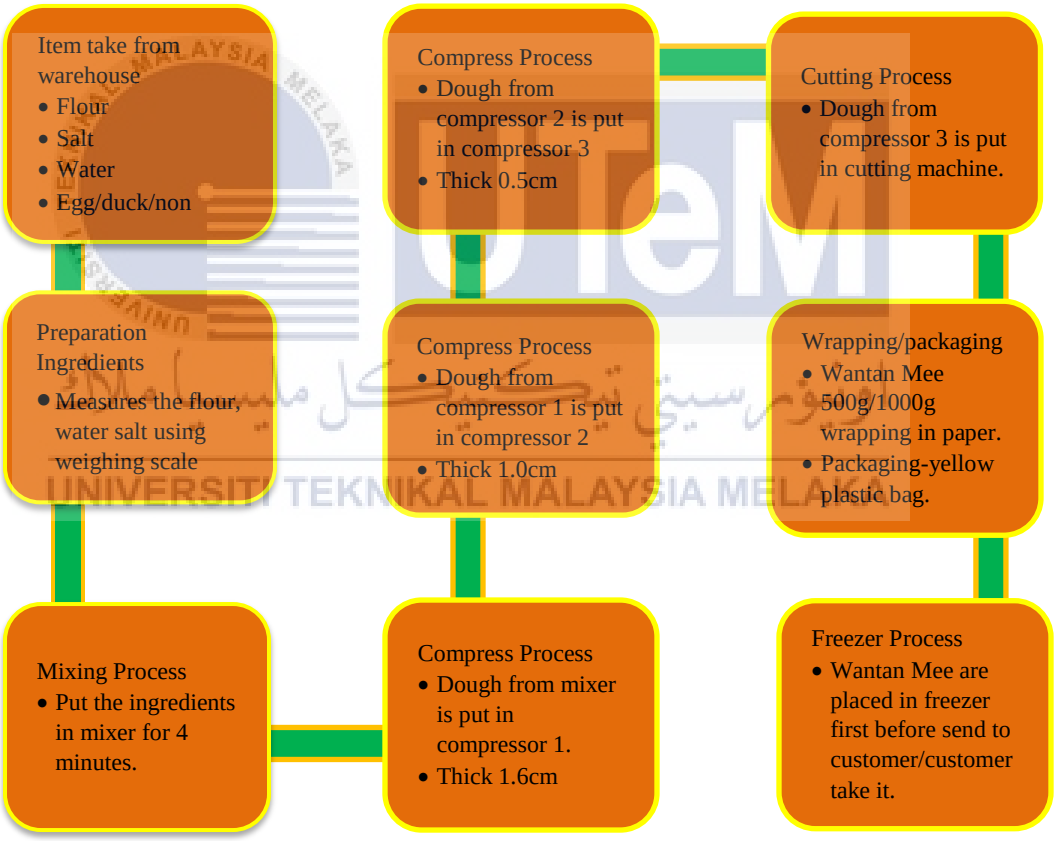

Figure 3.8 Work Instruction

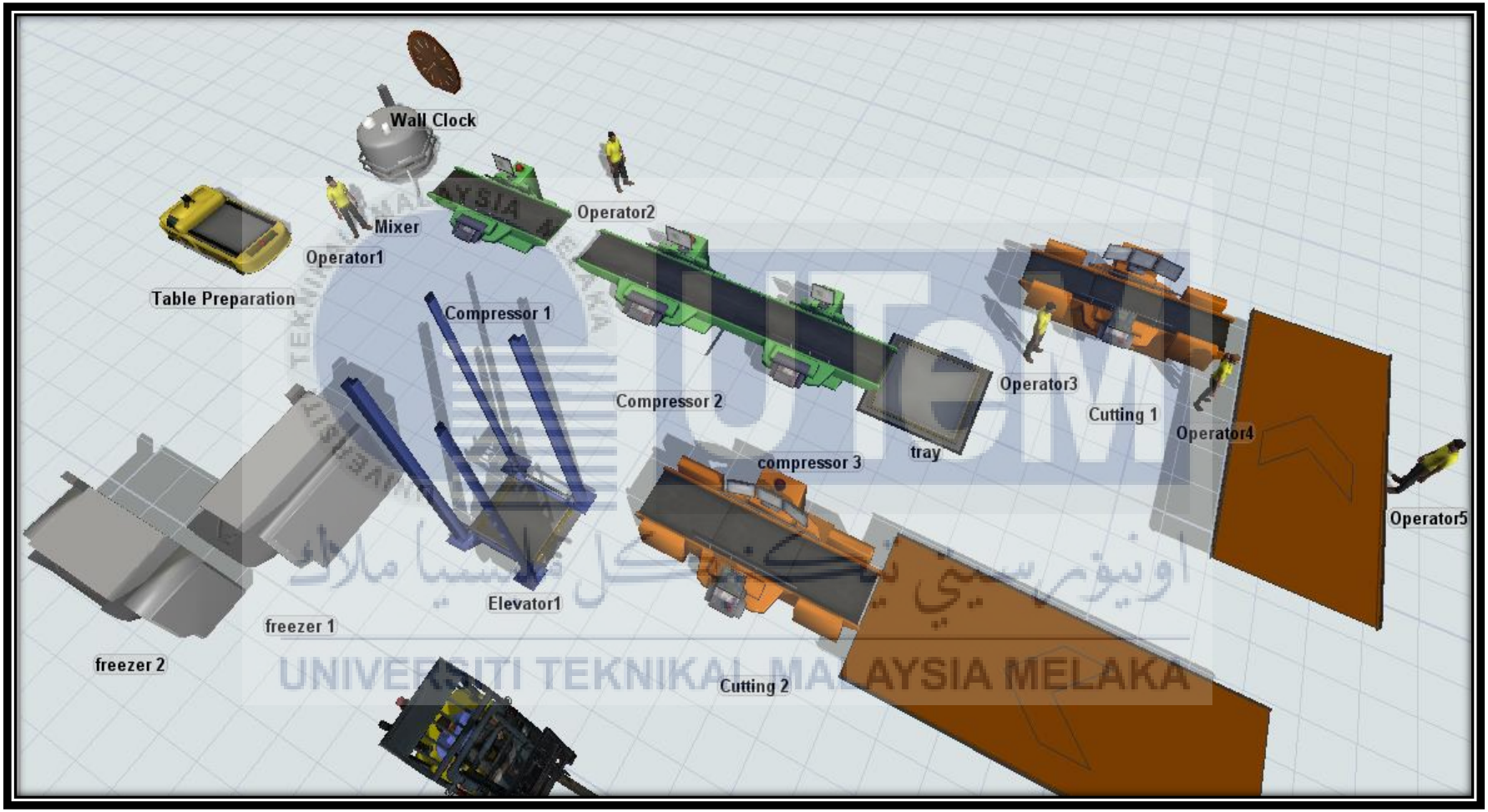

Figure 3.9 Wantan Mee and Yee Mee dough Workstation

4.2.2 Do Phase

Poka Yoke implement for avoiding simple human error in the workplace. This implement is to take over repetitive tasks that rely on memory or vigilance and guard against any lapses in focus. For this phase, the checklist for workplace safety and housekeeping also done perfectly for three weeks, it is one of Poka Yoke tool that prevents the workers skip the process what they need to do without prompting.

CHECKLIST FOR SAFETY AND HOUSEKEEPING

Machine : Operator :

Product : Date :

No	TASK	M	T	W	T	F	S	REMARKS
1.	Wear appropriate clothing (apron, net cap, shoes).							
2.	There are no unnecessary items in the work area.							
3.	Work area is clean and tidy.							
4.	Clean the ingredient container.							
5.	Machine and equipment are in place and secure.							
6.	Tools are in good condition and in their location.							
7.	Cleaning the cutting tool before and after using it.							
8.	Throw away the eggshell or other that have been used in space provided.							
9.	After done process, clean the machine using sprayers wind							
10.	Throw trash into garbage bin at outside production.							

Figure 3.10 Cleanliness checklist in production

Figure 3.11 Wantan Mee andYee Mee processing

4.2.2.1 Mistake

The error happened when worker and customer confused the packaging item that doesn't have label and same packaging sometimes. The table below shows the error not often happened, but productions really need to avoid it from happened.

Table 3.2 Mistake happen while taking product

Error / Mistake In Production By Worker And Customer							
WEEK/DAY	**MON**	**TUE**	**WED**	**THU**	**FRI**	**SAT**	**TOTAL**
WEEK 1	0	0	1	0	0	1	2
WEEK 2	1	0	1	0	0	1	3
WEEK 3	0	0	0	0	0	0	0
WEEK 4	0	0	1	0	1	0	2
WEEK 5	0	0	0	2	0	0	2
WEEK 6	1	0	0	0	0	0	1
WEEK 7	0	0	0	0	0	0	0
WEEK 8	0	1	0	0	0	0	1

