Analyzing Non-value Added Process In Order To Improve Layout Design At P211A Rear Bumper Production Area In Hicom Teck See.

SIVARAJAH A/L VEERAMONY

Report submitted to the Faculty of Manufacturing Engineering in
Partial Fulfillment of the Requirement for the
Degree of Bachelor Engineering Manufacturing Engineering

Faculty of Manufacturing Engineering
Universiti Malaysia Pahang

JUNE 2013

ABSTRACT

On this study, Hicom Teck See Sdn. Bhd has selected to make a case study for this project, Production line of P211A Front Bumper at Hicom Teck See has been selected. Even though many LPS tools are implemented at HTS in production line to achieve maximum production and reduce waste, there are some problem occur throughout the manufacturing process. Problems in terms of material handling, cross flow during production and higher distance between machines in production line has been identified. By using systematic layout planning (SLP) process tools, such as fish bone diagram, activity relationship diagram and operation chart this problem has overcome. The improved layout could reduce the excessive movement 34.65% from the old layout. Newly selected layout reduce from 202 meters to 132 meters. As a result new efficient layout design has carried out to reduce material handling distance, cross flow and total cycle time. In production line. At last the target of research has been achieved.

ABSTRAK

Toyota Production system (TPS) adalah dihasilkan daripada Toyota, idea asalnya adalah *just in time* (JIT) dimana ia adalah idea dari sakiichi toyoda, kinchiri toyoda dan jurutera mereka, taiichi Ohno.Tujuan utama sistem ini adalah untuk merekabentuk muda (pembaziran), mura (ketidakselarasan) dan muri (bebanan kerja) Di Malaysia system ini mula digunapakai di dalam industri automotif, terutamanya di Proton dan Perodua begitu juga dengan vendor-vendor mereka. Hicom Teck See (M) Sdn. Bhd. merupakan salah satu vendor Proton dan Perodua yang menghasilakan bahagian yang diperbuat daripada plastic seperti bumper depan. Pada kajian ini, Hicom Teck See Sdn. Bhd telah dipilih untuk membuat kajian kes bagi projek ini, Barisan Pengeluaran P211A Front Bumper di Hicom Teck See telah dipilih. Hicom Teck See adalah salah satu daripada pengeluar terbesar bagi bahagian-bahagian kereta. Walaupun banyak alat LPS dilaksanakan pada HTS dalam barisan pengeluaran demi mencapai pengeluaran maksimum dan mengurangkan sisa, terdapat beberapa masalah yang berlaku sepanjang proses pembuatan. Masalah dari segi pengendalian bahan, menyeberangi aliran semasa pengeluaran yang lebih tinggi dan jarak antara mesin dalam pengeluaran telah dikenal pasti. Dengan menggunakan systematic layout planningn (SLP), fish bone diagram, activity relationship diagram dan operation chart masalah ini telah diatasi. Susun atur yang lebih baik boleh mengurangkan pergerakan yang berlebihan 34.65% dari susun atur yang lama. Yang baru dipilih susun atur mengurangkan dari 202 meter kepada 132 meter.Reka bentuk susun atur yang cekap telah dijalankan untuk mengurangkan jarak pengendalian bahan, menyeberangi aliran dan jumlah masa kitaran. Selaras pengeluaran. Akhirnya sasaran penyelidikan yang telah dicapai.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

SLP	Systematic Layout Planning
JIT	Just In Time
HTS	Hicom Teck See
HMS	Hicom Management System
LPS	Lean Production System
MJEPA	Malaysia-Japan Economic Partnership Agreement
SWCT	Standard Work Combination Table
SWC	Standard Work Chart
TPS	Toyota Production System
WIP	Work In Progress

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

LPS was develop by Toyota or known as TPS (Toyota Production System), Kinchiri Toyoda and Taiichi Ohno had go to America to visit and observed what are the system used by ford to develop their production until they success, after visit the ford plat Kinchiiri Toyoda and Taichi Ohno not satisfy because they see a lot of car at ford inventory, and wait for customer to order. They were impressed when go to one shop known as piggly wiggly, they observed that the simple idea of an automatic drink resupplied; when the customer wants a drink, he takes one, and another replaces it the delegation was inspired by how the supermarket only reordered and restocked goods once they had been bought by customers. So they has used this system on their production and known as JIT (Just in Time). This system the subsequence work station withdraws the necessary product on the necessary quantities at the necessary time, (Miyazaki. S, 1996). The objective of TPS or the top of TPS house is to improve quality, reduce cost, and improve delivery time, employee involvement and high morale. TPS house has 2 pillars which is JIT and Jidoka. Jidoka is stop and identify the abnormalities. Figure 1.1 show house of TPS, which the the objective of this system to produce high quality of product with lowest cost to produce it and shortest lead time, have high morale of workers and safety work place.

