REDUCTION OF LEAD TIME FOR BETTER DELIVERY OF CUSTOMIZED CABINET PRODUCT

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SUPERVISOR'S DECLARATION

We hereby declare that we have checked this thesis and in our opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Bachelor of Industrial Technology Management with Honours.

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

Signature :
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ID Number : PC12068
Date : JANUARY 2016

Dedication

To my beloved parents Mr.Zulkifli bin Jusuh and Mrs.RahimahbintiCheAmat for being supportive.

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In the name of Allah, the Most Gracious and the Most Merciful. Alhamdulillah, all praises to Allah for the strength and His blessing in completing this thesis.

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ABSTRACT

This study is entitled of reduction of lead time for better delivery of customized cabinet product. This research was conducted in the furniture company in Kuantan and the company is participated in this research to completethis research which is focusing on reduction of lead time for each process. The objective of the research is to identify the elements that contribute on the longer lead time of producing the customized cabinet product, to analyse which strategy that can be implement in the process to reduce the lead time and the last objective is to propose a suggestion of improvement to the process of making customized cabinet. The researcher will identify all the process that involved in the process of producing the customized cabinet in the company and will only focusing on sub process that involved the process of prepare materials, measurements, cutting, patching, making body and glue, finishing and painting and drying. The method that has been used by the researcher in order to complete this study is time study. The researcher observe the time study of each process to record the past lead time of each process in the company and the time study is structured in the table. After that, the researcher identify the causes that contributed on the longer lead time in the process and find out the factors that caused the longer lead time in order to minimizing the lead time and the root cause of each process is structured by using Ishikawa's diagram or also called as Cause and Effect diagram. The last method is using Failure Mode and Effect Analysis (FMEA) to identify the most critical process that contribute on the longer lead time and to rank the severity (SEV), occurrence (OCC), detection (DET), and RPN.
The data is collected by the observation and interviews. In addition, the strategy or suggestion of improvement is structured in the table in chapter 5. The proposals are references from literature from past researchers as a guide and additional information.

ABSTRAK

Kajian ini bertajuk pengurangan penggunaan masa untuk penghantaran produk kabinet yang telah ditempah khas. Kajian ini telah dijalankan dalam syarikat perabot di Kuantan dan syarikat itu telah mengambil bahagian dalam kajian ini untuk menyiapkan penyelidikan ini yang memberi tumpuan kepada pengurangan masa utama bagi setiap proses. Objektif kajian ini adalah untuk mengenal pasti elemen-elemen yang menyumbang kepada penggunaan masa yang lebih lama untuk menghasilkan produk Kabinet yang ditempah khas, untuk menganalisis strategi yang boleh dilaksanakan dalam proses untuk mengurangkan masa yang diambil dan objektif yang terakhir adalah untuk mencadangkan cadangan penambahbaikan kepada proses membuat kabinet yang ditempah khas. Penyelidik akan mengenal pasti semua proses yang terlibat dalam proses menghasilkan kabinet yang ditempah khas dalam syarikat itu dan hanya akan memberi tumpuan kepada sub proses yang melibatkan proses menyediakan bahan-bahan, ukuran, memotong, menampal, membuat badan dan gam, kemasan dan pengecatan dan pengeringan. Kaedah yang telah digunakan oleh pengkaji untuk melengkapkan kajian ini adalah kajian masa. Penyelidik memerhatikan kajian masa bagi setiap proses untuk merakam utama masa lalu setiap proses dalam syarikat dan kajian masa yang disusun dalam jadual. Selepas itu, pengkaji mengenal pasti punca yang menyumbang kepada masa yang paling panjang dalam proses dan mengetahui faktor-faktor yang menyebabkan masa yang lebih panjang dalam usaha untuk mengurangkan penggunaan masa yang dan punca utama yang menyebabkan setiap proses distrukturkan menggunakan gambarajah Ishikawa atau juga dipanggil sebagai rajah Punca dan Kesan. Kaedah terakhir menggunakan Mod Kegagalan dan Analisis Kesan (FMEA) untuk mengenal pasti proses yang paling kritikal yang menyumbang kepada pengambilan masa yang lama dan pangkat keterukan (SEV), kejadian (OCC), pengesanan (DET), dan RPN. Data dikumpulkan melalui pemerhatian dan temu bual. Di samping itu, strategi atau cadangan penambahbaikan disusun dalam jadual didalam bab 5. Cadangan ini adalah berdasarkan daripada pengkaji yang terdahulu sebagai panduan dan maklumat tambahan.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Just-In-Time (JIT) application is one of the most popular application that has been implemented in the industries in around the world such as manufacturing, oil and gas, transportation and so on. JIT manufacturing has been implemented successfully in Japan for the past 20 years. It is a philosophy as well as a technique that guides a manufacturing company in organizing and managing its business to become more effectively, and the operations becomes more efficiently in planning and controlling. It is a way to achieve high velocity manufacturing. The objectives of just-in-time application is to reduce or eliminate any waste in the production line, reduce lead time, reduce the product cost and achieve better quality in the company. JIT have a lots of advantages and strength in order to achieve the company's goals and objectives.

On the phrase provide the goods just in time as promised when the order is placed by the customer. The opposite of the JIT production is known as JIC which is just in case system where it produces goods for inventory with the intention of having goods just in case a customer places an immediate order. JIT production system identifies the hidden problems in the value chain and reduces the production waste of the system while increasing the throughout sales to raw material cost. JIT is not cure all for every manufacturing problem, but if the system implemented properly, it is provided low cost method in order to improving the manufacturing process (Dr Ralph G Kauffman, 2004). Even though the JIT system seems to be interesting and less complicated it requires lot

of coordination with supply chain to avoid delays in the production schedule in the industries. The whole concept of the JIT is differentiated from traditional productions systems using push vs. pull systems of production. The push system of production pushes materials to the next stage of the production irrespective of whether time and resources are needed at the next level of production creating lot of inventories at each level of the production flow. The pull system is a method of maximizing individual production rates (Roberta S and Russell, 1990). The traditional manufacturing organizations adopt push system where they produce for inventory and work in progress or called WIP. The pull system of production is where the materials are pulled by next level of the production only when is signaled or required by the next stage of production. This drastically reduces the inventory held as it does not keep any WIP. JIT concept is built based on the concept of pull production which eliminates the total inventory.

The underlying concept of the Just-in-Time (JIT) philosophy is to smooth the manufacturing process through the efficient handling of materials such as providing the right materials in the right quantity and with the right quality just in time for production (Low and Chan, 1997) to eliminate or reduce waste in the company, thus producing the maximum value for the customer. JIT has helped to reduce lead time, throughput or set-up times, defects, ultimate costs, reworks, factory overheads, inventory levels and storage space, and it has also enhanced the competitive advantage of firms (Akintoye, 1995; Low and Chan, 1997; Low and Tan, 1998; Low and Mok, 1999). Reasearcher will focusing on the reduction of lead time of making the customize cabinet in the company that researcher has been choosed. This is because the reduction of lead time appropriately will improve the productivity and the time consuming in the process of making the customize or called custom made product in the furniture's company.

1.2 BACKGROUND OF STUDY

The furniture company is an industry that produced varieties of furniture such as closet, cabinet, chair, table and other furniture. But in this study, researcher will focused on the furniture company that producing the customized cabinet which is have been produced based on the customer's requirements. The study will identify the elements that contribute on the lead time process of producing the customized cabinet in the furniture company in Kuantan. The short lead times in the process will produce better performance to the company in the furniture to meet the demand from the consumers.

When seeing the process of producing the customize product in the furniture company, there are fundamental principles included with general philosophy of good practice. The just-in-time application can be apply in the process of making the customize furniture to meet the company's goals and objectives. The JIT will control the cost, time, and waste during the process in the company and maintaining the quality of the product itself. The first step is identify the elements that contribute on the lead times process of making the customized cabinet and analyse the strategy that can be apply in the lead times process to reduce the lead time.

The purpose of this study is to introduce the basic JIT concept which is focusing on the response time in the process in the company. There are many sub process in the process of making the product in the company such as preparing the materials, cutting the woods, build the furniture and so on. The elements consumed time to become a finished product.

When the elements that contribute on lead time in producing the customized cabinet is fully recognized, the process will be suggested to implement the JIT application to meet the company's goals which is reduce waste, cost and time consuming while to grab the better response time in the processing.

1.3 PROBLEM STATEMENT

Time is money, shorter lead time or throughput time is always good thing for producers and customers. The production timing effort of each planning step that gives information about the starting and ending dates, which are necessary for an exact scheduling of the whole production process. Based on good planning that shorter project lead time is easy to get a way to realize.The problem occurred in the furniture's company that has been choosed is longer lead time in the process of producing the customized cabinet product in order produce the product at the right time. one of the problem was about waiting time to receive the materials from supplier in the company since the materials is important things in the furniture's company, lead time of making customized product and also sometimes failed to fulfil the customer's requirement. The new strategy is to reducing the lead time for each process involved and the strategy is able to improve the company's performance. An issue related to the whole process of producing the customize cabinet in the furniture's company that caused trouble such as product out of spec, lack of materials needed or stock and increasing of time consuming in producing the product. The customized or custom made products are fully based on the customer's and client's requirement such as the size, colours, design, trend and others. The furniture's company have to plan appropriately and design the product using the specific software before they propose the design to their customers. It takes time to fulfil the customer's requirements.

1.4 RESEARCH OBJECTIVES

I. To identify the elements that contributed on the longer lead time of producing the customized cabinet product.
II. To analyse which strategy that can be implement in the process to reduce the lead time.
III. To propose a suggestion ofimprovement to the process of making customized cabinet.

1.5 RESEARCH QUESTION

I. What are the elements that contribute on the longerlead time in the process of making the customized cabinetproduct.
II. What is the strategy that can be implement to reduce the lead time.
III. What are the suggestions for improving the lead time in the process of making customized cabinet.

1.6 SCOPE OF STUDY

The scope of this review will focus on the elements that contribute in the lead time during process of making the cabinet in the furniture's company that located in Kuantan. Researcher choose the furniture's company is to analyse the weaknesses in the process of making product during producing the customize product which is focused on the customize cabinet. From my research and observation, there are some weaknesses in the furniture's company such as product defects, uncompleted materials and time consuming. This research will focus primarily on the lead time from the beginning of the process until become a finished product and analyse the strategy that can be apply in the lead time using just-in-time application. The JIT will focusing on the response time during the processes and improve the processes becomes efficient and going smoothly without bottle neck in the processing. In addition, the process that suitable with the JIT will be obtained for this study and the data will beanalyse. The target area of this study is furniture's company in Kuantan.

1.7 LIMITATION

This research are focus on the elements that contribute in the lead time that involved in the process of making the customized cabinet in the furniture company and make it more efficient by reducing the lead time. Another process that did not involve directly with this would be out of scope. The proposed solution and strategy will be made only for furniture's company and could work for similar process with lead time. This research begins with a fully information about process lead time in the furniture company that has been choosed. The techniques or method that has been used is reduction of lead time are explained and followed by proposed of recommendation. The method of collecting data is observation and interview. The study requires careful observation of the process in the company and factory in order to achieve the better results. This is because the interview is done face-to-face with involving with interior designer and manager since they will be able to answer all questions researcher that wish to ask.

1.8 SIGNIFICANT OF STUDY

This study responds to that company's process of making the customize furniture. The importance of this research is solving the lead time in the company. Recently, a new idea for a lead time using the just-in-time was proposed in the literature to reduce time while reducing waste and cost. The study in elements of lead time in the processes of making the customized cabinet will be implemented by the JIT application that focusing on reduction of lead time and using the fastest response time during the processes. The response time provide satisfaction to the customers if the response time is efficiently. In addition, this study also aims to suggest the implementation of JIT application which is quick lead time in the process of producing the customize cabinets to improve the response time in the company. Researcher is also hope that this suggestion can be apply by any furniture's company.

1.9 OPERATIONAL DEFINITION

1.9.1 LEAD TIME

In today's focused business world, organizations require little lead times, low expenses and high client administration levels to survive. As per Silver, (1998), lead time as the time spent that slips by between the position of a request and the receipt of the request into stock, lead time may impact client administration and impact inventory cost. Lead time is the duration or time taken that involved in the process of producing goods or product in the industries. The duration of lead time depends on the process in the industries which is using the different process for each company. Lead time will going smoothly if the process is systematically because the duration for each process is based on the difficulties of the process. In a business dictionary, number of minutes, hours, or days that must be allowed for the fulfillment of an operation or process, or must elapse before a desired action takes place. See also manufacturing lead time. Other than that, lead time is also the period of time between the initial phase of a process and the emergence of results, as between the planning and completed manufacture of a product. Lead time is a period taken from start of procedure until get to be done.The lead time is a subset to the cycle time in manufacturing. Researcher has concluded that lead time is total time required to complete one unit of a product or service which is required lead time of every process. The figure below shows the lead time in the lead time activities.

Figure 1.1: The lead time of producing the product in industries

1.9.2 CUSTOMIZED PRODUCT

Customized product is a product that fully based on the customer's requirement with the specification such as size, colour, design and materials for the product. The customized product usually made by the customers based on their taste and latest trend. The customize product also called custom-made product since there are order from the customer and the product will be produced when received orders from the customers. The option will be provided from the furniture's company in order to design the product and achieve the customer's satisfaction and expectation. Customized product also called custom-made product which is special order from customers and did not using what is available.

1.9.3 JUST-IN-TIME

A philosophy of manufacturing excellence based on pursuit of the planned elimination of all waste and consistent improvement of productivity. According to APICS, (1992), It encompasses the successful execution of all manufacturing activities required to produce a final product from design engineering to delivery and including all stages from conversion of raw material onward Just-In-Time (JIT) manufacturing is a Japanese management philosophy that applied in any manufacturing which involving the five right which is the right items of the right quality and in the right quantity at the right place and at the right time. It has been broadly reported that the best possible utilization of JIT assembling has brought about expansions in quality, profitability and effectiveness, enhanced correspondence and declines in expenses and waste. The potential of gaining these benefits has made many organizations question and consider this approach to manufacturing. For these reasons, JIT has become a very popular subject currently being investigated by many worldwide organizations. Just-In-Time management involves the application of old management ideas. JIT is a framework that enhanced the organization's efficiency using the system which is decreasing the cost, waste, lead time and defect in the organization.

