REDUCE INVENTORY COST IN MANUFACTURER AND EXPORTER OF PARAWOOD FURNITURE "CASE STUDY OF PANDA THAI WOOD PRODUCT COMPANY LIMITED (PTW)"

by

Ms. Warangkana Chailimpamontri

A Final Report of the Three-Credit Course
CE 6998 Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer and Engineering Management
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Project Title	Inventory Cost Reduction of a Manufacturer and Exporter of Parawood Furniture: A Case Study of Panda Thai Wood Product Company Limited (PTW)
Name	Ms. Warangkana Chailimpamontri
Project Advisor	Mr. Smith Tungkasmit
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The Graduate School of Assumption University has approved this final report of the three-credit course. CE 6998 PROJECT, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management.

Approval Committee:

(Mr. Smith Tungk mit)
Advisor

(Prof.Dr. Srisakdi Charmonman)
Chairman

(Dr. Chamnong Juh tlarfapanich)
Dean and Co-advisor

(Assoc.Prof. Somchai Thayarnyong)
MUA Representative

November 2001

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INTRODUCTION

1.1 General

This consultant internship report emphasizes the key issue to reduce inventory cost in Panda Thai Wood Product Company Limited (PTW) that produces and exports parawood furniture to worldwide market. The reason we select the mentioned company in our case study is because PTW faces the problem of excess inventory as a major problem, which leads to high inventory cost, and thus making the company a slow pace in the competitive market.

1.2 Objectives and Scope

To investigate and analyze the inventory of PTW; namely, raw material, work-in-process and finished goods, in order to find a solution for reducing inventory cost, managing work-in-process time, and reducing finished goods inventory.

In order to find the solution for PTW to reduce its inventory cost and obtain better inventory management, this report concentrated only on one model of occasional table (model 5147-04) by investigating and analyzing raw material, work-in process, and breakdown time in Bangkok Factory. (Refer to Appendix T)

II. LITERATURE REVIEW

2.1 The Furniture Industry in Thailand

Developing Thai Furniture for World Markets

Although Thailand has been experiencing an economic crisis in the past two years, furniture industry is still one of the industries that has a great positive expansion trend and continues to record the positive growth. Furniture is now one of the top fifteen foreign exchange earners. Thai furniture has also gained wider acceptance in the world especially where consumer demand is for greater diversification, higher quality, better design and competitive price. Thai furniture will continue to play an important role in the growth and prosperity of our economy.

Thai Furniture Industry has developed the quality of its innovative products as well as the use of modern technology to fulfill the demands of the customers consistently so that it is accepted widely both in the Japanese and the USA markets. Many entrepreneurs can now use their own brand names and develop the production systems to meet the international standards of quality management with ISO 9000. Hence it can be expected that Thailand will become the leader and production center of furniture in the Asian region in the near future.

Survival against Adversity

Furniture export ranks among Thailand's top fifteen exports. It has been growing encouragingly against great odds. The ASEAN financial crisis that broke out two years ago dealt the Thai economy a very severe blow. In spite of some positive trends in recent months, recovery is still far from complete. Although continuing to grow albeit at a slower pace, Thailand's furniture export is facing an ever-increasing challenge from

its neighbors, like Malaysia, Indonesia, the Philippines, and China. Competition has intensified and there is a growing shortage of raw materials.

Following the government policy to restrict cutting in forests in 1989, the structure of the furniture industry of Thai Furniture industry has changed, especially, for wooden furniture with change of raw material from hard wood to parawood.

In order to increase competitiveness up to international markets manufacturers and exporters should seriously utilize their respective advantage that is fundamental to ensuring economy of scale in the production capabilities.

The industry is improving in line with good economy in macro and micro-economic situations. Besides, the government seriously and continuously supports small and medium enterprise manufacturers in exports. Entry barriers into the furniture industry have been reduced and there are many other supporting factors. Investment opportunities are therefore high.

Production

Parawood furniture accounts for 60 percent of total production of wooden furniture. It is a labor-intensive industry, with over 10,000 workers in approximately 200 factories. Due to the economic crisis, manufacturers have been facing liquidity crunch, causing them to reduce production to 30-50 percent of the total production capacities. A major weakness of the industry is that most products are manufactured in accordance with order from foreign buyers due to a lack of skilled designers, resulting in a lack of production diversity and high on production process loss of 50 percent. The cost of parawood furniture industry comprises domestic material cost, mainly on dries parawood, labor cost, imported material cost such as paint, glue, lacquer and hinges and other costs. However the cost of imported material is likely to decrease after the Board of investment (BOI) adopted investment promotion strategies to stimulate exports and

the economy by granting tax exemption for imported materials in furniture and decoration industry.

Production of parawood furniture is predicted to increase in the years 2000-2001 as a result of more liquidity and demand from foreign market. A short-term problem is the short supply of parawood because wood traders chose to export processed wood to China and Taiwan at a higher price than domestic price. However the production capacity utilization is expected to increase to over 50 percent because the local wood supply can last for at least 10 years if Thailand can manage the resource efficiently.

Domestic Market

Domestic market value of parawood furniture accounts for about 30 percent of total market value. In recent years, demand had fallen in line with low public purchasing power and decline of real estate business. The market value during 1997-1999 decreased by 30-40 percent. Therefore most manufactures reduced their selling prices by 20 percent in order to increase sales volume and maintain market share. An increase of product imitation has been another significant problem.

It is predicted that the domestic market will continue to be sluggish during the next 1-2 years. Despite the sign of economic recovery, purchasing power is not likely to move up scale.

However, in the long term the market tends to expand because of positive factors, namely low interest rate, economic recovery and increasing demand for residence which is predicted to surge from 30,000 units in 1999 to 60,000 units in 2001, generating high demand for furniture and decoration accordingly.

Foreign Market

Approximately 70 percent of parawood furniture is exported to foreign market. Most of the export products are in the term of knock down furniture. Exports during

1997-1999 amounted to Bht 10 billion annually, an increase of 10 percent a year. Major 80 percent of total export value.

During 2000-2001, the export value is expected to grow by 3-5 percent to approximately Bht 12 billion annually because of the strong Baht and intensified competition. In the long term, export is likely to expand at higher rates, as overseas demand is still strong. Japan and the United States will continue to be our major market but Japan tends to reduce furniture imports from Thailand due to problems in the Japanese financial sector and high competition from Malaysia, Indonesia, Taiwan, China and Vietnam. As a result, Thailand may lose some market shares to these competitors who benefit from lower production costs. Moreover, Thai exports should explore new potential markets such as Australia and the Middle East, together with improving product style and quality in order to enter into trade liberalization and to improve long-term competitiveness in the world market.

Thai Furniture Industry Background Summary

(1) Tight liquidity has been a hindrance to both production and marketing of parawood furniture. Producers are unable to use full production capacity. However in the long run the capacity can be increased due to plenty of raw materials and skills labor.

(2) Weaknesses of this industry include a lack of diversity in product styles and higher costs of production and labor than those competitors. Furthermore, no factory received IS09000 for product quality and IS014000 for environmental management. However the cost of production should decrease as the government has already announced an exemption of duties on imported materials for the wooden furniture industry.

(3) The domestic market will remain sluggish during the next 1-2 years. Although the economy continues to recover in the second half of 1999 and demand for residence tends to expand, the public purchasing power will not rise significantly. Moreover, Thai consumers do not have a habit of changing furniture frequently.

Exports are expected to grow continuously. Although some key markets, especially Japan is facing internal economic problems. Thai parawood furniture has become increasing popular in other markets. Furthermore, Thai exporters will have more opportunity to expand the market after the opening of ASEAN Free Trade Area (AFTA).

2.2 Panda Thai Wood Company Limited (PTW) Background

PTW, the family owned business, was established in 1977 with share capital of Bht 1 million. It started from producing director chairs to United States by dealing with customers' agents. Its head office and factory were located on Lad Phrao Rd. employing 25 workers.

In the years 1979 - 1980 it joined Parawood Company Limited to produce dining sets. Its products not only were exported to United States, Japan, Hong Kong, etc. but also were sold domestically. Parawood Company Limited was the supplier of chairs for Panda dining sets and these products were sold under the brand name of "Panda" by employing about 100 workers.

In the years 1981-1985 it expanded the product line to produce occasional tables (coffee table) and sold them both to domestic and international markets. Most of them were the mass products, employing 250-350 workers.

In the years 1987-1989 it established R&D department to develop the product models to have more varieties and changed from mass products to luxury products with

high prices. It started to deal with customers and wholesalers in the United States, Europe and Australia directly. The sales volume was 24 containers per month, employing 350-500 workers.

In the years 1991-1993 it increased the share capital of Bht 1 million to Bht 15 million. Furthermore it expanded to have a second branch office and factory, that were located on Sukapibal 2 Rd. The sales volume was increased to 36 containers per month, employing 500 to 600 workers. It began to do business with the United States 100 percent and it dealt with them directly.

In the years 1994 it expanded further for the third branch of factory that was located on Chonburi Rd. The sales volume was 36 containers per month employing about 1000 workers. Therefore it encountered a ton of problems because of high expenditures.

In the years 1995-1996 it developed a lot of new luxury occasional tables and exported to the United States.

In the years 1997-1998 the company was downsized to become one office and 2 factories. One factory is located in Bangkok that operates the batch production of Rough Mill (RM), Smooth Mill (SM), and Veneer & Board (VB) line. Another one is located in Chonburi that operates the batch production for Assembly (AS), Packaging (PK) and flow production of Finishing (FN) line. The sales volume increased to 48 containers due to reduced expenditures, employing 700 workers.

In the year 1999 it expanded further product line such as upholstery parts, entertainment unit, cabinet, shelf and etc. Its competitors are China, Malaysia and Indonesia that were very tough. So it tried to seek new strategies in order to compete with many competitors in the world market.

At present (year 2000) the company faces the problem of production capacity, which cannot meet the customer's needs. Besides, the company also has limited space for expansion, therefore, the new factory is established at Chonburi province for supporting customers' needs. The sales volume is still 48 containers per month due to more difficulties in production process, employing 800 workers.

In future the company plans to move all present factories in Bangkok and Chonburi provinces to the new one in order to reduce the transportation cost and reduce all expenditures, plus having a smooth production line, being convenient in communication and being able to manage the immediate problems.

2.3 Panda Thai Wood Company Limited (PTW) Vision

(1) Expanding to European market within year 2001

(2) Exporting parawood furniture worldwide

(3) Expanding the product line in order to enter new markets

(4) Providing warehouse for customers in order to maintain customers orders and meet customers' needs

(5) Being a billionaire company within the next five years

(6) Being number one parawood furniture manufacturer in Thailand not only the sales volume required standard quality but it is also mandatory

2.4 Panda Thai Wood Company Limited (PTW) Mission

(1) Satisfying customers in terms of product quality with lower prices all the time

(2) Providing a great work environment

(3) Contributing positively to our communities and environment

2.5 Organization Structure

From Figure 2.1, The managing director of the company manages PTW. The company has three main departments, which are Marketing, Manufacturing and General and Administration. A manager who reports directly to the managing director heads each of them.

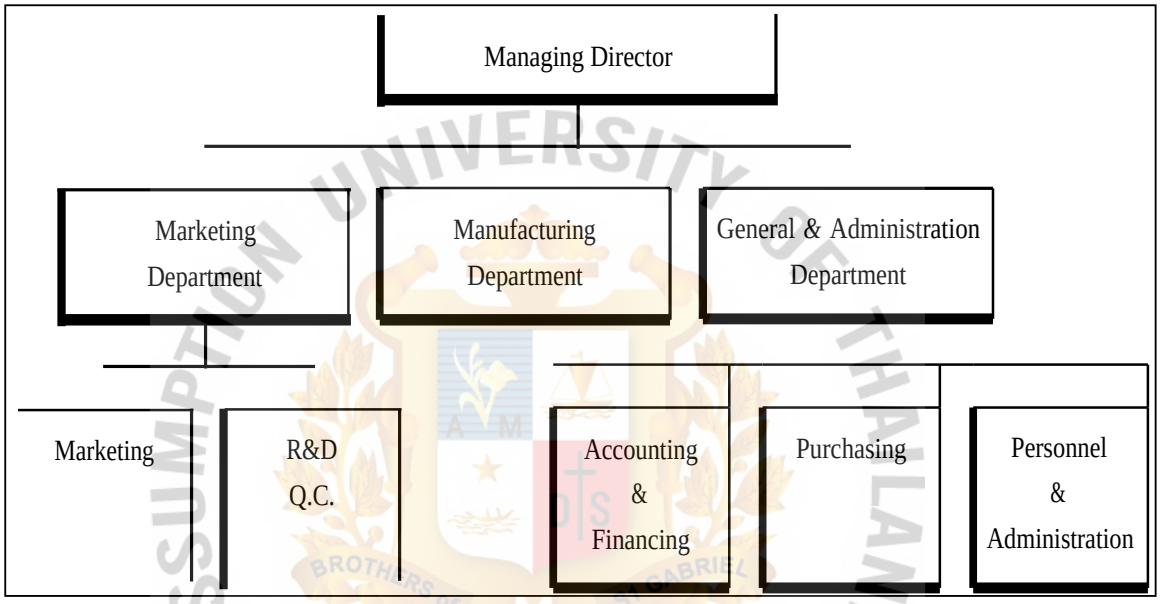


Figure 2.1. Panda Thai Wood Organization Structure.