Incorporated in 1991, HICOM-TECK SEE Manufacturing (M) Sdn. Bhd.(HTS) is part of DRB-HICOM group of companies. With 533 employees, HTS are the leading manufacturer of precision plastic injection mouldings for the Malaysian automotive industry.

Its subsidiary, HICOM Automotive Plastics (Thailand), started operation in 2003 to supply automotive plastic components for overseas market. HTS also has branch in Shah Alam, Tanjung Malim, and Pekan. HTS are accredited to ISO/TS16949 and EMS ISO 14001:2004 and was awarded the Automotive Component Manufacturer of the Year (Malaysia) in the 2008 ASEAN Automotive Awards by Frost & Sullivan.

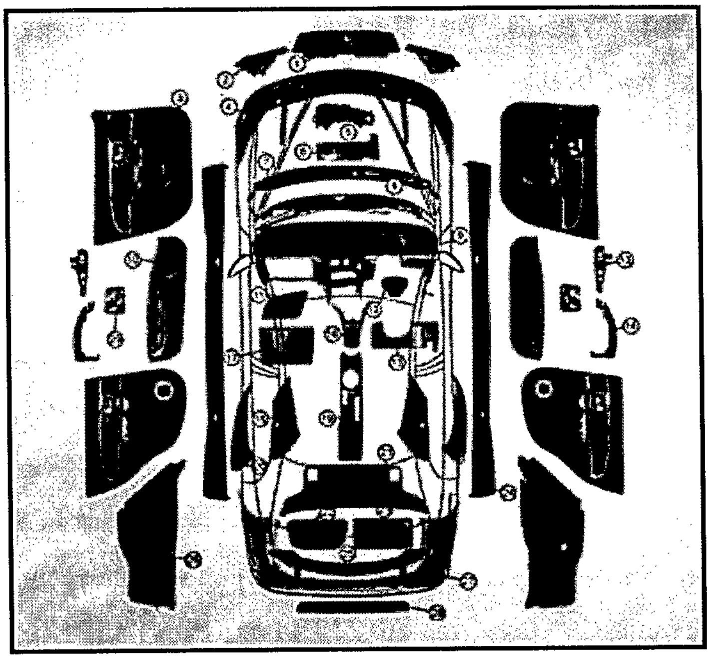


Figure 1.1: Example product produce by HTS

HICOM-TECK SEE has the capability to produce injection molded parts of up to 3000 tones clamping force. They specialize in Front Bumper Assembly, Bumper Impact Beam, Rear Bumper Assembly Instrument Panel, Bumpers, and various interior and exterior trim parts.

As a witness to their capability, they supply some of the biggest names in the automotive arena, both local and international. Their customer profile at present comprises the following companies; Proton, Perodua, Toyota, Isuzu, Brose, Honda, Nissan, Ford, Johnson Controls, and Calsonic Kansei.

Inefficient layout design has obtained high cycle time in production and lead to production did not achieve the target.

1. Why the non-value added process is too high?
2. Why the total production rate are at lowest pointer?
3. How to prevent non-value added process problem do not occur?
4. How to improve problem in process layout?

1.3 OBJECTIVE OF PROJECT

1. To reduce cross flow in material handling at production line.
2. To reduce the operation distance in layout design.
3. To study, analysis and propose ways in reduction of non-value added process and layout problem in order to achieve targeted production.
4. To propose a more efficient layout.
5. Identify and review the material handling problem.

1.4 SCOPE OF PROJECT

1. Area

   Area of study is at HTS which is a vendor to Proton and Perodua for automotive plastic components.

2. Tools use.

   The tools that will be used for this study is Flow chart, Histogram, Control Charts, Brainstorming, Ishikawa diagram, Time study , Motion Study and Action planning for failure mode.