1.10 EXPECTED RESULT

After completing this chapter, it is expected to achieve the stated objectives. In addition, it can provide faster lead time during the process of making the customize product that required from the customers in the furniture's company. Other than that, it can also implement the just-in-time application which is focused on the reduction of lead time in the process that will provided with faster response time, good implementation of JIT and improve lead time to achieve the objectives in order to apply the efficient processes of making the customized cabinet in the furniture's company. The shorter lead time will increase the productivity and performance in the furniture's company while reducing the lead time itself.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The just-in-time (JIT) application in the furniture's company will affect the company's productivity which is will reduce the lead time in the process of making the customized furniture in the company, reducing waste and reduce cost that incurs in the production of furniture in the company. The just-in-time will improve the furniture's company processes in making the product and produced more profit while provide good response time to the company. JIT is a application that avoid company from any defect and problem such as inefficiencies and unproductive time in the production processes. This study will focus on the reduction of lead time in producing the customized cabinet in the company.

The Japanese experience of using Just-In-Time (JIT) production shows that there are points of interest and advantages connected with their endeavors to control lead time. Japanese manufacturers are known for their strong and lasting partnership with their suppliers. This helps reduce lead time and is one of the sources of success of their JIT philosophy. Lead time has been a topic of interest for many authors like Das, Foote et al., and Magson, and Naddor. Before year (1980), customers tolerated long lead times which enabled producers to minimize product cost by using economical batch sizes. Later, when customers began to demand shorter lead times, they were able to get them from competitors. This is the point at which the issue emerged and organizations began to search for changes to be more aggressive.

2.2 LEAD TIME

In today's focused business world, organizations require little lead times, low expenses and high client administration levels to survive. The primary center of organizations in the twentieth century was the clients in light of the fact that in today market, exchanging item to clients at the briefest conceivable time is favorable position. To perform in a worldwide business sector, short lead times are vital to give consumer loyalty. Associations that have concentrated on process duration as an efficiency measure can diminish conveyance time and enhance quality, in this manner making more fulfilled client. Process duration or lead time is from the time a client discharge a request until the time they get the completed item. As indicated by Silver, E.A.,Pyke, D.F. also, Peterson (1998), lead time as the time that passes between the situation of a request and the receipt of the request into stock, lead time may impact client administration and effect stock expenses. As the Japanese illustration of in the nick of time creation has appeared, therefore decreasing lead times may build efficiency and enhance the aggressive position of the organization. There are numerous elements of long lead time in the assembling, for example, bottleneck, absence of machine, augmented time of material getting thus on.Shorter lead time is dependably something worth being thankful for. In other markets, quick delivery can justify a premium price and willcertainly enhance customer satisfaction. In all cases, shorter lead time increasesflexibility, reduces the need for inventory buffers and lowers obsolescence risk.

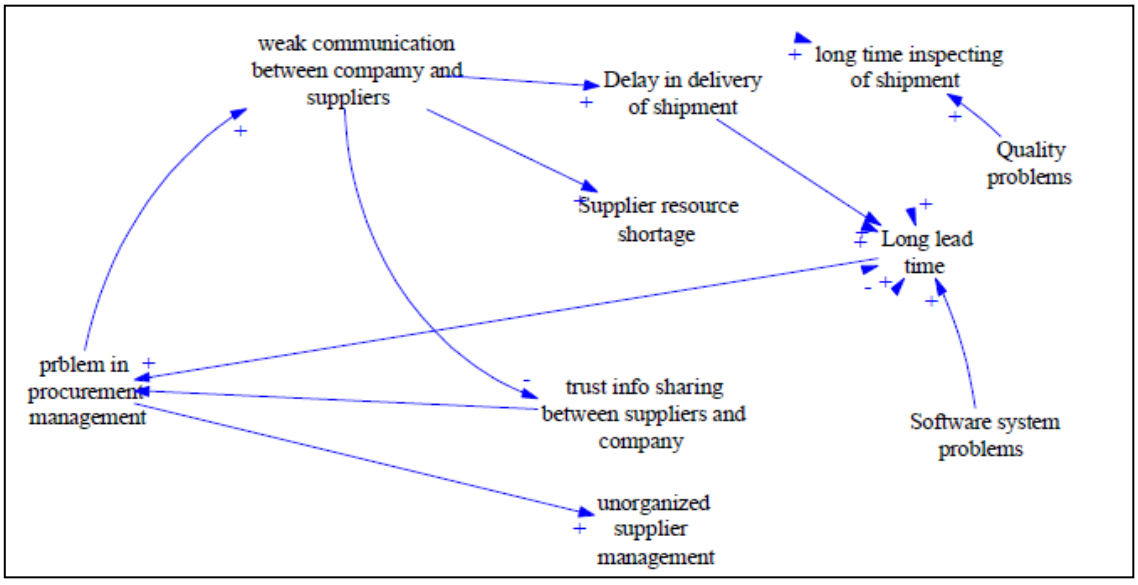


Figure 2.1 : The factors of long lead time in the manufacturing industries

According to the figure 2.3.1 above, there are two main problem that highlighted as he limitations brought upon by poor communication between the procurement department and suppliers and problems at the procurement management, where the latter could cause unorganized SRM as considerable factors, which in turn could be the main reasons for most of the problem, for example, delay, source shortage of supplier due to delayed and reciprocal info transferring, lack of trust in relationship and communication, poor quality of shipment and software problems. Futhermore, deep communication between the procurement department and suppliers can solve many associated problems and as a result, the main problem which is long lead time (LT) will be reduced.

2.3 JUST-IN-TIME (JIT)

Just in time (JIT) is a production strategy which helps the company or organization to achieve and improve their return on investment (ROI) by reducing material inventory with the associated carrying costs in the furniture's company. It is a logistics philosophy which is has been practiced in many furniture's companies in the world with the specific aim or goals of reducing inefficiencies and unproductive time in the production process. In any case, earlier research and experience recommend that the interrelationship between JIT and other manufacturing system's components, for example, product design and business strategies are more complex than it is suggested by the traditional JIT studies. According to Helo (2004), JIT required the companies to have a several reliable suppliers and it is believed to enhance productivity in the company, while according to Curry and Kennedy (1999), JIT build a leaner manufacturing system which reducing inventories and minimize which minimize risk and helps reduce the cost of manufacturing. So, we can conclude that JIT is the best practice in the company to improve the productivity and reduce the inventory while reducing cost and lead time in the company. JIT inventory management as a application to cut operational expenses with using several method in JIT that has been discussed by several authors or researchers (Sohal et al. 1993; Mehra and Inman 1995; White and Pearson 2001; Pheng and Min 2005; Adeyemi 2010).

2.4 RESPONSE TIME

Response time is one of the elements in the JIT system or application that implemented in the company or organization. The fastest response time the better because customers did not want to waiting for too long to receive their order and they want to receive the product as soon as possible once they order. The response time can be improved by the effective process in the inventory and reducing the work-in-process (WIP) in the inventory to meet the company's goals. One of the most noteworthy accomplishments in keeping the price of products low is the gradual shortening of the production cycle. The longer an research is in the process of manufacture and the more it is moved about, the greater is its ultimate cost (Henry Ford 1926). So, the response time occurred cost in the production in manufacturing.

According to Lieberman and Demeester (1999), raw materials tend to show an immediate reduction. In the meantime, the reduction of work in process (WIP) reducing the costs of stock holding and related activities. At last, the level of finished goods inventory should be decreased as a result of improvements in process reliability and reduced process duration. Along these lines, the shortest cycle times in the production the better response time to the customer's demand.

2.5 FURNITURES INDUSTRY

Nowadays, the developments of furniture's industry become growth from time to time because there have lots of demand from the customers. The furniture's industry is a large of product and service with the varieties of furniture or product and producing lots of profit in the industry. But there are several issues that come out from the furniture industry which is lack of product differentiation, lowest response time and also incurs cost if the product is defect. The furniture industry is trendy in some areas. Many styles have come and gone and then returned again. But some have stayed popular over time. current trends have been focused on antique reproductions and also furniture that combine a painted look with natural wood looked. The furniture industry as a whole is a fairly stable industry with the future trends indicating limited growth in the retail area.

In addition, the custom furniture manufacturers are still relatively few. According to IDC (1998), Manning (1996) and Scott (1996), low growth and rising unemployment have a bad effect on furniture's demand. The demand in the furniture's industry is given to strong cyclical fluctuations linked to general economic conditions that affect consumer confidence and household spending in the form of personal disposable income.

The furniture industry is not exempt from this new world context. Market changes are affect the entires sector and the quality to satisfy customers is making more competitive. The knowledge of furniture production and markets inherited from the small number of existing furniture's firms was shared with the newcomers and developed as a common asset and resource of the region in the many years (Lorenzen 1999). In terms of the furniture industry, the products must satisfied the consumers, and meet demands for high standards related to comfort, design, innovation and Technology. According to Stalk and Hout (1990), such a competitive scenario that generated by the need for new products to be introduced in the market in a short time and according to the customer's needs andexpectations that will meets the newest competitive strategy paradigm which time-based competition.

Time reduction in each phase from product creation to delivery makes companies more integrated with the customers' constantly changing needs, transforming their response time in relation to innovation faster. So, the response time will provide the faster innovation in the industry. According Vickery et al. (1995), the furniture industry has been plagued by long delivery lead times and unreliable schedules. It is a competitive domain and is forcing manufacturers to be in touch with their customers' needs in order either to preserve or to increase their market share. Time compression seems to be a highly competitive advantage source allied to logistics and supply chain strategies and challenges, in order to place the right product at the right time to the right customer in the right quantity. As a conclusion, the furniture's industries need to control their production planning using the some methods to achieve their goals and objective that will increase their productivity, response time, product differentiation and getting the lowest cost.

2.6 CUSTOM DESIGN (custom-made)

The custom design or called customized design is a customer get the design that they want and not based on the design that available in the manufacturing company. The company have ability to match colours, design, styles and finishes on special order. Based on the past researchers, they said that custom furniture will look towards the product that antique restoration and furniture refinishing, furniture delivery, set up and installation, furniture design and style matching, changing needs which is custom furniture will easily be able to adapt production to meet the changing styles and customer preferences and custom furniture encourage new designs and product improvement through employee bonus and incentive programs. The strength of custom furniture is larger variety and style of product, mass production of certain line, well established and trained production staff.

According to Urban and Hauser (1993), designing and introducing a new product to the market require identification of the product's key benefit to customers, determination of product attribute that are based on customer needs, definition of the product's functional specification, and realization of the product in a form that meets the specification and fulfil the key benefits and according to Green and Srinivasan (1990), successful new product deliver benefits that closely match with the customer's needs and several tools including classical ones such as conjoint analysis. So, to summarize what has been told by the previous researchers, the new product that based on the customers' requirement is a benefit to them as a consumer.

2.7 CUSTOMER'S REQUIREMENT

The customer's requirement is an important thing that needs to be focusing in the furniture's manufacturing industry because we need to fulfil the customer's requirement in order to meet the customer's satisfaction. In order to meet the customer's satisfaction, the furniture's industries need to identify the latest trend, the new design that never come out before, the new materials with the good quality and lowest cost and also provide the lowest price. Besides that, the furniture's industry need to provide their

product with varieties price and affordable price and also implement the product differentiation in their company.

According to AshishAgarwal and Ravi Shankar (2005), the developed a system dynamics model to understand the dynamic behaviour of customer satisfaction, cost minimization, lead-time reduction, service level improvement and quality improvement which plays a major role in improving the performance of supply chain and also observed that with the improvement rate for delivery speed, data accuracy, centralized and collaborative planning, market sensitiveness the behaviour was very slow initially and later increases. there are proven by the past researcher that there are methods to use in order to meet the customer's satisfaction by the fulfil the customer's requirement first.

2.8 JUST-IN-TIME METHOD

The methods that will be used to the furniture company that has been choose is just-in-time (JIT) application in order to improve the efficiency in the company with provide the faster response time in the furniture company. The JIT provided with good efficiency, relevant cost associated, response time or good time consuming and less waste. There are JIT concept that will control overall process in the industries. According to previous researchers, MusaraMazanai (2012), one of the approaches which have long been proven effective in the manufacturing sector in cutting costs, improving quality, productivity, efficiency and decreasing waste is the just in time (JIT) management approach.

Manufacturing environments can be changed to make arranging and control frameworks less difficult and more powerful. For instance, items are intended to have high comparability in preparing and are blended in a devoted creation line with unimportant lead times. Since lead-times are abbreviated, this transforms a make-to-stock item into a make-to-request item. Just-in-time is not only a control technique, but also a way to improve the manufacturing environment. JIT control systems are only effective in JIT environments. Introducing Kanban systems into a non-JIT environment means nothing to an organization.

JIT Control can be fused into an ERP framework as a control part with a condition that the framework must be in a JIT domain. The JIT theory manages the advancement of the JIT environment. The JIT environment gives the establishment to executing the JIT control strategies. The JIT philosophy, JIT environment, and the JIT technique can be expressed in Figure 2.8.1 below.

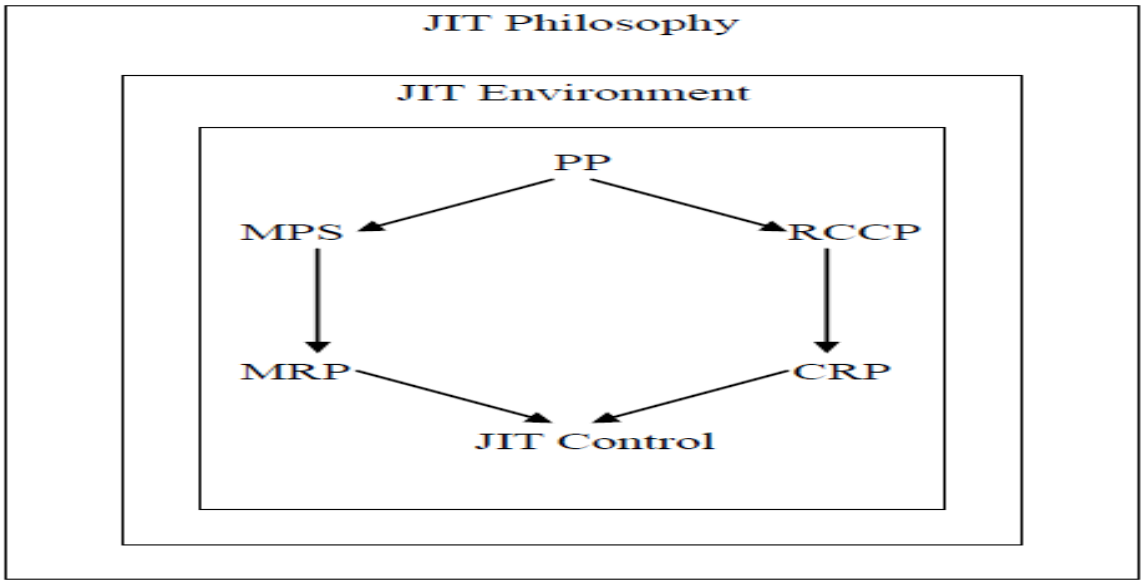


Figure 2.2: JIT Concept (Denny Hong-Mo Yeh)

The JIT methods can improve the problem such as waste of overproduction, waste of waiting, waste of movement, waste of inventories, waste of motion, waste of making defect and also waste from the product itself. JIT improves the manufacturing system gradually rather than drastically, as in business process reengineering (BPR). This progressive nonstop change is characterized by APICS Dictionary as "one less at once": a procedure of slowly decreasing the parcel size of the quantity of things in the assembling pipeline to uncover, organize, and take out waste. As per Kaneko and Nojiri (2008),it was in this way received by Toyota and numerous Japanese fabricating foundations with extensive achievement in eliminating so as to raise efficiency waste.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This study extracted to examine the just-in-time (JIT) application or system in the furniture's company in Kuantan, Pahang. Here the researcher want to know the most importance just-in-time system that will be implement in the processes of making the customized product and the response time in the company. This chapter will discuss about the methodology involved. Different methods of data collection are discussed which is focusing on the reasons for choosing the particular methods over others. Next it will be preceded by adequate explanation of data collection and data analysis procedures and the concluding section that summarizes the entire research process. Lastly, the methods of analysing data will be reviewed.