(1) For Marketing Department, it consists of two sections which are marketing and research and development / quality control

Marketing Section — responsible for:

(a) Contacting customers both operation work and customer service

(b) Receiving purchase orders from customers

(c) Arranging shipment schedule to customers

(d) Surveying new markets and new customers

(e) Determining the product's price based on costing

(f) Launching new products into the furniture market

(g) Meeting with Research & Development Teams and Quality Control Teams

Research & Development and Quality Control Section consists of two subsections as follows:

(a) Research & development - responsible for:

(1) Developing sample product designs

(2) Designing new products and hardware

(3) Drawing the structure of production

(4) Designing how to pack the finished good

(b) Quality control - responsible for:

(1) Controlling product quality throughout the production process

(2) Checking Quality inspection list

(3) Informing the problem of defective products

(2) For General and Administration Department, it's divide into three sections which are accounting and financing, purchasing and personnel and administration

Accounting and Financing section — responsible for:

(a) Controlling the cost of products

(b) Managing account receivables and account payables

(c) Preparing cheque to the suppliers for payment

(d) Planning, operating and controlling cashflow and leverage

(e) Dealing with banks for letter of credit, packing credit, B/L, OD, T/R, L/G, etc.

(f) Reporting company's financial statements

(g) Preparing salaries to employees

Purchasing section — responsible for:

(a) Purchasing all raw materials both in local and internationally

(b) Opening purchasing order base on purchasing requirement

(c) Following up all raw materials from suppliers and delivery schedules

(d) Bargaining the price, credit terms, services and any other conditions

(e) Searching the alternative sources for comparison

Personnel and Administration section — responsible for:

(a) Recruiting workers and staffs

(b) Taking care of general affairs

(c) Reporting number of new workers and resigned worker to people concerned

(d) Preparing wages to all workers

(e) Providing welfare program to all workers

(f) Checking the reasons of resigned workers

(3) For Manufacturing Department (Figure 2.2), it separates to two factories, which are Bangkok factory and Chonburi factory.

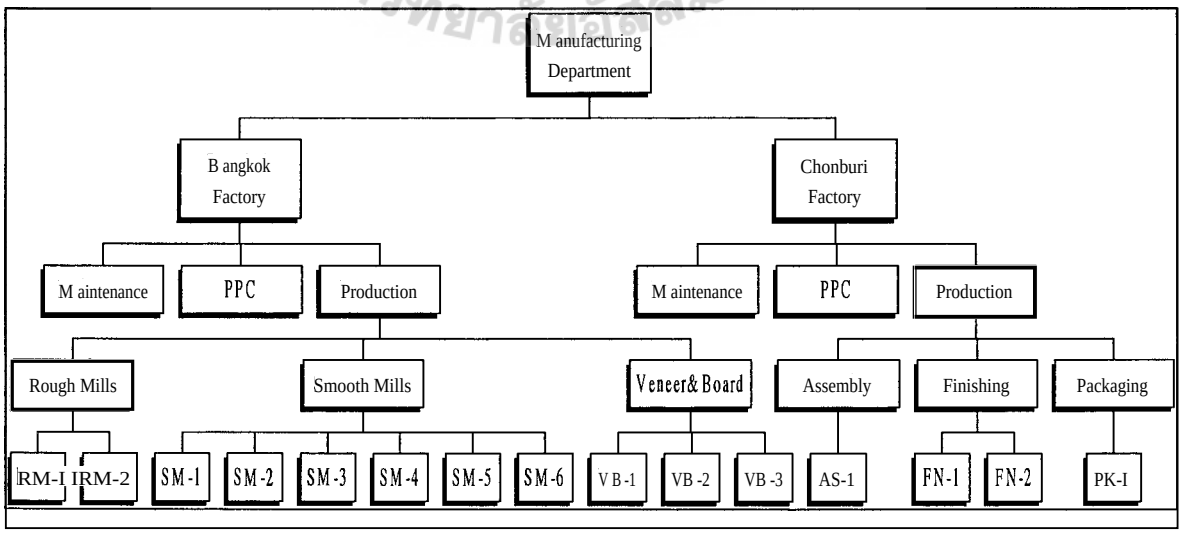


Figure 2.2. Manufacturing Department Organization Structure.

The manufacturing department is separated into two factories, which are Bangkok factory and Chonburi factory. Each of them has three sections that are Maintenance section, Production Planning Control (PPC) section and Production section.

Maintenance section — responsible for:

(a) Taking care of machines, tools, motors, air dryers, etc

(b) Checking the problem of machine's break down and list the solutions

(c) Repairing the machines, tools, etc

Production Planning Control (PPC) section — responsible for:

(a) Planning production schedule

(b) Planning production capacity

(c) Checking parts before sending to Chonburi factory

(d) Loading parts and finished goods to containers

(e) Controlling the production to achieve the company's goal

(f) Reporting actual shipment

Production - Bangkok Production has three subsections which are Rough Mills, Smooth Mills, Veneer and Board while Chonburi also has three subsections, which are Assembly, Finishing and Packaging. (Refer to layout Appendices C and PI

(a) Rough Mills — responsible for:

(1) Cutting off parawood for making edge, leg, apron, etc by using cut off saw machine (RM1)

(2) Planning a plank by using four side planer (RM1)

(3) Checking the size of parawood after planning a plank (RM1)

(4) Laminating the parawood to make it be wider by using laminate machine (RM1)

(5) Joining parawood to make it be longer by using finger joint machine (RM2)

(6) Cutting the corner block, cleat, drawer (RM2)

(7) Planning a plank by using two side planer (RM2)

(b) Smooth Mills — responsible for:

(1) Moulding leg and apron by using radial arm saw (SM1)

(2) Cutting and drilling the apron (SM1)

(3) Cutting parts as the actual size (SM2)

(4) Doubling the short and long apron (SM2)

(5) Sanding all parts by horizontal sponge sander and hand stroke belt sander (SM3)

(6) Checking the quality (SM3)

(7) Assembling parts by using nail max and double nail max (SM4)

(8) Turning the leg with back knife turning lathe (SM5)

(9) Carving parts by hand and router (SM6)

(10) Making the sample for production (SM7)

(11) Making the sample for marketing (SM8)

(c) Veneer and Board — responsible for:

(1) Cutting veneer according to the production pattern (VB1)

(2) Cutting board and MDF for making the top by using circular saw with sliding table (VB2)

(3) Pressing the top with veneer by using hot press (VB2)

(4) Assembling drawer and edge by using nail max and double nail max (VB2)

(5) Sanding the top by using sanding master (VB2)

(6) Molding the top by using rotary machine (VB3)

(7) Sticking the edge with the top (VB3)

(8) Sanding by using hand stroke belt sander (VB3)

(9) Checking the quality (VB3)

(d) Assembly — responsible for:

(1) Assembling all parts of tables before finishing line (AS1)

(e) Finishing — responsible for:

(1) Flowing the assembly parts in finishing line 1 (FN1)

(2) Flowing the assembly parts in finishing line 2 (FN2)

(f) Packaging — responsible for:

(1) Packing the finished good (table) into the carton (PK1)

2.6 Panda Thai Wood Product Customers

PTW, one of parawood furniture manufacturers in Thailand, is well known in producing and exporting parawood occasional tables to the wholesalers in the United States. Its reputation is known among the wholesalers and the retailers in the United States under the brand name of each wholesaler.

PTW deals with the customers (wholesalers) in 2 ways

1. PTW contacts the wholesalers through agents (trading companies).

The list of each agent which related to wholesalers brand are as follows:

Agent	LEWIS & SON
Wholesalers Brand:	Hammary, JDI, Flexsteel, Silver
Agent	PACIFIC MARKETING INTERNATIONAL
Wholesalers Brand:	Phillip Bell, Palliser, Standard, Progressive, Bence Craft, Jofran, MW, RTG (Room to go)

Agent INTER SPEC

Wholesalers Brand: Manchester

Agent INTERNATIONAL OUTLOOK

Wholesalers Brand: Thomas Ville, Broyshill

Agent FURNMART

Wholesalers Brand: Emerald

2. PTW contacts directly to the wholesalers.

These are the wholesalers that PTW sells directly under their own brand names. The wholesalers' brand names are listed as follows:

(a) Ashley

(b) Brick

(c) Coaster

(d) Phillip Bell

(e) Dales

(f) Mazin

(g) H&S (Hamilton & Spill)

2.7 Material Process

In order to capture the overall material flow, the Figure 2.3 shows the material process of inventory from raw materials to finished goods.

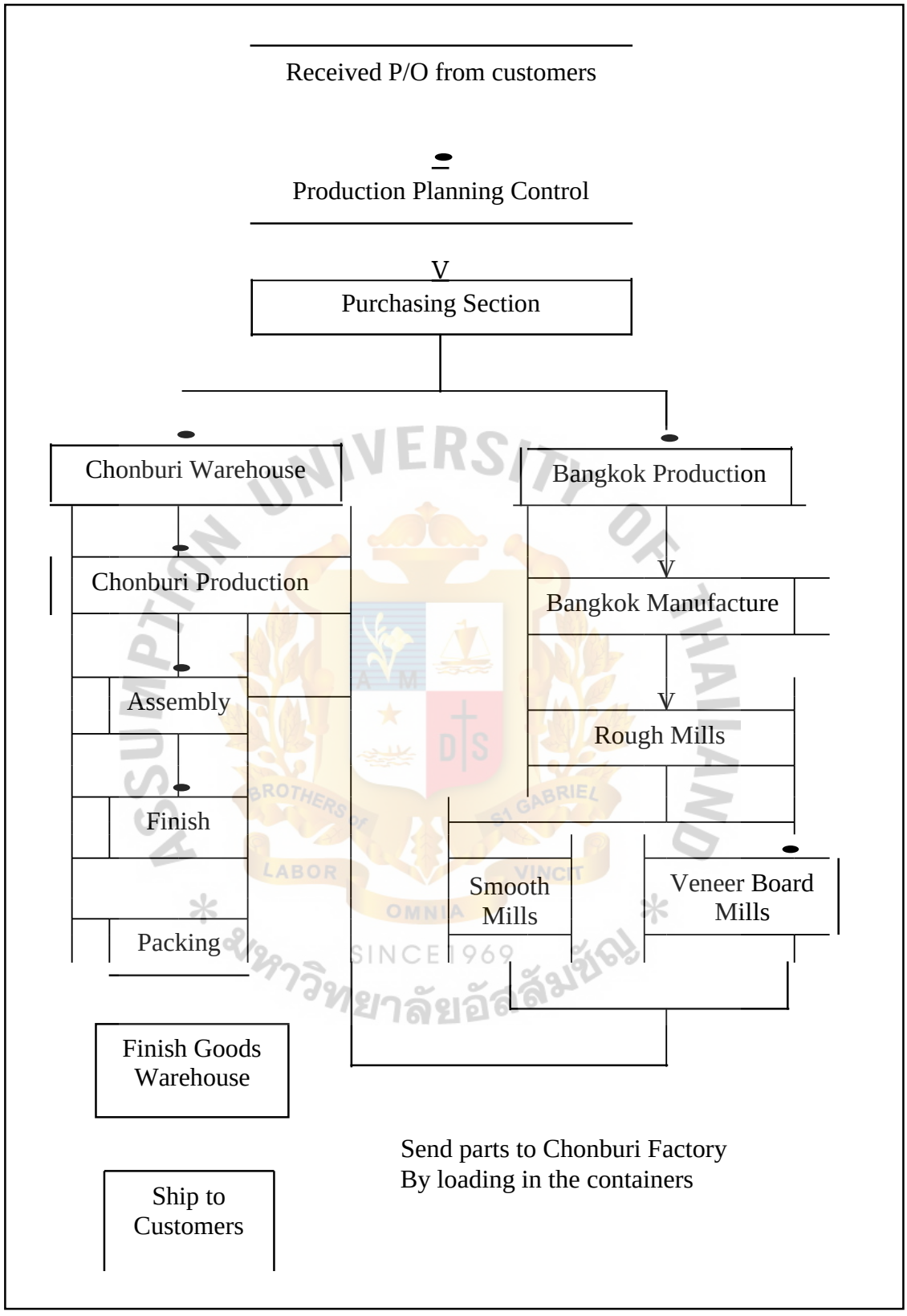


Figure 2.3. Material Process Flow.

(1) PPC plans the production schedule, PPC will send the schedule to purchasing section to order raw materials for production.

(2) Purchasing section orders raw material according to the production schedule that receives from the PPC by opening purchase order to suppliers. Raw material will be sent to a warehouse once a week. There are two warehouses; Bangkok warehouse and Chonburi warehouse. Raw Materials will be sent to the warehouse, specified in the purchase order.

(3) Raw materials will be kept in the warehouse until they are required for production process.

(4) For Bangkok factory the process is the batch production, there are three key processes, namely Rough Mills, Smooth Mills and Veneer & Board. Rough Mills takes about one week production process then they are passed on to Smooth Mills and Veneer & Board as the parallel production. The production time takes about one week for each line to complete the operation of Rough Mills. Hence, the total production time taken in Bangkok factory is two weeks.

(5) After the parts from Smooth Mills and Veneer and Board are completed, all parts will be sent to Chonburi factory by loading up the containers. The process of Chonburi factory is to assemble all these parts in order to flow in the finishing line. It takes about 1 week for assembly, finishing and packaging the products until they are ready to be shipped.

(6) Finished Goods will be loaded up the containers in order to be shipped to customers by PPC.

(7) The products are sold in terms of FOB price. The customers will contact directly with couriers for shipment.

III. METHODOLOGY

3.1 Theoretical Model

The contribution of materials management to boosting the efficiency of a company can be just as dramatic as the contribution of production and marketing. Material management encompasses the activities necessary to get materials to a production facility (including the costs of purchasing material inputs), through the production process and out through a distribution system to the end user. The potential for reducing costs through more efficient material management is enormous. For the average manufacturing enterprise, the material and transportation costs account for 50-70 percent of revenue. Even a small reduction in these costs can have a substantial impact on profitability. According to the estimation, for a company with revenues of Bht 1 million, a return on investment rate of 5 percent and materials management costs that amount to 50 percent of sales revenues (including purchasing costs), increasing total profit by Bht 15,000 would require either 30 percent increase in sales revenues or 3 percent reduction in material costs. In a saturated market, it would be much easier to reduce material costs by three percent than to increase sales revenues by thirty percent.