CHAPTER 2

LITERATURE REVIEW

2.1 TOYOTA PRODUCTION SYSTEM

Toyota production system or TPS had been developed by Toyota. After World War II Japanese manufacturers were faced with vast shortages of material, financial, and human resources. These conditions resulted in the birth of the "lean" manufacturing concept (Womack et al., 1990). Kiichiro Toyoda, the president of Toyota Motor Company at the time, recognized that American automakers of that era were out-producing their Japanese counterparts by a factor of about ten this system usually apply by automotive industries. The oldest part on Toyota production system is 'jidoka', it developed by sakinchi toyoda on 1902. This concept pertains to notion of building in quality at the production process as well as enabling separation of man and machine for multi-process handling. Toyota developer, sakichi toyoda, his son, kinchiri toyoda and engineer taiichi ohno , These guys had gone to American to study the system that use by ford. But what they found, ford has a lot of car at their inventory. So this not impressed them, while they go to supermarket, these supermarket is known as piggly wiggy , they observed that the simple idea of an automatic drink resupplied; when the customer wants a drink, he takes one, and another replaces it the delegation was inspired by how the supermarket only reordered and restocked goods once they had been bought by customers. Toyota applied the lesson from Piggly Wiggly by reducing the amount of inventory they would hold only to a level that its employees would need for a small period of time, and then subsequently reorder. The principles underlying the TPS are embodied in Way. Production shop focus to use just in time concept among job that exists on manufacturing industry (Amasaka.k , 2007).

The main objective of TPS is to reduce muda (waste), mura (inconsistence) and muri (overburden). There are 7 type of waste that listed by TPS, there are transportation, overproduction, over processing, waiting, movement, defect and inventory. While mura (inconsistence), when doing something, the job must be consistence, example operator collect a part that come out from injection moulding machine, then need to collect before put into polybox. So they need to collect 5 part before put the part into polybox, to make it consistence, they need to make sure the part is 5 units of parts before put the part into polybox. And muri (overburden) is more related to operator, they operator shouldn't to a job that are dangerous and heavy. Figure 2.1 show house of TPS, the top of TPS house is improve quality, reduce cost, and improve delivery time, employee involvement and high morale. Then it has two pillars, which is JIT and Jidoka. Jidoka is stop and identify the abnormalities.