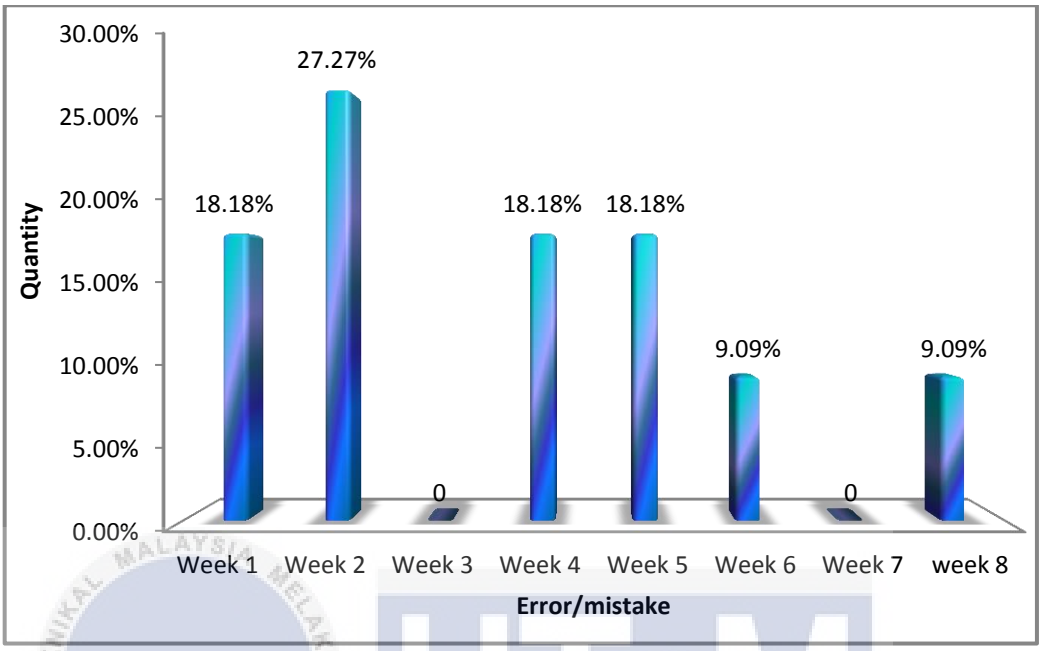

Figure 3.12 Graph for mistake happen in production

Even the percentage for mistake not really big issue but it still need to prevent due to complaining from customer. To prevent this process from make a mistake, Poka Yoke tool was create for labelling the Wantan Mee. Picture below shows the labelling for freezer. It is because the labelling for freezer in production just a number, so labelling for freezer was create and it show the item in that freezer. It easy to identify the Wantan Mee with labelling and different plastic bag.

Table 3.3 Labelling for freezer

WANTAN MEE	PLASTIC BEG COLOUR
No egg	
With egg	
More egg	
Duck egg	

For additional suggestion in Wantan Mee production, it also need to improved using Poka Yoke method by upgrading the facilitation. Such as the mixer for ingredient using wall clock and operator always need to alert the time for four minutes and stay at the machine. So, mistake-proofing principles or methods (Poka Yoke) are to replacement for more reliable process to improve and make work easier to perform.

Figure 3.13 Mixer using wall clock for operator alert

Suggestion for Poka Yoke system approach in this processing is warning approach. A warning or alarm system can be used to get an operator attention. This approach will utilize in manufacturing which lead to successful 'zero defect' quality. Poka Yoke help eliminate errors and defects by giving machine the 'intelligence' to stop and give a signal.

Figure 3.14 example warning signal replacement wall clock [Internet Source]

4.2.2.2 Defects

Additional problem occur in this production are defects and it's mostly happened at Yee Mee process. The progressing for Yee Mee dough using same machine with Wantan Mee but Yee Mee has own cutting tool and frying place as picture shown at below.

Figure 3.15 Yee Mee fried processing

Have three types of defect that occur while process Yee Mee;

a) **Weight**

The defect of Yee Mee in weight are7 before frying it was 85g - 90g, so the weight after frying should be 70g – 75g. Yee Mee packaging was 375g that equal to five pieces in one plastic bag.

Figure 3.16 Yee Mee Weigh

b) **Waste**

The wastes are Yee Mee separate surplus that broken, it occurs due to human error while handling it for packaging.

Figure 3.17 Packaging waste

Waste also happen while processing, so on this machine need to install barrier to avoid falling noodles. Picture 4.16 shows Yee Mee noodles after cutting when to fry place then waste occur before frying.

Figure 3.18 waste occur at machine

c) <u>Colour</u>

Yee Mee fried process need to set the temperature for 175 °C. Operator need to check the temperature first before start frying process. The defect from temperature also occurs when not enough fry.

Figure 3.19 Yee Mee not fried enough

A data defect for 8 weeks was taken as show in table 4.4. This defects production needs to minimize it. Average for Yee Mee process output was 9000 pcs/week and 1 pc equal to 75g.

Table 3.4 Yee Mee defects

	OUTPUT (PCS)	WEIGHT (PCS)	COLOUR (PCS)	WASTE (PCS)
Week 1	9000	241	42	246
Week 2	9100	230	33	237
Week 3	9100	226	21	234
Week 4	9000	237	36	230
Week 5	9000	244	48	241
Week 6	9000	239	21	239
Week 7	9100	235	27	231
Week 8	9000	228	19	247
TOTAL		1880	247	1905