Improving the efficiency of the materials management function typically requires the adaptation of just-in-time (JIT) inventory systems. The basic philosophy behind JIT is to economize on inventory holding costs by having materials arrive at a manufacturing plant just in time to enter the production process and not before. The major cost saving comes from increasing inventory turnover, which reduces inventory-holding costs such as warehouse and storage costs.

3.2 Just-In-Time-System (JIT)

Just in time is a philosophy of continues and forces problems solving. With HT suppliers and components are "pulled" through a system to arrive where they are needed, when they needed. When good unit do not arrive just as needed, a problem has been identified. This makes JIT an excellent tool to help operations manager add value by driving out waste and unwanted variability. Because there is no excess inventory or excess time in JIT system, costs associated with unneeded inventory are eliminated and throughput improves.

Waste Reduction

This can be anything that does not add value. Product being stored, inspected or delayed, products waiting in queues and defective product do not add value. They are 100 percent of waste. Any activity that does not add value to a product from the customer's perspective is waste. JIT will allow faster delivery times and reducing work-in-process. Reducing work-in-process release assets in inventory for other more productive purposes.

Variability Reduction

To achieve just-in-time material movement, managers reduce variability caused by both internal and external factors. Variability is any deviation from the optimum process that delivers perfect product in time, every time. Inventory hides problems. The less problems the less waste in the system.

Pull versus Push

JIT is the pull system. A pull system uses the signal to request production and delivery from stations upstream to the station that has production capacity available. The pull concept is used both within the immediate production process and with suppliers. By pulling material through the system in very small lots size just as it is

needed, the cushion of inventory that hides problems is removed, problems become evident and continuous improvement is emphasized. Removing the cushion of inventory also reduced both investment in inventory and manufacturing cycle time (the time between the arrival of raw materials and the shipping of finished products).

JIT inventory also plays a part. Under a JIT system, defective parts enter the manufacturing process immediately; they are not warehoused for several months before use. Hence, defective inputs can be quickly spotted. The problem can then be traced to the supply source and corrected before more defective parts are produced. Under a more traditional system, the practice of warehousing parts for months before they are used may mean that a supplier before the production process produces large numbers of defects.

JIT Partnership

JIT partnerships exist when supplier and purchaser work together with a mutual goal of removing waste and driving down cost. Such relationships are critical for successful JIT. Every moment the material is held, some process that adds value should be occurring.

Characteristics of JIT Partnerships

(1) Suppliers:

(a) Few and nearly suppliers

(b) Repeat business with same suppliers

(c) Analysis to enable desirable suppliers to become or to stay price competitive

(d) Competitive bidding mostly limited to new purchase, buyer resists integration and subsequent wipeout of supplier business

(e) Suppliers encouraged extending JIT buying to their suppliers.

(2) Quantities:

(a) Steady output rate

(b) Frequent deliveries in small-lot-quantities

(c) Long-term contract agreements

(d) Minimal paperwork to release orders

(e) Delivery quantities fixed for whole contract term

(f) Little or no permissible overage or underage

(g) Suppliers package in exact quantities

(h) Suppliers reduce their production lot sizes (or store unreleased material)

(3) Quality:

(a) Minimal product specifications imposed on supplier

(b) Help suppliers to meet quality requirements

(c) Close relationships between buyers' and suppliers' quality assurance people

(d) Suppliers use process control charts instead of lot-sampling inspection

(4) Shipping:

(a) Scheduling of inbound freight

(b) Gain control by use of company-owned of lot-sampling inspection

A major source of poor quality finished goods is poor-quality component parts. To decrease product defects, a company has to work with its suppliers to improve the quality of the parts they supply. The primary responsibility in this area falls on the material management function, since it is the function that interacts with suppliers.

To implement JIT systems with suppliers and to get suppliers to adopt their own total quality management programs, two steps are necessary. First, the number of

suppliers has to be reduced to manageable proportions. Second, the company must commit to building a cooperative long-term relationship with the suppliers that remain. Asking suppliers to invest in JIT is asking them to make a major investment that ties them to the company. For example, in order to implement a JIT system fully, the company may ask a supplier to relocate its manufacturing plant so that it is next to the company's assembly plant. Suppliers are likely to be hesitant about making such investment unless they feel that the company is committed to an enduring long-term relationship with them.

3.3 Material Resources Planning (MRP)

MRP is the dependent demand technique that uses bills of material (materials and parts requires to make the product), inventory (what is in stock), expected receipts and a master production plan schedule (what is to be made and when) to determine material requirement.

The plan also includes a variety of inputs including financial plans, customer demand, engineering capabilities, labor availability, inventory level, suppliers' performance and other consideration. Each of these inputs contributes in its own way to the production plan as shown in Figure 3.1.

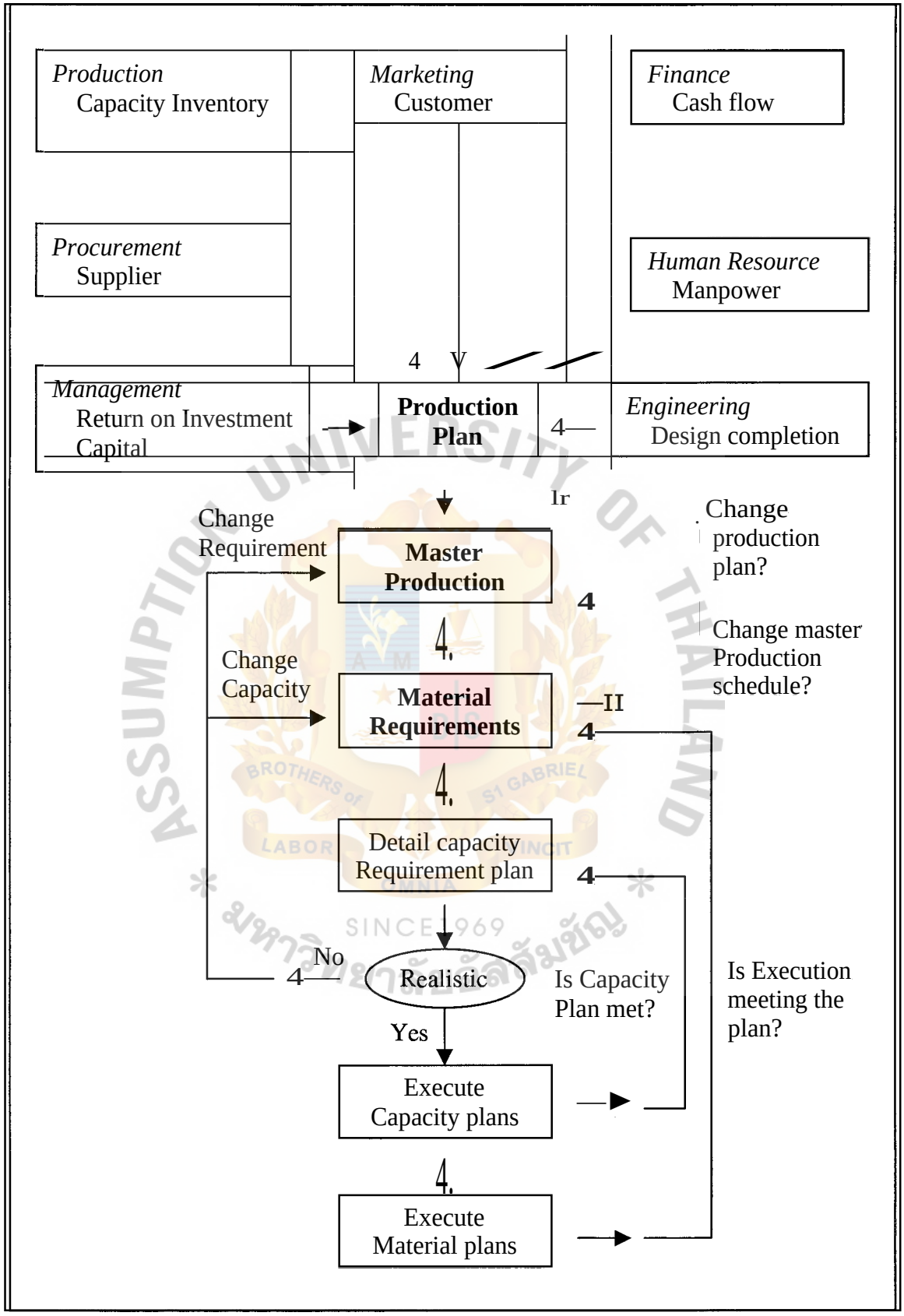


Figure 3.1. Master Production Schedule.

As the planning process moves from the production plan to execution, each lower level plan must be feasible. When one is not, feedback to the next higher level is used to make the necessary adjustment. One of the major strengths of MRP is the ability to determine precisely the feasibility of schedule within capacity constraint. This planning process can yield excellent results. The production plan sets the upper and lower bounds on the master production schedule. The result of this production planning process is the master production schedule.

The allocated quantity has the effect of increasing the requirement (or, alternatively, reducing the inventory quantity on hand). The logic of net requirement MRP is:

[(gross requirement)+(allocations)] — [(on hand)+(schedule receipts)] = net requirement

Total requirement — Available inventory = Net Requirement

MRP and JIT

MRP is a planning and scheduling technique with fixed lead-time, while JIT is a way to move material expeditiously. Fixed lead-times can be a limitation. For example, the lead-time to produce 50 units is very substantially from the lead-time to produce per unit. This limitation complicated the marriage of JIT and MRP. In many respects, however, an MRP system combined with JIT provided the best of both worlds. MRP provides a good master schedule and an accurate picture of requirements and JIT reduces work-in-process inventory. The following two approaches may be used for integrating the two systems: Small Bucket Approach and The Balanced Flow Approach.

Small Bucket Approach

MRP is an excellent tool for resource and scheduling management in process-focused facilities. Such facilities lead-times are relatively stable and poor balance between work center is expected. Schedules are often driven by work orders and lot sizes stem from exploded bill-of-materials. In this enterprise, MRP can be integrated with JIT through the following steps:

Step 1: reduce MRP bucket from weekly to daily to perhaps hourly (bucket are time units in an MRP system)

Step 2: the plan receipts that are part of a firm's planned orders in an MRP system are communicated to the work areas for production purposes and used to sequence production.

Step 3: inventory is moved through the plant on JIT basis.

Step 4: as products are completed, they are moved into inventory (typically finished goods inventory) in the normal way. Receipt of these products into inventory reduces the quantities requires for subsequent in MRP system.

Step 5: a system known as back flush is used to reduce inventory balances. Back flush uses the bill-of-material to reduce component inventory quantities as each product it is based upon is completed.

Balanced Flow Approach

MRP supports the planning and scheduling necessary for repetitive operation such as assembly line. In this environment the planning of MRP is combined with JIT execution. The JIT pulls the material to the facilities. In these systems, execution is achieved by maintaining a carefully balanced flow of material to assembly areas with small lot sizes.

3.4 Fishbone Analysis

The Figure 3.2 is used in this report as the theoretical model to design the questionnaires. It enabled the root causes of the problems to be determined. The following four topics were focused on:

(1) Manpower

(2) Machine

(3) Material

(4) Management

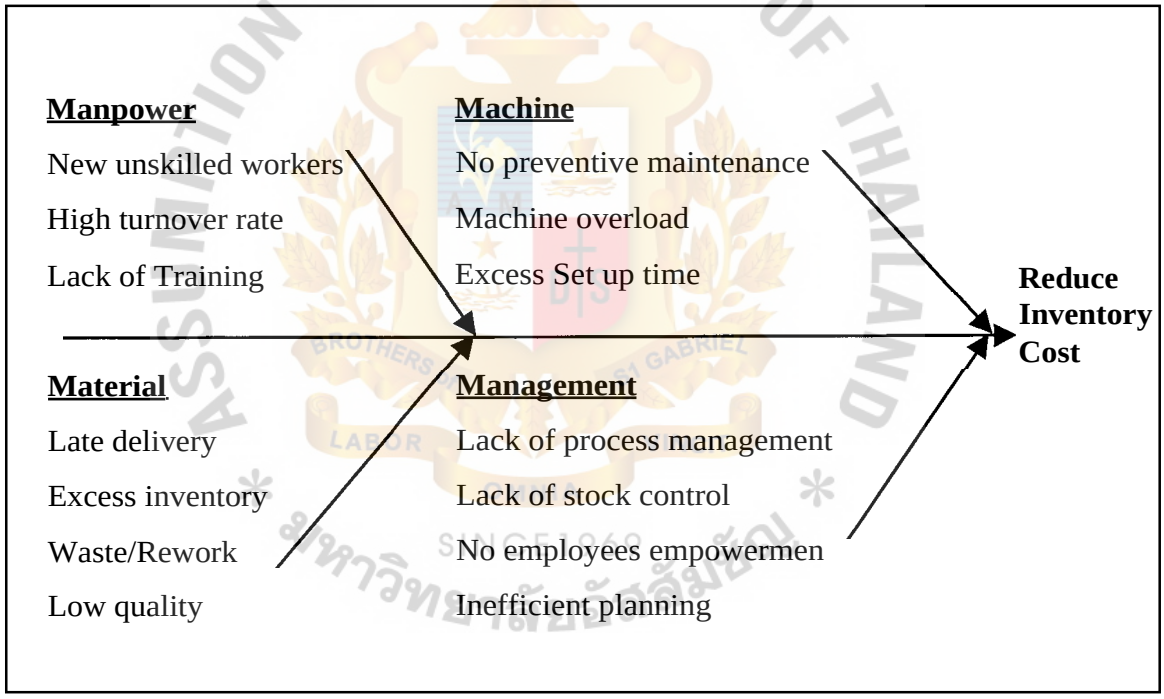


Figure 3.2. Fishbone Analysis.

The following problems were found for each topic:

(1) Manpower — there was a high employee turnover rate; new unskilled workers and a lack of training.

(2) Machine — there were few, (if any) on preventive maintenance activities, machine overload and excess time to set up.

(3) Material — there were problems in late material delivery, excess inventory, a lot of waste/work repetition and low product quality.

