



IMPROVEMENT IN THERMAL PRINTER LINE PRODUCTION BY USING KAIZEN METHOD.

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

by

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DECLARATION

I hereby, declared this report entitled “Improvement in Thermal Printer Line by using Kaizen Method” is the results of my own research except as cited in reference.

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of Universiti Teknikal Malaysia Melaka as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering

The members of the supervisory committee are as follow:

.....
(DR. ZULKEFLEE BIN ABDULLAH)

ABSTRAK

Dalam kajian ini, kaedah Kaizen merupakan salah satu pendekatan alternatif untuk meningkatkan produktiviti dalam barisan pengeluaran. Tujuan penyelidikan ini adalah untuk mengkaji pelaksanaan Kaizen di industri Malaysia dan merekabentuk gelang motor dulang baru memandangkan permintaan ALPS Electric Sdn Bhd memenuhi permintaan pengendali syarikat. Skop kajian ini adalah untuk merekabentuk produk yang diminta, reka bentuk konseptual terbaik dipilih dengan menggunakan teknik pemilihan utama yang berkaitan dengan proses kejuruteraan serentak. Reka bentuk produk konseptual terbaik dalam perisian Computer Aided Design (CAD) melalui Solidwork. Skop ini juga termasuk penggunaan Additive Manufacturing (AM) yang dikenali sebagai 3D (Tiga Dimensi) Printing atau Rapid Prototyping (RP) untuk menghasilkan reka bentuk konseptual baru produk tertentu yang diminta. Untuk menentukan sama ada dengan menggunakan kaedah Kaizen ini berjaya atau tidak, data masa kitaran proses pemasangan 3, pemasangan 4 dan pemasangan 5 adalah rekod sebelum dan selepas pemasangan dulang baru dan slider motor baru. Penyelidikan ini tidak memerlukan sebarang modal atau kos buruh dalam menghasilkan produk tertentu yang diminta kerana syarikat ini menyediakan semua alat dan mesin untuk menghasilkan dulang baru dan slider motor baru dengan menggunakan model pencetak 3D ANCUBIC 13MEGA.

ABSTRACT

In this research, Kaizen method is one of the alternative approach to improve productivity in production line. The purpose of this research is to study the implementation Kaizen in Malaysia industry and design a new tray motor slider as ALPS Electric Sdn Bhd request fulfill the company's operators' demand. The scope of this research is to design the particular requested product, the best conceptual design is selected by applying key selection techniques that related to the concurrent engineering process. Design the best conceptual product in Computer Aided Design (CAD) software via Solidwork. The scope also include the uses Additive Manufacturing (AM) known as 3D (Three Dimension) Printing or Rapid Prototyping (RP) to produce the new conceptual design of particular product requested. In order to specify whether by applying this Kaizen method is successful or not, data of the cycle time of process assembly 3, assembly 4 and assembly 5 is record before and after installation of new tray and new motor slider. This research did not require any capital or labor cost in producing the particular product requested because this company provided all tool and machine to produce the new tray and new motor slider by using 3D printer model ANCUBIC 13MEGA.

DEDICATION

TO MY BELOVED FAMILY,

My mom Aisah Binti Md Daud, my brothers Shaharudin, Syazwan, Nizam, my little brother
Roshidi

For their support in my whole life through moral and financial.

TO MY HONOURED SUPERVISOR,

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For his advices, support, motivation and patience during completion of this project

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For their cooperation and advices to complete this project

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LIST OF ABBREVIATION

SME	Small Enterprise Manufacturing
AM	Additive Manufacturing
3D	Three Dimensional
RP	Rapid Prototyping
CAD	Computer Aided Design
FYP 1	Final Year Project One
QFD	Quality Function Deployment
HoQ	House of Quality
AHP	Analytical Hierarchy Process
FYP 2	Final Year Project Two
STL	Stereolithographic
CI	Continuous Improvement'
CNC	Computer Numerical Control
ASCII	American Standard Code for Information Interchange
Assy 3	Assembly Three
Assy 4	Assembly Four
Assy 5	Assembly Five
PLA	Polylactic Acid
PF	Priority Factor
CD 1	Conceptual Design One
CD 2	Conceptual Design Two
TCT	Target Cycle Time
LCT	Longest Cycle Time
5S	Five Sort, Set, Shine, Standardize, Sustain

CHAPTER 1

INTRODUCTION

Continuous improvement on production line based on Kaizen method is no longer a new thing to industry of manufacturing. The worldwide take this opportunity to improve the productivity in the company and gain profit. Besides that, Kaizen is one of an approach to reduce all the waste and losses of production.

