Faculty of Manufacturing Engineering

QUALITY ENHANCEMENT IN PRODUCTION OF SAFETY PINS THROUGH THE IMPLEMENTATION OF KAIZEN ACTIVITY

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MASTER OF MANUFACTURING ENGINEERING
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A thesis submitted in fulfillment of the requirements for the degree of Masters of Manufacturing Engineering (Quality System Engineering)

Faculty of Manufacturing Engineering

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2018

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DECLARATION

I declare that this thesis entitled "Quality Enhancement in Production of Safety Pins through the Implementation of Kaizen Activity" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : Hozaifah Abdulaziz Alneaimi

Date : 17/2/2018

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APPROVAL

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

Signature : 

Supervisor Name : Associate Professor. Dr. Effendi Mohamad

Date : 17/2/2018

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DEDICATION

Abulaziz Alneaimi (my beloved father)

Mona Talalini (my beloved mother)

Obadah Abdulaziz Alneaimi

Hossam Abdulaziz Alneaimi

Huda Abdulaziz Alneaimi

Fatima Abdulaziz Alneaimi

Afaf Abdulaziz Alneaimi

Eng. Talha Kherfan

Eng.Ebrahim Hegaze

Assoc. Prof. Dr. Effendi Bin Mohamad (my supervisor)

All lecturers and staff of FKP UTeM

Universiti Teknikal Malaysia Melaka (UTeM)

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ABSTRACT

Kaizen Activities (KA) is one of Lean Manufacturing tools usually being used to eliminate or reduce waste in manufacturing industries. KA is a continuous improvement method which is dedicated to the improvement of productivity, efficiency, quality and, in general, of business excellence. This study was conducted to improve quality in a metal manufacturing company by implementing KA. The company produces sewing notions, garments and craft accessories such as safety pins, pearliest pins, ball pins, straight pins, sew-on press fasteners and many more. The main source of waste in the company is 70% rejected loads of safety pins per day due to some quality issues. Therefore, the main targets of this project are to identify the quality issues occurring in the production of safety pins, analyzing it using analysis methods, and implement KA to improve quality and reduce rejection rates. The methodology starts with dividing the manufacturing company into two departments which are pretreatment and posttreatment. KA is implemented in each department by which the existing problem is identified and analyzed. Once the causes of the problems are identified, solutions were generated followed by quality check tests to indicate any improvement. This study shows that the rejection in safety pin production was due to the rough point issue which is uneven surface on the tip of the safety pin. The root causes for this problem were dust on the wire of the safety pins and the inaccurately supplied voltage and current of the nickel plating tanks. The implementation of KA in this company has improved the production quality of the safety pins and reduce rejection from 70% to 40 % in less than a year. KA in the company is still ongoing as it is continuous improvement strategy to reach zero defects with the best quality result.

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CHAPTER 1

INTRODUCTION

1.0. Introduction

Mass production companies are producing millions of products every day which covers all our needs from the smallest products that we can carry with our hands to the largest products such as vehicles which can carry us from one place to another. Such big amount of massive production need continuous improvement activities to prevent any defect in the final product. In this project a continuous improvement activities will be applied to reduce waste and defect in its final product. In this chapter the problems that occur during the manufacturing phase will be explained as well as the main problem statement and later the objective of solving such an issue and last but least will come the scope of this project.

1.1. Background

The metal manufacturing company is a German company located in Melaka, Malaysia. Aside from their branch in Malaysia it has other branches in Europe and the USA. The company produces several types of metal products that can be used in our daily life such as safety pins, hand sewing needles, Hooks & Eyes, snap fasteners and straight pins. Basically the company produces all type of sewing and needlework products. The main targeted market of this company

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is the United States and Europe as well as Malaysia too. This project focus on safety pins' manufacturing process as shown in Figure1.1.