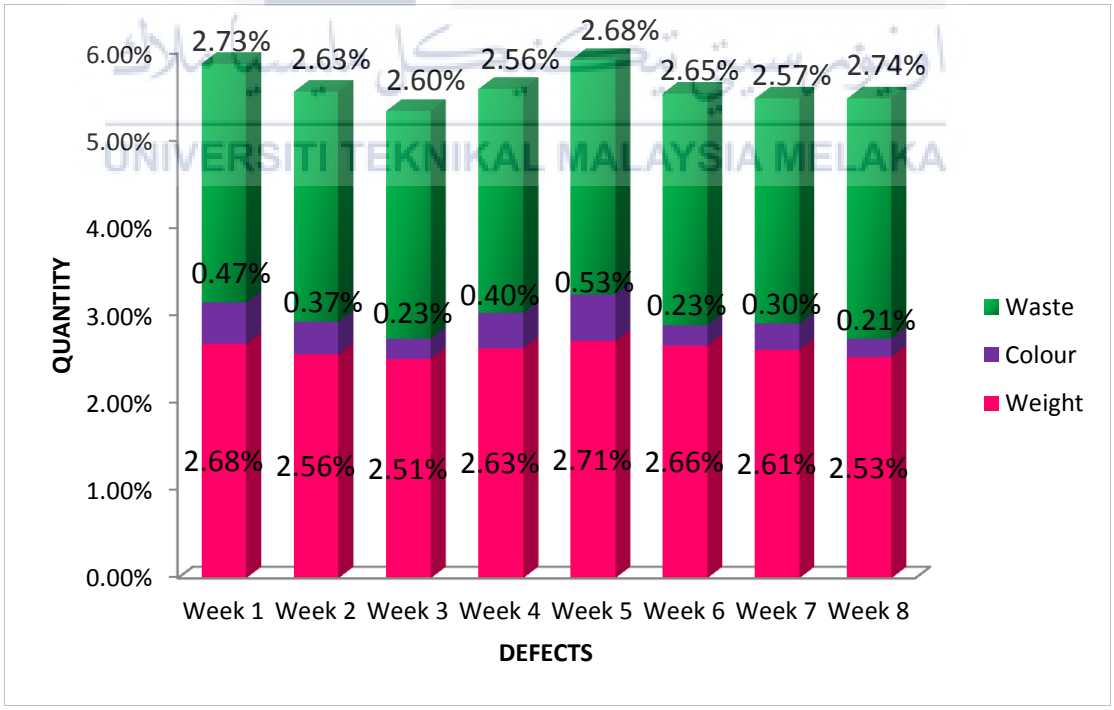

Figure 3.20 Graph of defects percentage

Graph shows defect mostly happen at Yee Mee production is light weight and waste. Even the graph shows not critical but this defect should be eliminated to prevent company losses.

4.2.2.3 Cause and Effect Diagram

Cause and effect diagrams used to analyse the root cause of defects. The factors that are being considered are 4M which are Man, Machine, Method and Material. Every possible cause is taken out in order to find the real causes of the problem so that the countermeasure from the problem can be overcome. Cause and effect diagram can be referring at Figure 4.18 below.

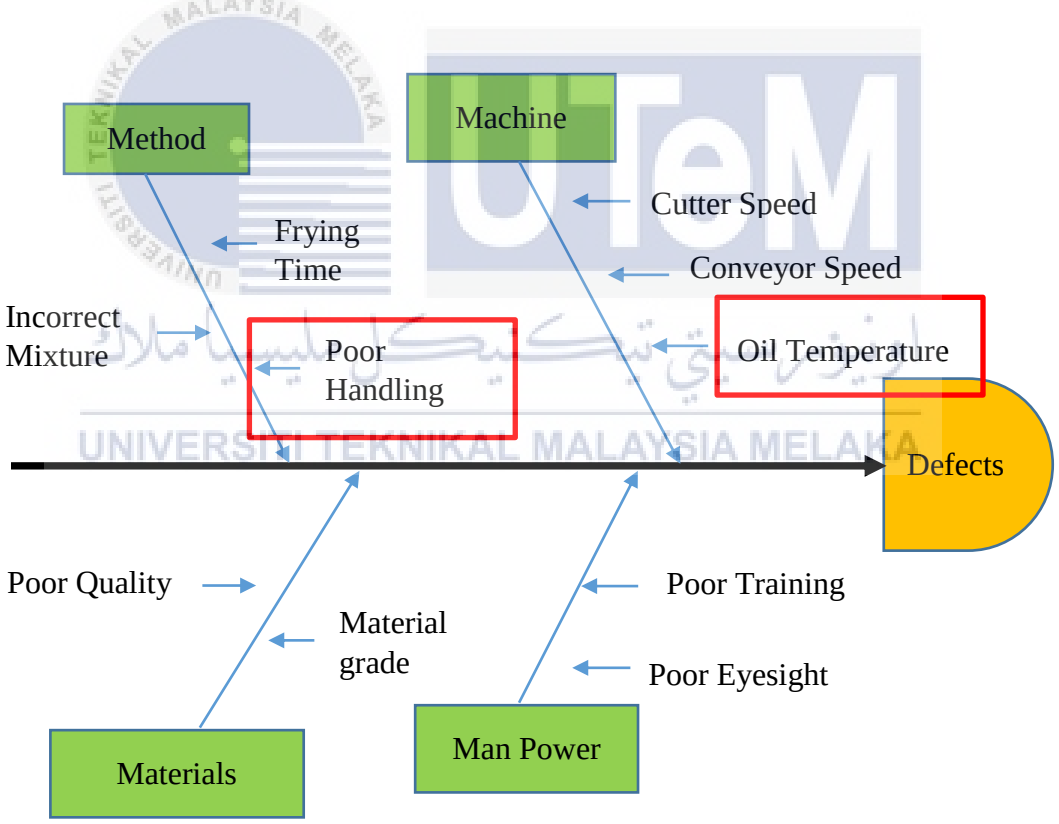

Figure 3.21 Cause and effect diagram

In machine setup and operation, before run the machine need to set temperature to 175°C. Avoid running machine before oil temperature low than 175°C. At method section, waste always occurs due to poor handling from operator. Ensure not rough while packaging the product or need to upgrade machine.

4.2.3 Check Phase

After analysing the cause of error and defects, a countermeasure for preventing and minimize this problem in action. Figure below shows the labelling and packaging were done to prevent a mistake.

Figure 3.22 Before

Figure 3.23 After

Figure 3.24 Before

Figure 3.25 After

Figure 4.18 until figure 4.21 shows the small change in production to labelling the freezer for worker and customer easy to know what inside the freezer. The packaging also changes to multicolour packaging for easy to differentiate Wantan Mee.