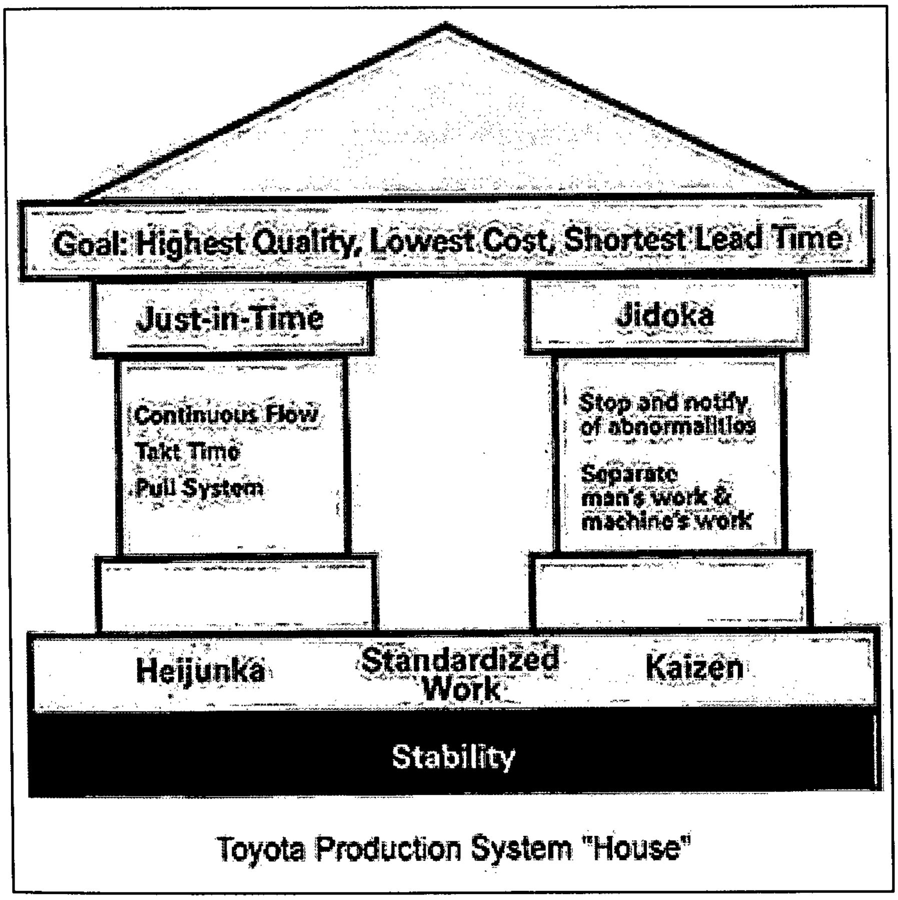


Figure 2.1: House of TPS

Toyota production system “house” consist a few part. the initial concept came from the invention of the automatic loom that allowed the loom to stop as soon as the thread would break, allowing one worker to support 12 machines instead of just one dramatically dropping the cost of weaving. Jidoka also consist a few elements such as andon , andon is an information tool which provides instant visible and audible warning to the operators team that there is an abnormality within that area, then poka yoke, Japanese term that means "fail-safing" or "mistake-proofing", Its purpose is to eliminate product defects by preventing, correcting, or drawing attention to human errors as they occur. Next is automatic stop, this mean if there any problems at production line, the operator will pull a tool that can stop the line, so the line will automatically stop and they can identify and repair the problem. Next person machine separation or automation, It may be described as "intelligent automation" or "automation with a human touch (Taiichi Ohno, 1988). After that in station quality control, this mean the part that come out from a station must be check before the part go to other station. And lastly are 5 why’s, the 5-Why analysis method is used to move past symptoms and understand the true root cause of a problem, asking why for 5 times can solve the problem because we can identify the root causes (Taiichi Ohno,1988). Next is pull system, this system will reducing stocks because they try to eliminate queues, not provide for them (M.C Bonney , Zongmao Zhang, M.A Head, C.C Tien, R.J Barson, 1999). Toyota only produce what customer order, they don’t make an inventory for the car. After that quick change over or single minute exchange die (SMED), SMED is rapid changing for next product, this can reduce production lot size and thereby improve production flow. And lastly is integrated logistics, is an integrated approach to the management of logistic disciplines in the military, similar to commercial product support or customer service organizations.

For JIT pillar also has a few elements, first is cycle time, cycle time is the maximum allowable time in order to meet demand, Cycle Time is the pace by which product is produced and must fall within the Cycle Time or set equal to the Cycle time; if not, then there will be customer demand that might go unfulfilled (Ana,.R, 2008). Second is continuous flow, produces a part via a just-in-time and kanban production approach, and calls for an ongoing examination and improvement efforts which ultimately requires integration of all elements of the production system.

At the bottom of the house is heijunka, standardized and kaizen. And to support the entire element it needs stability. Heijunka is leveling; ideally production can easily be leveled where demand is constant but in the real world where actual customer demand appears to fluctuate two approaches have been adopted in lean: Demand leveling and production leveling through flexible production. While kaizen (continuous) improvement, is as a key factor in the economic success of Japanese industries. With "traditional" techniques such as quality circles (or small-group activity) and management circles (plan-do-check-act), kaizen may turn a profitless company into a profitable one without an enormous investment in equipment (Lyu, J.R, 1996).

2.2 PLAN LAYOUT

The importance of a layout would be better appreciated if one understands the influence of an efficient layout on the manufacturing function: it makes it smooth and efficient. Operating efficiencies, such as economies in the cost of handling materials, minimization of production delays and avoidance of bottlenecks all these depend on a proper layout. An ideally laid out plant reduces manufacturing costs through reduced materials handling, reduced personnel and equipment requirements and reduced process inventory (Sree Rama Rao, 2006). The objectives or advantages of an ideal layout are outlined in the paragraphs that follow. The advantages are common to all the plants, irrespective of age; and whether a plant employs 50 workers or 50,000 makes no difference in so far as the applicability of the plant layout advantages is concerned. Some of these advantages are:

2.2.1 Economies in Handling

Nearly 30% to 40% of the manufacturing cost is accounted for, by materials handling. Every effort should, therefore, be made to cut down on this cost. Long distance movements should be avoided and specific handling operations must be eliminated. A cynic may say that the cheapest way to handle materials is not to handle them at all. But, in a factory, materials have to be handled; and therefore, it all depends on the layout.