(4) Management — there were problems of lacking of management process, lack of stock control system, no employees' empowerment and inefficient planning.

3.5 Data Collection Methods

Manufacturing department manager and production planning control manager were interviewed to collect data about the ordering process, material flow process, inventory, etc. of PTW because all relating decision making depend upon these two managers. (Refer to interview checklist in Appendix I)

Eighty questionnaires were distributed to five employees of the company in order to gather data about management, material, manpower and machine. (Refer to questionnaires in Appendix **J)**

The flow of inventory materials within the company was investigated. In this way additional data supporting the cause of high inventory cost was obtained.

3.6 Details of Respondents

Respondents from Interviews

From interviews with Mr. Anirun Wongarn, manufacturing department manager, and Mr. Surachai Assavaraksawong, Production Planning & Controlling manager, (refer to Appendix K), The following information was collected:

(1) A customer places order to the company via communications through fax or mail.

(2) Upon receipt of the purchase order from customers, PTW would take about 60 days to deliver the product.

(3) PTW has approximately 150 companies as suppliers.

(4) The delivery lead-time for suppliers to deliver raw materials to PTW is around 7-30 days, depending on the raw material and the supplier.

(5) **PTW** orders raw materials from suppliers by placing purchase order to suppliers by fax. The quantity of raw materials that the company ordering will be related to each purchase order received from customers.

(6) The company will reserve about 10 percent of raw materials as inventory stock for each purchase order.

(7) The inventory is kept as raw materials for 7 days. Then raw materials will be used in the production line as work-in-process inventory for 21 days. All finished goods will be shipped to customer within 3 days as and when ready.

(8) Customers can make any change in product design before the production starts and it takes about 1 day to set up change of run.

(9) The minimum order for each product model is one container (40 feet), that can contain 500 pieces of table.

(10) The minimum production set for each day is 2 containers (40 feet). Therefore the company needs to produce about 1000 pieces of occasional tables each day.

IV. DATA ANALYSIS

4.1 Interview Results

After interviewing two senior top managers we can summarize the problems of PTW that may be summarized as follows:

Marketing

Information

The customer places orders by sending their purchase orders to the company at least 60 days in advance. The minimum order is a container (40') -one purchase order for one container, which can mix many models of each product. A container can contain about 500 pieces of occasional tables (finished goods). The marketing department has to send new orders to all people who are concerned such as purchasing department to order raw materials, PPC to plan the production schedule, etc. If customers want to make any change in product design or the shipment date, they have to inform the company at least 30 days before production. Marketing and PPC have to coordinate to arrange the shipment schedule (which one is the priority) to achieve the production goal.

Problems

Firstly, the company has poor communication among departments. Therefore, the revised information is not necessarily distributed to all people concerned. For example, Marketing does not inform or write a memo to PPC and Purchasing when customers confirm changes in design, shipment order, cancellation, etc. These problems cause excess inventory due to excess supply and time wasted.

Secondly, there are conflicts between Marketing and PPC due to different goals in their work. For Marketing, the customers are "God" so they need to keep promises with the customers of the shipment date whereas the capacity of the production is out of their

concern. On the other hand, **PPC** plans the production schedule based on the production capacity, whereas, the priority of customers is ignored.

Purchasing

Information

The relationship between the company and suppliers is very important because the company bargaining power in getting lower raw material price and good services depends on good relationships. At present, the company has more than 150 suppliers to deal with and the company has not gained any advantages from them. It needs many suppliers to diversify risk if anyone fails to deliver raw materials on time. The lead-time of each supplier varies, depending on the type of raw materials and their capacity. Faxing of a purchase order to suppliers for a week in advance is the method of ordering raw materials. They will order all raw materials that are used in the week of production and receive all of them once a week (at beginning of the week).

Problems

Purchasing deals with many suppliers, so they have less purchasing power to bargain for the best/low price (the company gets higher price when comparing with other companies) and not be served with the best service (delivery once a week). The suppliers are the ones who determine the minimum order with the company for delivery so some materials are not used immediately but they are kept in the warehouse until they are needed, Therefore, PTW faces the problem of high raw materials inventory cost. Purchasing planned the schedule of receipt inefficiently by receiving all orders once a week. If delayed shipment or any change in production schedule, these raw materials are kept as the stock.

Warehouse

Information

All raw materials ordered are kept in the warehouse for the manufacturing section. Stock Control is not well managed; they merely check the stock of receiving and distributing materials in each day. At the end of the week they plan to order raw materials for the next week by considering on the current stock.

Problems

Because of not using the First In First Out (FIFO) system, some raw materials are kept until they are expired or damaged and then they will be counted as dead stock. In the present warehouse section, (Bangkok and Chonburi) a checked stock of all materials is done once a year, which in fact should be checked monthly.

Production

Information

The production process has a number of stages and it takes three weeks to complete all stages. The process is the batch production in Rough Mills, Smooth Mills, Veneer Board, Assembly, Packing and the flow production in finished process. The production is run follow **PLO** by PLO and the production's goal is about 1,000 pieces per day. The furniture work is labor-intensive so it needs more skilled workers to work in the production line. During the production the machines have to be set up when changing to another batch. Each model is produced in each batch but it does not determine the exact number of tables to produce. It depends on customer' orders. The company has to take about 15-30 minutes per machine to solve the machine break down problem that is the immediate problem for the production line.

Problems

Batch production methods are used. If one operation is not completed, the entire batch is held. They cannot pass on to next stage of the process. It wastes time to wait for process in the next stage, causing the problems of delay in shipment. It takes 3 weeks to complete all stages as the finished goods, which gives the company more work in process inventory. Most workers are unskilled, so the company needs to train them until they can perform the task. Unfortunately, the turnover rate is very high. They cannot manage the problem immediately nor set up the machines when changing the batch of production. Waste occurs frequently during the production process. For the packaging section, all products are loaded to containers. The company sells in FOB price so the customers deal directly with couriers. So when the company cannot ship the goods on time, it will inform about late shipment to customers. Then the customers will deal with the couriers for another ship schedule and reconfirm the company for the shipment date. These problems have resulted in having more finished goods inventory for the company.

4.2 Questionnaire Results

The questionnaire data and analysis on the critical parts are summarized as follows:

Manpower

Most workers have no experience in manufacturing furniture. Before starting the work they are trained by the supervisor of each section and there is very limited time allocated to training. In fact, workers need more training. Moreover the company faces the problem of high turnover due to workers resigning to start their own businesses.

Machine

The Company faces the problem of machine breakdown during production about once a month. Each time it occurs, the average maintenance cost is Bht 20,000 to 30,000. Maintenance attempts to fix it within one day. There are many problems of machine breakdowns associated with unskilled workers, aging machines, machine overload, etc. The main problem, however, is non-preventive maintenance.

Material

There are many problems about material inventory such as dead stock, low quality material, material shortage, etc. But the major problem is excess inventory. The company meets the problem of late delivery once a week. When the workers find the low quality material they inform the purchasing section to take an action. The company has policy and criteria for selecting suppliers. These are quality of product, delivery & service, price and credit terms payment respectively.

Management

The company has an inefficient plan for receipt of materials, stock control, process management, and material cost control. The company orders the material by using purchase orders but it creates uncontrolled stock in the warehouse, causing the excess inventory, dead stock, and shortage of inventory. It also cannot control the direct and indirect production cost. Due to inefficient process management, defective products amount to 5 to 10 percent per day. When any problems occur, the company does not empower its workers to solve them. Only supervisors solve problems by meeting each other more than twice a week.

4.3 Investigate Inventory Management in Panda Thai Wood Product

(1) Type of inventory

(a) There are three types of inventory, which are raw materials, work in process and finished goods

(b) Maintenance and Repair keep excess stock of raw material for maintenance and repair. They are not using any criteria to set minimum stock for the raw material.

(c) No controlling for operating supply such as sand paper, cutters, etc. that is used for production. They provide no limit of operating supply. This leads to more and more use of operating supplies, leading to high cost of production.

(d) Work in process inventory takes about 3 weeks. But sometimes it takes longer than 3 weeks to finish work in process. These certainly affect the production schedule.

(e) Excess raw material for production due to poor production planning and inefficient purchasing raw materials.

(f) Over supply of finished goods caused by over production. The company produces more than the quantity required in purchase order. Furniture is a very sensitive product and needs skill in producing. Therefore, if one part breaks down it needs to restart that part again from the beginning process. To produce more is the method that the company uses to guarantee the quantity required by customers.

(2) Current Problem

(a) Inefficient in production capacity planning

(b) Lack of stock inventory control system — now they have no method to control the inventory.

(c) Inaccurate lead times — many suppliers with different lead time.

(d) Suppliers determine minimum order therefore the company needs to fill in the order according to suppliers' minimum order requirements.

(3) Types of waste

(a) The company has waste of raw materials during the production so it leads to high cost of inventory.

(b) Some parts need to wait for another part before it can be assembled such as the leg parts usually have problem because of the machine breakdown.

(c) Unnecessary motion — there are some parts of production which are not important and can cut down in order to reduce work in process time.

(d) Many defective products can lead to the quality problems therefore the production line needs to recheck the product before passing it to another line. Time is wasted.

(4) Scheduling

(a) PTW has never set any criteria to determine the material level that gives the difficulties in calculating the cost of raw materials.

(b) No schedule is used to control incoming raw materials. Therefore the company has too many raw materials in stock which leads to high inventory cost.

(c) The company has too many suppliers for one raw material. For example the company has about 6-10 suppliers for packaging, giving difficulties to calculate the cost of production. Besides, it also creates the problems in managing material schedule.

(5) Type of material and suppliers

The company has two types of raw materials (imported and local):

Table 4.1. The Example of Imported Raw Materials.

Country	Suppliers' Name	Material Type	Lead-Time (day)
Singapore	Danzer Vencorsae Pte Ltd.	Pecan Veneer thickness 0.6 mm.	15
USA	M. Bohlke Veneer Corp.	Mape Veneer thickness .055 mm	45
Taiwan	Kon Enterprise	Brass knob Y-Y3	45
Taiwan	Gen Chyn Enterprise	Diamond Pull 4 inches	60

(a) Imported raw material (Veneer, hardware, mechanism, etc.) Each has different delivery lead-times. (Table 5.1)

PTW has paid a lot of money for stocking imported raw material because this type of material needs a long lead-time delivery. The company has to inform its suppliers 15 days in advance if there are any changes in scheduling. Plus, PTW has problems in communication with its suppliers in postponing schedule or delivering materials.

(b) Local raw material (wooden knob, stainless steel, glass refiner, etc.) Lead-time is about one week.

From Table 5.2, PTW has many suppliers for each material, therefore, the company cannot manage these suppliers efficiently because the company needs to allocate order among suppliers in order to keep relationship with every suppliers. Besides, each supplier will receive only a small quantity of order thereby making the PTW no bargaining power to gain lower price.

Table 4.2. The Example of Local Raw Materials.

Suppliers' Name	Material Type	Lead -Time (day)
Sathit Interpacking (Samutsakorn Province)	CTN-Leg	7
T.N.C. Packaging (Bangkok Province)	CTN-Leg	7
Ekarach Paper Industry (Bangkok Province)	CTN-Leg	7
Kruangthong Packing (Bangkok Province)	CTN-Leg	7
Hiwa Interprise (Samutsakorn Province)	CTN-Leg	7
Nakornsri Rubberwood (Bangkok Province)	Parawood	7
Admice Parawood (Bangkok Province)	Parawood	15
Star Parawood (Yala Province)	Parawood	7
Zenith Parawood (Samutprakarn Province)	Parawood	7
Rainbowsutar Parawood (Surathanee Province)	Parawood	15

VI. SYSTEM EVALUATION

5.1 Bill of Material for Model 5147-04 (Bangkok Factory)

Refer to bill of material of model 5147-04 in Appendices Q and R: there are direct materials for producing in Bangkok Factory such as parawood, chipcore, MDF, particle board, T-nut, tapping screw and veneer. BOM shows unit price of each items, quantity needed per table and per lot size, total cost per items and total direct material costs for producing one table.

For example, the customer ordering the occasional table model 5147-04 for 207 pieces. But the company method for ordering raw material from suppliers will add 10 percent of quantity required in purchase order for replacing waste during production. From the schedule of BOM, the total material costs per table is Bht 238.98. Total material per order (207 pieces) is approximately Bht 49,469 and total material costs per lot size (228 pieces) is approximately Bht 54,487. There are excess cost of material for 21 pieces which cost about Bht 5,018 (excluding labor cost and opportunity cost associated with other products). At present, the company faces the problems of high inventory in almost all items for amount of Bht 3,651,094.41 (beginning inventory) and the excess inventory of Bht 3,596,606.86 (ending inventory).

The material should be sent to the company only when it is needed. At present, the material will be withdrawn from the store even if it is not necessary. Additionally, the raw materials are sent to store in the warehouse with no controlling. The warehouse does not use the First In First Out method therefore some material are kept until expiry or damage and counted as dead stock. To solve this problem, the material resources planning and just in time are recommended because it can monitor the current stock of

raw material and show the raw material needed for production. The materials are required only when needed.

5.2 Production Process for Model 5147-04

Refer to production process of model 5147-04 in Appendices S and T: the process of producing tables has a number of stages. This model is composed of table's parts such as top, apron, moulding apron, leg, drawer, corner block, cleat and edge. All of these parts are operated in the batch production of Bangkok factory. Each subsection produces parts on a number of units of product; then they are passed on to another subsection for the next stage of the process. Some parts are completed through one department but the other needs to pass to other departments to make it complete. The production process schedule shows the average production time in seconds and number of workers for each process of each part.

For the table's top, the production process passes on many machines such as cut off saw, hot press, wide belt sanding, stroke belt sander, etc. in the area of veneer&board department which spends total working hours of 21.59 minutes per piece of top.