This implement for two weeks shows an improving from worker and customer that clearly know the different Wantan Mee in different packaging colour. For this implement in this freezer only have Wantan Mee with egg and Wantan Mee no egg.

Suggestion for defect that occur in Yee Mee production due to operator poor handling are need to replacement it to automatic packaging that need to use long conveyer with packaging machine. Picture 4.23 below show suggestion to implement in production for use automatic packaging machine.

Figure 3.26 Yee Mee manual packaging

Figure 3.27 Yee Mee automatic packaging [Internet source]

4.2.4 Act Phase

The countermeasure can be evaluation over time since PDCA is cyclical and not linear. Even when error was prevents and defects were minimized and the effective improvements have been consistent, process management should not end. Variables such as new technology, change over time might be considered to make new improvement in order to produce product with high quality

4.3 Conclusion

After error data for 8 weeks was taken and analysed, the error that continuously happen are taken wrong item. Worker and customer also always confused the item either that Wantan Mee has egg, more egg, duck egg or no egg because they had same plastic. A method that was used during making a countermeasure action is a PDCA Cycle method and Poka Yoke technique. Plan Phase is the first step that needs to be taken where all the work step for the involved station has been familiarize. Next, during Do Phase, a labelling and vary the colour of bag plastic has been created that acts as a Poka Yoke that used by operator when making their process. After that change, it needs to be check for their effectiveness whether it brings an improvement when implementing it. Lastly, when the change is confirmed will successfully overcome the error, it will be implemented at the production line. Throughout this research, there are few problems faced while minimized the non-value added in production. Firstly, there is a limitation to change the works that have been fixed for operator and machine. The observation can only be making when the production line is running and have person in charge at there to monitor. The checklist also hasn't done every day but the cleaning still in control. Next, the problem faced is when labeling and change the plastic bag packaging. Because of limitation of plastic bag at warehouse, only two types labelling for Wantan Mee can be done.

CHAPTER 5
CONCLUSION

5.0 Introduction

This chapter discusses the conclusion and suggestion for future work to further improve the work process at the production. It also stresses the significance and recommendation that can be made in future.

5.1 Conclusion

As a conclusion for this research, the objectives of this research are achieved. The first objectives of this research are to mapping the flow of production line and identify the non-value added activities occur in production line and lastly to implement lean manufacturing tools and minimize the non-value added activity. Lean tools that had been selected in this research are PDCA Cycle and Poka Yoke method. The flow of this research is used by followed the steps in PDCA Cycle. During the Do Phase, a checklist and labelling with characteristics of Poka Yoke which is mistake proofing was implementing. Result from three weeks after implementation is, there is no mistake happened. There are few problems faced to not be fully able to implement and just give suggestion due to it's a small company and not enough budget; such as defects that

suppose being minimize during this research and need to improve by using auto packaging. If this technology has in production line, it completely eliminate waste occur in production line. Continuous improvement can always be make in order to achieve low manufacturing cost.

5.2 Recommendation

In future, there a few improvements that can be made on production line. First, for this small production need done checklist for cleanliness everytime and everyday if company really needs get Halal from JAKIM. For production management, daily production board also needed for easy worker movement. The technology of machine need to improve such as have warning signal. In this production only use wall clock for mixer to alert the operator stop running machine. With the warning signal it wills automatic stop the mixer and gets the operator attention. To solve the defect problem, just need additional automatic machine for packaging. This technology is needed to automatic packaging fried Yee Mee because the product was breakable that's why needed to use automatic packaging. So, the waste occur will less than human mistake/poor handling. With this recommendation, it will successfully bring productivity improvement.