1.1 Research Background.

Nowadays, most of manufacturing industry more focus on improving the production performance in the term of productivity output in order to survive in a competitive market (Azizi, 2015). A case study is conduct of a company in Pahang, Malaysia start on 10 February 2018. The company is a Japanese company, but is led by a local director. This company manufactures semiconductor products and supply in all around the world. This company wants to improve the productivity of the thermal printer line. The production of thermal printer line production has remained the same for past three years. Therefore, this company wants to improve the production line by applying the Kaizen method.

Most of company in Malaysia poorly applies the Kaizen method in production line, especially Small Enterprise Manufacturing (SME). Kaizen was initially led by Toyota Motor Company as one of the effort in order to improve the productivity after World War II. By applying Kaizen in their automotive industry can emphasize the incremental change by low cost spent, since economy condition of Japan itself is unstable after the World War II. Kaizen is the

best solution for better improvement in the standard way of work through benchmarking. (Maarof & Mahmud, 2016)

Additive Manufacturing (AM) is also known 3D (three dimensional) or Rapid Prototyping (RP) is used to conduct this case study. The term of AM is referring to the advanced technology or an additive process depicts the growing of AM recently. RP also is known as a quick process to create a model or prototype and mostly have a very good surface finish. This finish good create a lot of benefit to all manufactures industry. It prevents the repetitive work and save a lot of cost and time. For the last few years, most of the manufacturing industry embraces this AM technologies to enjoy a lot of benefits from the investment of buying the RP machine and install into the company. By comparing this technology to the traditional manufacturing one, this AM have advantages because the old one create a lot of inventory and waste a lot of time. By rework. Approachable of this AM growing robustly the business market in manufacture industry (Attaran, 2017).

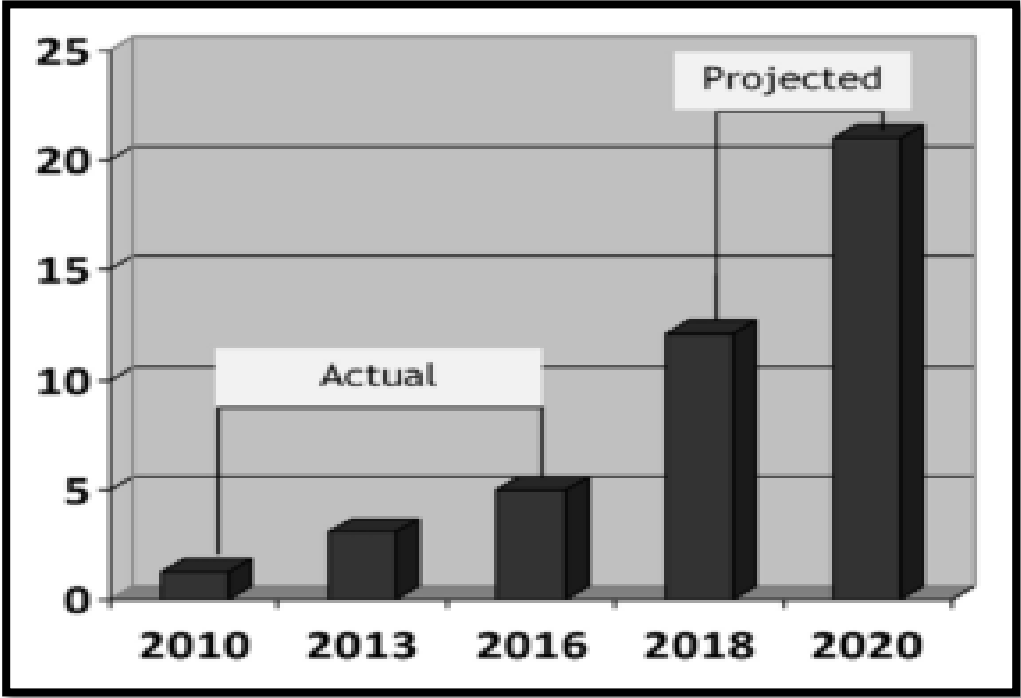


Figure 1.1: Additive Manufacturing worldwide revenue.(Attaran, 2017).

1.2 Problem Statement

According to (Maarof & Mahmud, 2016), there are a limited number of study and implementation of Kaizen in Malaysian industry. A study had found that, there's a lot of challenges to implement Kaizen such as confusion in order to maintain the continuous improvement and dealing with immature worker. Several organizations faced failure during implement the Kaizen especially to motivate the worker to involve and participate in Kaizen activity. In addition, Kaizen activity provides a tiny reward or compensation. Lack of training in the proper way and lack of good understanding about Kaizen are the biggest challenge to implement Kaizen in certain industries.