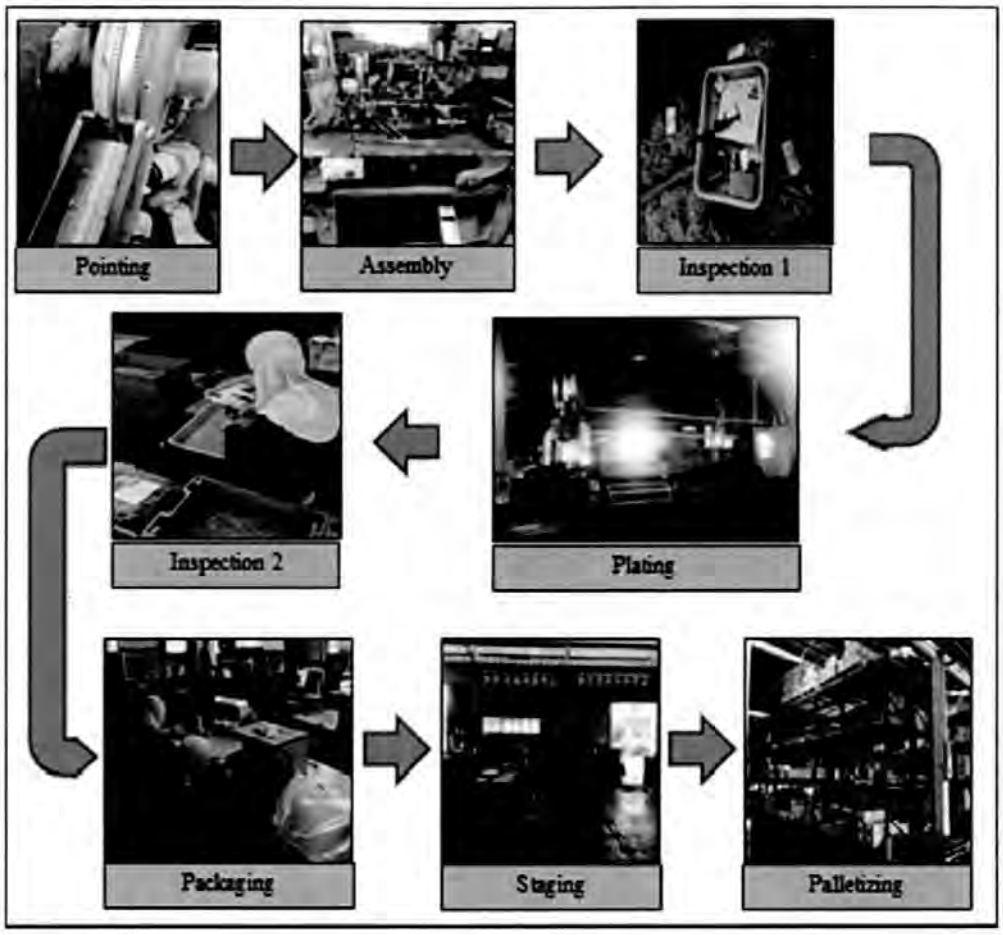

Figure 1.1: Manufacturing process flow of safety pins

The raw material used in safety pins production is stainless steel, brass and spring steel. The metal manufacturing company uses brass and steel in producing the safety pins. Brass is a companion of copper and zinc. Brass is the most expensive material used in the safety pins production. Brass's strength is suitable for all types of safety pins applications. Nowadays most of the safety pins manufacturing process is automatic. A specialized machine is used to perform all the steps needed to produce safety pins .therefore, workers are replaced, cost reduced and

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efficiency of manufacturing process is increased. First process to be done is to make the wire out of the pig iron, it will be molten in a high temperature and then formed into slabs in a method called pig as continuous casting. The molten steel then poured into a mold while the water jets cool down the metal in the same time a straightening rollers will form the mess into a bar called a billet until it will be cooled slowly. The cold metal then reshaped into a wire with different sizes.

The coil spring steel wire are to be placed into a spools and fed into the roll straighter where this machine's main job is to cut and straightens the wire in the desired length from a few millimeters to 10- 15 centimeter . The wire which is cut into pieces are carried by a cart to the point where it will meet the head of the safety pin. Inside this advanced machine the coiled wire and the sharpened, hooked will meet up with the cap. The cap then will be compressed around the hooked end of the wire where at this point the safety pin will be formed with a closed clasp as shown in Figure1.2.