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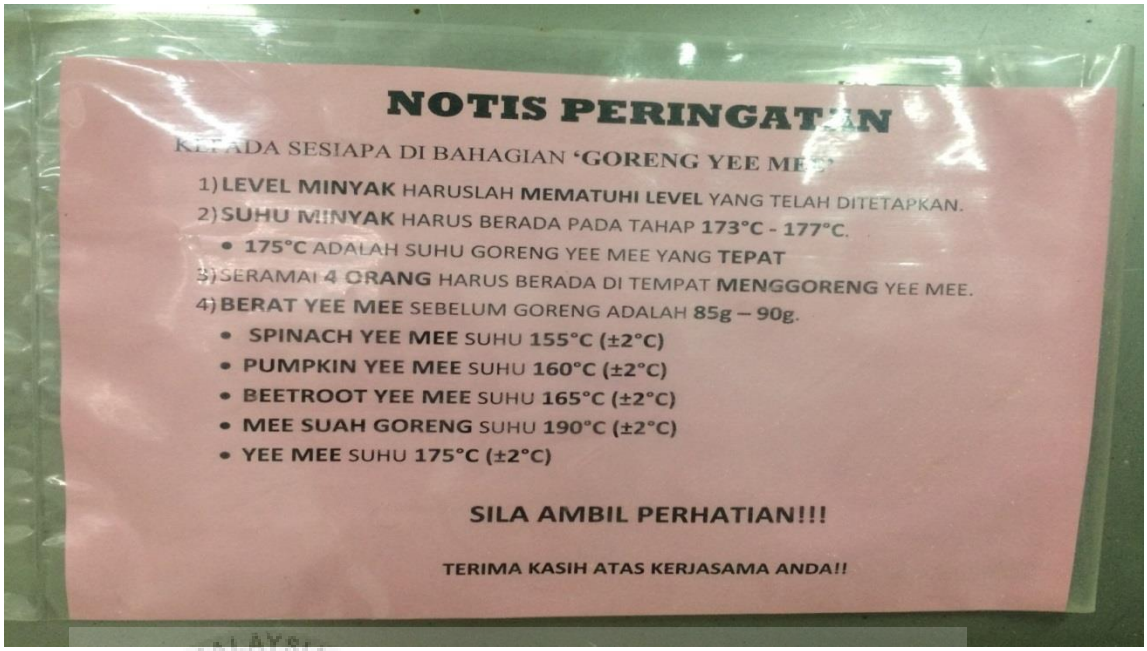
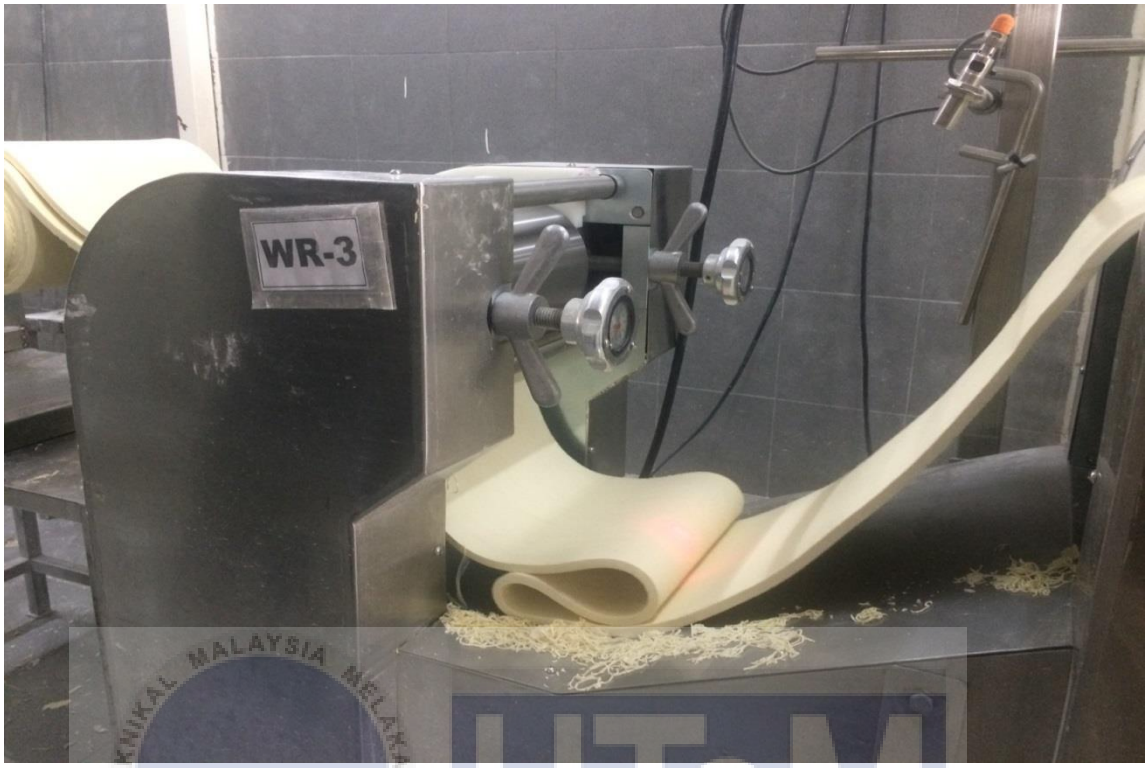
APPENDIX

Warehouse in factory

Yee Mee packaging box 10x375g



Yee Mee temperature setting



Wantan Mee/Yee Mee dough

Operator not fully cover hair and hand

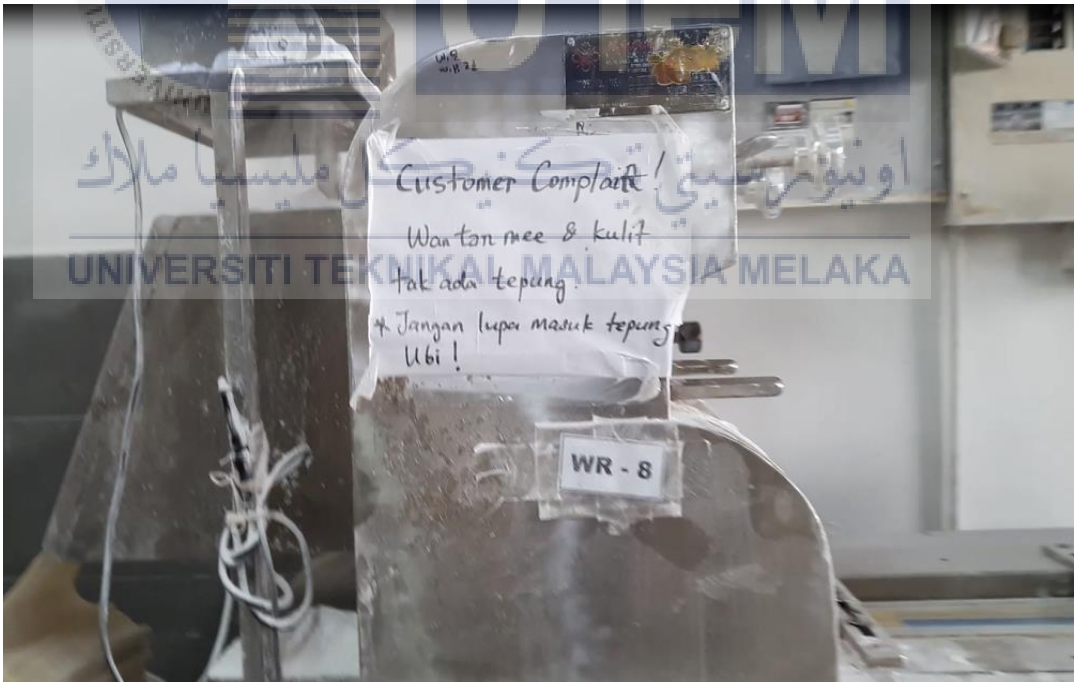
Shoes not cover, sand can enter in dough