3.2 DATA COLLECTION

Collection techniques are important aspects that need to be considered during the process of data collection. The data collection is a method which information that related to the scope of study is gathered by the most suitable mediums. The types of data are basically classified on the basis of their collection methods and also their characteristics. There are two types of data which are primary data and secondary data. The primary data is the data that has been collected first hand and original by the researcher who was part of the study and the methods vary on how researchers run the study and follows the scientific method. It is typically original research without relying

on any kind of pre-researched information. The common primary data collection techniques are interviews and observation. The secondary data is the data that collected from other means instead of the researchers. In addition, the secondary data is types of information that has been gathered by the researchers and has recorded in books, articles and the other publications. For the examples of secondary data are included government census and company surveys. Based on the past researcher, Joop j. Hox and Hennie R. Boeije (2005), one of the information gathering methodologies within qualitative research design the data collection strategy typically involves collecting a large number of data on a rather small, purposive sample, using techniques such as in-depth interview, participant observation, or focus groups.In this study, there are two types of data that really helpful that is primary data and secondary data. Nordquist (2011) state that primary information is the result digging true primary sources, for example, documents, text, historical, works, experiments, and interviews. The researcher also state that secondary data that has been gathered by researchers and are recorded in a book, articles, and others publications.

3.2.1 PRIMARY DATA

Primary data is a first-hand data that has been collected by the researcher. The data obtained must be precise and relevent as well as trustable. This is very important because the final result from the study is based on the data obtained in the research. Specific and precise primary data will produce better and good findings or results of the research. In addition, it is important to collect the data using the right and suitable types of data collection. This study is qualitative study.Primary data that are collected for the research problem at hand, using procedures that fit the research problem best. (Joop j. Hox and Hennie R. Boeije 2005). The data obtain the information about the just-in-time system in the process of making the custom made product. All the factors about the reduction of lead time will be used as a data collection technique. The types of data collection provide the researcher become more reliable data and trustable data. In this study, the strategy to reduce the lead time for the process of making the customized product should be conducted in the furniture's company that has been choose. The data collection will be conducted through the observation and interview with the manager

and interior designer in the company. Table 3.1 below shows the example of primary data.

Table 3.1: Example of Primary Data

Category	Examples
Written Documents	Federal and state laws; Federal, state, or local government documents, including birth, marriage, and death records, court records, census records, etc; Autobiographical works, including books and memoirs; Personal papers, including diaries and correspondence; Creative works, including fiction; Magazine, newspaper, or journal articles written during the time period that you're writing about; Accounts of research, including research diaries, reports, and articles.
Oral Histories or Traditions	Interviews, speeches, and personal narratives. Often these are sound/audio or video recordings.
Visual Artifacts	Paintings, films, photographs, maps, coins, stamps, tombstones, or other creative media.

Source: Summer Leibensperger (2005)

3.2.2 SECONDARY DATA

Secondary data is a data that has been gathered by the researchers and it has recorded in other publication such as books, articles, journals and other publications. In this research, the secondary data is obtained through the reading from academic materials, online journals and also from the articles that are available. The data cannot be classified as a first-hand data like the primary data because it is collection of information and data that has been published by the past researchers from many field of study. In addition, this material created by other researchers is made available reuse by the general research community and it is called secondary data. (Joop j. Hox and Hennie R. Boeije 2005). Besides that, the secondary data is data that already collected and collated by someone for some reason other than current study. It is provided with clear understanding to the readers by the researchers about the certain topics. As a conclusion, the secondary data provide a better and new perspective in the current study and the secondary data is also act as a supplement and guide in conducting the study to the researchers.

As a comparison, the secondary data that has been used in this study is as published journals and articles, reading materials and scholar's opinion. There are lots of past researches that conducted their research in this topic. So, the past researches will be as a reference to guide the researcher in the just in time topics. There are some books especially in the just-in-time system that used as a guide during the research.

In addition, secondary data has a lot of advantage but need to aware because by take secondary data also being misused (Atkins, 2001; White 2010). All secondary data that already taken should be examined to make sure that data are reliable, timely, and fulfil what need.The one thing that need to account is the age of the secondary data because sometimes the age of the data can be an issue. The data should not out dated and situation surrounding the data must be same. For example, using 13 years old data on number of hours per week Malaysian family uses a television would show very different result from the same data collected today.

3.3 RESEARCH PROCESS

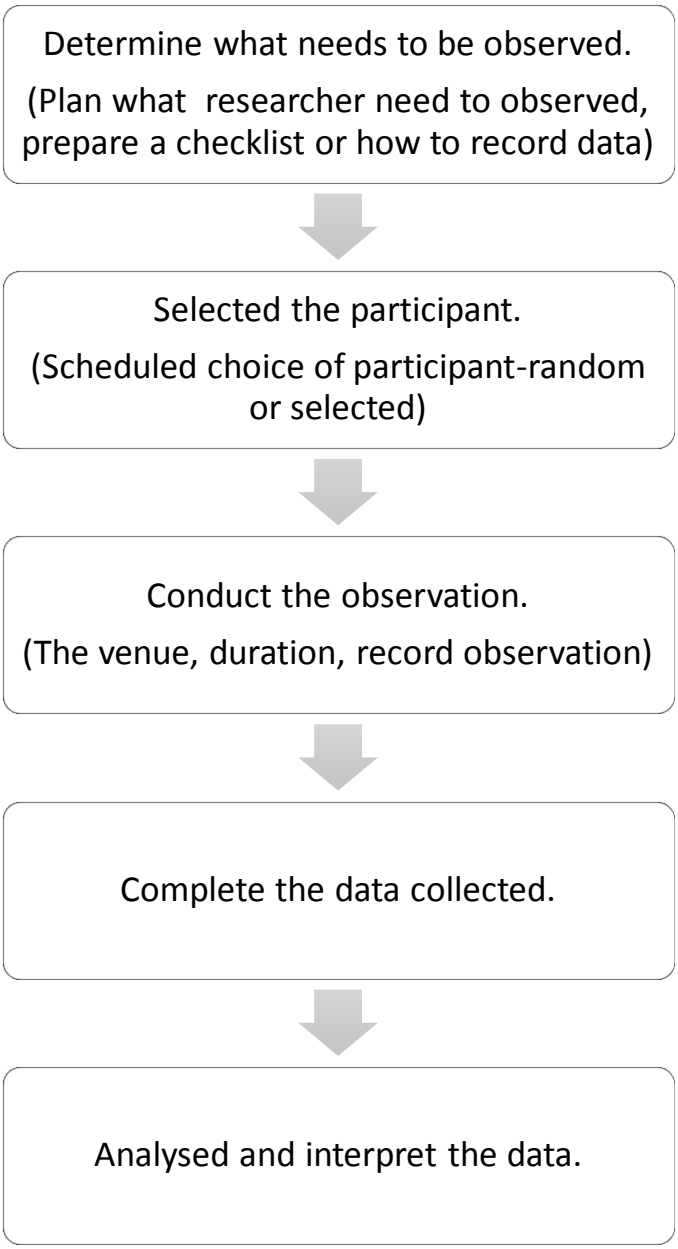


Figure 3.1: Research of Observation Process

3.3.2 RESEARCH FRAMEWORK

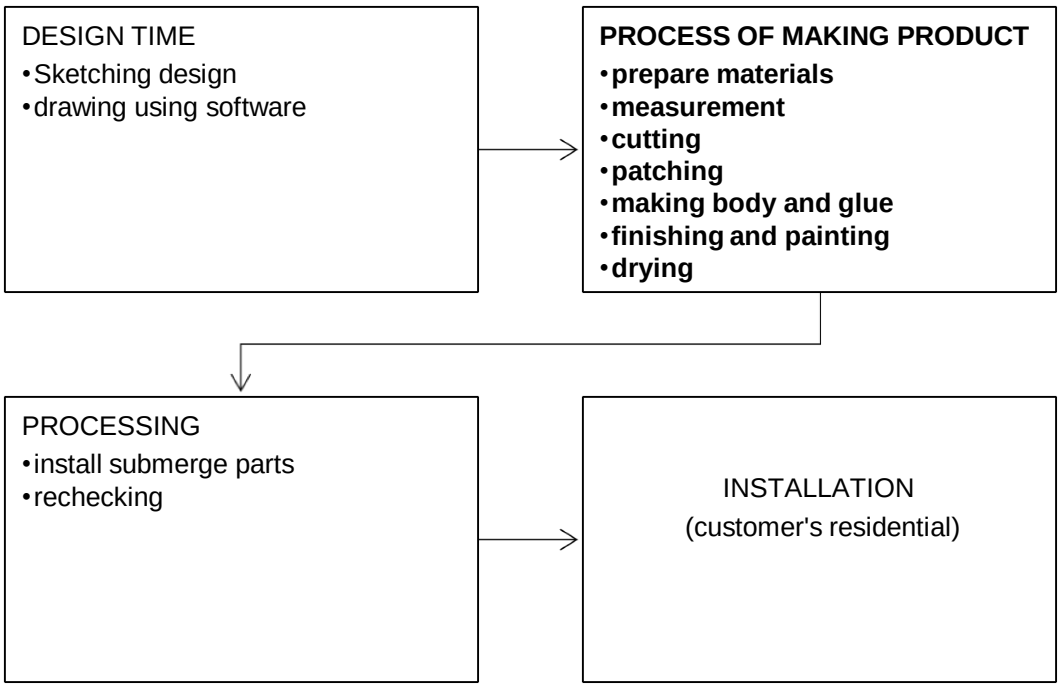


Figure 3.2: Process flow of customized cabinet in the Furniture company.

The figure 3.2 above shown the process of making the customized cabinet in the company that has been choose by the researcher. This study will focused on the process of making product activities which is involve some process such as preparing, measurements, cutting, patching, making body and glue, finishing and drying in the company in order to reduce the lead time duration to meet the companies goals in achieving the efficiency and getting the high productivity in the company. Researcher will observe the lead time on the process of making the customized cabinet in the company.

3.3.3 PROCESS OF MAKING CUSTOMIZED CABINET IN THE CHOOSEN FURNITURE'S COMPANY.

There are the process of making the customized cabinet in the company of Indahreka Perabot that has been choose. The steps in the process that has been used for so many years since the company has started around 20 years ago. The first step is introducing the product and design to the customer. The customer will provided with the stated design in the catalogue of the furniture's company and they will choose the design that they interested. But they have another option which is develop the model or design based on their own requirements. The second step is list down all the customer's requirement which is the interior designer have to job down all the important note and requirement that customer want in order to avoid any problem between the requirement and finished product. The third step is prepare all the materials needed and order the materials based on the list that customers want. At the same time, the company will call their supplier to order the materials and stock for the customers. The forth step is make a payment or deposit and agreement. The customer needs to pay amount of money as a deposit payment to the company and sign the agreement with the company. The fifth step is go to site for measurement of size and space needed in the customer's residential. The interior designer with the worker will go to site to measure the size of cabinet and the space that will place the cabinet. The sixth step is sketching and drawing the design for confirmation. The interior designer will draw the plan design using the 2020 software to make a three Dimension drawing 3D to proposed to the customer for confirmation. After they agreed, the plan design will be sent to the factory to produce the cabinet.

The supervisor will study the plan design and the next step will followed which is producing the product based on the requirements. It will take a few weeks depends on the design and demand. After the product is finished, they will go to site which is customer's residential to send the customized cabinet and place the cabinet at the right place and at the right time. the last step is customers need to make a full payment to the company. The customers will provided with free item as a gift from the company. According to Talha (2002), in order to compete effectively, companies must be capable of manufacturing high quality products at a low cost, and also provide a first class

customer services. In addition, they must have the flexibility to cope with short product life cycles, demands for greater product variety from more discriminating customers and increasing international competition.

3.4 RESEARCH PROCESS

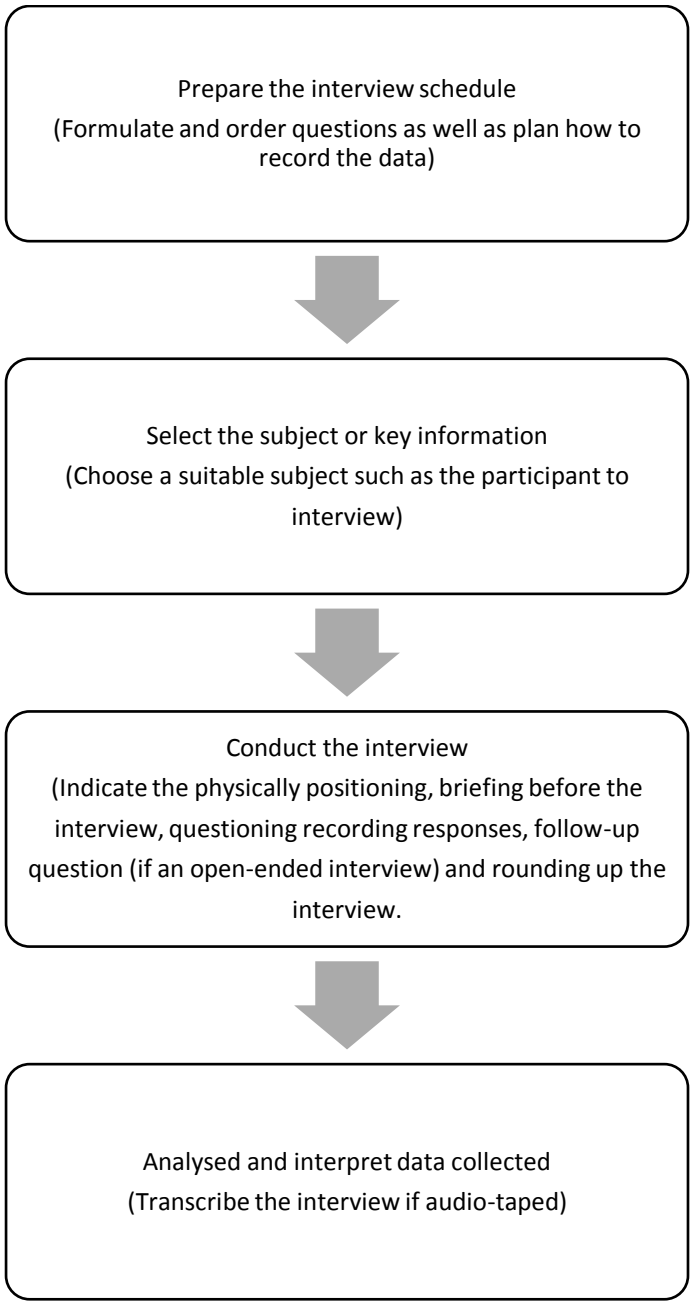


Figure 3.3: Research Of Interview Process

There are five step for the preparation of observation process in this study. The first step is determine what needs to be observed which is plan what researcher want to observed, prepare a checklist or how to record data in order to collect the data in the furniture company. The second step is Select the participant which is schedule the choice of participant whether random or selected participant. The third step is Conduct the observation such as the venue, duration, record observation (notes/ tape recorder), and take photographs if permitted by the company for records as a evidence. The forth step is complete the data that has been collected in the furniture company that has been observed. The final step for research of process of observation is analysed and interpret the data that has been collected.