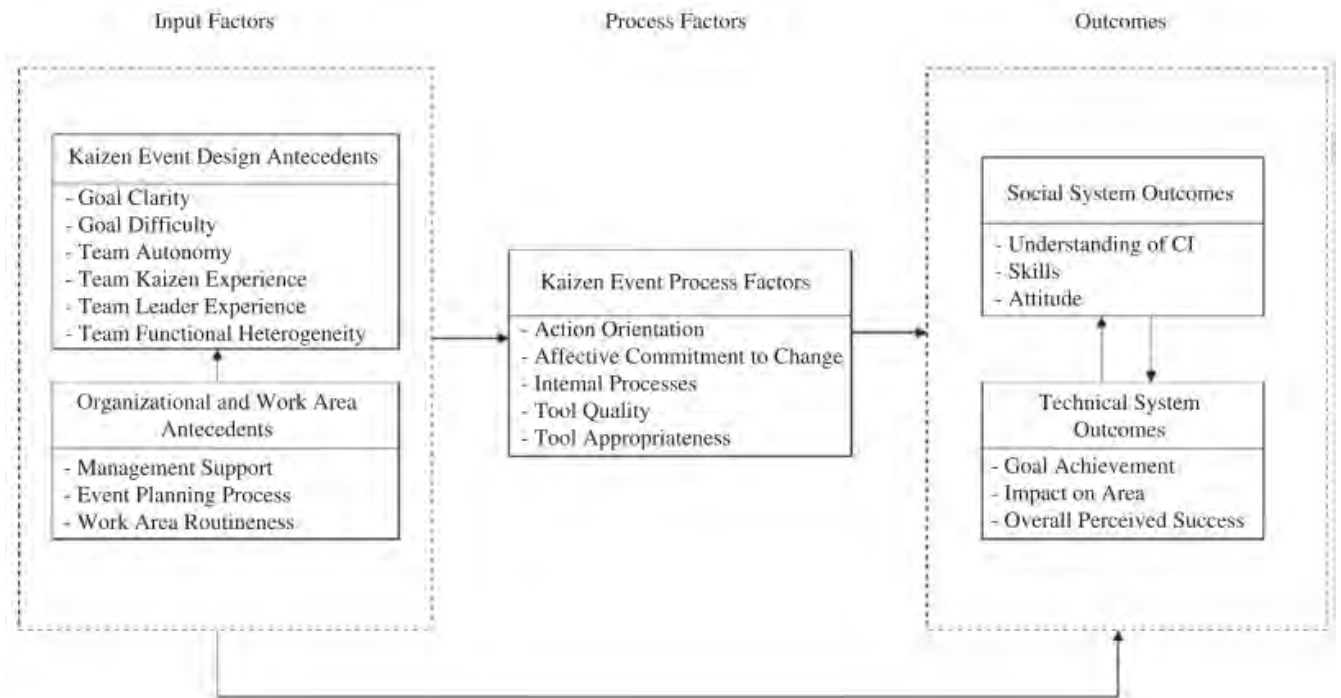


Figure 1.2: Initial research model (Farris, Aken, Doolen, & Worley, 2009).

In order to maintain the continuous improvement in the standard way of work to produce a product, the worldwide faced high competition in marketing. Most of manufacturing industries

began to realize that by implementing Kaizen a lot of advantages can be gained if the worker really work with endless effort in an organization (Boca, 2011). Most of SME in developing country start too aware about Kaizen because the economist had recognized the managerial capital is one of the factor associate with the enterprise productivity, development, growth and longevity. (Fujishima, Mori, Nishimura, & Ohno, 2017).

Alps Electric Sdn Bhd in Jengka Pahang Malaysia has requested to design a new finger friendly, tray and motor slider since the original tray and motor cases has a lot of problem with storing the production line of thermal printer components. The major purpose of designing a new tray and new motor slider is to prevent operators' take more than one part and fingertips stuck respectively. Besides, to improve the comfortability in the working environment of operator at once. The original tray did not have the criteria of finger friendly. The operator always mistaken to take more than one component at one time to assemble process of thermal printer. The operator has to put the excess part back to the original tray. That's the main problem which it's led to waste time by increasing the cycle time. Other than that, operators in thermal printer have multitasking work. Sometimes replacement the other operator work whenever the other operator an off day or have a break time. The operator has different size of fingertips. In order to help the other operator, stuck up fingertips on the original motor cases during process of assemble occur. Hence, the company takes an approach by request a new design of motor sliding.

1.3 Objectives

The objectives of this study are as follow:

- i. To study the implementation of the Kaizen method in Malaysia industry.
- ii. To apply the Kaizen method to improve the thermal printer production line.
- iii. To design a new tray that has criteria of one pick up point of component to assemble process of thermal printer.

- iv. To design a new motor slider that help solve operator's problem regarding fingertips access.

1.4 Scopes of Research.

The scopes of this research as follows.

- i. Applying key selection techniques and method that related to concurrent engineering process in Kaizen.
- ii. Design the conceptual tray and design in Computer Aided Design (CAD) via Solidwork software.
- iii. Produce the new design of tray and new design of motor slider prototype using 3D printer model ANCUBIC 13 MEGA.