Example Appropriate Apron fully cover in Food Industries

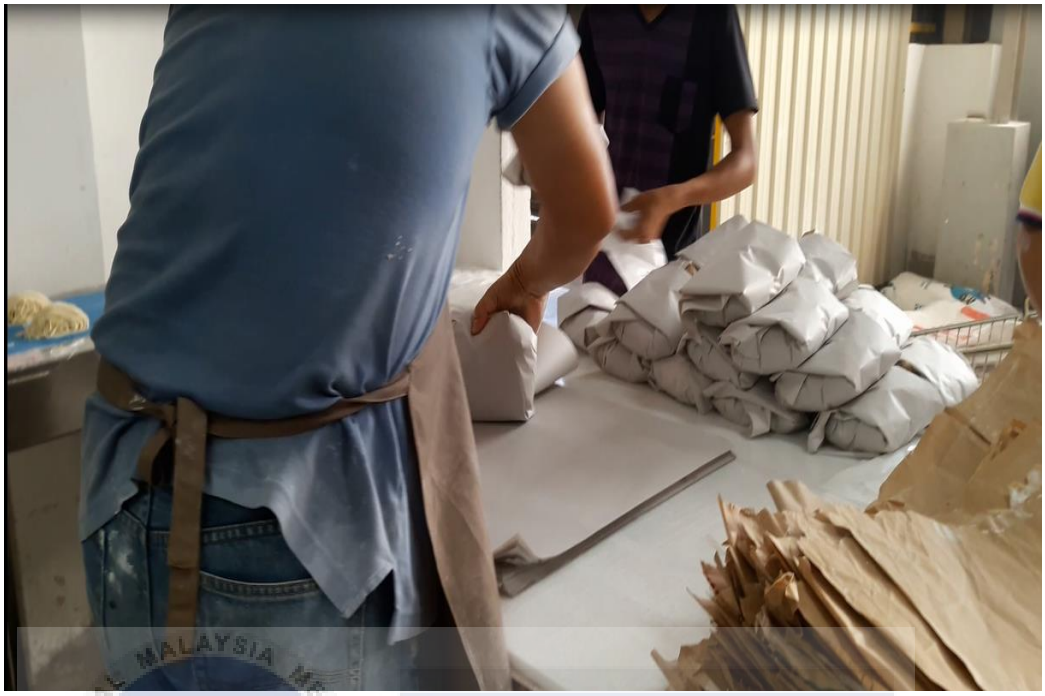
Working environment

Yee Mee Production Line (Bottleneck)

Ingredient preparation space



Customer complain due to human mistake



Wantan Mee wrapwith paper then packaging with yellow plastic and label with marker pen

Wind spray for Wantan Mee cutting tool

A. PROJECT PLANNING

List down the main activity for the project proposal. State the time frame needed for each activity.

Project Activity	(PSM 1) 2016																				(PSM 2)2016																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Journal	BP Briefing							Mid Term Break								Study Week	Final Semester Examination		Semester Break									Mid Term Break							Study Week	Final Semester Examination		
2. Proposal																																						
3. Chapter 2 : Literature Review																																						
4. Chapter 1 : Introduction																																						
5. Chapter 3 : Methodology																																						
6. Presentation PSM 1 and send report																																						
7. Direct Industry																																						
8. Chapter 4 : Result and discussion																																						
9. Implement Poka Yoke																																						
10. Chapter 5: Conclusion and Recommendation																																						
11. Full Documentation																																						
12. Project presentation																																						

CHECKLIST FOR SAFETY AND HOUSEKEEPING

Machine : ~~3~~ 3

Product : YM, WM

Operator : Keshar

Date : 24/10 – 29/10

No	TASK	M (24)	T (25)	W (26)	T (27)	F (28)	S (29)	REMARKS
1.	Wear appropriate clothing (apron, net cap, shoes).				✓	/	/	NOT FULLY COVER
2.	There are no unnecessary items in the work area.		✓	✓	✓	/	/	
3.	Work area is clean and tidy.		✓	✓	✓			
4.	Clean the ingredient container.				✓			
5.	Machine and equipment are in place and secure.		✓	✓	✓	/	/	
6.	Tools are in good condition and in their location.		✓	✓	✓	/	/	
7.	Cleaning the cutting tool before and after using it.	/	✓	✓	✓	/	/	
8.	Throw away the eggshell or other that have been used in space provided.	/	✓	✓	✓	/	/	
9.	After done process, clean the machine using sprayers wind	/	✓	✓	✓	/	/	
10.	Throw trash into garbage bin at outside production.				✓			

Check by :

.....

