

#### TECHNICAL UNIVERSITY OF MALAYSIA MALACCA

# **An Analysis Incoming Quality Control Of Material in Manufacturing Company**

Project submitted in accordance with the requirements of the National Technical
University of Malaysia Malacca for the Degree of Bachelor of
Engineering (Honors) Manufacturing (Management)

By

Low Kuan Chuen

Faculty of Manufacturing Engineering
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#### **ABSTRACT**

Quality control of incoming materials is one of the important consideration for improving the quality performance and customer satisfaction of XX Company. This thesis would mostly concern in area of receiving incoming parts.

The methodology of this thesis is conducted to ensure the successive of thesis completion. The results of the data collection is related to the problem of incoming material issue through the data analysis by using quality techniques and tools approaches such as QC Tools and MIL-STD-105E for controlling incoming quality control. From the data findings, there are recommendations on problems occurred and suggestions for future improvement construct in this thesis.

#### **ABSTRAK**

Kawalan kualiti bagi bahan kemasukan merupakan satu pertimbangan yang penting untuk meningkatkan taraf persembahan kualiti dan kepuasan pelanggan di XX Syarikat. Tesis ini akan menitikberatkan di lokasi penerimaan bahan kemasukan.

Kaedah bagi tesis ini telah dijalankan bagi memastikan penyiapan tesis dengan jayanya. Keputusan pengumpulan data berkenaan dengan isu masalah bahan kemasukan melalui analisa data dengan menggunakan teknik kualiti dan peralatan seperti Peralatan Kawalan Kualiti dan 105E-Tetapan Militari untuk mengawal kawalan kualiti kemasukan. Daripada penelitian data, penilaian terhadap masalah yang dihadapi dan dengan itu beberapa cadangan bagi peningkatan masa akan datang telah dilaksanakan dalam tesis ini.

## CHAPTER 1 INTRODUCTION

#### 1.1 Background of Quality Control

Generally, the quality control normally competition among the companies in order to control and produce the products in the best condition. The goal of the best quality control is customer satisfaction. Besides, quality is important for giving customer expectations and needs. Quality control is a management function whereby control of the quality of raw materials, assemblies, produced materiel, components, services related to production, and management, production, and inspection processes is exercised for the purpose of preventing undetected production of defective material or the rendering of faulty services.

As a general rule, if defects are eliminated or minimized through quality control, the cost of production due to waste will decrease. It is simply common sense that when products which deviate from the intended standard are made, they must either be repaired or discarded and this would obviously incur extra costs. If it is possible to turn out goods that will fulfill the standard, naturally costs will decrease in addition to improved customers' satisfaction. It is therefore appropriate to clearly define first what quality control is before we identify the need for quality control. The most common notion of quality control is the checking or inspection of the product to ensure its conformance to specifications.

The concepts of quality control have undergone changes in evolutionary process of refinement and application. Like quality, they have many definitions. One useful definition for quality control is that helps to put the preceding discussion on standards and measurements into an action mode as follows:

"Quality control is the regulatory process through which we measure actual quality performance, compare it with standards, and act on the difference." (Juran, 1988, p.27)

The Japanese Industrial Standards defined quality control as:

Quality Control is a system comprising all the means used in the economically manufacturing of products or services that meet the quality requirements of the buyer.

Quality control should therefore encompass the activities of Prevention, Detection and Correction of product defects that could cause customers' dissatisfaction. The key point in quality control is therefore the faithful conformance of the product specifications or standard. Product defects or deviations from specifications can result from any or combination of some of the following:

- i. Poor product design
- ii. Defective raw material
- iii. Inadequate, inappropriate machines and tools
- iv. Inappropriate environment
- v. Human errors

A quality control system should therefore be designed and instituted to cover all these areas. The basic elements in quality control which can be translated directly into the objectives of a Quality Control System are:

- i. To maintain design standards
- ii. To meet customers' specifications
- iii. To determine department/personnel effectiveness

#### iv. To detect and correct defective products

In particulars of quality concept, it can affect other vital elements of a company such as productivity, cost, and delivery schedules. It may also have an effect on the workplace environment. Quality leaves its imprint on society and on the quality of government. In recognition of the many aspects of quality, to describe the wide spectrum of applicability, the authors have developed a broad and comprehensive definition of quality. A few companies continue to emphasize only the inspection aspect of quality control, whereas inspection is actually one useful element in an overall quality system who stated by (Stephen, 2000).