2.2.2 Effective Use of Available Area

Every inch of the plant area is valuable, especially in urban areas. Efforts should therefore be made to make use of the available area by planning the layout properly. Some steps for achieving this end are: location of equipment and services in order that they may perform multiple functions; development of up-to-date work areas and operator job assignments for a full utilization of the labor force.

2.2.3 Minimization of Production Delays

Repeat orders and new customers will be the result of prompt execution of orders. Every management should try to keep to the delivery schedules. Often, the deadline dates for delivery of production orders are a bug-a-boo to the management. Plant layout is a significant factor in the timely execution of orders. An ideal layout eliminates such causes of delays as shortage of space, long-distance movements of materials, spoiled work and thus contributes to the speedy execution of orders.

2.2.4 Improved Quality Control

Timely execution of orders will be meaningful when the quality of the output is not below expectations. To ensure quality, inspection should be conducted at different stages of manufacture. An ideal layout provides for inspection to ensure better quality control.

2.2.5 Minimum Equipment Investment

Investment on equipment can be minimized by planned machine balance and location, minimum handling distances, by the installation of general purpose machines and by planned machine loading. A good plant layout provides all these advantages.

2.2.6 Avoidance of Bottlenecks

Bottlenecks refer to any place in a production process where materials tend to pile up or are produced at a speed, less rapid than the previous or subsequent operations. Bottlenecks are caused by inadequate machine capacity, inadequate storage space or low speed on part of the operators. The results of bottlenecks are delays in productions schedules, congestion, accidents and wastage of floor area. All these may be overcome with an efficient layout.

2.2.7 Better Production Control

Production Control is concerned with the production of the product of the right type, at the right time and at a reasonable cost. A good plant layout is a requisite for good production control and provides the production control officers with a systematic basis upon which to build organization and procedures.

2.3 TIME STUDY

Time study is a direct and continuous observation of a task, using a timekeeping device (e.g., decimal minute stopwatch, computer-assisted electronic stopwatch, and videotape camera) to record the time taken to accomplish a task and it is often used when, there are repetitive work cycles of short to long duration, wide variety of dissimilar work is performed, or process control elements constitute a part of the cycle. The Industrial Engineering Terminology Standard defines time study as "a work measurement technique consisting of careful time measurement of the task with a time measuring instrument, adjusted for any observed variance from normal effort or pace and to allow adequate time for such items as foreign elements, unavoidable or machine delays, rest to overcome fatigue, and personal needs.

The systems of time and motion studies are frequently assumed to be interchangeable terms, descriptive of equivalent theories. However, the underlying principles and the rationale for the establishment of each respective method are dissimilar, despite originating within the same school of thought. The application of science to business problems, and the use of time-study methods in standard setting and the planning of work, was pioneered by Frederick Winslow Taylor. Taylor liaised with factory managers and from the success of these discussions wrote several papers proposing the use of wage-contingent performance standards based on scientific time study. At its most basic level time studies involved breaking down each job into component parts, timing each part and rearranging the parts into the most efficient method of working. By counting and calculating, Taylor wanted to transform management, which was essentially an oral tradition, into a set of calculated and written techniques. Taylor and his colleagues placed emphasis on the content of a fair day's work, and sought to maximize productivity irrespective of the physiological cost to the worker. For example, Taylor thought unproductive time usage (soldiering) to be the deliberate attempt of workers to promote their best interests and to keep employers ignorant of how fast work could be carried out. This instrumental view of human behavior by Taylor prepared the path for human relations to supersede scientific management in terms of literary success and managerial application (Matthew P. Stephens, 2012).

The time study procedure has been reduced to 10 steps, and the time study form has been designed to help the time study technologist perform the 10 steps in the proper sequence. This section is organized according to the following 10 sequential steps.