For the apron, it spends average production time of 0.28 minutes in the area of veneer&board department then they are passed on to the area of smooth mills department which spends average production time of 0.90 minutes. So the total working hours for one piece of apron is about 1.18 minutes.

For the moulding apron, it spends average production time of 0.32 minutes in the area of rough mills department then they are passed on to the area of smooth mills department which spends average production time of 0.35 minutes. Hence the total working hours for one piece of moulding apron is about 0.67 minutes.

For the table's leg, it spend average production time of 1.02 minutes in the area of rough mills department then they are passed on to the area of smooth mills department which spends average production time of 5.00 minutes. So the total working hours for one piece of leg is about 6.02 minutes.

For the drawer, corner block, cleat, each of them is completed by the area of rough mills department which spends total working hours of 0.83 minutes.

For the table's edge, it is also completed by the area of rough mills department which spends total working hours of 0.62 minutes per piece of edge. After these parts are completed , they will be sent to Chonburi Factory for the next stage of processes.

If the production takes longer times than the above data, the production process will certainly take more than three weeks. This leads to the delay of shipment.

5.3 Machine Breakdown Time

Refer to report in Appendices U and V: machine parts, tools, supplies and maintenance expenses in September 2000. It shows the total cost of machines' breakdown within a month which are maintenance cost and opportunity cost. In September the maintenance cost is approximately Bht 112,581 and the opportunity cost is approximately Bht 22,923. (Calculated the opportunity cost from waste time (hours) multiple by labor cost per hour. The labor cost per day is Bht 162 and the working hours per day is 8 hours). Each machine is responsible by number of workers depending on machine type. When the machines breakdown the workers who are responsible for that machine will be shifted to work in other areas that they have no experiences. Therefore the company has no worth from shifting those workers and it creates the opportunity loss to the company.

Besides, the production in Bangkok factory is batch production. The production line needs to produce follow step by step. It cannot pass on to the next stage of process,

which results in work-in-process inventory. Moreover, the company faces the problems of late delivery because of machines breakdown.

At present, if there are some operation machine breakdown, there will be a lot of work in process inventory hold on. This generated two results. Firstly, the upstream machine cannot operate because of no feeding parts from the machine that breaks down. Secondly, the machine located in downstream will generate a lot of excess inventory because the parts cannot be fed to the breakdown machine.

PTW faces the problems of high inventory of raw material and work-in-process due to the inefficient plan of material receipt, stock control system, process management and machine breakdown time. This report focuses on solving the problems of the two main points. The first one is high inventory cost. Another one is the machine breakdown, which generate waste in the production line.

Implementing the JIT and MRP system is the best solution for PTW.

To implement JIT and MRP, the management should start step by step in order to minimize resistance from the employees. Besides, the employees also can adapt themselves to the changed environment. The implementation should be as follows:

Step 1: Management announces to all employees that PTW will start using JIT and MRP system in order to reduce inventory cost. This also support company's mission, which are lower pricing strategy to compete with competitors.

Step 2: The management must fix the existing problems by reviewing the production capacity for each machine and find out the bottleneck of the process. For example, if there is one machine that has lowest production capacity, which is only 950 tables a day. The rest of them should minimize the production quantity to the same level (950 tables/day), due to the batch production, even if the other machines can produce

more quantity but there is one machine that cannot produce more and it creates the left over parts waiting in the line.

At present, the company set the production target to 1,000 tables a day (2 purchase orders) by not concentrating on the capacity of the machines.

Step 3: Management has to review the process of withdrawal materials from store through production line. The process of withdrawal material must be changed to "pull system" The material will be requested only when needed. Besides, the purchasing staffs should monitor the incoming raw material carefully. The materials should be sent to the company only when it is needed.

The inventory must be monitored by production line weekly. For example, the production of Smooth Mills (SM) for model 5147-04 is totally one week. Therefore the line should keep the work-in-process inventory of the mentioned model for one week only.

Step 4: Implement the preventive maintenance system and provide basic maintenance knowledge for workers in production line in order to fix uncomplicated problems by themselves. Provide training course to workers to ensure the flexibility of production line (cross-trained employees).

Step 5: Start implement JIT with occasional table model 5147-04 that has been selected in our discussion first by minimizing the number of suppliers for each material. Building close relationship with suppliers in order to get the material only when it is needed and try to reduce lot size per order. Building JIT partnerships.

Step 6: Producing model 5147-04, the operation staffs start recording the important data on the traveler card in order to monitor material cycle time. For example, Rough Mill line records the material before production started to monitor how many table parts that can produce from this amount of material. On the process if there are

any breakdown machines, the breakdown machine must be recorded. Which machine breaks down? How many times? How long is it inoperative? By the end of production of model 5147-04 the Rough Mill must record the quantity produced and number of defective parts. All these parts are sent to Smooth Mill and Veneer and Board together with the traveler cards. In addition, the following lines should continue record as well. As a result, the company will know the cycle time of material, the number of defective and accepted parts for this lot. Hence, the company can also monitor the production line that creates the defective parts and find the solution for that line.

Step 7: After the company is successful in implementing JIT with model 5147-04, the company should start to implement this system with other models following one by one until it covers every model.

Step 8: Provide training program to the purchasing staffs, production planning control staff, operation staffs, supervisors, managers and other staff that are concerned with the MRP software.

Step 9: Selected MRP software that is suitable to the company and install the software. Run the MRP system parallel with the previous (manual) system to monitor the reliability of the MRP system for 3-4 months before switching to use 100 percent MRP system.

To run MRP, all employees must understand the logic of the system and install data required in the program. The needed data are as follows:

(1) Supplier names and lead-time of each material for each supplier - In some types of materials the company has more than one supplier (for example, carton box has about 6 - 8 suppliers for one model). The company should contact only 2 - 3 suppliers and allocate the quantity to these suppliers.

(2) BOM (Bill of material) - The company must divide the raw materials into direct materials and indirect materials. For example, direct material is parawood and indirect material is epoxy. Bill of material shows only direct material because indirect material is expendable and difficult to count and monitor about the usage.

(3) Production schedule - The Company has to check the production capacity of each production line and the lead-time of work in process. If wrong data were installed in the system, the system will calculate wrong quantity of material. For example, the production target per day is 1,000 tables, the production capacity that the system calculated will be 6,000 tables per week and system will request raw material for producing 6,000 tables per week. But if the actual capacity plan is only 800 tables per day, the weekly production capacity will be 4,800 tables. Therefore, the production line needs only 4,800 tables of materials. If wrong data is installed, there will be excess raw material in the stock.

(4) Raw material available - after installing the correct data in the system, all inventories level will be shown in the system such as inventory at warehouse, inventory at production line and schedule of incoming material.

The above systems could build a competitive advantage and lead PTW to be one of the leading companies in manufacturing occasional tables in Thailand.

VI. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions and Recommendations

To reduce inventory cost in PTW, the recommendation was solving the existing problems, implementing Just in time (JIT) and Material Resources Planning (MRP).

PTW needed to focus on four main topics which are manpower, machine, material and management in order to solve the existing problems.

Manpower

There are high employees' turnover rate, unskilled worker and lack of training. PTW should provide training to workers before working. Therefore PTW knows workers capability and skills in order to assign the right job to the right workers by the production supervisors. These could prevent the waste that can be occurred in production lines.

Machine

There is no preventive maintenance and machine overload. PTW should implement preventive maintenance and provide basic maintenance knowledge to workers in production. The preventive maintenance will reduce waste production time and maintenance costs. Moreover, the identification of any bottleneck is needed in order to reduce work in process inventory.

Material

There are excess raw materials inventory, late delivery, and excess work in process inventory. Besides, PTW also has an inefficient system in withdrawal raw materials from warehouse. PTW should review raw materials ordering process and start using First In First Out (FIFO system) to withdraw materials from warehouse.

Management

There are lack of management process and inefficient production planning. The management should set the policy to reduce inventory cost in production line to make profit and as it also supports company's mission which are lower costing strategy in order to compete with competitors by announcing the policy to all employees.

After solving the existing problems, PTW should implement J1T system with product model 5147-04 first because it is the current product and has a short process. The inventory will be monitored weekly by staffs in production line. When the JIT system succeeds with the first model, the company could continue implementing it with other models until all desired models are included. J1T system can solve the inventory holding cost.

PTW also has to reduce inventory cost such as warehouse and storage cost. MRP system is the solution for the problems about lack of capacity planning, delivery date and excess inventory. All inventory levels should be shown in the system such as current inventory, inventory required, inventory at production line, schedule of incoming material, etc. The MRP system must be run parallel with the previous (manual) system to monitor the reliability of software for 3-4 months before switching to JIT 100 percent.

Both systems could provide competitive advantages and lead PTW to be one of the leading companies in manufacturing occasional tables in Thailand.

APPENDIX A

COMPANY NAME AND ADDRESS

COMPANY NAME AND ADDRESS

Panda Thai Wood Product Company Limited

23/1 Moo 14 Serithai Rd. Minburi

Minburi Bangkok, 10510

APPENDIX B

FINANCIAL STATEMENT

FINANCIAL STATEMENT

Table B.1. Income Statement.
Panda Thai Wood Product Co., Ltd.

Unit: 1,000 Bahts	Actual	
	1999	2000
Profit & Loss		
Gross Sales	609,427.13	688,046.84
U.S.A - Occasional		
U.S.A - Bed Room		
Europe		
Domestic		
Others		
Less: Return & Discount		
Total Net Sales	609,427.13	688,046.84
Cost of Goods Sold		
Raw Materials	363,426.66	477,672.87
Direct Labor	42,336.92	57,652.47
Factory Overhead	42,091.76	36,869.41
Total cost of Goods Sold	447,855.34	572,194.75
Gross Profit	161,571.79	115,852.09
Selling & Administrative Expense	56,268.55	51,993.72
Operating Profit	105,303.24	63,858.37
Interest Expenses	25,026.97	15,349.65
Other Income	4,455.78	4,737.65
Net Income (Loss) Before Tax	84,732.05	53,246.37
Corporate Income Tax	-	11,620.09
Net Income (Loss)	84,732.05	41,626.28

Table B.2. Operating Expenses.
Panda Thai Wood Product Co., Ltd.

Unit: 1,000 Bahts	Actual	
	1999	2000
Operating Expenses		
Selling & Administrative Expenses		
Salary & Employee Expenses	15,046.07	16,276.41
Travelling & Vehicles Expenses	1,982.59	2,543.86
Transportation & Shipping Expenses	9,575.03	12,490.33
Entertainment	466.57	494.31
Legal, Audit & Professional Fee	67.77	61.75
Loss on Exchange Rate	14,572.27	1,588.45
Repair & Maintenance Expenses	173.15	1,321.79
Other Expenses	12,486.05	14,813.95
Depreciation	1,899.05	2,402.87
Total Selling & Administrative Expenses	56,268.55	51,993.72
% Selling & Admin Expenses of Net Sales	9.23%	7.56%

Table B.3. Balance Sheet.
Panda Thai Wood Product Co., Ltd.

Unit: 1,000 bahts	Actual	
Balance Sheet	1999	2000
Asstes		
Current Assets		
Cash in hand	9,648.70	17,155.67
Account Receivable	26,263.48	35,140.02
Inventories	16,550.79	24,796.90
Other Current Assets	80,759.77	91,120.44
Total Current Assets	133,222.74	168,213.03
Gross Fixed Assets	146,352.93	164,211.05
Less : Accumulated Depreciation	76,695.40	90,858.51
Net Fixed Assets	69,657.45	73,352.54
Other Assets	7,232.75	7,071.03
Total Assets	210,112.94	248,636.60
Liability & Shareholders' Equity		
Current Liablities		
Bank Overdraw	11,337.07	7,380.97
Packing Credit & T/R	53,742.84	58,436.73
Account Payable	94,879.67	96,342.83
Cheque in Advance	2,219.01	1,370.30
Accured Expenses	5,077.46	17,234.59
Other Current Liabilities	32,467.76	28,666.29
Total Current Liabilities	199,723.81	209,431.71
Medium Term Loan		
Long Term Loan	24,931.02	12,167.27
Other Liabilities	46.77	0.00
Total Liabilities	224,701.60	221,598.98
Shareholders' Equity		
Common Stock	15,000.00	15,000.00
Beginning Retained Earning	-114,320.71	-29,588.66
Net Income (Loss)	84,732.05	41,626.28
Ending Retained Earning	-29,588.66	12,037.62
Total Shareholders' Equity	-14,588.66	27,037.62
Total Liabilities & Shareholders' Equity	210,112.94	248,636.60
Current Ratio	0.67	0.80
Debt to Equity Ratio	-15.40	8.20

Table B.4. Inventory Cost.
Panda Thai Wood Product Co., Ltd.