The quality control of company is very important because of being the strategy that can bring:

- i. Better quality as well as at incoming materials, production and assembly parts until the finish goods before outgoing and delivery.
- ii. Better quality in term of saving cost or cheap with good quality due to apply continuous improvement.
- iii. Better providing the customer satisfaction, creating greater markets and thus reducing overall cost resulting from improved quality is a reasonable measure of the correctness of its application.

Generally, if it is costing more than it is saving, it is improperly applied. This places great importance on quality cost analysis, a significant element in a quality system that will be explored subsequently. Stressing quality can produce all the desired results for examples; less work, greater productivity, lower unit cost, price flexibility, improved competitive position, increased demand, larger profits, more jobs and more secure jobs. Customers get high quality at a low price, vendors get predictable long term sources of business, and investors get profits.

According to incoming quality control, adequate communication of requirements to suppliers is important because of specifications should be understandable and precise. Process capability requirements on suppliers, together with process controls, can reduce or eliminate inspection of incoming suppliers.

#### 1.2 Problem Statement

First, quality of the incoming quality control on raw materials in any industry has played an important role. All industries have their responsibilities on managing their quality on raw materials in order to make sure that this output products can be produced. Company not only has to provide cost effective product but also quality in incoming materials, which satisfy the further processing line and good output.

The measurements should be broadly classified as follows:

- 1. To measure the characteristics of an individual article for the purpose of determine whether or not the piece conforms to the specifications.
- 2. To measure the characteristics of the pieces in a sample taken at random from a lot
- 3. To measure and choose the supplier giving most problem for incoming material.
- 4. To measure supplier performance by supplier audit

#### 1.3 Objective of Study

The objectives of this study are:

- i. To understand the concept of incoming quality of raw material for production line purposes to further process.
- ii. To identify the current problem about the incoming materials in industry company
- iii. To apply the concepts of incoming quality control of material in producing better quality product.

#### 1.4 Scope of Study

In order to understand the incoming quality control, a history development, definition using sampling plan, quality tools and techniques and the standardized Quality Management System (QMS) as stated in ISO 9001:2000, Clause 5.4.2.(Quality Management System Planning). A research on XX Company was done in Incoming Quality Control Department. This study about measurements in checking the incoming raw materials parts to identify the parts whether in specification or out of specification limit. From this task of measuring, any tools and equipments we been use important for determine that which tools are suitable for the measuring. There are some methods for summarize the result using many quality tools such as Pareto diagram and cause and effect diagram.

In the procedures of inspection the quality of the materials, some of the samples taken for checking whether they have any defects or any incomplete parts not fulfill. Importantly, inspections of quality control based on incoming are:

- 1. To improve the quality of the input materials with less variation
- 2. Greater productivity on the process of checking and transferring to production section
- 3. The way of improve the better supplier relations so that suppliers always keep quality conformance level for the parts incoming time to time.

#### 1.5 Organization of the Thesis

Based on the thesis for Projek Sarjana Muda (PSM) I, an organization has been constructed for the process flow of completion. This organization is use for students purposely follow the format and understands sequences of doing the project as good as possible to fulfill course of Degree in UTeM. The format of organization as follow:

#### i. Chapter 1: INTRODUCTION

This chapter presented the background of quality control, objectives of study, problem statement, scope of study and the organization for the thesis.

#### ii. Chapter 2: LITERATURE REVIEW

This chapter summarized all the finding that related to the quality control based on incoming materials. Then, this is followed by data measurements and analysis. Finally, find and observe different of tools and techniques of quality control approaches to overcome the current problem statement occurred in company.

#### iii. Chapter 3: METHODOLOGY

This chapter gave the ideas on how to solve the problems in ways such as data collections, secondary data and the tools and techniques for analysis the problems and finally solves them for better improvements.

#### iv. Chapter 4: RESULT

This chapter would cover the company background after researched. Besides, data measurements and collections taken for the quality control on the incoming materials where visited and researched the XX Company. This is followed by the detailed calculation carried out for the problems. Supplier selected for the most contributed defects on part after using Pareto Chart.

#### v. Chapter 5 : DISCUSSION

This chapter discussed about the findings that related to theory or current understanding in quality control of incoming materials. The tool using is Cause and Effect diagram to show the problem cause. Better understanding from diagram and to show the recommendation later for future improvement.