While there are four steps for preparation of interview process in my study which is the first step is prepare the interview schedule which is formulate and order questions as well as plan how to record the data during the interview session. The second step is select the subject or key information which is suitable subject such as the participant to interview. The data will be collected for those who expert in this kind of field. The third step is conduct the interview include the indicate the physically positioning, briefing before the interview, questioning recording responses, follow-up question (if an open-ended interview) and rounding up the interview and the last step of interview process is analysed and interpret data collected which is transcribe the interview if audio-taped.

3.5 PARTICIPANTS

In this research, the respondent is the process of making the customized cabinet in the furniture company that has been selected at Kuantan. The data will be collected based on the duration or cycle time during the process of making the customized cabinet based on the customer’s requirement. Besides that, the data also collected by the information that obtained from the workers in that company.

3.6 DATA ANALYSIS

Firstly, after identifies the elements, the researcher will use a table as her diagram to show the elements involved by following the objectives. The table that researcher use is as following:

TABLE 3.2 : The description of elements in the furniture company.

NO	ELEMENT	PROBLEM	STRATEGY
1			
2			
3			

By using the table, the elements that contribute to the lead time of the process of making the customized cabinet in the furniture company can be clear and easy to understand to the reader in order to identify the problem occurred. After that, the researcher will use all the strategy to overcome the problems. The data that has been taken by the researcher will be analysed using the table to determine the best solution. The final decision will made after the final result comes out.

TABLE 3.3: The Process duration (lead time) in process of making product in the production line

Operation	before	after	Improvement of time
1			
2			
3			
4			
5			
6			

The table above will provide the duration in process of making product activities in the company that has been choose by the researcher. The lead time will be record as before and after implementation of new method or suggestion from the researcher. The change of time or improvement will be shown in the table above. The reduction of time in the lead time will be recorded in the table to show the result after the reduction of lead time in JIT is implemented.

TABLE 3.4: DETAIL OF TIME REQUIRED IN LEAD TIME OPERATION

OPERATION NUMBER	PROCESS	ACTIVITY	TIME REQUIRED (hours/days)
1		Internal	
2		Internal	
3		Internal	
4		Internal	

Table 3.4 above shows the process and activity that involved in the process of making product activities and provided with time required for each process. Researcher will identify the time required for each process in the process ofmaking product activities. The time required will be record in a day because the process takes a longer time to complete all the process.

3.7 DATA COLLECTION TECHNIQUE

For data collection technique, one furniture company has been choosing to interview and the furniture company that has been selected to ask questions about the process of making the customized cabinet.The company background and the target of the study in the company have been identified. The factors that influence the problem arise in the company can be determined through analyse the process flow of producing the product in the company. In this study, the data were collected using two major

sources which is the primary data and secondary data collection. Data is a facts, figure, materials, past and present, serving as basic to study and analysis in helping researchers for references on specific issues and problem (Cavana Y . et all, 2009) In this study, the primary for data collection is done by obtaining relevant data from observation and interview. Researchers choose this method because it can provide the unique opportunity to uncover rich and complex information. This method of interview was through face to face interview and the designed interview will based on the six factors which are the pattern of interview, listening, questioning, and observation. According to Cavana Y. et all, (2009), secondary data were used as a reference and supplement data for the research. Besides, secondary data also referred to the information gathering by the previous researchers. Therefore, secondary data were obtained from various sources such as journals, books, internet, reports or conferences, statistical abstracts, database and other sources. Usually researchers use a secondary data in the literature review to support the statement and give better understanding on the research.

3.7.1 OBSERVATION

Observations were conduct to observe the process flow of making the customized product in the furniture company and will be focusing on the process of making the product which is to reduce the lead time in the process. The process flow and the time required will be observed and record to identify the lead time during the process. Step by step will be test to get the right data before implementation of the strategy to reduce the lead time in of producing the customized product in the company. The time study for observation will be depends on the information and data needed and will be observe at least three time in one month. Observation is conducted to complete the time study of lead time of each process in the company. Another widely used method is participant observation, which generally refers to methods of generating data that involve researchers immersing themselves in a research setting and systematically observing interactions and others. (Joop j. Hox and Hennie R. Boeije 2005).

3.7.2 INTERVIEW

Interview sessions were conduct with two person in the company which are the manager and the interior designer who was responsible to manage the company. Interview is one of the most effective way of collecting data and detailed information. A second established primary data collection strategy is the interview survey which is characteristically, a large number of standardized questions are asked and the responses are coded in standardized answer categories. (Joop j. Hox and Hennie R. Boeije 2005).These interviews were a structure interview with ten questions where only those questions were asked to gain the necessary information. The sessions were conducted by face to face interview. The interviews were recorded and later transcribed for data analysis and interpretation. The question of interview is open-ended question. The open-ended questions were requiring participant to answers in relevant information or express their personal opinion.

3.8 CONCLUSION

In this chapter, we had identified the guide lines and procedures that will be applying in this research. Research methodology leads the work throughout the life cycle of a research. This chapter discussed various aspects of the study related to the research methodology includes data collection, research process, participants, data analysis, and data collection techniques. Since the purpose of this research is to identify the elements that contribute on the longer lead time of producing the customized cabinet product in order to reduce the lead time in the furniture company for this study.

Moreover, a survey method has been done using an observation and interview in order to gain a better understanding of the research area. The question of the interview was developed based on research questions and research objectives. The data collected through the interviews and observation were analysed using a few suggestion that researcher propose to overcome the problems. The statistics results were presented in table form with detailed description. Research schedule has also been designed using Gantt chart to be a guide in this research in order to ensure the research is done in a systematic and effective manner.

Researcher will analyse the data of lead time in the furniture company that has been choose to suggest some methods to reduce the lead time in the company. lead time is a important element in the production because the lead time will affect cost and response time. researcher may suggest some improvement to meet the research objective in this study. McIntosh, Owen, Culley, and Mileham (2007) have proposed that the potential improvements in the changeover time can be done either by changing the sequence of activities without any variation in the way of performing tasks or by altering the existing activities to complete the task more rapidly.

CHAPTER 4

DATA ANALYSIS (RESULT AND DISCUSSIONS)

4.1 INTRODUCTION

This chapter presents the result that obtained by the structured table that showing the issues or elements that contribute in the longer lead time in IndahrekaPerabot. Then, it will propose by the new solution or suggestion for each elements or problem that come out from the process of producing the customized cabinet or furnitures in the company. The problem focused on their processing in the factory of the company. So that, it will overcome the problem with new strategy and suggestion in order to reduce the lead time of producing the furniture in IndahrekaPerabot. The new suggestion or solution will be apply by the company in order to improve the lead time and also can be implement by others furniture's company to achieve the research objectives.

The data in the table below is collected based on my research and observation in the company and based on the information given by the company. The data will be structured in the table and all of the information and answer of the research question will be summarized in the table.

4.2 TABLE OF PROCESS DESCRIPTION

Table 4.1: Description of the Problem and Strategy for each Element in Producing the Customized Cabinet.

NO	ELEMENT	PROBLEM	STRATEGY
1	Prepare materials	Weak relationship with the supplier and the location between the supplier.	forecasting on regularly ordered and make a buffer stock, reducing the order frequency, find reliable supplier and build Strong relationship with the supplier.
2	Measurement	Lack of skill worker and the site location.	Support training for all worker.
3	Cutting	Lack of skill worker and lack of machine.	Using standard design and size for some product, using standard cutting technique and add more advance cutting machine.
4	Patching	No machine provided.	Purchase a machine for the process.
5	Making body and glue	Lack of machine and skill worker.	Standardize the body frame for customized furniture and purchase a advance machine.
6	Finishing and painting	Lack of machine.	Using standardize (delayed differentiation) for the process and add more machine.
7	Drying	No advance machine and no specific space for drying.	Purchase drying machine.

The table above shows the elements that focusing on the process of prepare materials, measurement, cutting, patching, making body and glue, finishing and painting and drying. The table is provided with the problem that occurred in the processes of producing the furniture and the table is also provided with the strategy that can be used to solve the problem occurred. The strategy that can be use is based on our discussion and the strategy might be incurred high cost since every improvement and productivity will incur cost and time.