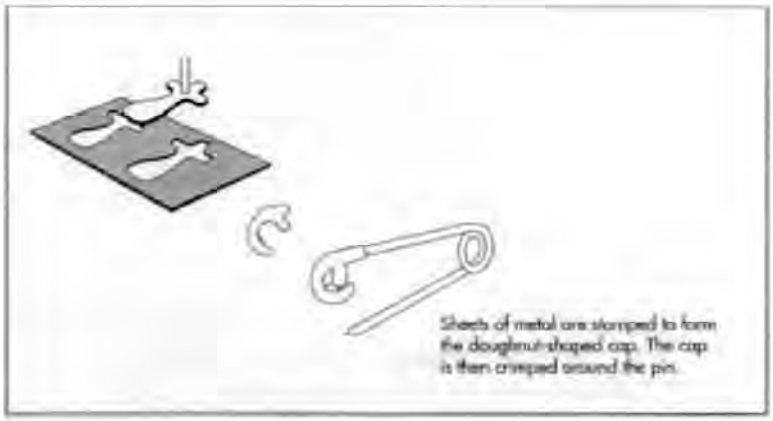

Figure 1.2: Safety pin assembly (Madehow, 2006)

The last point of manufacturing is the plating process where all the safety pins will pass by several tanks which will enhance the brightness and resistance of the safety pins. The process

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includes several stages which starts by washing the safety pins and then it will pass by electro cleaner and soak cleaner with a temperature up to 70 ° C and then to a nickel plating where the tank will be filled with special nickel sulfate solution supplied with high current which will pass by the surface of the safety pins forcing the nickel to stick to the surface of the safety pins (Madehow, 2006).

1.2. Problem Statement

The main problem happens during the nickel plating phase where the safety pins will have a shiny nickel cover. It will give the safety pins a better look but the problem is that during this phase the safety pins head will have a rough points which can only be felt by touching it. Consequently all of these safety pins will be rejected by quality check (QC) department which will increase the waste in general .The rejection of safety pins reach up to 70 percent due to rough points and some other quality (Figure1.3).

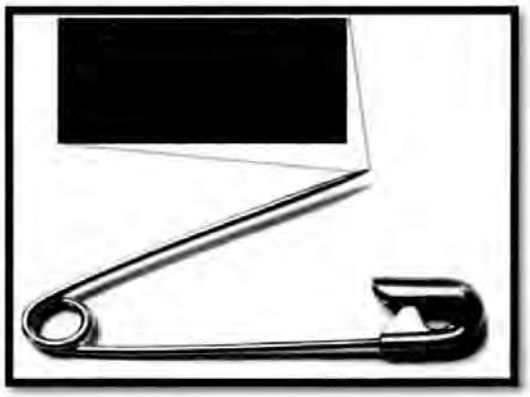

Figure 1.3: Rough Point

The problem occurs in line five process which is the final step of manufacturing where the safety pins will be washed and plated with nickel cover.

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1.3. Objective

The objectives of this project are:

a. To identify problems that occur in the head of safety pins.

b. To analyze problems that occur in head of safety pins.

c. To propose solutions by implementing Kaizen Activities (KA).

1.4. Scope

The manufacturing process of safety pins starts with the pointing process and finishes with the palletizing process (as mentioned in Section 1.1).This project focus on the pointing stage as well as line five process as where most of the rough points .

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CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

The chapter covers the discussion of literature reviews on Lean, Lean Manufacturing, Importance of Lean Implementation and its application. The advantages and disadvantages of using lean and the application of lean manufacturing tools. Further, this chapter will tackle about the literature reviews of Kaizen Activity since it will be used in the basis of this project. As well as Defining Problem & Gathering Data, Data Presentation & Analysis, Product Design and Development, Design Concept Evaluation which will be helpful in implementing Kaizen Activity in this project.

2.1 Lean

"Lean" is commonly defined as reducing waste or waste elimination. The word "lean" itself is, which, among other things, means "lacking richness, sufficiency, or productiveness.

Lean as defined by Womack and Jones (1994) as denotes a system that utilizes less, in terms of all inputs, to create the same outputs as those created by a traditional mass production system, while contributing increased varieties for the end customers. It manufactures only according to the needs of the customer, when it is needed and the number

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of market that requires it. The aim is to minimize the wastes by ensuring its highest quality and at its lowest cost as cited in Fawaz Abdullah, (2003).

Kerber and Dreckshage (2011) came with their own defined for lean as a philosophy that pursues to focus on flowing value to the customer, eliminate waste from all processes, right-size of the resources (machines, material, people, time, etc.) and also provide the tools for people to continually improve their work.

According to Agbulos and Abourizk, (2003), the research team from Toyota that leads by Taichi Ohno are the personal responsible that adapted the principles of lean thinking in LM philosophy. The research team is working on international auto production to reveal both the waste decline characteristic of Toyota's production system and to compare it with craft and mass forms of production. The basic philosophy of LM theory is the avoidance, elimination, or reduction of waste (i.e. failure to meet the unique requirements of a client).