#### vi. Chapter 6: CONCLUSION

This chapter included the recommendation and summary of for thesis. Future improvement conducted in this chapter for the further study related to quality control on incoming materials.

## CHAPTER 2 LITERATURE REVIEW

#### 2.1 Introduction

Quality control is defined in ISO 9000-2000 as "Part of quality management focused on providing confidence that quality requirements are fulfilled" (American Society for Quality, 2000). Quality control refers to the activities or tools that are used to provide this assurance. The word "quality" here refers to the fitness of a product or service for its intended use. This fitness is usually measured with great difficulty and expenses, and by general agreement (in terms of specifications), certain quantities, called attribute, are used as fitness surrogates. They should be defined in such a way that when they fall within their specifications, the product or service will be fit for its intended use.

The benefits of quality control are improving quality of products and services to meet customers' needs, increasing the productivity of manufacturing process and commercial businesses, ensuring on-time deliveries and availability. In this quality control focus on incoming raw material inspection that is an appraisal activity that compares goods or services to a standard. "Garbage in; garbage out" suits for describe the importance of in-coming quality control for the material purchased in manufacturing company. Thus, every input must be acceptable for checking conformance before going to production line.

Inspection before and after production often involve acceptance sampling procedures. In order to determine whether a process is functioning as intended or to verify a batch or lot of raw materials or final products does not contain more than a specified percentage of defective goods, it is necessary to physically examine at least some of the items in question. The purpose of inspection is to provide information on the degree to which items conform to a standard. The basic issues are:

- a. How much to inspect and how often.
- b. At what points in the process inspection should occur.

#### 2.2 Development of Quality Control Knowledge

#### 2.2.1 Earlier Development

One of the earlier references to quality control in the United States was in report by Alexander Hamilton, then Secretary of the Treasury, to the U.S. House of Representatives in 1791 [Syrett (1966)]. This reference is contained in a report entitled "Report on Manufacturers" and is as follows:

### Chapter IX. Judicious regulations for the inspection of manufactured commodities

This is not among the least important of the measures, by which the prosperity of manufacturers may be promoted. It is in many cases one of the most essential. Contributing to prevent frauds upon consumers at home and exporters to foreign countries-to improve the quality and preserve the character of the national manufacturers, it cannot fail to aid the expeditions and advantageous sale of them, and to serve as a guard against successful competition from other quarters. The reputation of the flour and lumber of some stats, and of the Potash of others has been established by an attention to this point. And the like good name might be procured for those articles, wheresoever produced, by a judicious and uniform

system of inspection; throughout the ports of the United States. A like system might also be extended with advantage to other commodities.

Much of the earliest documented work in quality control centered on the Bell Telephone System. Telephone networks are giant series systems. For conversations to be possible over long distances, every piece of the network must function correctly. This means that each telephone, drop wire, and switch and all other transmission facilities must be designed, manufactured, installed, and maintained to exacting standards. The early realization of this fact led on an AT&T document in 1892 emphasizing the importance of managing the quality of all products intended for the rapidly growing network. Fagan (1974) tells us that even before that, in 1882, the contract between the Western Electric Company and the American Bell Telephone Company (an early name of the AT&T Company) states:

At all times during their manufacture and upon their completion the instruments and materials employed shall be subject to the inspection and acceptance...by [the American Bell Telephone Company].

From 1925 to 1941 the developments of quality control and quality assurance methodology were remarkable. Golomski (1967) writes about this early period:

On 16 May 1924...Dr. Shewhart prepared a little memorandum only about a page in length. About a third of that page was devoted to a simple diagram which we would all recognize today as a schematic control chart. That diagram, and the short text which preceded and followed it, set forth all of the essential principles and considerations which are involved in what we know today as process quality control.

Shewhart published this concept in the December 1925 issue of the *Journal of the American Statistical Association* [Shewhart (1925)]. In this paper he introduced the control chart, which became a basic manufacturing tool used around the world.

#### 2.2.2 Latest Development of Quality Control

At the beginning of U.S. involvement in World War II, there was an immediate need for large quantities of war material-everything from guns to radar equipment to shoes. United States industry expanded rapidly at the same time that the country's armed forces were expanding. Therefore, many people who had never before worked in a manufacturing organization were employed by these new and expanding factories. The War Department engaged Bell Telephone Laboratories, Edwards and some of his people to go out to manufacturing plants and teach people simple methods of quality control ["Dr. W. Edwards Deming" (1980)]. Other instructors were selected from local universities.