(Supervisor)

CHECKLIST FOR SAFETY AND HOUSEKEEPING

Machine : 3 Operator : Bahadur & Keshar

Product : WM Date : 31/10 — 5/11

No	TASK	M (31)	T (1)	W (2)	T (3)	F (4)	S (5)	REMARKS
1.	Wear appropriate clothing (apron, net cap, shoes).	✓	✓	/	/	/	✓	NOT FULLY COVER
2.	There are no unnecessary items in the work area.	✓	✓	/	/	/	✓	
3.	Work area is clean and tidy.		✓	/	/	/	✓	
4.	Clean the ingredient container.	✓	✓	/	/	/	✓	
5.	Machine and equipment are in place and secure.	✓	✓	/	/	/	✓	
6.	Tools are in good condition and in their location.	✓	✓	/	/	/	✓	
7.	Cleaning the cutting tool before and after using it.	✓	✓	/	/	/	✓	
8.	Throw away the eggshell or other that have been used in space provided.	✓	✓	/	/	/	✓	
9.	After done process, clean the machine using sprayers wind	✓	✓	/	/	/	✓	
10.	Throw trash into garbage bin at outside production.		✓			/		

Check by :

.....

(Supervisor)

CHECKLIST FOR SAFETY AND HOUSEKEEPING

Machine : 4 Operator : Kamil

Product : Yee Mee Fried Date : 7/11 – 10/11

No	TASK	M	T	W	T	F	S	REMARKS
1.	Wear appropriate clothing (apron, net cap, shoes).	/	/	/	/	/	/	ok
2.	There are no unnecessary items in the work area.	/	/	/	/	/	/	
3.	Work area is clean and tidy.	/	/	/	/	/	/	
4.	Clean the ingredient container.	/	/	/	/	/	/	
5.	Machine and equipment are in place and secure.	/	/	/	/	/	/	
6.	Tools are in good condition and in their location.	/	/	/	/	/	/	
7.	Cleaning the cutting tool before and after using it.	/	/	/	/	/	/	
8.	Throw away the eggshell or other that have been used in space provided.	/	/	/	/	/	/	
9.	After done process, clean the machine using sprayers wind	/	/	/	/	/	/	
10.	Throw trash into garbage bin at outside production.	/	/	/	/	/	/	

Check by :

.....

(Supervisor)

CHECKLIST FOR SAFETY AND HOUSEKEEPING

Machine : 3 Operator : Bakadur

Product : YM Date : 14/11 – 19/11

No	TASK	M	T	W	T	F	S	REMARKS
1.	Wear appropriate clothing (apron, net cap, shoes).	✓	✓	✓	✓	✓	✓	ok
2.	There are no unnecessary items in the work area.	✓	✓	✓	✓	✓	✓	
3.	Work area is clean and tidy.	✓	✓	✓	✓	✓	✓	
4.	Clean the ingredient container.	✓	✓	✓	✓	✓	✓	
5.	Machine and equipment are in place and secure.	✓	✓	✓	✓	✓	✓	
6.	Tools are in good condition and in their location.	✓	✓	✓	✓	✓	✓	
7.	Cleaning the cutting tool before and after using it.	✓	✓	✓	✓	✓	✓	
8.	Throw away the eggshell or other that have been used in space provided.	✓	✓	✓	✓	✓	✓	
9.	After done process, clean the machine using sprayers wind	✓	✓	✓	✓	✓	✓	
10.	Throw trash into garbage bin at outside production.	✓	✓	✓	✓	✓	✓	

Check by :

.....

(Supervisor)

CHECKLIST FOR SAFETY AND HOUSEKEEPING

Machine : 3 Operator : Kalaivar

Product : YM, K, WM Date : 25/11 – 26/11

No	TASK	M	T	W	T	F	S	REMARKS
1.	Wear appropriate clothing (apron, net cap, shoes).	/	/	✓	✓	✓	✓	ok
2.	There are no unnecessary items in the work area.	/	/	✓	✓	✓	✓	
3.	Work area is clean and tidy.	/	/	✓	✓	✓	✓	
4.	Clean the ingredient container.	/	/	✓	✓	✓	✓	
5.	Machine and equipment are in place and secure.	/	/	✓	✓	✓	✓	
6.	Tools are in good condition and in their location.	/	/	✓	✓	✓	✓	
7.	Cleaning the cutting tool before and after using it.	/	/	✓	✓	✓	✓	
8.	Throw away the eggshell or other that have been used in space provided.	/	/	✓	✓	✓	✓	
9.	After done process, clean the machine using sprayers wind	/	/	✓	✓	✓	✓	
10.	Throw trash into garbage bin at outside production.	/	/	✓	✓	✓	✓	

Check by :

.....

(Supervisor)