4.3 ISHIKAWAs (CAUSE AND EFFECT) DIAGRAM

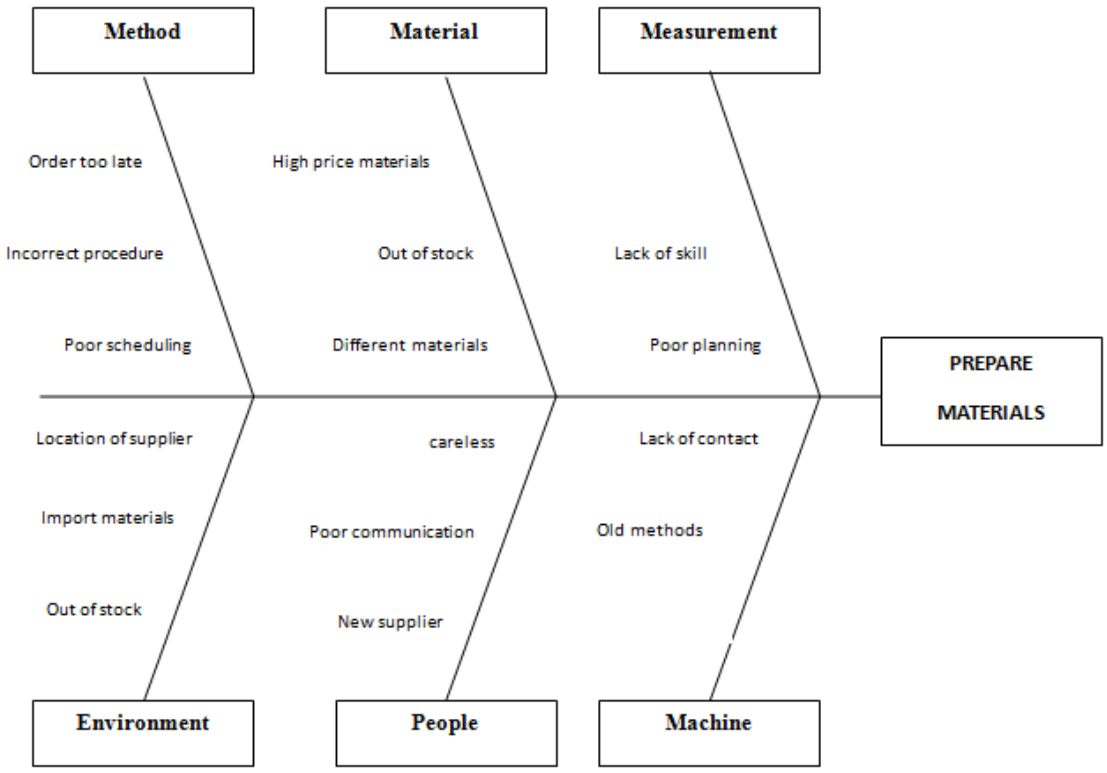


Figure 4.1: Cause and Effect Diagram of Prepare Materials Process

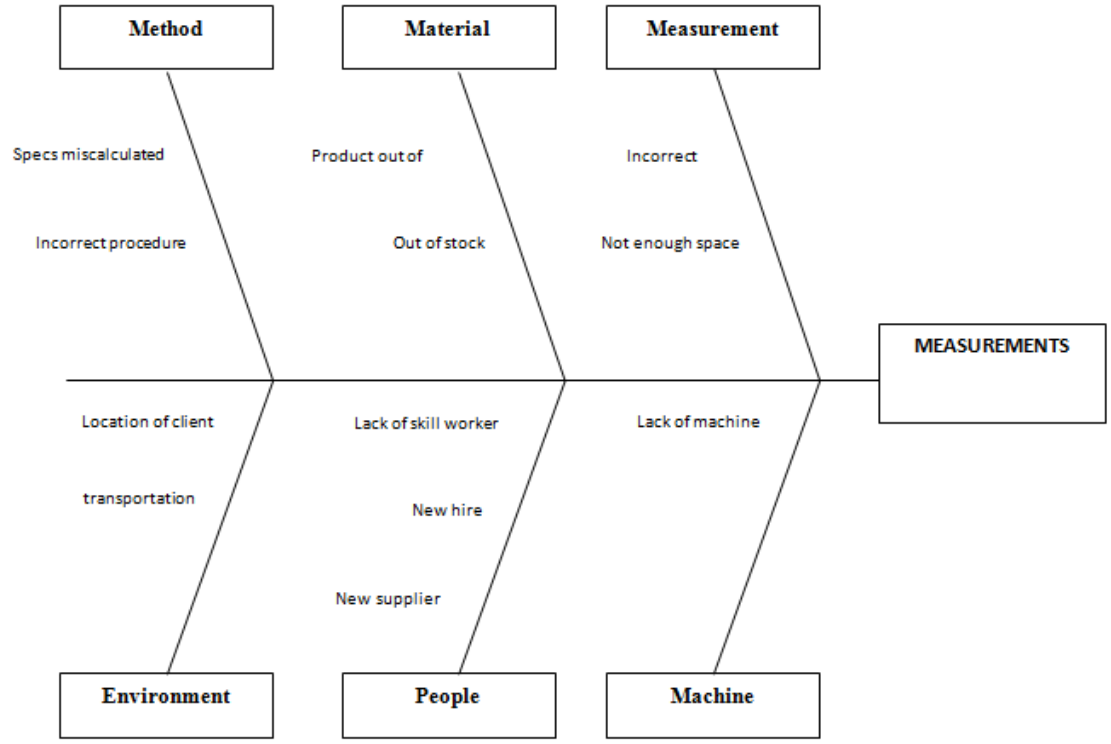


Figure 4.2: Cause and Effect Diagram of Measurements Process

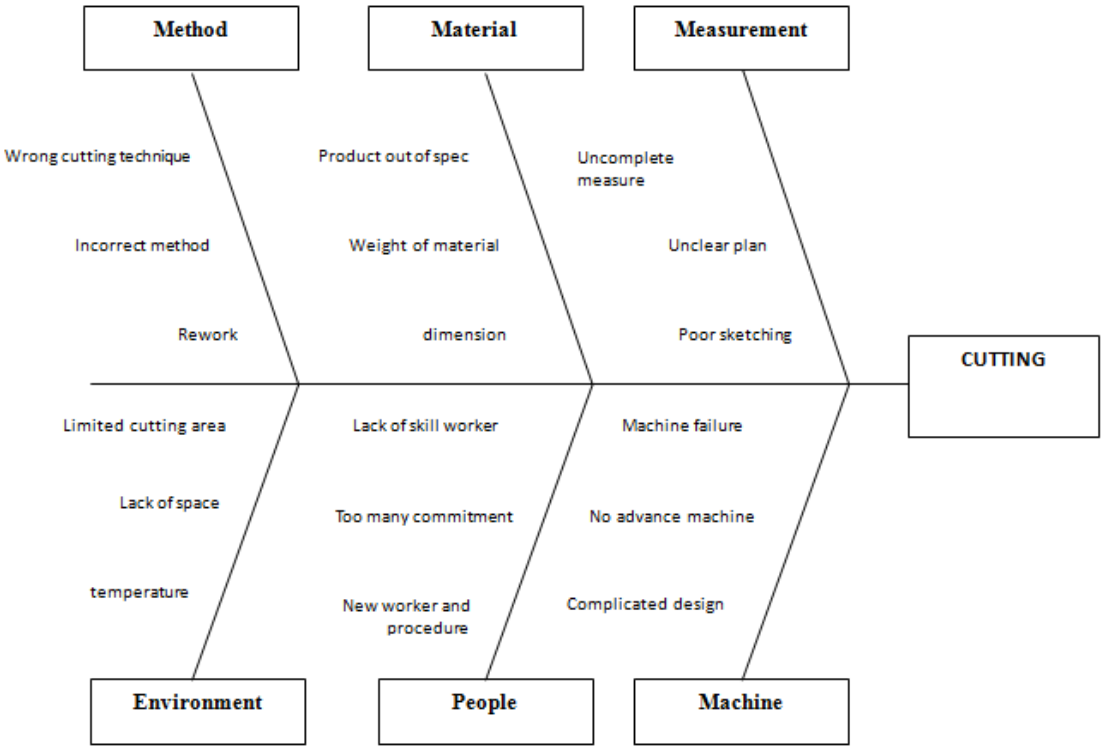


Figure 4.3: Cause and Effect Diagram of Cutting Process

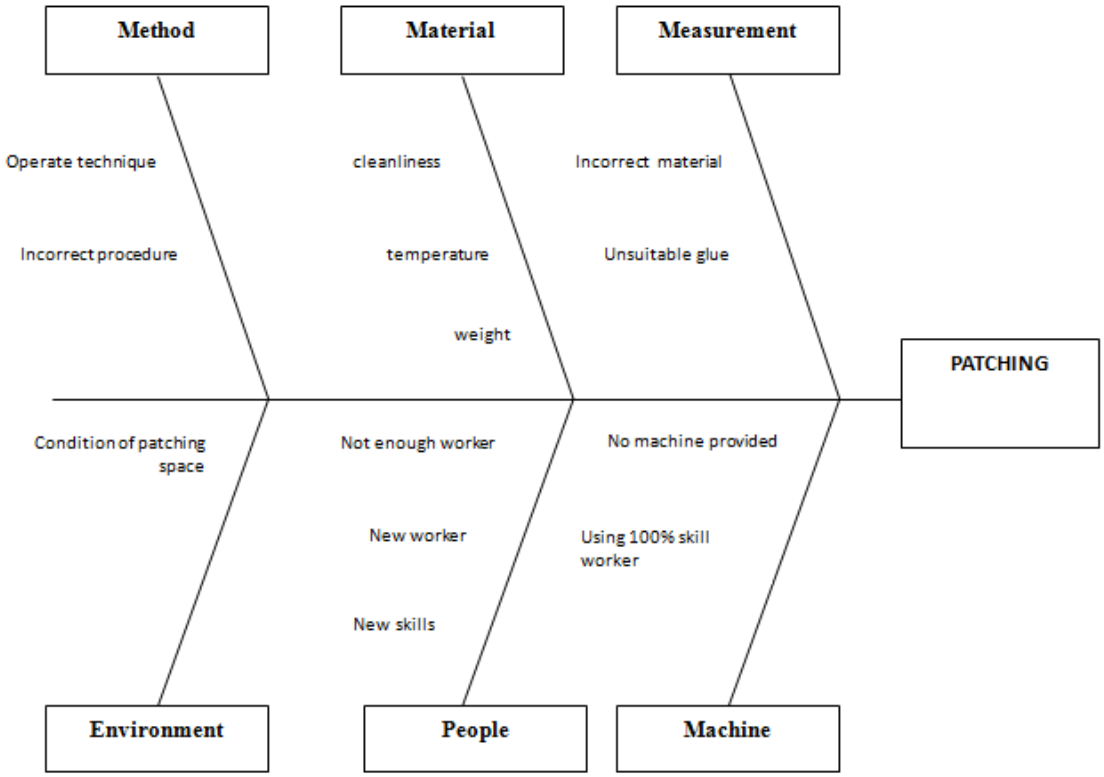


Figure 4.4: Cause and Effect Diagram of Patching Process

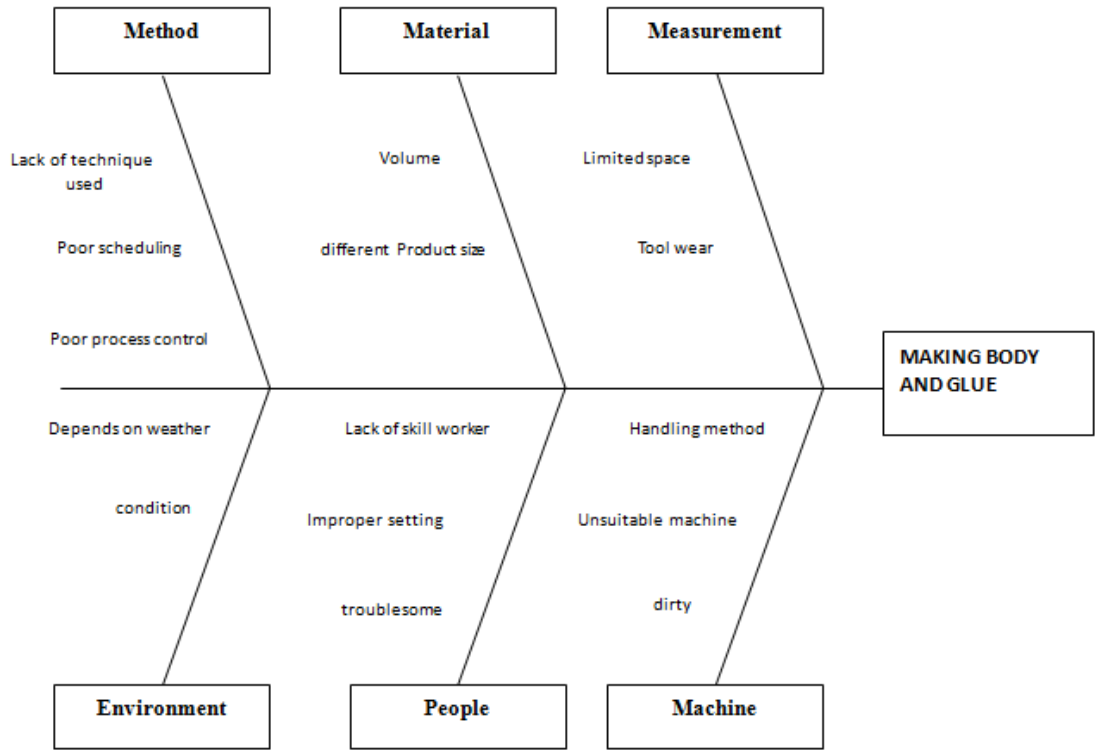


Figure 4.5: Cause and Effect Diagram of Making Body and Glue Process

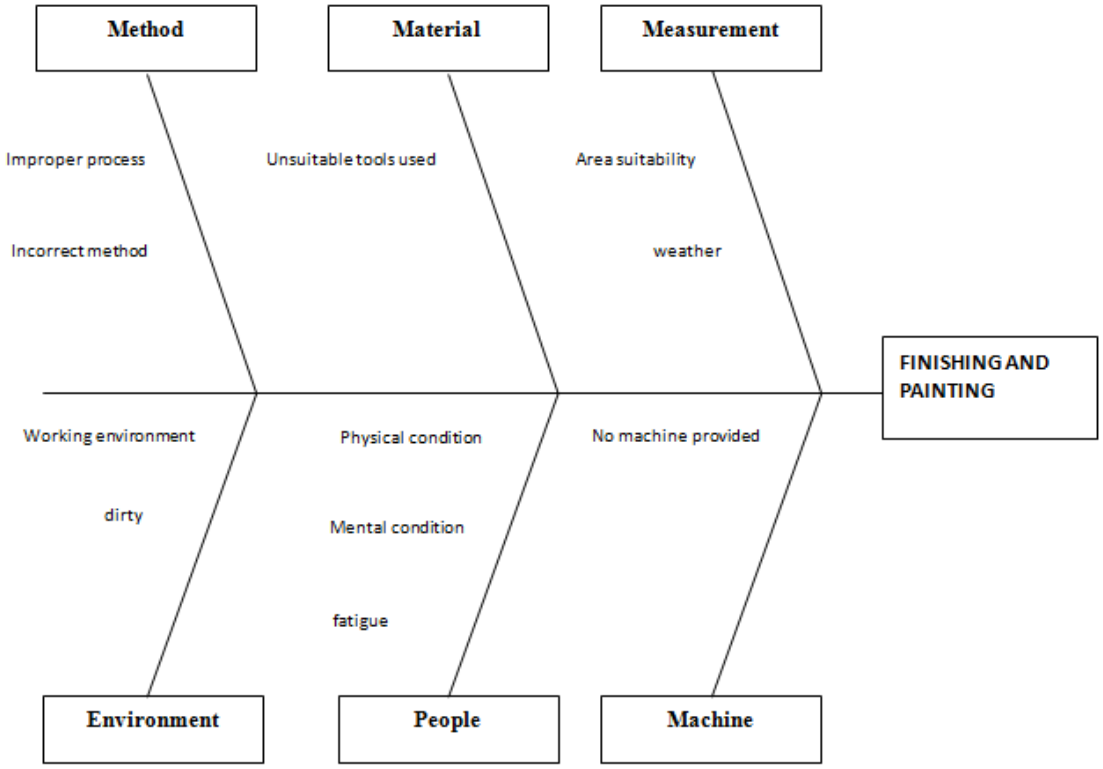


Figure 4.6: Cause and Effect Diagram of Finishing and Painting Process

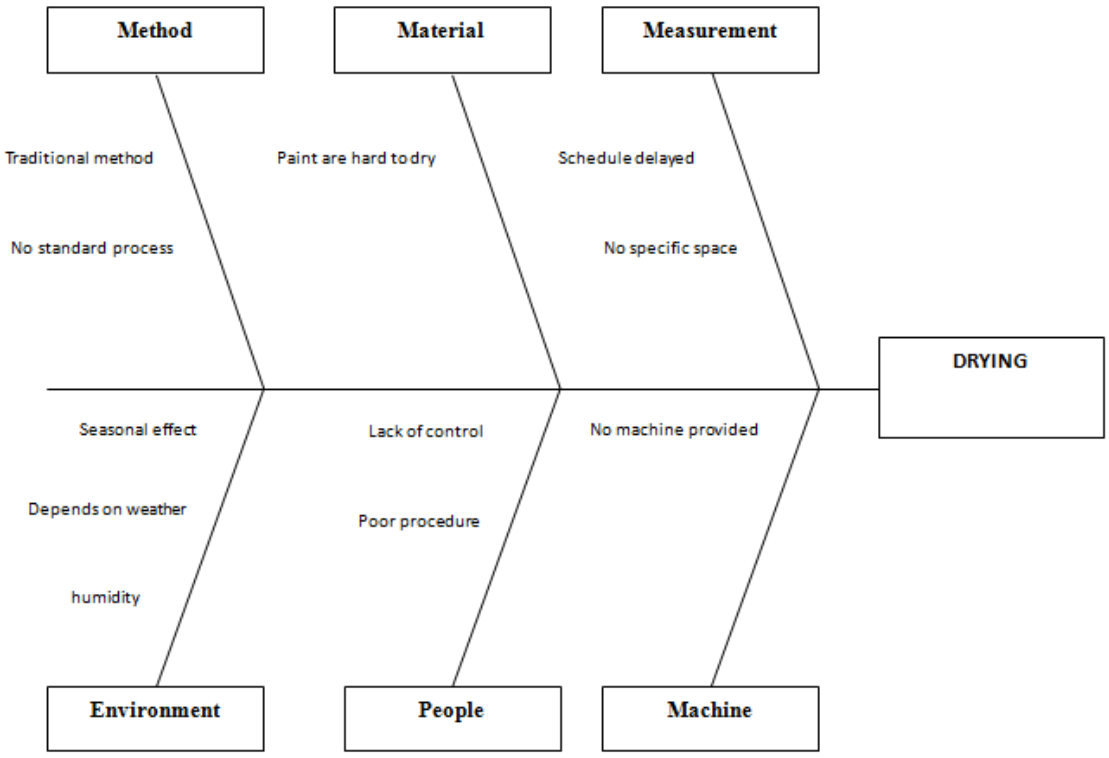


Figure 4.7: Cause and Effect Diagram of Drying Process

The cause and effect diagram above explain about the root causes of each process in producing the customized furniture which is divided by six (6) elements such as measurement, material, method, machine, people and environment. There are explanation of the effect that caused longer lead time to produce the customized furniture in the company.