The founding editor of the second publication was Dr. Lloyd Nelson, then of General Electric Company. This publication, the *Journal of Quality Technology*, is devoted to the more technical aspects of quality control, much of it of a statistical nature. Another journal that has contained significant technical papers on quality, reliability, and productivity since its beginning is *Technometrics*, a joint publication of the American Statistical Association and the American Society for Quality Control. The *Journal of the American Statistical Association*, now more than ninety years old, has presented many of the major technical papers in quality and reliability. The publication *Quality* presents papers for managers and engineers in the areas of quality assurance. The ASQ has recently added two new journals to its publication list. These are *Quality Engineering* and *Quality Management Journal*. *Quality Engineering* has technical articles that are at a somewhat lower statistical level than those in the *Journal of Quality Technology*. *Quality Management Journal* has articles dealing with research and applications in the field of quality management.

In the 1950s through the 1970s these standards were the only ones published by ISO that dealt with quality control. In the meantime, the International Electrotechnical

Commission (IEC), a sister organization to ISO, through its Technical Committee 56, was developing standards dealing with reliability, maintainability, and related topics. Thus, in those times, quality practitioners gravitated to those two committees in an effort to standardize the field of quality assurance. However, by the late 1970s it was recognized that standards dealing with the management of quality were needed and that these two committees were unable to meet this need.

An example of Japan's training effort is summarized in the following quotation from Ishikawa (1968), in which he emphasizes the use of public media for quality control training in Japan:

QC courses through radio began in July 1956. The Nippon Shortwave Broadcasting Co. (NSB) held a 3-month course seven times. Since 1957, NHK (Japan Broadcasting Corporation) held an introductory course called "Management and Quality Control" for 7 weeks (15 minutes per weekday). More than 100,000 copies of this textbook have been distributed. From 1957 to 1962, there were seven NHK radio QC courses. In 1960 and 1961, NHK TV broadcast two courses called Quality Control and Standardization for 4 months.

Many companies require their suppliers to be registered to one of the standards. The ISO 9000 standards are a set of standards. Three of them-ISO 9001, 9002 and 9003 are the contractual standards that are used for auditing purposes. These were revised in 1994 and a third edition was published in 2000. In this latter edition, ISO 9002 and 9003 were dropped so that only contractual standard is ISO 9001.

#### 2.3 QC Tools and Techniques

There were numbers of techniques useful in conducting investigations to achieve improvements. The following shows the examples of the tools and techniques may have needed to improve the incoming quality control.

#### 2.3.1 Sampling Plan

A key element of acceptance sampling is the sampling plan. Sampling plans specify the lot size, the sample size, the number of samples to be taken, and the acceptance /rejection criteria. A variety plans can be used. Some plans call for selection of a single sample, and others call for two or more samples, depending on the nature of the plan. The plan used is Single Sampling Plan and as shown in Table 2.1.

In the single plan, one random sample is drawn from each lot, and every item in the sample is examined and classified as either "good" or "defective." If any sample contains more than a specified number of defectives, c, that lot is rejected.

	.010	.015	.025	.040	.065	.10	.15	.25	.40	.65	1.0	1.5	2.5	4.0	6.5	10.0
LOT SIZE	.010	SAMPLE SIZE														
LOT SIZE																
2 to 8	*	*	*	*	*	*	*	*	*	*	*	*	5	3	2	2
9 to 15	*	*	*	*	*	*	*	*	*	*	13	8	5	3	2	2
16 to 25	*	*	*	*	*	*	*	*	*	20	13	8	5	3	3	2
26 to 50	*	*	*	*	*	*	*	*	32	20	13	8	5	5	5	3
51 to 90	*	*	*	*	*	*	80	50	32	20	13	8	7	6	5	4
91 to 150	*	*	*	*	*	125	80	50	32	20	13	12	11	7	6	5
151 to 280	*	*	*	*	200	125	80	50	32	20	20	19	13	10	7	6
281 to 500	*	*	*	315	200	125	80	50	48	47	29	21	16	11	9	7
501 to 1200	*	800	500	315	200	125	80	75	73	47	34	27	19	15	11	8
1201 to 3200	1250	800	500	315	200	125	120	116	73	53	42	35	23	18	13	9
3201 to 10,000	1250	800	500	315	200	192	189	116	86	68	50	38	29	22	15	9
10,001 to 35,000	1250	800	500	315	300	294	189	135	108	77	60	46	35	29	15	9
35,001 to 150,000	1250	800	500	490	476	294	218	170	123	96	74	56	40	29	15	9
150,001 to 500,000	1250	800	750	715	476	345	270	200	156	119	90	64	40	29	15	9
500001 and over	1250	1200	1112	715	556	435	303	244	189	143	102	64	40	29	15	9