Inventory - Ending

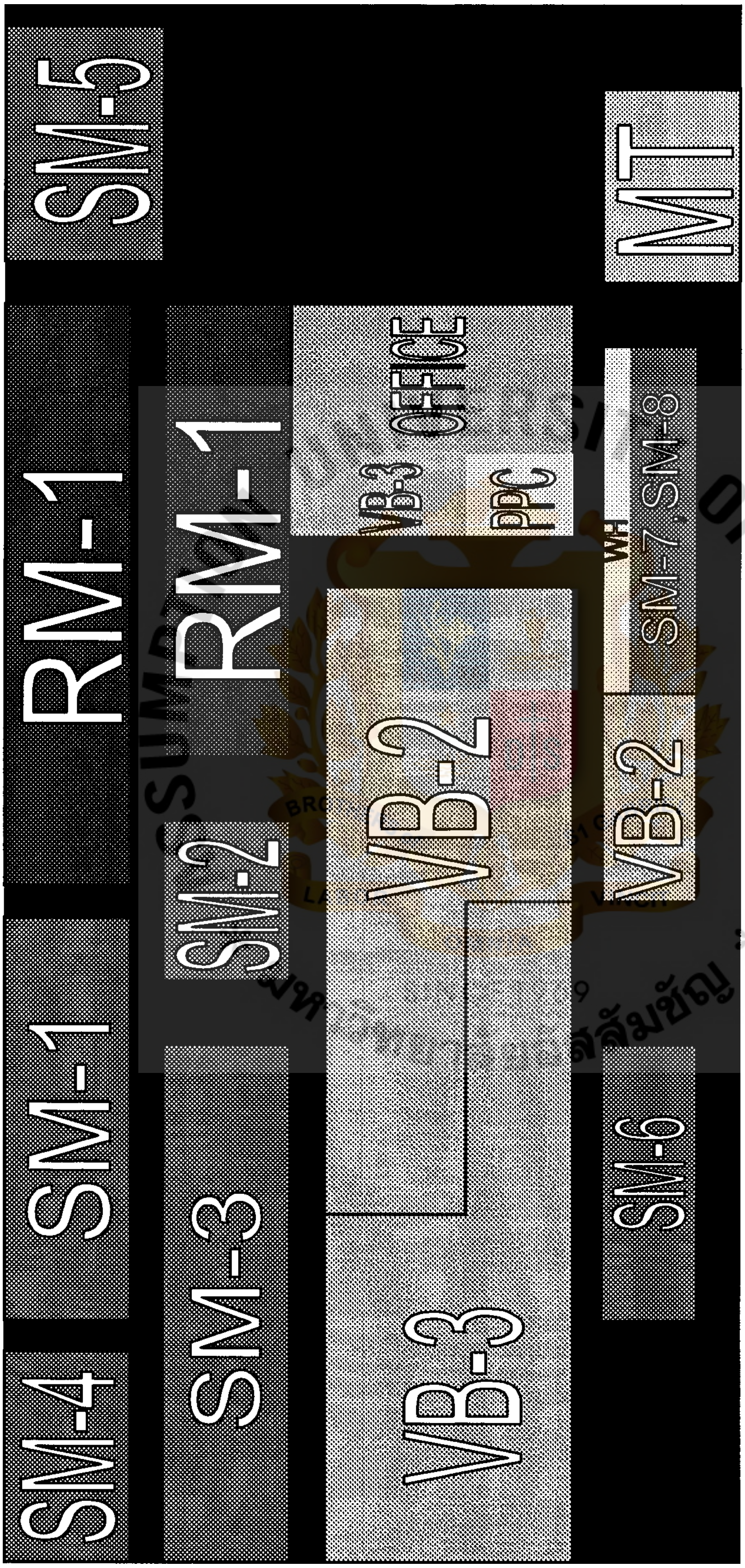
	1999	2000
Finishing	1,626,369.17	2,007,375.00
Fitting	4,115,755.18	6,487,120.97
Packing	577,384.46	857,785.40
Veneer	2,449,499.09	3,027,916.99
Wood	7,517,946.00	12,218,756.43
Supply	159,632.46	141,473.25
Others	104,200.76	56,476.10
	16,550,787.12	24,796,904.14

Table B.S. Cost of Goods Sold.
Panda Thai Wood Product Co., Ltd.

Unit: 1,000 Bahts	Actual	
	1999	2000
Cost of Goods Sold		
Beginning Inventories	18,250.56	16,550.79
Raw Material Purchased	211,726.89	285,918.98
Ending Inventories	16,550.79	24,796.90
Material Used	363,426.66	477,672.87
% Material Used of Net Sales	59.63%	69.42%
Labor Cost	42,336.92	57,652.47
% Labor Cost of Net Sales	6.95%	8.38%
Factory Overhead		
Salary & Employee Expenses	3,771.59	6,136.84
Electricity & Utilities	6,978.65	8,396.48
Other Expenses	17,638.79	10,575.93
Depreciation	13,702.73	11,760.16
Total Factory Overghead	42,091.76	36,869.41
% Factory Overhead of Net Sales	6.91%	5.36%
Total Cost of Goods Sold	447,855.34	572,194.75
% Cost of Goods Sold of Net Sales	73.49%	83.16%

APPENDIX C

BANGKOK FACTORY LAYOUT



Veneer&Board
Production Planning & Control
Warehouse
Office

Figure C.1. Bangkok Factory Layout.

APPENDIX D

CHONBURI FACTORY LAYOUT

Finishing Line
Maintenance
Packaging
Warehouse
Assembly Line

Chonburi Factory Layout.

APPENDIX E

CUSTOMER PURCHASE ORDER

Pacific Marketing international

tkoting WarnockOol *Roy Ltd,* St*=2001,20th Floor, Central lkaxa,10 HataurRoml, Wanchg,* HongKong
Tel:(11t0-437.4194 Pa.012444-325-0.8 Fr:2:0604-323424Z

Purchase Order

Waiting PRG to confirm ship date, Will advise later.

DATE :

CUSTOMER			
VENDO		SHIPPING DATE	
PAYMENT		DESTINATION	

CUSTOMER ITEM#	PIVT	DESCRIPTION	CITY PCS/SET	PRIC (U $	AUUNT USD
			OUTL KJ		HALAN
			1111111111		
			11111111111		
			1111111111		
			11111		
			111111		
OTAL	1x40 HC		111.1111111111		

SHOULD SHIP ALL ABOVE QUANTITY OR SHIP IN PROPORTION.

Remark

I ; USE 'PROGRESSIVE SPECIAL WOO'

2 TO LIE INSPECTED BY PACKER: MARKETING Dill, (LIK) LTD.

3 SNIP VIA YML-AW

4 ; "Consignee:
PROGRESSIVE INTERNATIONAL
2588 HEART DRIVE, CLAREMONT, NC 28610
**Notify Party::
PROC.iRESSIVE INTERNATIONAL
2588 HEART DRIVE, CLAREMONT, NC 28610 FAX: 820459,9762 ATM. DAN LOVER
JOHN S. LAWN co.
:'2128 BURNETT BLVD., WILMINGTON, NC 28401
ATTN: SUE SULLIVAN TEL:910-343-0700 FAX:910343-1041

S Certificate of oriO4 in required.

z PARTS AT F.O.C.; *a* EACH OF LEGS, 11/5'/ ARP, & IoyyokpRoN AN)) 20 'KNOBS.

7 : SDI? TO ADDRESS: (MUST BE SHOWN oN Sri)
2515 PENNY ROAD, CLAREMONT, NC 28610

Signed By Vendor

Pacific Mediating Ire (HI() Ltd

atiiiirekikont<24€2-

endarattruestoterms condrtiona

by:Dtat77r---

Figure E.1. Customer Purchase Order.

APPENDIX F

CUSTOMER PURCHASE ORDER FORM

FURNMART INTERNATIONAL LTD.

CHINA OFFICE	HONGKONG OFFICE
UNIT C&D, 2/F, YA PAK BLDG.,	7F, SILVER COMMERCIAL BLDG.,
YA CHUI GARDEN, SOUTHERN	719 NATHAN ROAD, KOWLOON,
AREA, ZHANGMUTOU TOWN,	HONG KONG
DONG GUAN, CHINA	
TEL 86-769-7717257	TEL: 852-2308 1693
FA) 86-769-7713023	FAX: 852-2782 5286/2390 9283

TO: PANDA THAI WOOD PRODUCT CO.,LTD.
23/1 MOO 14 SUKHAPIBAL 2 RD.,
MINBURI, BANKOK IOSIO, THAILAND

DATE:
PURCHASE ORDER

I	DESCRIPTION	Q'TY PCS	UNIT PRICE USD	TOTAL USD
			F.O.C.	
			USD	

1. PRICE TERM: FOB BANGKOK
2. TOTAL SAY U.S. DOLLARS
3. DELIVERY: 1X40'HQ SHIP TO:
4. +/-5% IN QUANTITY IS ALLOWED.
5. PLS PAY SPECIAL ATTENTION TO THE FINISHING QUALITY OF TOP SURFACE OF THE APRON & LEG WHEN THE LIFT PART IS MOVED UP.
6. INFORM FURNMART TO DO QUALITY INSPECTION 10 DAYS EARLIER WHEN THE ORDER WAS FINISHED 50% AT LEAST
7. THE CUSTOMER'S ACCEPTANCE OF SHIPMENT WILL BE THE FINAL.
8. CARTON MARKING & SHIPPING INSTRUCTION AS ADVISED.
9. PAYMENT: 50% DEPOSIT 30 DAYS BEFORE SHIPMENT TO THE APPOINTED ACCOUNT, THE BALANCE TO BE WIRED UPON THE RECEIPT OF FULL COPY SHIPPING PAPERS.
10. PLS SIGN & RETURN ONE COPY TO US FOR THE ACCEPTANCE OF THE ORDER.

PANDA THAI WOOD PRODUCT CO.,LTIFIJRNMART INTERNATIONAL LTD.

Violet Yang

AUTHORIZED SIGNATURE AUTHORIZED SIGNATURE

Figure F.1. Customer Purchase Order Form.

APPENDIX G

PURCHASE REQUISITION

PANDA THAI WOOD PRODUCT CO.,LTD.

Purchase Requisition (61,1J11t1) - IT111141Y11 6T14 **NO.** _____

DATE _____

El (To)	gin (From)
ebti (Dept.)	eliti (Dept.) 111-11E13114 **(Section)**

i ila No.	Code	I'lunqi Dscriptions	viliqu irtit,i.h4	4-11.rau Unit	@ (Bht)	%Pan 914./vitigti	1rAI (11110

1)1341211,Vikl : -	113.1 (Total)	
(TmtILIsa°A1Pilun9TMIfa (Purposes)	inn n1g3,1nf1llfill 7%(Vat)	
1,6811711 1141.111 6ri4	grJarkli'Ll (Grand Total)	

kalmrNlviryTuvi 1 linlajihrmrimAwvatillifq AN 'lull	L Ii milukI1J2L'inwEEK _____

61itta/Requisitioned **bytIFIVriZZ**1J / Reviewed by	6914,9401 / Approved by
/ / / /	/ /

Figure G.1. Purchase Requisition.

APPENDIX H

PURCHASE ORDER FORM

asigiM Ab- BVa1:hai Wood Product Co.,

p a :,,,.,,, Moo 14, Serithai Rd.. Minburr Bangki* 10510, Thailand.
0,1 1 1114 04 II win All aiiiitrO nvillyv Imo ll'rrAyllurr
Tti(g,321(;17 -11001 -1 Fax : (tl62) 21T-1870

Pa F; 0

,m1');,1115 1011 3 10 1 0319.7

PURCHASE ORDER. tiuMR.

Code

Supplierftlt re	Ordtr !tin.hz41.1)ira4u	1Date of Orderntl
	70totovicial forioliRittilittitit t	11.1er"mni Dareinrnrito
	'Pent! of Paymeanxbilirnib	
Sead toinvilliin	Charge toArtmlotris.trilfitwil	

tem Ol'in	Panda Pali No. k: Parr Name T5ri0>Eittfitain111014111tilt	Quantity tlnit ilrr r.1 Irsi m ---f---	Unit Prioo 1 11110011010	A:moot i'lrinill,
		1-		

Officer ftatit Manager Dare 213113f11:g Director Date.

Eadory 1 : 23/1 Moo 04, 2irithai Rd, itiinbuti Bangkok: 10510
,01/1 N 14 0.103150 041.410ii twiliner rrioarm 10510

Factory 2 : 5t Moo 1, Nw>g F. Roo, Banbuong.
Oa 011 t srmaniVirar obtr]114 9.711115

This Purchase Order is not said unless signed by 3 *natures.
Tlns ull be stated in vendor invoice 8: Pricking list.
111t1445119llSI1tt591 Ttlfli10 11.1101131.1 3 kitiv.4 4
anehthriftilraullliinrandlultniihnli) :rtOr.rritritutirre;

Write = Vendor Yellow A/C-Inventory Blue = Purchasing

Figure H.1. Purchase Order Form.

APPENDIX I

INTERVIEW CHECKLISTS

INTERVIEW CHECKLISTS

Interview: Production process in Panda Thai Wood Product Company Limited (Focus on Bangkok Factory)

Name:

Title:

Age: Years

Product: Occasional Table

The interview is to evaluate the production process in Panda Thai Wood Product Company Limited to identify the cause of problem that lead to the high production cost.

(1) How do the customers place order?

……

……

(2) What is the minimum order?

……

……

(3) How long for the delivery lead-time?

……

……

(4) How many suppliers do the company has?

……

……

(5) What is the delivery lead-time for suppliers to deliver the raw material to the company?

……

……

(6) What method does the company use for ordering raw material?

……

……

(7) How many percent of raw material does the company stock as the inventory for each order?

……

……

(8) How do the inventory flows?

……

……

(9) Can the customers make any change in product design?

……

……

(10) How long does it take to set up change of run?

…… ……

……

(11) How many coffee tables produce in a day?

……

……

(12) How the company determines the reorder point for raw material?

……

……

Thank you for your kind cooperation.

APPENDIX J

QUESTIONNAIRES

QUESTIONNAIRES

(1) Do you workers train before working?
a) Yes b) No

(2) How many average time per week do the machines breakdown?
a) 2 times b) 4 times
c) 6 times d) more than 6 times

(3) What are the main problem of machine breakdown?
a) No preventive maintenance b) Unskilled worker
c) Old fashioned machines d) Others.....

(4) If the machine breakdown during the production process, how the company solves the problems?
a) immediately b) one hour after informing
c) within one day d) more than one day

(5) How much does the maintenance cost per week that the company spends?
a) lower than 10,000 baht b) 10,000-20,000 baht
c) 20,000-30,000 baht d) more than 30,000 baht

(6) Does the company plan the schedule of receipt materials?
a) Yes b) No

(7) How often does the company meet the problem of late delivery (raw materials)?
a) Never b) Once a week
c) Twice a week d) More than twice a week

(8) How does the company control stock in the warehouse ?
a) FIFO systems b) Minimum stock
c) HT system d) Uncontrolled

(9) How many times a year that the company has physical inventory?
a) Once a year b) Every quarter
c) Every 6 months d) Every month

(10) What is the main problem about the material inventory?
a) Excess inventory b) Dead stock
c) shortage of material d) Low quality

(11) What method the company uses to order the materials?
a) Zero stock b) Minimum point
c) By usage d) By purchase requirements

(12) Rank the importance of choosing suppliers from alternative? (4 = the most important, 3 = excellent, 2 = good and 1 = the least important)

Quality of goods
Delivery and services
Price
Credit term

(13) What is the biggest problem of defective product?

a) Low quality of materials
b) Unskilled workers
c) Lack of process management
d) Others .....