4.4 THE LEAD TIME OF CUSTOMIZED FURNITURE PROCESS

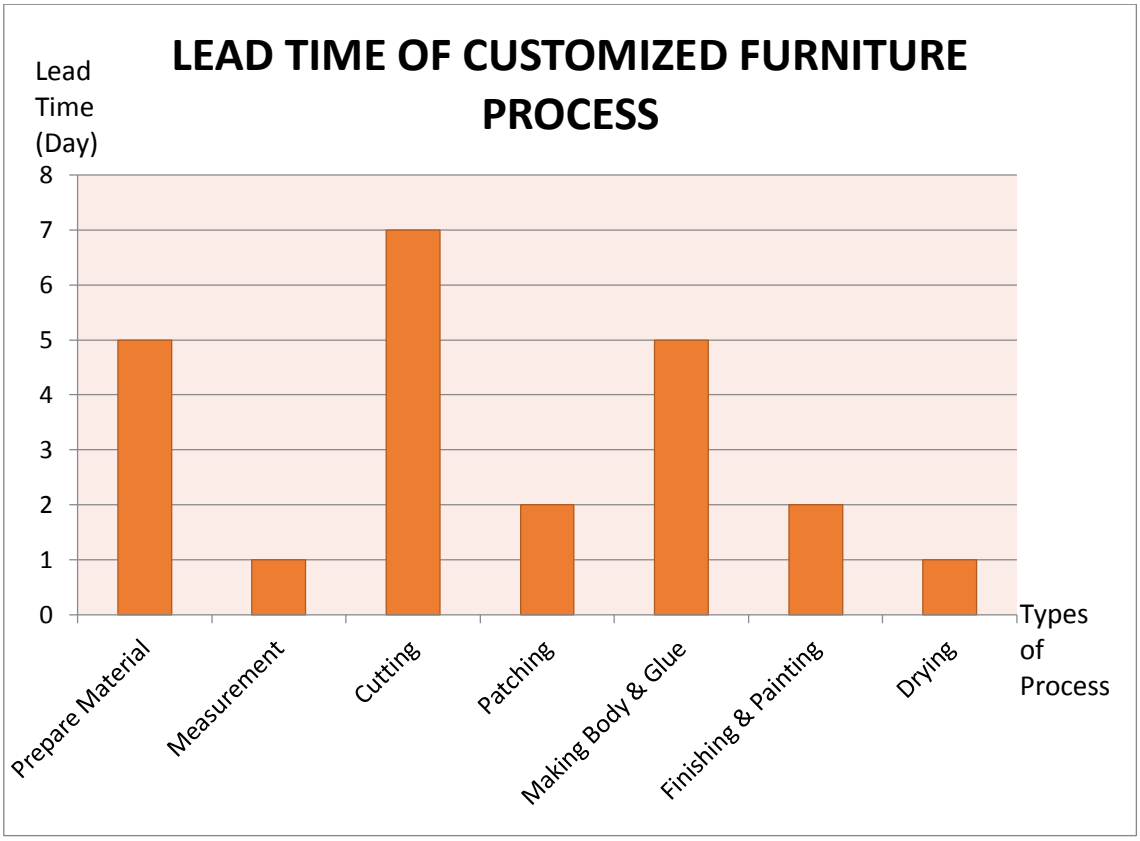
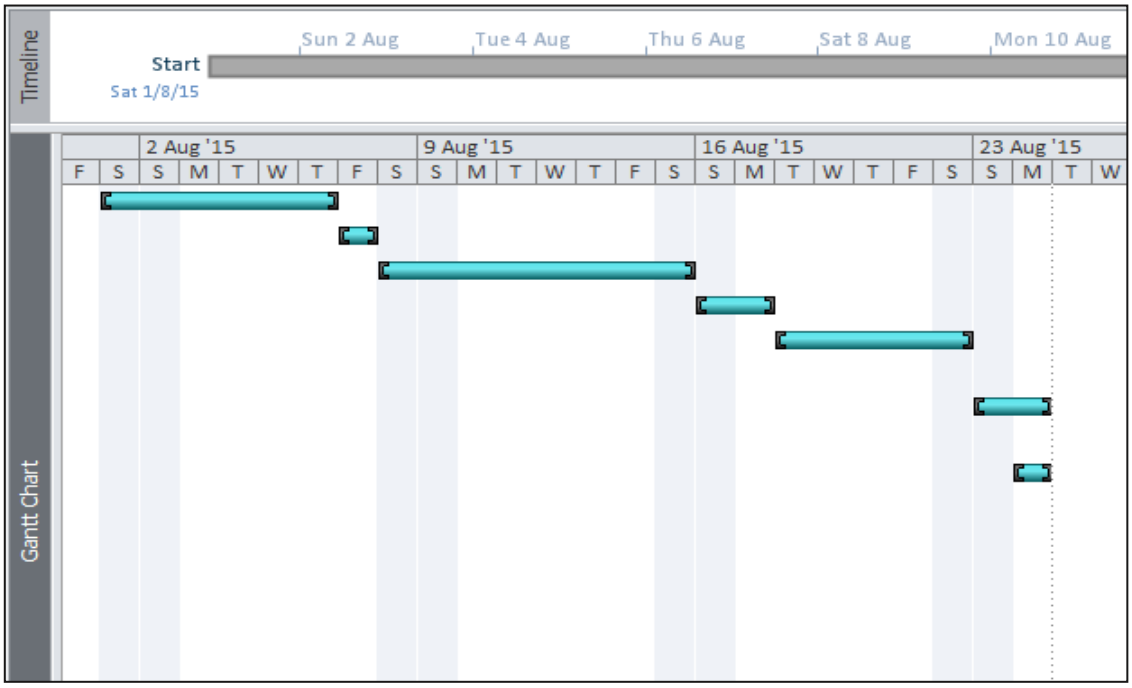
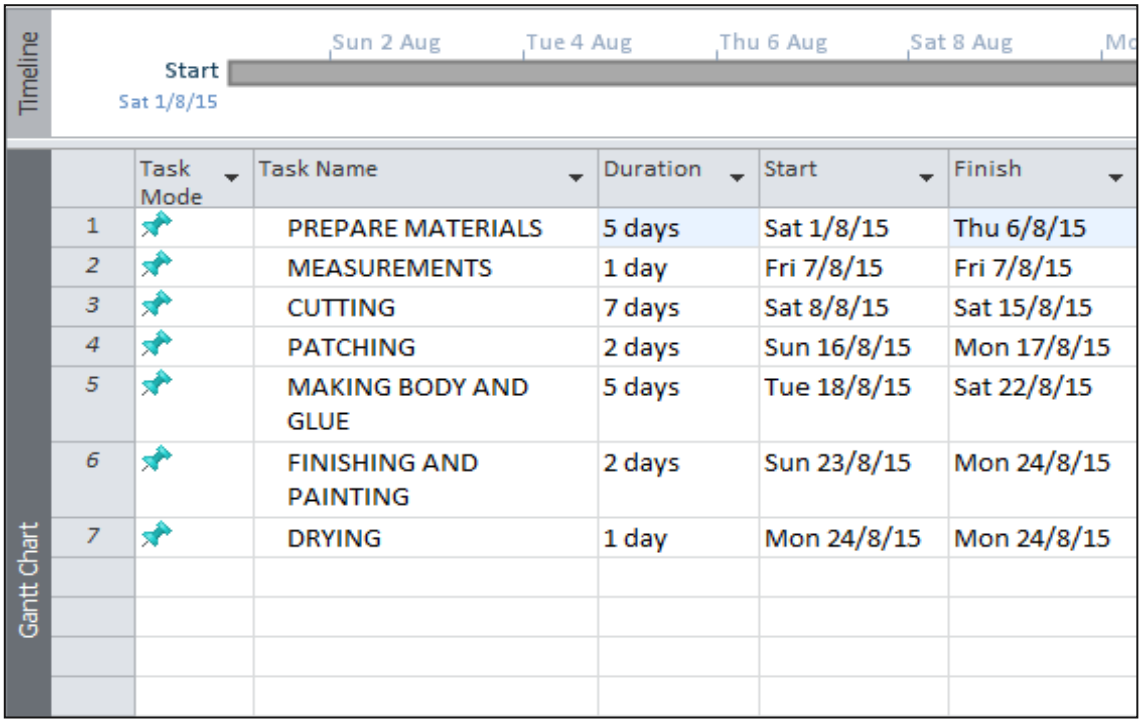


Figure 4.8: Lead Time of Customized furniture Process

The figure above shows the lead time of each process that involved in producing the customized furniture which is focusing on seven (7) process. The chart shows the cutting process is higher lead time than the other processes involved in the company. The cutting process is most critical process in the company which are take a longer lead time.

4.4.1 GANTT CHART: PROCESS OF PRODUCING THE CUSTOMIZED FURNITURE





	Task Mode	Task Name	Duration	Start	Finish
1		PREPARE MATERIALS	5 days	Sat 1/8/15	Thu 6/8/15
2		MEASUREMENTS	1 day	Fri 7/8/15	Fri 7/8/15
3		CUTTING	7 days	Sat 8/8/15	Sat 15/8/15
4		PATCHING	2 days	Sun 16/8/15	Mon 17/8/15
5		MAKING BODY AND GLUE	5 days	Tue 18/8/15	Sat 22/8/15
6		FINISHING AND PAINTING	2 days	Sun 23/8/15	Mon 24/8/15
7		DRYING	1 day	Mon 24/8/15	Mon 24/8/15

Figure 4.9: Gantt Chart of Producing Customized Cabinet

4.5 THE PROCESS LEAD TIME OF CUSTOMIZED FURNITURE BEFORE AND AFTER THE IMPLEMENTATION OF NEW STRATEGY

Table 4.2: Old and New Lead Time (Duration) of Producing the Customized Cabinet

Operation	Before (Day)	After (Day)	Improvement of time
Prepare materials	**5**	**3**	**2**
Measurements	**1**	**Less than 1**	**-**
Cutting	**7**	**5**	**2**
Patching	**2**	**1**	**1**
Making body and glue	**5**	**3**	**2**
Finishing and painting	**2**	**1**	**1**
drying	**1**	**Less than 1**	**-**

The table above shows the duration required for each process in producing the customized furniture or cabinet in the furniture company. The duration or lead time of the process is divided by two columns which are before and after. For the second column, there are duration before researcher applies the strategy for shorter lead time in Just-in-time application and the third column is provided with the duration of the process after researcher implement the new strategy and suggestion for the company.
The readings in the table above shown some improvement when researcher implement the strategy in order to reduce the lead time in the company while reducing the waiting time.

Simple calculation

Before = 23 day (old method)

After = 15 day (new method)

Improvement = 8 day

4.6 DETAIL OF TIME REQUIRED IN INTERNAL OPERATIONS

Table 4.3: Time Required For Internal Operation

Operation Number	Process	Activity	Time Required (Hours/day)
1	Cutting	INTERNAL	5
2	patching	INTERNAL	1
3	Making body and glue	INTERNAL	3
4	Finishing and painting	INTERNAL	1

The table above shows the internal processes which are the processes that involved in the factory only. There are four processes which is cutting, patching, making body and glue and finishing and painting. The time required in day is recorded after the implementation of strategy that has been stated in the table of description above.

The internal processes depends 100% to the skill worker in the factory to fulfil all the customer's requirements. One of the strategy of improving and reducing the lead time is provide the training for all worker to be a skill worker for all processes and not only for the one process only.

4.7 THE COMPARISON BETWEEN OLD AND NEW LEAD TIME OF EACH PROCESS OF PRODUCING THE CUSTOMIZED PRODUCT.

4.7.1 OLD LEAD TIME OF PRODUCING THE CUSTOMIZED CABINET.

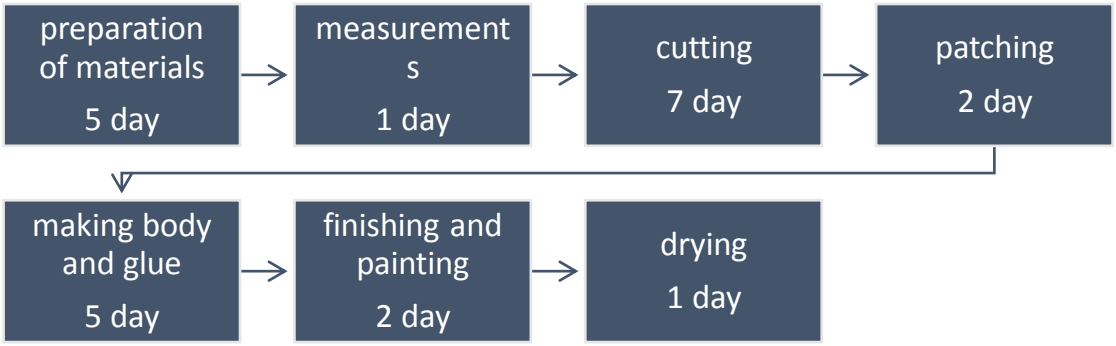


Figure 4.10: Old Lead Time of Producing the Customized Cabinet.

4.7.2 NEW LEAD TIME OF PRODUCING THE CUSTOMIZED CABINET.

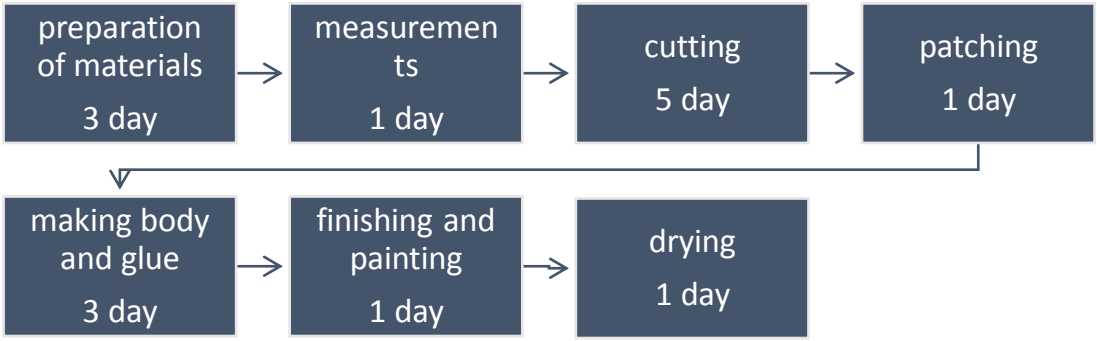


Figure 4.11: New Lead Time of Producing the Customized Cabinet.