Table 2.1: Sample Table of Single Sampling Plan

#### 2.3.2 Pareto Chart

Pareto Analysis is a technique for focusing attention on the most important problem areas. The Pareto concept, named after the 19<sup>th</sup>-century Italian economist Vilfredo Pareto, is that a relatively few factors generally account for a large percentage of total cases for example, complaints, defects, problems. The idea is to classify the cases according to degree of importance and focus on resolving the most important, leaving the less important. Often referred to as the 80-20 rule, the Pareto concept states that approximately 80 percent of the problems come from 20 percent of the items, and thus it is useful to prepare a chart that shows the number of occurrences by category, arranged in order of frequency. Example of Pareto chart shown in Figure 2.1.

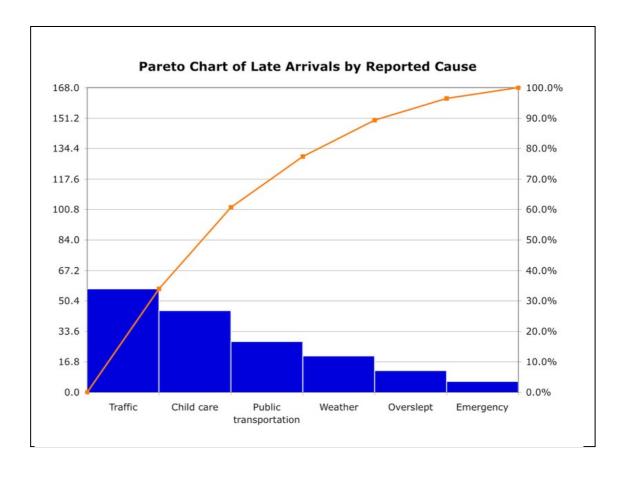


Figure 2.1: Sample of Pareto Chart

The dominance of the problem with traffic becomes apparent. Presumably, the manager and employees would focus on trying to resolve this problem. Once they accomplished that, they could address the remaining defects or problems in similar fashion. Child care would be the next major category to be resolved, and so on. Hence, in later Pareto diagram, categories such as "traffic" may still appear but would be much less prominent.

#### 2.3.3 Cause-and-Effect Diagram

A cause-and-effect diagram offers a structured approach to search for possible cause(s) of problem. It is also known as a *fishbone diagram* because of its shape, or an *Ishikawa diagram*, after the professor who developed the approach to aid workers overwhelmed by the number of possible sources of problems when problem solving. This tool helps to organize problem-solving efforts by identifying categories of factors that might be causing problems. Often this tool is used after brainstorming sessions to organize the ideas generated. Figure 2.2 illustrates one form of a cause-and-effect diagram.

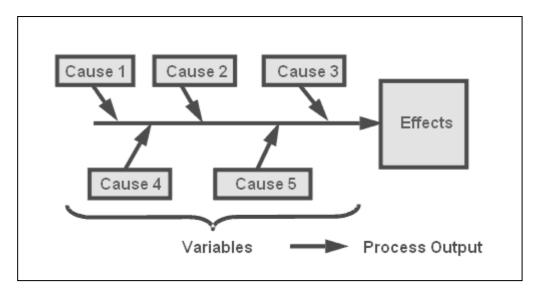


Figure 2.2: Format of Cause-and-Effect Diagram

An example of an application of such a cause-and-effect diagram is shown in Figure 2.3. Each of the factors listed in the diagram is a potential source of unwanted variation in output. Some are more likely causes than others, depending on the nature of the errors. If the cause is still not obvious at this point, additional investigation into the root cause may be necessary, involving a more in-depth analysis.