(14) How many percents of defective product per day?

a) Lower than 5%
b) 5 — 10 %
c) 11 — 15%
d) more than 15%

(15) What do the workers feedback after finding out the material low quality?

a) Do nothing
b) Informed purchasing action
c) Informed Supervisor action
d) Other .....

(16) How does the company control indirect material (supplier) cost?

a) Uncontrolled
b) Buy base on production schedule
c) Buy every week
d) Buy base on purchase requirement

(17) How often do the customers complain about quality problem per month?

a) Never
b) Once a month
c) twice a month
d) More than twice a month

(18) Does the company give the empowerment to the workers to solve any problems?

a) Yes
b) No

(19) How often do the foremen in each department to have meeting when the problems?

a) 1 time
b) 2 times
c) more than 2 times
d) do nothing

(20) What is the main reasons of high turn over rate (workers)?

a) Low wages
b) Low benefits & welfare
c) Get the new job
d) Do own business

APPENDIX K

NAME OF RESPONDENTS FROM INTERVIEW

NAME OF RESPONDENTS FROM INTERVIEW

1.	Mr. Surachai	Assavaraksawong	PPC Manager
2.	Mr. Anirun	Wongarn	Manufacturing Manager

APPENDIX L

NAME OF RESPONDENTS FROM QUESTIONNAIRES

NAME OF RESPONDENTS FROM QUESTIONNAIRES

1.	Mr. Udorn	Tantakul	Purchasing Manager
2.	Mrs. Vorawan	Spencer	Marketing Manager
3.	Mr. Tawatchai	Santudkhun	Production Manager
4.	Mrs. Suratwadee	Wongwaodee	Supervisor
5.	Mr. Jiradet	Sirimuang	Supervisor

APPENDIX M

QUESTIONNAIRES RESULTS

QUESTIONNAIRES RUSULTS

Five questionnaires were distributed five employees in Panda Thai Wood Product Company Limited. They are Purchasing Manager, Marketing Manager, Production Manager and 2 Supervisors. Finally the data was collected as follows:

(1) Do the workers are train before working?

100 percent answer: All workers are trained before working.

(2) How many times per week do the machines breakdown?

20 percent answer: the machine breakdown 2 times a week

20 percent answer: the machine breakdown 4 times a week

60 percent answer: the machine breakdown 6 times a week

(3) What is the main problem of machine breakdown?

20 percent answers: the main problem is the machines are old-fashioned machine.

20 percent answers: the main problem is the machines are used by unskilled workers.

60 percent answer: the main problem is there are no preventive maintenance.

(4) If the machine breakdowns during the production process, how the company solves these problems?

40 percent answer: the company solves these problems more than once in day.

60 percent answer: the company solves these problems within one day.

(5) How much does the maintenance cost per week that the company spends?

20 percent answer: the company spent not more than Bht 10,000 as maintenance cost.

20 percent answer: the company spent about Bht 10,000 to Bht 20,000 as maintenance cost.

60 percent answer: the company spent about Bht 20,001 to Bht 30,000 as maintenance cost.

(6) Does the company plan the schedule for receipt material?

20 percent answer: the company plans for receipt of materials.

80 percent answer: the company has not planned for receipt of materials.

(7) How often does the company meet the problem of late delivery (raw material)?

20 percent answer: the company has met the problem of late delivery more than twice a week.

20 percent answer: the company has met the problem of late delivery twice a week.

60 percent answer: the company has met the problem of late delivery once a week.

(8) How does the company control stock in the warehouse?

20 percent answer: the company cannot control stock in the warehouse.

80 percent answer: the company uses FIFO system to control stock in the warehouse.

(9) How many times a year that the company has physical inventory?

100 percent answer: the company has physical inventory once a year.

(10) What is the main problem about the material inventory?

20 percent answer: the main problem about the material inventories is dead stock.

20 percent answer: the main problem about the material inventories is shortage of material.

20 percent answer: the main problem about the material inventories is low quality.

40 percent answer: the main problem about the material inventories is excess inventory.

(11) What method the company uses for ordering materials?

20 percent answer: the company uses for ordering materials by using minimum point.

20 percent answer: the company uses for ordering materials by usage.

60 percent answer: the company uses for ordering materials by purchase requirements.

(12) Range the important criteria of selecting suppliers (From most important to least important)

Quality of products, Delivery & Services, Price and Credit term.

(13) What is the biggest problem of defective product?

20 percent answer: the biggest problem of defective product is low quality of material.

20 percent answer: the biggest problems of defective product are caused by unskilled labor.

60 percent answer: the biggest problem of defective product is because of a lack of management process.

(14) How many percents of defective product per day?

20 percent answer: there are lower than 5 percent of defective product.

20 percent answer: there are 11 percent to 15 percent of defective product.

60 percent answer: there are 5 percent to 10 percent of defective product.

(15) What are the workers feedback after know that there are low quality material?

20 percent answer: the workers inform supervisors to take an action after knowing that there are low quality materials.

80 percent answer: the workers inform purchasing section to take an action after knowing that there are low quality materials.

(16) How does the company control indirect material (operating supply) cost?

20 percent answer: the company controls the indirect material by buying the mentioned material based on production schedule.

80 percent answer: the company controls the indirect material by buying the mentioned material every week

(17) How often do the customers complain about quality problem per month?

20 percent answer: the customers never complain about the quality problem.

20 percent answer: the customers complain twice a month about the quality problem.

60 percent answer: the customers complain once a month about the quality problem.

(18) Does the company give the empowerment to the workers to solve any problems?

20 percent answer: the company does give the empowerment to the workers to solve any problems.

80 percent answer: the company does not give the empowerment to the workers to solve any problems.

(19) How often do the foremen in each department have a meeting when problems occur per day?

20 percent answer: the foremen in each department have a meeting 2 times per day when problems occur per day.

20 percent answer: the foremen in each department have a meeting more than 2 times per day when problems occur per day.

(20) What is the main reason of high employees' turnover rate?

20 percent answer: the main reason of high employees' turnover rate is low wages.

20 percent answer: the main reason of high employees' turnover rate is because the workers get a new job.

60 percent answer: the main reason of high employees' turnover rate is because the workers start their own business.

APPENDIX N

PICTURE OF PRODUCT MODEL 5147-04

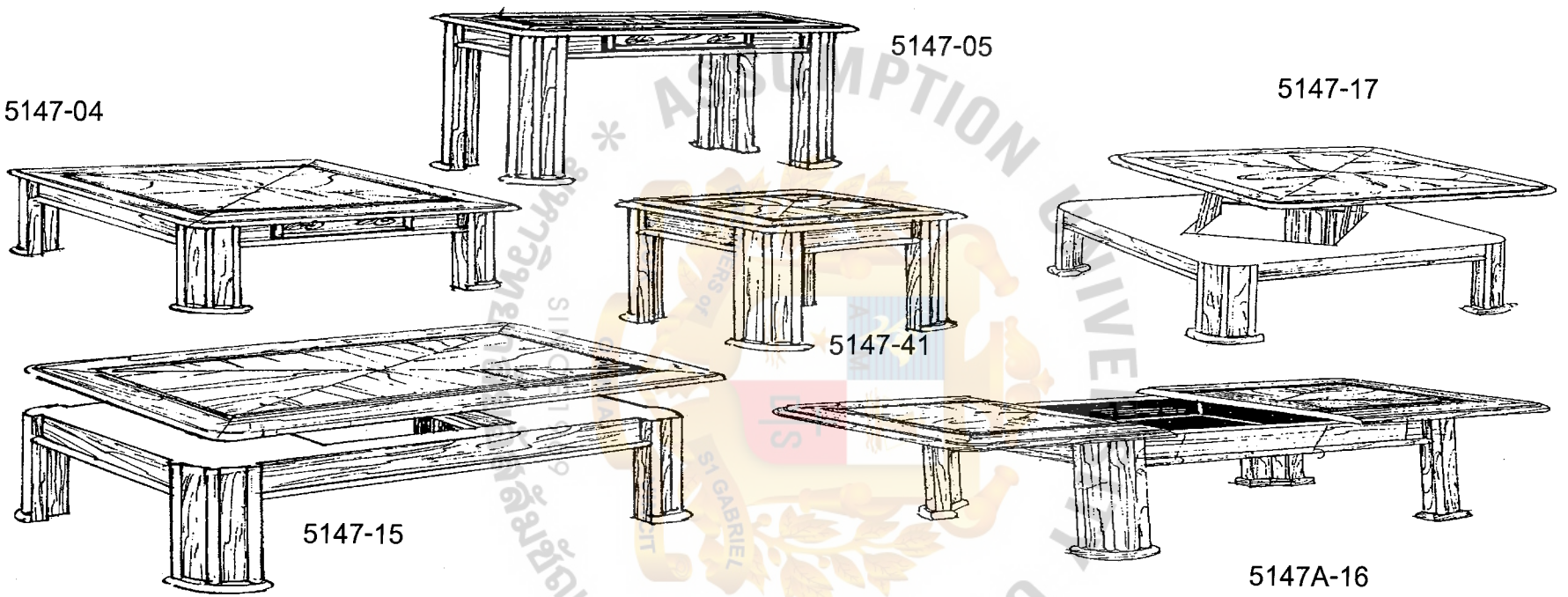
PICTURE OF PRODUCT MODEL 5147-04

Figure N.1. Picture of Product Model 5147-04.

APPENDIX 0

DETAIL OF PRODUCT (MODEL 5147-04)

DETAIL OF PRODUCT (MODEL 5147-04)



EMERALD#T244 (OAK #72HL)

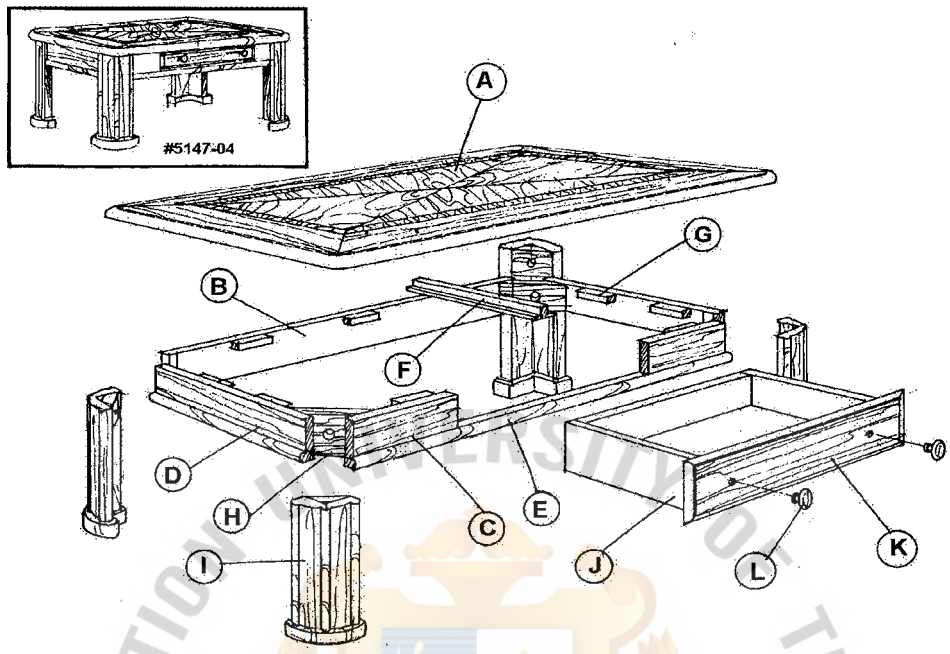
5147-17	Corner Lift Top Table Oak	36 x 36 x 16"H	5147-05	Sofa Table	47 1/4 x 17 x 27"H T244-04
5147-16	Sliding Storage Table Oak	47 1/4 x 27 x 16"H	5147-41	Recend Table Oak	27 x 22 x 20"H T244-03
5147-04	Square CKTL Table Oak	36 x 36 x 16"H	5147-15	Lift Top Oak	47 1/4 x 27 x 16"H T244-09

Figure 0.1. Detail of Product (Model 5147-04).

APPENDIX P

NAME OF TABLE'S PARTS

NAME OF TABLE'S PARTS



NAME OF PARTS (MODEL 5147-04)

A TOP

B BACK APRON

C FRONT ARRON

D SIDE APRON

E MOULDING

F DRAWER GLIDE

G CLEAT

H CORNER BLOCK

I LEG

J BOX

K DRAWER

L KNOB

Figure P.1. Name of Table's Parts.