Step 1 : Select the job to study
Step 2 : Collect information about the job
Step 3 : Divide the job into elements
Step 4 : Do the actual time study
Step 5 : Extend the time study
Step 6 : Determine the number of cycle to be timed
Step 7 : Rate, Level, and Normalize the operator's performance
Step 8 : Apply allowancee
Step 9 : Check for logic
Step 10 : Publish the time standards

2.4 STANDARD WORK CHART

Standard work chart or SWC is a chart that explain the sequence that operator need to follow if there are working it one work station. This SWC only show the sequence on one work station only. Usually to start make an improvement, SWC must be create first to show the sequence and time of each operation and operator (Matthew P. Stephens, 2012). To build SWC there must have a few criteria that need been identify, there are

a. Takt Time

This is the rate at which products must be made in a process to meet customer demand. The formula to produce takt time is Customer demand divide to Working hours.

$$T = \frac{T_a}{T_d} \quad (2.1)$$

Where

T = Takt time, e.g. [minutes of work / unit produced]

T_a = Net time available to work, e.g. [minutes of work / day]

T_d = Time demand (customer demand), e.g. [units required / day]

But, as a vendor to Proton, the time demand must be working hours for customer working hours not Hicom teck see working hours.

b. Work sequence

Work sequence for the work station must be known and write, this is important to see the current sequence, because from the current sequence we Can identify the problem if cycle time of the process is higher than takt time. After we make an improvement we can see a difference sequence before and after improvement.

c. Standard inventory

Inventory is a finish good that store at the warehouse, where this part are preparation if the delivery for finish good product has a problem to deliver to customer, or there has a problem in production line that make the line stop, so production cannot continue and inventory can be used to settle this problem. Each company must have their own standard inventory so if there has a problem, finish good from inventory can be used.

To make standard work chart, some tools need to be ready, there are time study and standard work combination table. These tool need to be complete up before standard work chart have to make. There are Time study table and SWCT (Standard Work Combination Table).

a. Time study table

Time study were develop by Federick winslow Taylor, it's part of scientific management. It use to collect time based on operator movement, people that use this chart must identify the movement of operator (work element) first before they take time of each movement and recorded by stop watch, and the movement of operator must same from start until end of this process, figure 2.2 show the format that use by HTS to determine cycle time for a processes. The objective of time study is to determine time for a qualified worker to perform specified work under stated conditions and at a defined rate of working. On time study it has allowance as an extra time to give a relaxation to operator, or there has some interrupt when operator doing his work, the example of relaxation such as:

1. Recovery from the effort of carrying out specified work under specified conditions (*fatigue allowance*).
2. Attention to personal needs.
3. Adverse environmental conditions.
4. Others concerned with machine operations.

2.5 ISHIKAWA DIAGRAM

Ishikawa diagram or fish bone diagram are created by Kaoru Ishikwa (1968), this diagram is to show causes of a specific problem. Usually use to solve quality problem at factory to identify the main causes of a problem. On this diagram, causes are group into few type, there are:

1. Man
2. Method
3. Machine
4. Environment.

It firstly using on Kawasaki shipyard, because of shape it likes a fish bone from side, it also known as fish bone diagram. It was firstly used on 1960, and consider as one from 7 QC tools besides with the histogram, Pareto chart, check sheet, control chart, flowchart, and scatter diagram. Figure 2.2 shows example of Ishikawa diagram.