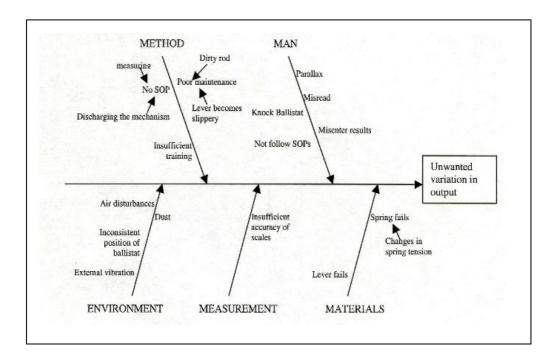


Figure 2.3: Cause-and-Effect Diagram for Unwanted Variation in Output

#### **CHAPTER 3**

#### **METHODOLOGY**

#### 3.1 Introduction

In this chapter, it explains the research methodologies that were used for supporting the analysis of the study. Some of the elements in methodology include the study plan, flowchart of the research, data collection and analysis techniques.

#### 3.2 Study plan

This study plan is to identify and analyze for the incoming material based on quality control in the manufacturing industry. In Figure 3.1 can shows that the research is carried out in procedure according to the flow chart. This flow chart is a graphical or symbolic representation of a process. Each step in the process flow is represented by a different symbol and contains a short text description of the process step in the flow chart symbol. It helps to identify a starting point, a sequence of actions, the decisions that must be made, and the conclusion or end to the process. Besides, it can be used to identify areas of the problem, document the process and even serve as a planning tool for process improvement. Then, an analysis on the data collected and also discussion concluded. Lastly, recommendations and conclusions were carried out to complete final report.

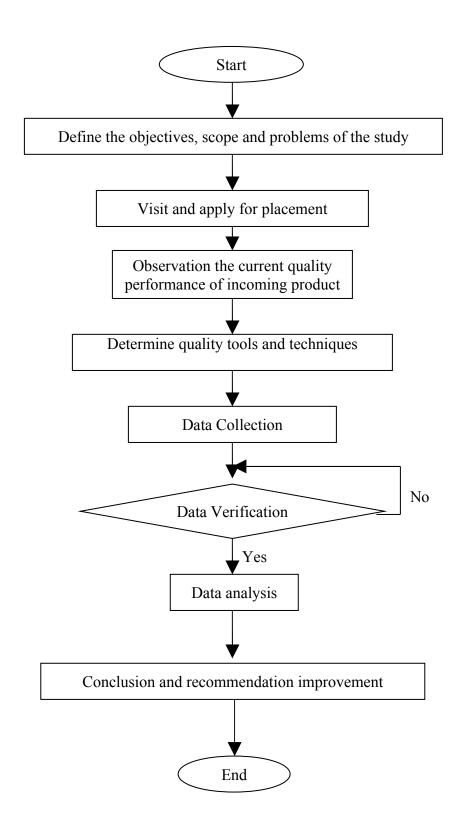


Figure 3.1: Methodology in Flow Chart

#### 3.2.1 Explanation of Study Plan

First in start point, the title is "An analysis incoming quality control of material in manufacturing industry" for this project. So, it needs to identify objective, scope of study and the problem statements for the project. Objective discussed the purpose and goal which need to be achieving in this project. Scope would represent the research area that covered in this project. In problem statement would discussed the problem that comes out of the manufacturing industry.

Next would be the going and visit industrial to apply placement for run the research more technical and practical. The application to industry visit being preceded to confirm the manufacturing industry for our study.

After confirmation for accept the permission from the manufacturing industry, something must be done before go to the industry. From here, observation for the current quality control system based on incoming materials or parts of the manufacturing industry. Then, sampling method must be determined to make the analysis more technical and practical.

So, till the stage of data collection, an observation for the data whether in control limit specification or out of the standard using different of tools. Besides, some of the measurements need to be carried out for getting the data of the material. This measurements could analyzed the quality of the raw materials or input parts before go through the production line is consider good.

This step shows the quantity of the data measurements has been carried out whether is enough for the research. Some of the data that has been measured achieved the numbers of acceptance or not. Besides that, the quality control technique that used for the received raw materials part in the factory also needs to be analysis. Verification of the

data to ensure data collected are enough for the data analysis otherwise the data must be repeatedly filled up.

At the stage of data analysis, it will concern to analysis quality level of the raw materials in the incoming location of factory. Sampling plan used for the acceptance or rejection; and quality control tools and technique have been used for analysis the data measurements. Some of the quality control tools for obtain the data of incoming parts can be performed by using Pareto chart, Cause-and-Effect Diagram.