4.8 THE FAILURE MODE AND EFFECT ANALYSIS (FMEA) FOR PRODUCING THE CUSTOMIZED FURNITURE.

Table 4.4: Failure Mode and Effects Analysis (FMEA)

Part and function	Potential failure mode	Potential effects of failure	SEV	Potential Cause(s) of Failure	OCC	Detection Method & Quality Controls	DET	RPN	Recommended Actions
PREPARE MATERIAL	Longer lead time	Poor planning	4	Product delayed from supplier	5	Forecasting on regularly ordered	4	80	Record all the regularly ordered materials
	Order delayed	Lack of skill	2	Long Waiting time to received order	3	Faster order before request from client	1	6	Systematic order
MEASUREMENTS	rework	Incorrect measures	5	Wrong measurement	3	Expertise should be involved	2	30	Systematic measurement based on space needed.
	Product defect	New hire	3	Incorrect calculation	2	Guide from expert people	1	6	Support training
CUTTING	Longer lead time and rework	Poor sketching	5	Wrong cutting size	6	Standardized the size of materials	6	180	Using standard size that regularly ordered
	Scrap and long lead time	Machine failure	5	Machine stuck	3	Organized machine systematically and	6	90	Using standard cutting technique

						smooth.			
PATCHING	Take extra time and rework	Unsuitable glue for patching	3	Low quality of glue	2	Use standard glue for patching	1	6	Using materials that already patched.
	Need several time	No machine provided	1	No specific machine	1	Purchase finished materials	2	2	Using finished materials
MAKING BODY AND GLUE	Longer lead time	Lack of skill worker	3	No expertise for cutting process	4	Hire expert people	2	24	Hiring expert people
	Long lead time	Different Product size	3	Size depends on client	3	Using standard size	1	9	Standardize the body frame
FINISHING AND PAINTING	Take time	weather	1	Depend on weather and temperature	1	Using space provided for the process	1	1	Provide specific space
	May additional time	No machine provided	2	Depend on worker skills	2	Delayed differentiation	2	8	Using standard procedure
DRYING	Postponement caused more time	Schedule delayed	2	Multitask or order volumes	2	Systematic scheduling	0	4	Provide more space for drying process
	Additional time	weather	1	Wet condition	2	In-house drying	2	4	Specific drying space in house

4.9 THE DETAILS ABOUT SEVERITY, OCCURRENCE AND DETECTION OF FAILURE MODE AND EFFECT ANALYSIS.

ADDITIONAL NOTE

Ñ = Critical characteristic which may effect safety, compliance with Gov. regulations, or require special controls.

SEV = Severity rating (1 to 10)

OCC = Occurrence frequency (1 to 10)

DET = Detection Rating (1 to 10)

RPN = Risk Priority Number (1 to 1000)

Calculate a Risk Priority Number (RPN)

The RPN prioritizes the relative importance of each failure mode and effect on a scale of 1 – 1000. It is calculated as follows:

RPN = (SEV) x (OCC) x (DET)

- ⊡ A 1000 rating implies a certain failure that is hazardous and harmful
- ⊡ A 1 rating is a failure that is highly unlikely and unimportant
- ⊡ Ratings above 100 will occur
- ⊡ Rating below 30 are reasonable for typical applications

Estimate potential severity (SEV) of failure and its effect

Table 4.5: Severity of Failure and its Effect

Ranking	Effect	Criteria: Severity of Effect
1	None	No effect
2	Very Minor	Very minor effect on product or system performance.
3	Minor	Minor effect on product or system performance.
4	Low	Small effect on product performance. The product does not require repair.
5	Moderate	Moderate effect on product performance. The product requires repair.
6	Significant	Product performance is degraded. Comfort or convenience functions may not operate.
7	Major	Product performance is severely affected but functions. The system may not be operable.
8	Extreme	Product is inoperable with loss of primary function. The system is inoperable.
9	Serious	Failure involves hazardous outcomes and / or noncompliance with govt. regulations or standards.
10	Hazardous	Failure is hazardous, and occurs without warning. It suspends operation of the system an/or involves noncompliance with govt. regulations

Table 4.6: Likelihood of Occurrence (OCC) Failure

Ranking	Possible Failure Rates	Probability of Failure
1	$\leq 1 \times 10^{-6}$	Nearly Impossible
2	1×10^{-5}	Remote
3	1×10^{-4}	Low
4	4×10^{-4}	Relatively Low
5	2×10^{-3}	Moderate
6	1×10^{-2}	Moderately High
7	4×10^{-2}	High
8	0.2	Repeated Failures
9	0.33	Very High
10	≥ 0.55	Extremely High: Failure Almost Inevitable

Estimate the likelihood that the detection method in place will actually detect the fault.

Table 4.7: Detection Probability

Ranking	Detection Probability
1	Almost Certain Detection
2	Very High Chance of Detection
3	High Probability of Detection
4	Moderately High Chance of Detection
5	Moderate Chance of Detection
6	Low Probability of Detection
7	Very Low Probability of Detection
8	Remote Chance of Detection
9	Very Remote Chance of Detection
10	Absolute Uncertainty – No Control

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

This chapter is provided with the conclusion of the finding of this research. It discusses the result that has been reported and collected in chapter 4. The further section in this chapter represents the recapitulation of the study, recommendation for the future study and also the conclusion of this study.

5.2 RECAPITULATION

The purpose of this study is to determine the lead time of each processes in producing the customized (custom-made) furniture in the furniture company at Kuantan. The study aimed to identify the processes involved during producing the customized cabinet product in the furniture company and the duration that has been taken to complete each processes. The objectives of this study was to identify the elements that contribute on the longer lead time of producing the customized cabinet product, analyse which strategy that can be implement in the process to reduce the lead time and then proposed several suggestion of improvement to the process of making customized cabinet in order to overcome the problem or slack time during the processes. This study is a qualitative study in which design research is based on qualitative research which is question and answer approach.

5.3 RECOMMENDATIONS

The result shows that an integrated comprehensive framework to better understand the issues or problem faced by the furniture company in producing the product more efficient and systematic. This study should be given serious attention from all aspects to be successful in future research studies. Thus, researcher have proposed several suggestion of improvements in terms of reducing the lead time by forecasting on regularly ordered and standardized the materials needed. Proposals could be adopted by the next researcher in a future study. Then, researchers can propose the new title such as "A STUDY ON EFFECT OF SHORT LEAD TIME OF PRODUCING THE CUSTOMIZED FURNITURE" for the next study. This is because, the proposal that have been presented by researchers associated with the topic and can be made as a references.

Additionally, for the next researcher is expected that increasing the respondents to two or three furniture company to make a comparison between each other in order to strengthen the results.

In addition, the question of appropriate and accurate information to answer all question clearly and specifically. Other than that, people who want to conduct research in the future need to equip themselves with all information and should be more aware of the depth of research and clarify to provide information to participants before answering the question that will be ask. This is because, researcher need to facilitate the respondents to answer thr question given by the researcher. In short, the respondent should be given an explanation related to the current strategy of reducing the lead time of producing the customized furniture before the start of the study so that the data to be obtained is relevant to answering all of the research objectives.

5.4 THE SUGGESTION OR SOLUTION OF IMPROVEMENT IN THE PROCESS OF PRODUCING CUSTOMIZED FURNITURES.

The table below shows the suggestion of improvement from researcher that can be use for references for the next research.

Table 5.1: Suggestion of Improvement In Producing Customized Furniture

issues	Suggestion/solution
Prepare material	Forecasting on regularly ordered and makes a buffer stock, reducing the order frequency, find reliable supplier and build strong relationship with the reliable supplier.
measurement	Support training for all workers with provides them with the methods and technique of measurement process and gives a reward to the worker that shows their high commitment.
Cutting	Using standard design and size for some product that regularly ordered from the customers, using standard cutting technique and add more advance cutting machine to reduce the cutting time.
Patching	prepare the finished materials that already patched for future order and purchase any machine for patching.
Making body and glue	Standardize the body frame for customized furniture, and add more worker to making body and glue processes.
Finishing and painting	Using standardize (delayed differentiation) for the process and add more machine for finishing.
Drying	Provide specific space for drying process and purchase drying machine that will dry the paint in less than 2 minutes.

5.5 THE COMPARISON BETWEEN OLD AND NEW PROCESS OF PRODUCING THE CUSTOMIZED FURNITURE

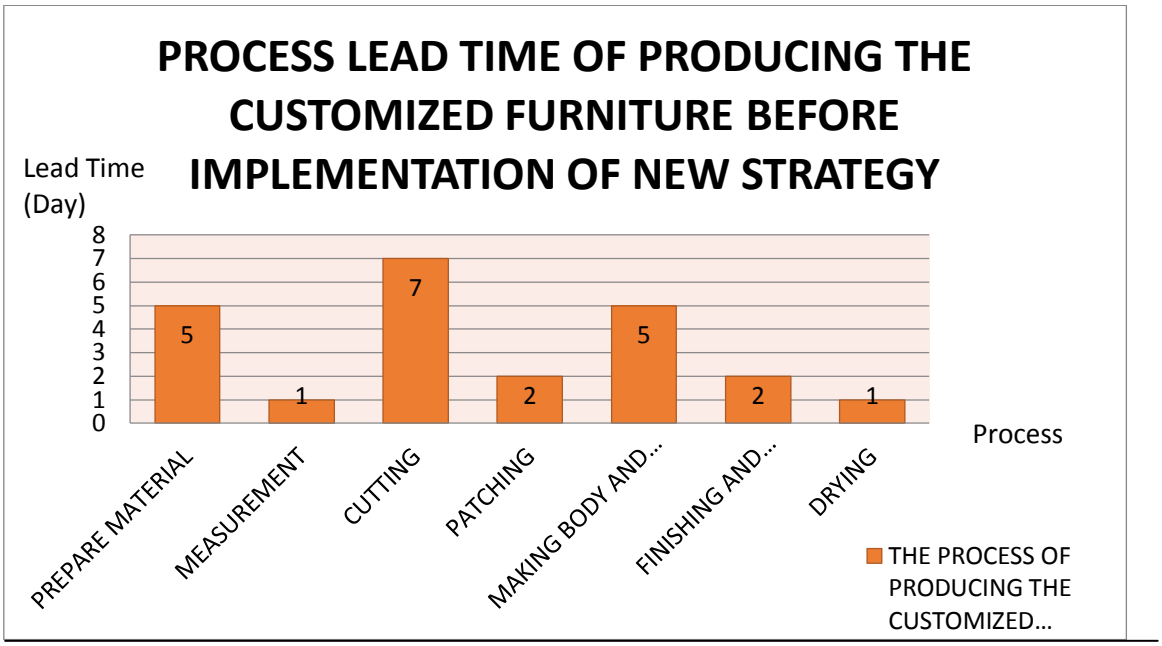


Figure 5.1: Lead Time of Producing Customized Furniture Before Implementation of New Strategy.

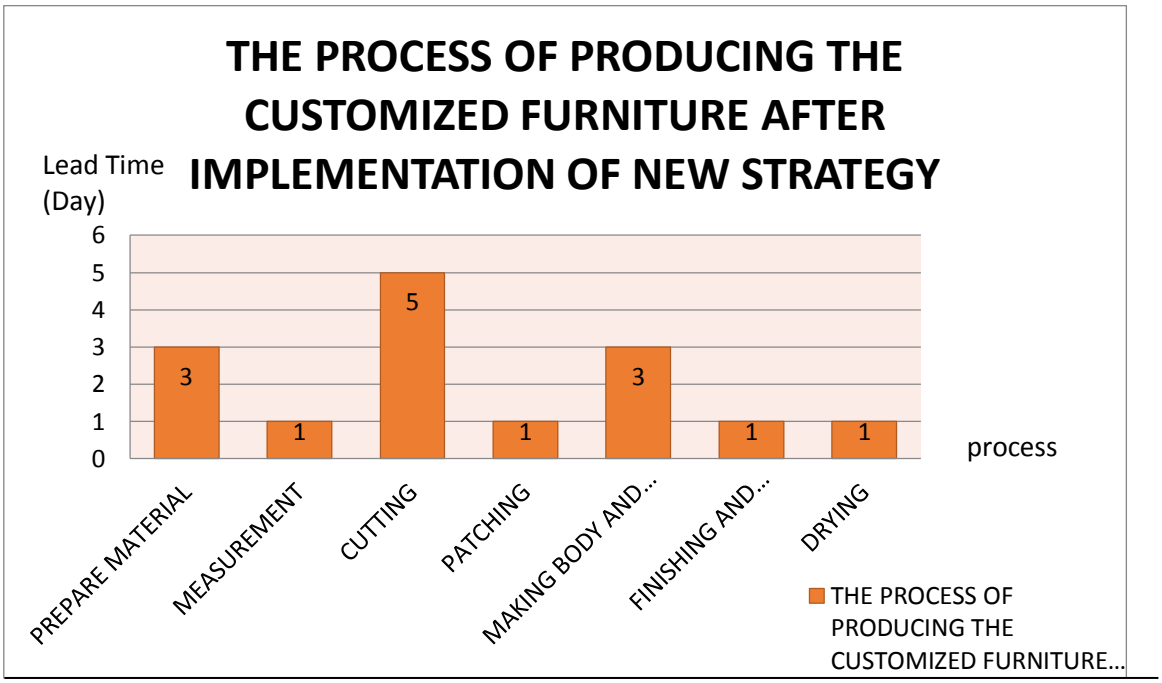


Figure 5.2 :Lead Time of Producing Customized Furniture After Implementation of New Strategy

5.6 CONCLUSION

All the objectives of this study can achieve the first objective, which is to identify the elements that contribute on the longer lead time of producing the customized cabinet product. The first objective was done through formal interviews session with the interior designer and informal interview with the manager itself and by the observation in the factory.

The second objective was also achieved in analysing which strategy that can be implementing in the process to reduce the lead time. The objective is achieved by question and answer session with the workers and the observations were made by the researcher about 3 hours. The data were collected and analysed.

Other than that, the third objective has been achieved by the suggestion and new strategy to the company to reduce the lead time. Proposals that have been proposed are based on observations and data collected during the site visit for several times.

In conclusion, all of the recommendation can be used by the furniture company who producing the custom-made furniture to reduce the lead time of each process and become more efficient and faster in order to reduce the waiting time. The faster, the better is a last word to the processes of producing the customized furniture because time is money. As a conclusion, researcher can answer all of the research objectives.

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APPENDIX

QUESTION FOR INTERVIEW:

1. What is your company background?
2. What is the current operation in your company?
3. What is the product of your company?
4. Can you explain the overall process of making the customized cabinet?
5. What is the elements that involved in the setup activities?
6. Can you explain about the duration of each activity in the company that contribute lead time?
7. What types of machine that your company used?
8. How long did your company take to produce the customized cabinet for the customer?
9. Who is responsible to make sure that customers satisfied with the product?
10. When your company decided to order the materials that need to be used?