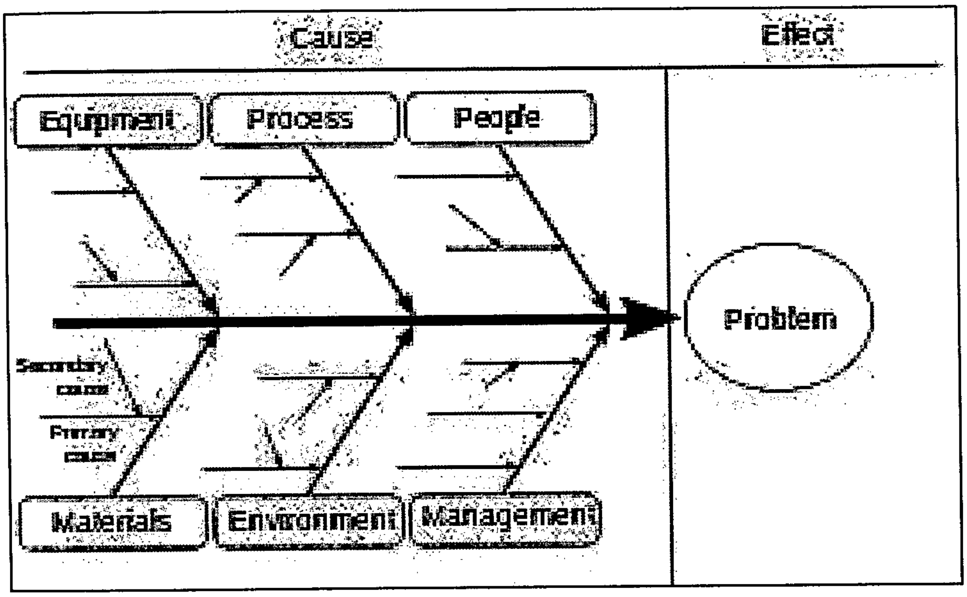


Figure 2.2: Example of Ishikawa diagram.

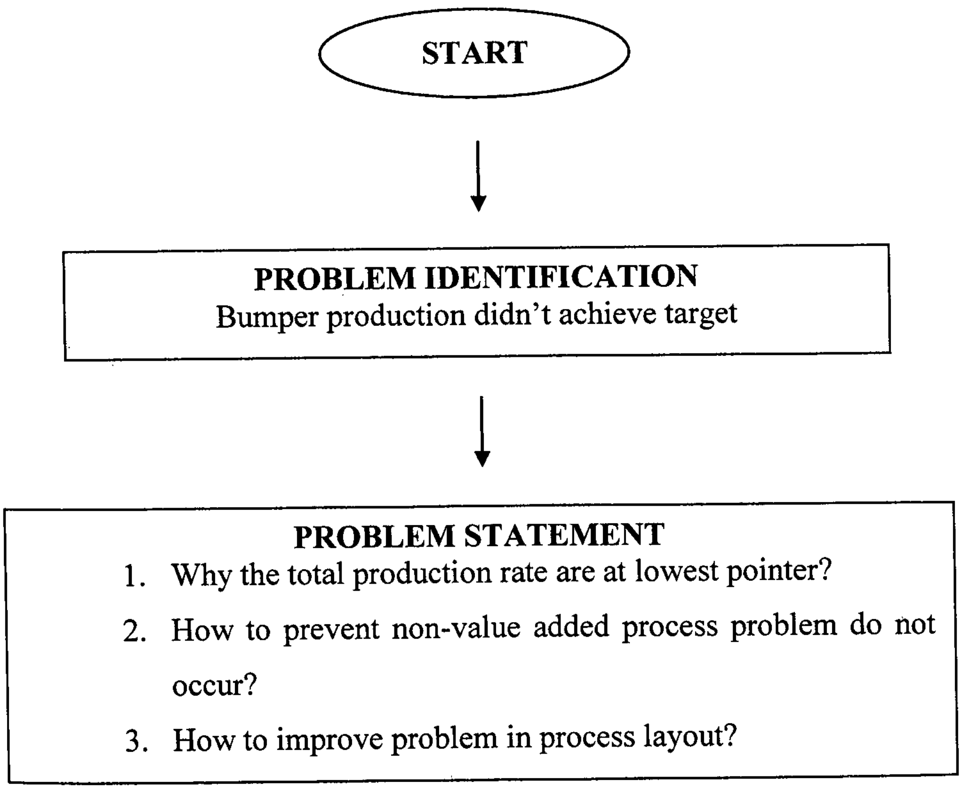
CHAPTER 3

METHODOLOGY

3.1 METHODOLOGY

Methodology is a process to make a study from beginning the study until the study is finish, it consist all step that required to make sure the objective of this study is complete and achieve, in this step all the study material will make the study easier. Figure below show the flow of this study.

3.2 FLOW CHART



↓

RESEARCH OBJECTIVE

1. To reduce cross flow in material handling at production line.
2. To reduce the operation distance in layout design.
3. To study, analysis and propose ways in reduction of non-value added process and layout problem in order to achieve targeted production.
4. To propose a more efficient layout.
5. Identify and review the material handling problem.

↓

DATA COLLECTION

1. Get a Operation Flow chart of P211A Rear Bumper Production
2. Identify non-value added processes in HTS company
3. Get layout plan of bumper production

↓

ANALYZE

6. Evaluate the SWCT sheet.
7. Brainstorming the layout design if HTS.
8. Analysis level of non-value added processes using fish bone diagram.

↓

CONCLUSION AND RECOMMEDATION

1. Give proposal for problem solution
2. Give an example of solution

↓

END