According to Pettersen (2009), Lean is to reduce and eliminate waste and at the same time increase the product quality, reduce production cost and satisfy customer needs. Pettersen (2009) also found that according to his research, Lean is the same as Total Quality Management (TQM) but different in some elements. Based on Lean and TQM philosophy, the main ideas are common, to improve the current system. However, the operational level and fundamentals value of Lean and TQM are quite different, especially regarding humanistic values.

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2.1.1. Lean Manufacturing (LM)

LM organizations systematically eliminate waste from their processes in order to achieve the highest quality, faster delivery and best price for their customers. There are five principles of Lean Manufacturing as cited in the book Womack and Daniels Jones (1991), "Lean Thinking". Below principles as follows:

1. Specify Value as perceived by the Customer: producing products or providing services that is up to the standards, wants, and needs of the customers at the specific time and with the reasonable price.
2. Identify the Value Stream- by analyzing and improving the materials required to produce a product or service according to the needs and wants of the customers.
3. Make the Value Flow through the Value Stream. - Products should flow through a lean organization at an affordable rate that meets the needs of the customers.
4. Pull the Value from the Value Stream- producing products according to the demand of target market.
5. Strive for Perfection. - producing and providing quality products that meets their wants according to their preferences in an affordable price and with lesser waste.

It is used to define the aim of any lean system which is to "Clearly specify value in order to line up all the activities for a specific product (family) along a value stream and make the value flow smoothly at the pull of the customer in pursuit of perfection."

Kerber and Dreckshage (2001) found that lean has been defined in various words. They found that, according to APICS Dictionary 12th edition, LM is defined as a philosophy of production that emphasizes the minimization of the amount of all the resources (including

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times) used in the various activities of the enterprise. It involves identifying and eradicating non-value-adding activities in design, production, supply management, and dealing with customers. While Lean Lexicon 4th Edition defined LM as a business system for organizing and managing product development, operations, suppliers and customer relations that requires less human efforts, less space, less capital, less material and less time to produce or manufacture products with fewer defects to precise customer desires compared with previous system of mass production.

Feld (2001) stated that there are Five Primary Elements for LM and the elements are listed as below:

a. **Manufacturing Flow**: Addresses physical changes and design standards that are deployed as part of the cell

b. **Organizations**: Focusing on the identification of people's roles or functions, training in new ways of working and communications

c. **Process Control**: Monitoring, controlling, stabilizing and practicing ways to improve the process

d. **Metrics**: Addressing the visible, results-based performance measures, targeted improvement, and team rewards/recognition

e. **Logistics**: Provide definition for operating rules and mechanisms for planning and controlling the flow of material

While according to Feld (2001), there are three stages of LM Principles as an approach to LM in order to find or understand the current situation of the production or manufacturing before the implementation of Lean as shown in Figure 2.1.