Before end point, the summary of the research represent the conclusion. From conclusion, it also obtain that objectives of the project have been achieved. Meanwhile, some recommendations and suggestions being implement to solve the problem that face of the manufacturing industry. The solutions indirectly could provide the improvements for the manufacturing industry. The project of PSM subject has been completed at the end point stage.

#### 3.3 Data Collection

For the data collection that used in this project are to determine the quality control based on the incoming parts or materials in the manufacturing industry. The data collected through primary resources and secondary resources.

#### 3.3.1 Primary Resources

#### 3.3.1.1 Archival Collections

Archival collection defines to analyze and evaluate the quality control based on the incoming materials part in the manufacturing industry in Malaysia. Two ways of accessing the project, one is the library search and the other is the internet accesses. The others information was obtained through the online internet resources, journals finding related, reference books, and articles from the library of UTeM.

#### **3.3.1.2 Interview**

Interview conducted with the operator from the quality control department in XX Electronics Company carried out. From this session, the information can be collected about the quality control situation for their incoming checking inspection.

#### 3.3.2 Secondary Resources

#### 3.3.2.1 Reference Books

Reference books such as journals, articles, magazines and other books related are secondary sources purposely for report completion. The sources of reference books normally borrow through UTeM library. Some of the important articles and journals are scanned out for reference that related to the project. Mostly the information sources from reference books are more recognized compare to the information resource from online search which is internet.

#### 3.4 Analysis Tools and Techniques

Some of the procedures include of the analysis techniques and methods that used in this project are internet search and the sources of finding from the reference books. The

processes or methods that used in this project were acceptance sampling, Pareto diagram, and Cause-and-Effect diagram.

#### 3.4.1 Acceptance Sampling

In acceptance sampling is more focused to this project with inspection and measuring of the incoming raw material before going through the production. Acceptance sampling is a form of inspection that is applied to lots or batches of items either before or after a process instead of during the process. In this case, the lots represent incoming purchased items from suppliers of the factory. The purpose of acceptance sampling is to decide whether a lot satisfies predetermined standards. All inspections important in this incoming department that satisfy standards are passed or accepted while those do not are rejected.

#### **CHAPTER 4**

#### RESULTS

#### 4.1 Company Background

XX Electronics Company is established on 15<sup>th</sup> April 1994 as old company located in Free Trade Zone Fhase III Batu Berendam, Melacca. It is the largest manufacturing facility where Electronics manufactures digital entertainment products as well as Speaker Systems for the PC and the Internet.XX Company is a reliable electronics manufacturing service provider that emphasizes on high quality, flexibility, competitive prices and timely delivery to offer its customers a competitive edge. It is a world class integrated electronics manufacturing company which that through to:

- 1. Provides Quality Products and Services
- 2. Exceed Customers' Expectations
- 3. Committed Employees & Strategic Partners
- 4. Fulfill Business Objectives & Social Responsibilities

XX Company is committed to total customer satisfaction, accomplished through a process of continuous improvement to become a world class multimedia producer.

#### 4.2 Flow Chart Inspection

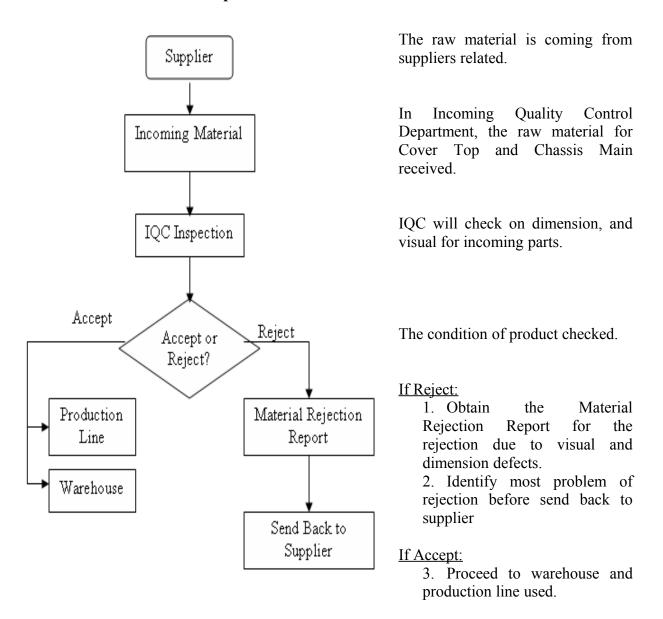


Figure 4.1: Flow Chart of Incoming Material

#### 4.3 Data Collection