1.5 Rational Research

The rational of this research is as follows.

- i. There are a limited number of studies of the implementation Kaizen method in Malaysia industry. The purpose this research is to multiply the number of studies about the implementation Kaizen method in Malaysia industry.
- ii. Specific information and deep understanding about the additive manufacturing such as 3D printing or Rapid Prototyping. Gather all the useful information about additive manufacturing.
- iii. Key selection techniques related to concurrent engineering process to choose the best conceptual design. Counted every demand criterion by operators.
- iv. Comparing the old cycle time with new the cycle time after installing the new tray and new motor slider. Obtain all the data and analyze.

1.6 Research Methodology

In Final Year Project One (FYP 1) the research have 5 parts. The first part are finding and collecting data about Kaizen method and Additive Manufacturing (AM) in literature review. The second part is proposing two conceptual design that meet the demand of operators. Third part is analyzing both conceptual design in Quality Function Deployment (QFD), House of Quality (HoQ) and Analytical Hierarchy Process (AHP). The fourth part is selecting the best conceptual design that fulfilled operators demand criterion. Finally start writing the report for FYP 1.

In Final Year Project Two (FYP 2), the research have 7 parts. The first part is designing the best selected design in Solidwork. The second part is converting from CAD software to stereolithographic (STL) file and print the design by using 3D printer. The third part is do the finishing to ensure the prototype have a good surface finish. The fourth part is installing the pat into the production line. The fifth part is recording the cycle time of assembly process and obtain the data. The sixth part is analyzing the result, discuss and compare to the previous cycle time. Finally start to write the report for FYP 2.

1.7 Thesis Organization

This thesis start of chapter 1. Chapter 1 begin with a research background, problem statement, objectives, scope of research, rational research, research methodology and end up by thesis organization. Chapter 2 consists of a literature review about Kaizen definition, Shewhart cycle, Kaizen format, Additive Manufacturing definition, eight generic AM process and benefits of AM in the industry. Chapter 3 consists of the flowchart of FYP 1 and FYP 2, step to determine the best conceptual design. Chapter 4 consists of discussion and result. Finally, Chapter 5 is the conclusion of the overall project.

1.8 Conclusion

As a conclusion, chapter 1 explained the fundamental issue of the project. Begin with research background which briefly described the background study of the industry. Followed by problem statement explained the current problem faced by industry. Continued by objective describe the aim and purpose of this research. Besides, scope of research included the things that covered in this research. Therefore, the rational research interpreted the reasons for conducting this research. Other than that, research methodology explained the method used to conduct this study in order to obtain the results. Lastly, the thesis organization represent the organization of this study from chapter 1 to chapter 5.

CHAPTER 2

LITERATURE REVIEW

This chapter has mainly described the theory and research which have been defined and done by different researchers in previous years. Related information of previous studies are extracted as references and discussion based on their exploration about Kaizen in production of industries.

2.1 Kaizen

Kaizen is popular among Western and Asian companies. It is a compound word involving two concepts: Kai (change) and Zen (for the better). The Japanese terms come from Gemba Kaizen meaning 'Continuous Improvement' (CI). Kaizen philosophy is broadly used by large industrial companies for the excellent of the production. It's an endless effort for improvement and makes everyone in the organization involved. (Singh & Singh, 2009).

The Gemba Kaizen implies continuous improvement that involved everyone such as managers and workers. It also required several costs for the implementation where the action or activity take place. Implementation studies based on Gemba Kaizen acclaimed that it was an interesting trend and increasing cases across the industries in particular, the service industries such as retail and health. A lot and various studies had explored numerous facets of continuous improvement to understand the waste reduction and large improvement in product quality. (Iberahim, H. Mazlinda, H. Marhainie M. D. Nur Hidayah, 2016).

Mostly company can be a constraint bankrupt by forceful contenders who have found an outside potential and abused this as a characteristic shortcoming in its objective organization. Plainly, survival and development also depends on how CI is coordinated towards essential business elements as the outside dangers and conceivable outcomes. Even if CI has been widely recognized for decades, CI still face many challenges. Even several of them still remain stable over years. (Hoem & Lodgaard, 2016).

In Malaysia economy, implementation among Small Company Enterprise (SME) is one of the major contribution development. The majority business entity in Malaysia was contributed by SME. According to (Maarof & Mahmud, 2016), average from 2010 to 2013 SMEs, more than 55 percent job opportunity was provided to Malaysian workforce. This condition shows a promising development of openings for work to be offered by the SMEs in Malaysia that could enable the Malaysian government to decrease the joblessness to rate in the nation. The implementation of Kaizen can be done through a cycle of Kaizen activity, also known as Shewhart Cycle.

2.1.1 Shewhart Cycle

Shewhart cycle is a Kaizen activity that uses method of quality management to improve a system or process.