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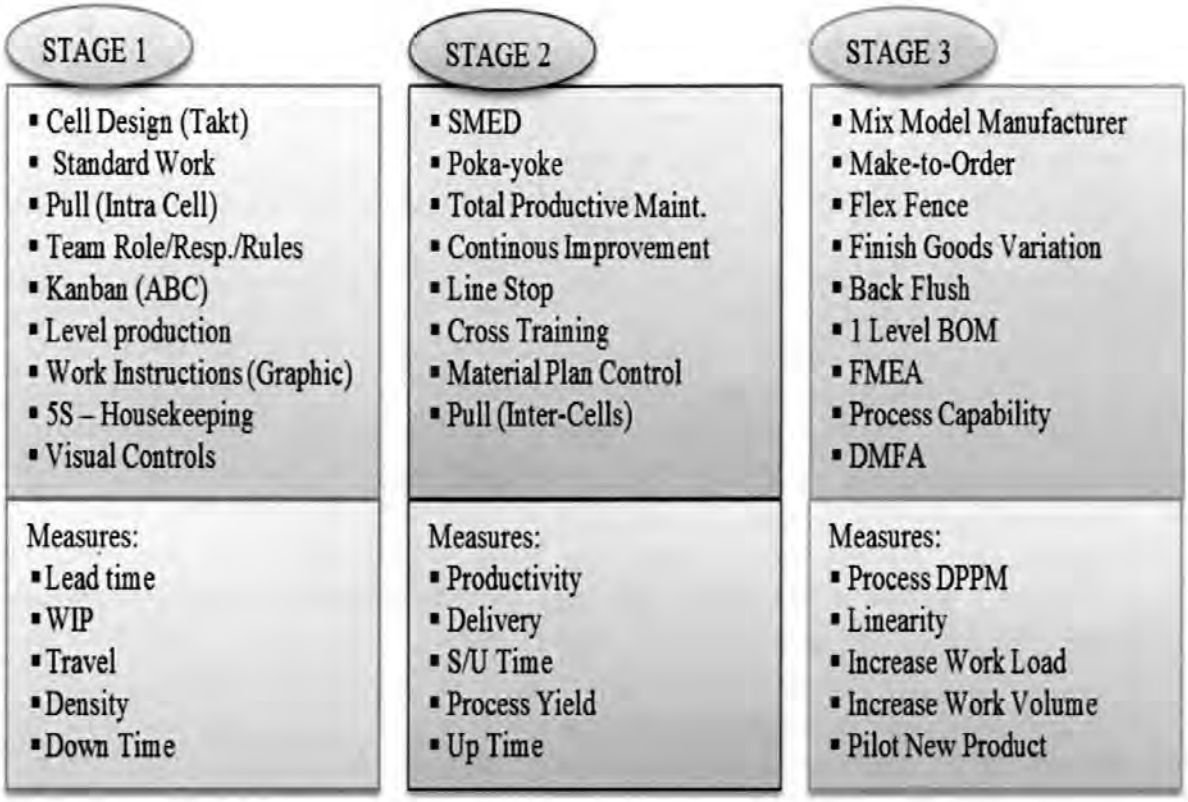

Figure 2.1: The Principle of LM (Feld, 2001)

2.1.2. Waste

According to Carvalho (2008) Waste is "Anything that does not add value from a customer perspective or the customer is not prepared to pay for". Waste or "muda", which is the key principle of Lean is the main problem in the company that resulting to operational inefficacy. According to Cudney et al. (2014) and Buggy and Nelson (2002) for the company to become efficient they should be able to identify wastes from their customer's perspective and determine how to eliminate it. There are 7 types of waste as shown on Table 2.1 below.

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Table 2.1: Type of Waste (Cudney et al. 2014)

Types of waste	Description
Overproduction	Excessive production of materials that surpass market demands resulting to a waste of time, materials, money, and manpower supply.
Waiting (time on hand)	Shortage of stocks, processing delays, equipment downtime which will use a lot of time by waiting that results to idle work time.
Unnecessary transport or conveyance.	Transporting unnecessary materials from one place to another will create a gap between works which can be a waste of time.
Over-processing or incorrect processing	Adding unnecessary procedures or steps in processing. Poor knowledge in processing the products resulting to inefficient works and producing defective and low quality products.
Excess inventory	Excess inventory resulting to waste, storage space problem, storage costs, reduce profits and deals.
Unnecessary movement	Unnecessary movements of employees while at work such as transferring from one place to another, searching for something, stacking parts, etc. can be consider a waste of time in the process.
Defects	Producing parts or correcting defective products will result to a waste of time, waste of materials, workforce and expenses.

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Such waste will increase cost and inefficiency in the process resulting to ineffective products which doesn't have any value in the manufacturing process (George, 2003) resulting to overproduction (Liker, 2004).

2.1.3. Importance of LM Implementation

Implementing LM allows the employees to act and think in decision making and to take full responsibility for their actions. LM can only be successfully implemented if there is an active involvement of the workers in the company.

Myerson (2012) found LM as a long-term health program for the company in order to make the company increasingly competitive in an unstable and generally challenging environment. Kerber and Dreckshage (2011) found that LM is being widely adopted by many companies because the companies use LM to:

a. Increase company velocity, cash flow, inventory turns, and profitability.

b. Decrease working capital.

c. Gain market share and also meet customer demands.

Besides that, Groover (2008) sees LM as one of the general approaches that are successfully being used to make sure the companies remain competitive in the global economy. Foo et al. (2013) found LM as one of the tools that will be able to help organizations in terms of operational improvement by eliminating waste without adding any real value to the service or product. The LM concept can be used everywhere, as long as there is a strong desire of showing better performance.

Lean thinking or principle is not only being applied in manufacturing industries, Lean also can be applied in service industries. Khodambashi (2014) in his research implemented

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