INTERVIEW SCRIPT

Formal interview

LIANA : RESEARCHER
CIK ATIKAH : INTERIOR DESIGNER

LIANA	Assalamualaikum Cik Atikah.
CIK ATIKAH	Waalaikummussalam Cik Liana.
LIANA	Ceritakan sedikit latar belakang tentang company anda…
CIK ATIKAH	Indahreka perabot telah diperbadankan dibawah akta syarikat 1965 pada 14 ogos 2003 dan mula beroperasi pada tarikh tersebut. Syarikat ini merupakan milik penuh bumiputera yang berpengalaman dalam bidang perniagaan dan kontrak. Indahreka perabot juga menyediakan perkhidmatan seperti kabinet dapur, perabot domestik, almari pakaian, reka bentuk dalaman, ubahsuai perabot dan bangunan. Barangan yang digunakan oleh company perabot adalah seperti kayu, tiles, dan barangan berkualiti. Pelanggan syarikat ini terdiri daripada individual, jabatan kerajaan, jabatan swasta dan lain-lain. Perkhidmatan terbaik syarikat kami juga bersedia memberi perkhidmatan terbaik kepada pelanggan kami. Ini bersesuaian dengan falsafah kami yang sentiasa mengamalkan sikap berdaya saing dan mengutamakan apa yang pelanggan mahukan.
LIANA	Jenis perniagaan apakah yang syarikat anda jalankan?
CIK ATIKAH	syarikat kami menjalankan service untuk mereka yang ingin mengubahsuai rumah seperti rekabentuk dalaman contohnya renovation house, cabinet dapur, bilik tidur, ruang tamu ataupun ruang-ruang bangunan seperti hospital, sekolah, dan syarikat-syarikat swasta dan sebaainya. Selain daripada itu, company kami juga menyediakan barang-barang yang berbentuk domestik seperti perabot contohnya

	meja study, kerusi, meja asrama, almari dan sebagainya…….
LIANA	Produk apakah yang company anda hasilkan?
CIK ATIKAH	company kami sediakan seperti membuat kabinet dapur secara custom made maknanya mengiku pilihan dan variasi yang diinginkan oleh client. Selepas itu, ada perabot-perabot domesstik seperti contohnya perabot untuk sekolah, hospital, bangunan-bangunan kerajaan dan asrama. Kami turut menerapkan produk interior seperti meja, display tv, display untuk living hall dan macam-macam lagi……..
LIANA	Bolehkah anda menerangkan proses untuk membuat kabinet atau perabot tersebut?
CIK ATIKAH	Yang pertamanya adalah kita mesti menyediakaan bahan-bahan dia, orang kata material laa… material kena order dekat supplier and then barang yang diorder itu, kita akan dapat dalam masa mengikut supplier hantar laa..contohnya kalau 5 hari, 5 hari laa barang tersebut..tapi kalau barang tu lebih mahal atau memerlukan cetakan dan kilang yang perlu buat lebih lama laa seperti 2 minggu atau 3 minggu tempohnya.selepas itu kita pergi kepada ukuran. Ukuran adalah kami menggunakan pekerja pakar untuk mengukur setiap tapak dimana kalau contohnya tu adalah kabinet maknanya kena ukur setiap inci kaabinet, berapa pintu dan juga bahan-bahan yang diperlukan. Proses yang seterusnya adalah pemotongan iaitu cutting. Cutting memerlukan bahan-bahan yang telah sampai kita bawa ditempat pemotongan contohnya menggunakan mesin potong, mesin daisen cheng saw, dan lain-lain lagi. Pemotongan tuu memerlukan kepakaran biasanya biasanya lebih kurang 1 minggu. Untuk yang seterusnya, membuat body atau pasang body dan gam. Penampalan proses ini memakan masa selama 2 atau 3 hari tapi bergantung kepada keadaan cuaca. Secara manual, yang perlu menampal adalah pekerja yang mahir contohnya melekatkan glue diatas body cabinet ke cabinet kayu ke atas papan..eemmm…proses seterusnya adalah finishing dan painting contohnya proses kemasan dan juga kerja-kerja pengecatan hanya dilakukan oleh tukang sahaja dan untuk yang menggunakan proses yang advance boleh

	menggunakan cat spray maknanya menggunakan cat lepastuu masukkan dalam mesin spray. So spray tu yang memerlukan kepakaran dan biasanya 1 hari je.. untuk proses yang terakhir adalah drying dimana proses pengeringan. Proses pengeringan dilakukan diluar kilang maknanya selepas habis kerja kemasan dan kerja-kerja mengecat. Kita boleh keringkan dengan menggunakan cahaya matahari. Jika company mempunyai mesin yang lebih advance, guna mesin pengeringan yang hanya boleh dikeringkan dalam masa 2 hingga 5 minit.
LIANA	Apakah elemen yang terlibat dalam proses tersebut?
CIK ATIKAH	proses tersebut adalah pertama tadi penyediaan bahan material, ukuran atau measurement, pemotongan bahan atau cutting dan making body and glue dan pemasangan body-body kayu dengan tampalan menggunakan gam. Lepas tuu finishing and painting, kemasan dan kerja-kerja pengecatan atau spray. Last sekali, spray dan pengeringan.
LIANA	Berapakah jangka masa yang diperlukan untuk menyiapkan proses tersebut?
CIK ATIKAH	Jangka masa untuk siapkan proses tersebut ialah kalau penyediaan bahan, selama 5 hari, ukuran dan measurement 1 hari sahaja, cutting 1 minggu bergantung kepada pekerja,kalau banyak pekerja cepatlah pemotongan dan juga bergantung kepada mesin untuk making body. Pasang kabinet ataupun bahan dan juga gam perlukan masa depends pekerja atau cuaca. Kalau cuasa elok, 1 hari pun daa cukup tapi kalau cuaca tak elok, bergantung kepada cuaca jugak lah..untuk finishing dan painting maknanya kemasan dan kerja-kerja pengecatan sama jugak memerlukan skill worker dan bergantung pada cuaca sama ada baik atau tidak cuacanya maka cepatlah kerja-kerja pengeringan dan kemasan untuk drying pon same, depend kepada cuca. Kalau cuaca elok, 1 hari pon dah okey.
LIANA	Apakah jenis alatan yang digunakan ataupun mesin yang digunakan?
CIK ATIKAH	Antara mesin-mesin yang kita gunakan adalah cheng saw iaitu mesin

	memotong kayu, mesin drill untuk kerja-kerja penampalan kayu, mesin melicinkan kayu atau marble atau tiles, mesin pemotong tiles, mesin pengeringan seperti membuat marble atau batu, mesin kompressor dan juga spray machine.
LIANA	Berapakah masa yang diambil untuk menyiapkan 1 projek atau 1 produk?
CIK ATIKAH	Biasanya tempoh yang diambil unutk siapkan 1 projek itu lebih kurang 14 hari atau 2 minggu.
LIANA	Siapakah yang bertanggungjawab untuk memastikan kepuasan pelanggan terhadap produk yang ditempah?
CIK ATIKAH	Orang yang bertanggungjawab untuk memastikan kepuasan pelanggan terhadap produk kami ialah pengurus, pelukis pelan dan juga pekerja itu sendiri untuk memastikan keselesaan pelanggan kami.
LIANA	Bilakah company anda membuat keputusan untuk membuat tempahan barangan?
CIK ATIKAH	Kebiasaannya company kami akan membuat tempahan barang apabila sesuatu client atau pelanggan tu dah bersetuju untuk menempah di syarikat kami dan membuat bayaaran seperti deposit. Selepas itu kami akan terus menempah material ataupun bahan untuk sesebuah projek itu.
LIANA	Itu sahaja soalan daripada saya dan saya ucapkan ribuan terima kasih kerana sudi ditemubual pada hari ini.
CIK ATIKAH	sama-sama.

INDAHREKA PERABOT

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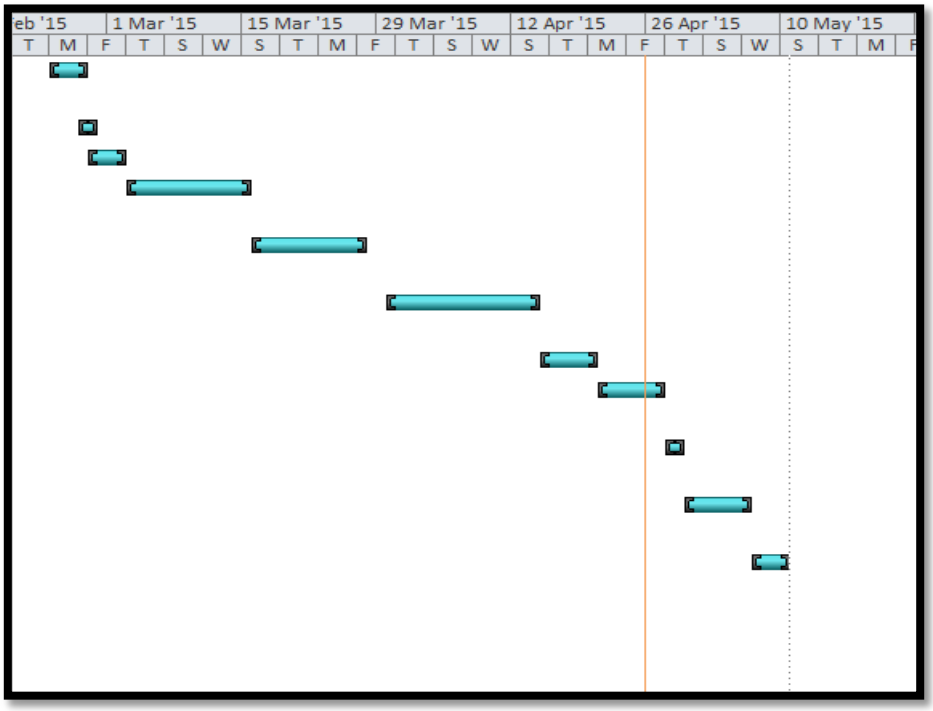
26060 Kuantan
Pahang Darul Makmur
Tel :- 09-5343826 Fax :- 09-5343826
H/P : 012-9473829,016-9861278, 016-9861277

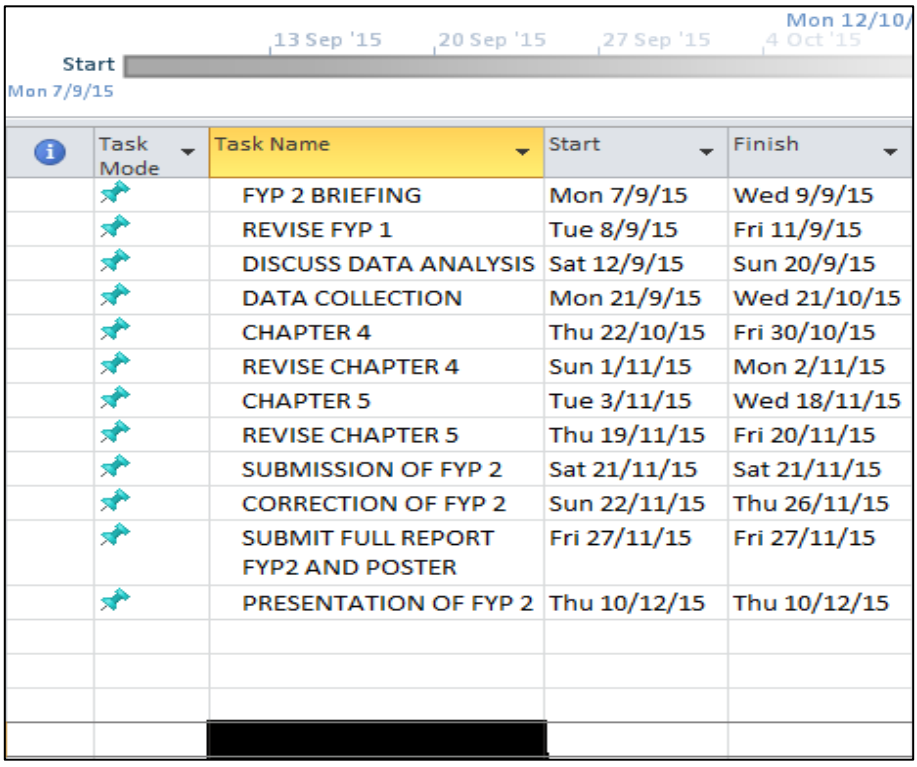
	AFTER			BEFORE	
NO	**NAME OF PRODUCT**	**CUSTOMER NAME**	**DURATION**	**STRATEGY**	**DURATION**
1	Kitchen cabinet	En. Sharif	30 day		14 day
2	Wardrobe	Pn. Ramlah	20 day		10 day
3	Display TV	Pn. Fadzillah	20 day		12 day
4	Island table	Pn. Rahaza	17 day		8 day
5	Kitchen cabinet	Pn. Saleha	28 day		11 day
6	Wardrobe (rak buku)	En. Najib	15 day		5 day
7	Living room display	En. Ahmad	25 day		10 day
8	Display(bilik solat)	Pn. Habibah	19 day		11 day
9	Kitchen cabinet	Pn. Hasnah	25 day		9 day
10	Display TV	En. Razak	12 day		5 day

GANTT CHART OF FINAL YEAR PROJECT 1

Task Mode	Task Name	Duration	Start	Finish
	finding the research title	4 days	Mon 23/2/15	Thu 26/2/15
	submit the research title	2 days	Thu 26/2/15	Fri 27/2/15
	research title approved	2 days	Fri 27/2/15	Mon 2/3/15
	write and submit chapter 1	10 days	Tue 3/3/15	Sun 15/3/15
	write and submit chapter 2	10 days	Mon 16/3/15	Fri 27/3/15
	write and submit chapter 3	12 days	Mon 30/3/15	Tue 14/4/15
	submit the proposal	4 days	Wed 15/4/15	Mon 20/4/15
	correction for the proposal	5 days	Tue 21/4/15	Mon 27/4/15
	submit the final proposal	2 days	Tue 28/4/15	Wed 29/4/15
	prepare for slide presentation	5 days	Thu 30/4/15	Wed 6/5/15
	presentation of final year project 1	3 days	Thu 7/5/15	Sun 10/5/15



GANTT CHART OF FINAL YEAR PROJECT 2



Task Mode	Task Name	Start	Finish
	FYP 2 BRIEFING	Mon 7/9/15	Wed 9/9/15
	REVISE FYP 1	Tue 8/9/15	Fri 11/9/15
	DISCUSS DATA ANALYSIS	Sat 12/9/15	Sun 20/9/15
	DATA COLLECTION	Mon 21/9/15	Wed 21/10/15
	CHAPTER 4	Thu 22/10/15	Fri 30/10/15
	REVISE CHAPTER 4	Sun 1/11/15	Mon 2/11/15
	CHAPTER 5	Tue 3/11/15	Wed 18/11/15
	REVISE CHAPTER 5	Thu 19/11/15	Fri 20/11/15
	SUBMISSION OF FYP 2	Sat 21/11/15	Sat 21/11/15
	CORRECTION OF FYP 2	Sun 22/11/15	Thu 26/11/15
	SUBMIT FULL REPORT FYP2 AND POSTER	Fri 27/11/15	Fri 27/11/15
	PRESENTATION OF FYP 2	Thu 10/12/15	Thu 10/12/15