APPENDIX Q

BILL OF MATERIAL FOR MODEL 5147-04

BILL OF MATERIAL FOR MODEL 5147-04

Description	Unit	Unit pice (Bht)	Purchase Order		Total cost			Beginning inventory		Ending Inventory	
			Qty per	Qty per lot size	per pcs	per order (207 pcs.)	per lot size (228 pcs.)	Qty	Cost	Qty	Cost
Rubber Wood 1 x 2-1/2 x 1.00	pcs	190.00	0.06	13.00	10.8300	2,241.80	2,469.23	705.37	134,021.06	692.38	131,551.83
Rubber Wood 1 x 2-1/2 x 1.30	pcs	190.00	0.03	6.34	5.2796	1,092.88	1,203.75	1848.83	351,277.70	1842.49	350,073.95
Rubber Wood 1 x 3 x 1.00	pcs	190.00	0.03	7.80	6.4980	1,345.08	1,481.54	2762.69	524,911.10	2754.89	523,429.56
Rubber Wood 1 x 3 x 1.30	pcs	185.00	0.03	6.76	5.4816	1,134.69	1,249.81	3096.58	572,867.30	3089.82	571,617.49
Rubber Wood 1 x 4 x 1.00	pcs	171.00	0.41	93.57	70.1785	14,526.95	16,000.69	3351.88	573,171.48	3258.31	557,170.79
Rubber Wood 1-1/2 x 2 x 1.00	pcs	193.00	0.07	15.60	13.2012	2,732.65	3,009.87	2320.74	447,902.82	2305.14	444,892.95
Rubber Wood 1-1/2 x 2 x 1.30	pcs	185.00	0.09	20.27	16.4501	3,405.18	3,750.63	309.98	57,345.56	289.70	53,594.93
Rubber Wood 1-1/2 x 3 x 1.00	pcs	193.00	0.15	35.09	29.7027	6,148.45	6,772.21	1067.24	205,977.32	1032.15	199,205.11
Chipcore 30 x 1850 x 1170 mm.	sq.ft.	270.00	0.14	33.04	39.1291	8,099.73	8,921.44	100.00	27,000.00	66.96	18,078.56
MDF2.6mm.4"x8"(1200pcs/truck)	sq.ft.	90.25	0.27	62.59	24.7759	5,128.61	5,648.90	4200.00	379,050.00	4137.41	373,401.10
Particle board 16 mm. 4" x 8"	sq.ft.	252.70	0.04	9.44	10.4657	2,166.41	2,386.19	580.00	146,566.00	570.56	144,179.81
T-Nut M6 x c18 x x7.2 x 9.5(h)	pcs	0.39	4.00	912.00	1.5480	320.44	352.94	39600.00	15,325.20	38688.00	14,972.26
Tapping screw FH 6 x 3/4"	pcs	0.09	16.00	3648.00	1.4480	299.74	330.14	40878.00	3,699.46	37230.00	3,369.32
Walnut Vaneer 0.6 mm. Thickness	sq.ft.	7.20	0.41	92.66	2.9266	605.82	667.28	23066.00	166,107.49	22973.34	165,440.22
Red Oak Veneer Thickness 0.60mm.	sq.ft.	0.12	8.88	2024.32	1.0654	220.54	242.92	382266.00	45,871.92	380241.68	45,629.00
Total					**238.9805**	**49,468.96**	**54,487.55**		**3,651,094.41**		**3,596,606.86**

Figure Q.1. Bill of Material for Model 5147-04.

APPENDIX R

PARAWOOD INVENTORY

PARAWOOD INVENTORY

ritwriazirvaA1,17tYmAnsq6ilo P0-3363 (MODEL 5147-04 4 rings 207)

NO.	Innoilif	stock	411421d kaltY1S	1101	LnU
1	3/4" X 2" X 1.00/1.10	2,183.77			2183.77
2	3/4" X 2" X 1.20	430.88			430.88
3	3/4" X 2" X 1.30/1.25	54.75			54.75
4	3/4" X 21/2" X 1.00	146.25			146.25
5	3/4" X 3" X 1.00/1.10	1,484.63			1484.63
6	3/4" X 3" X 1.20/1.30/1.25	3,417.32			3417.32
7	3/4" X 4" X 1.00/1.20	941.64			941.64
8	3/4" X 4" X 1.30/1.25	954.8			954.80
9	3/4" X 5" X 1.30				
10	7/8" X 2" X .80/.90/1.00	110.65			110.65
11	7/8" x 3" X 1.00	55.96			55.96
12	7/8" X 3" X 1.30	16.65			16.65
13	7/8" X 4" X 1.00	11.01			11.01
14	7/8" X 4" X 1.30	11.52			11.52
15	1" X 2" X 1.00/1.10	6,242.46			6242.46
16	1"X 2"X 1.20	1,353.34			1353.34
17	1"X 2"X 1.30	2,145.28			2145.28
18	1" X 21/2" X 1.00	705.37	12.996		692.37
19	1" X 21/2" X 1.20/1.30	1,848.83	6.3355		1842.49
20	1" X 3" X 1.00	2,762.69	7.7976		2754.89
21	1" X 3" X 1.20/1.30	3,096.58	6.7557		3089.82
22	1" X 4" X 1.00/1.10	3,351.88	93.5713		3258.31
23	1" X 4" X 1.20	5,237.16			5237.16
24	1"X 4" X 1.25/1.30	545.61			545.61
25	11/4" X 21/2" X 1.30	549.73			549.73
26	11/2" X 2" X 1.00	2,320.74	15.5952		2305.14
27	11/2" X 2" X 1.30	309.98	20.2737		289.71
28	11/2" X 3" X 1.00	1,067.24	35.0892		1032.15

Figure R.1. Parawood Inventory.

NO.	IIInGail	stock	imn la Gl 1t1qT	TIM	Lrila
29	11/2" X 3" X 1.30	986.45			986.45
30	11/2" X 4" X 1.00	342.82			342.82
31	11/2" X 4" X 1.30/1.20	424.43			424.43
32	11/2" X 5" X 1.20	464.57			464.57
33	13/4" X 31/2" X 1.00	27.93			27.93
34	13/4" X 31/2" X 1.30	2,036.03			2036.03
35	2" X 2" X 1.00	1,861.85			1861.85
36	2" X 2" X 1.30/1.20	2,144.76			2144.76
37	2" X 3" X 1.00				
38	2" X 3" X 1.30/1.20	1,725.23			1725.23
39	2" X 4" X 1.00	4,574.04			4574.04
40	2" X 4" X 1.20/1.30	2,820.31			2820.31
41	21/2" X 21/2" X 1.00	4,515.68			4515.68
42	21/2" X 21/2" X 1.20/1.30	4,673.67			4673.67
43	3" X 3" X 1.00	6,990.14			6990.14
44	3" X 3" X 1.30	5,933.01			5933.01
45	1" X 2" X 2.45 (BEECH)	14.41			14.41
46	1" X 3" X 2.45 (BEECH)	25.97			25.97
47	1" X 40mm. X 1.30 (BEECH)	24.99			24.99
	ra 1J	39,586.29	0.00	0	39586.29
	CU.FT/AM1	147.53	2.82	0	144.71

Figure R.1. Parawood Inventory. (Continued)

APPENDIX S

PRODUCTION PROCESS OF MODLE 5147-04 (GRAPH)

PRODUCTION PROCESS OF MODLE 5147-04 (GRAPH)

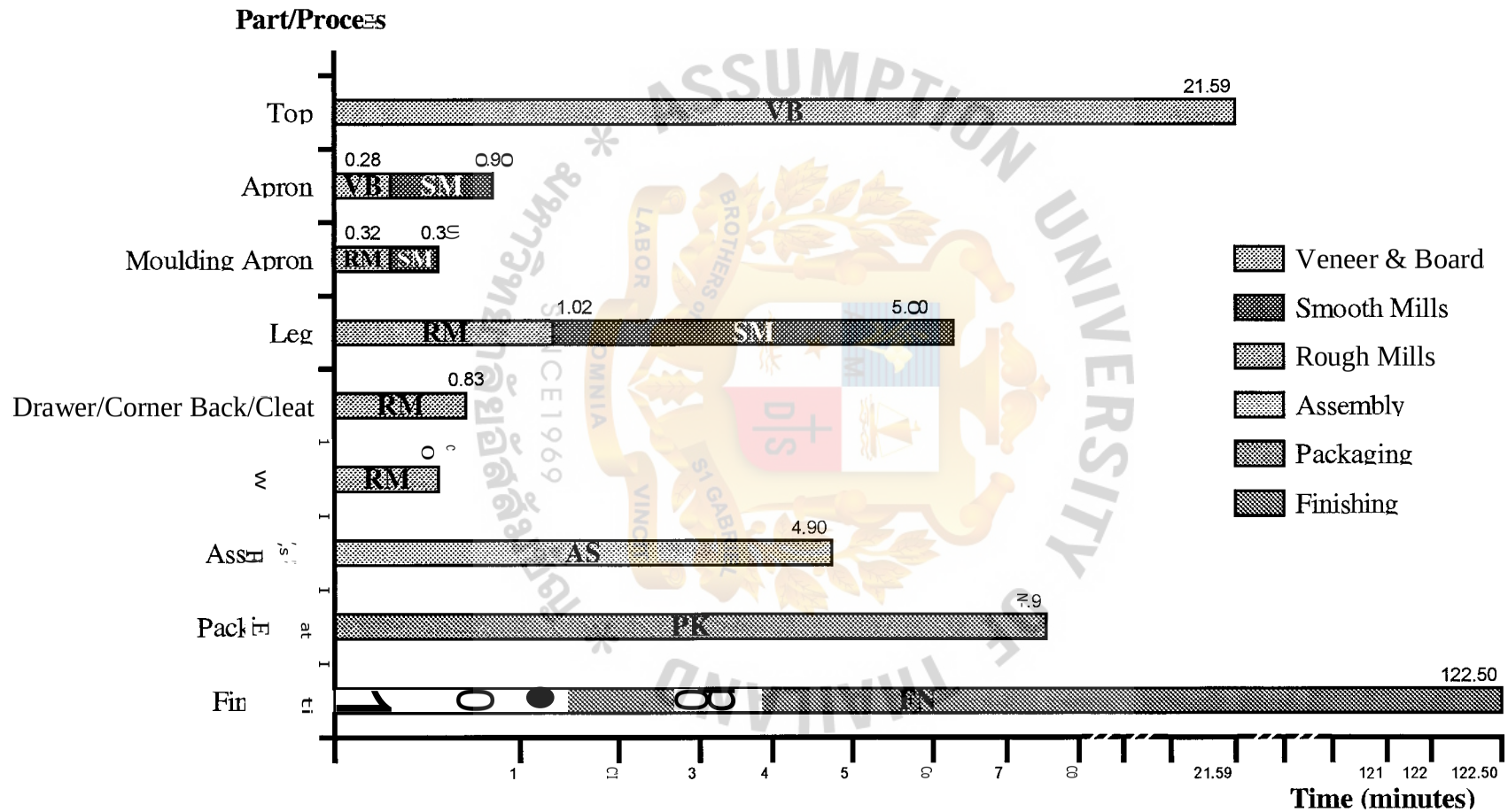


Figure S.1. Production Process of Model 5147-04 (GRAPH).

APPENDIX T

PRODUCTION PROCESS FOR MODEL 5147-04

PRODUCTION PROCESS FOR MODEL 5147-04

NO.	PRODUCTION PROCESS	NO. OF WORKER	AVG. PRODUCTION TIME (SECONDS)	WORKING HOURS (SECONDS)	DEPARTMENT
1	Cut paricle board by Circular saw	1	15.468	15.47	Veneer & Board
2	Cut chipcore by Circular saw	4	17.494	69.98	Veneer & Board
3	Cut MDF 2.6 mm.by Circular saw	2	25.530	51.06	Veneer & Board
4	Spread glue and shoot double nail max	2	75.600	151.20	Veneer & Board
5	Spread glue with MDF by Glue spreader	2	48.400	96.80	Veneer & Board
6	Press MDF by Hot press	4	18.178	72.71	Veneer & Board
7	Sand by Wide belt sanding	3	20.200	60.60	Veneer & Board
8	Spread glue with veneer by Glue spreader	2	22.000	44.00	Veneer & Board
9	Press MDF with veneer by Hot press	4	12.724	50.90	Veneer & Board
10	Sand by Wide belt sanding	3	19.600	58.80	Veneer & Board
11	Drill centre by Drilling machine	2	17.000	34.00	Veneer & Board
12	Curve moulding by Curving moluder	2	66.000	132.00	Veneer & Board
13	Sand the edge by Vertical spindle sander	5	10.744	53.72	Veneer & Board
14	Sand by Sponge sander	1	37.400	37.40	Veneer & Board
15	Sand by hand	2	84.400	168.80	Veneer & Board
16	Sand by Brush sander	2	15.400	30.80	Veneer & Board
17	Spray chalac	1	4.400	4.40	Veneer & Board
18	Sand by Brush sander	1	17.800	17.80	Veneer & Board
19	Spray sealer	1	5.260	5.26	Veneer & Board
20	Sand by Brush sander	1	19.200	19.20	Veneer & Board
21	Refine and check quality by Q.C.	2	17.552	35.10	Veneer & Board
22	Sand by Stroke belt sander #180	1	24.200	24.20	Veneer & Board
23	Putty	2	20.000	40.00	Veneer & Board
24	To sand by Stroke belt sander #240	1	21.200	21.20	Veneer & Board
			Total Working Hours (Seconds) per Piece of Top	1295.40	
			Total Working Hours (minutes) per Piece of Top	21.59	

Figure T.1. Average Production Time and Working Hours for TOP Part.

NO.	PRODUCTION PROCESS	NO. OF WORKER	AVG. PRODUCTION TIME (SECONDS)	WORKING HOURS (SECONDS)	DEPARTMENT
1	Cut the width and length of wood by Cut off saw	4	1.670	6.68	Veneer & Board
2	Spread glue by Glue spreader	2	0.490	0.98	Veneer & Board
3	Press veneer	4	0.310	1.24	Veneer & Board
4	Put veneer into the Hot press	4	1.960	7.84	Veneer & Board
5	Cut wood thinly the width size by two side planer	2	2.230	4.46	Smooth Mills
6	Cut the length of wood by Cut off saw	1	7.520	7.52	Smooth Mills
7	Sand by Wide belt sanding	2	1.830	3.66	Smooth Mills
8	Sand the edge by Vertical Spindle Sanding	2	1.940	3.88	Smooth Mills
9	Sand by Stroke belt Sander #180	1	5.640	5.64	Smooth Mills
10	Sand by Brush sander	2	6.840	13.68	Smooth Mills
11	Moulding	1	9.720	9.72	Smooth Mills
12	Wipe the glue	1	5.140	5.14	Smooth Mills
	Total Working Hours (Seconds) per Piece of Apron			70.44	
	Total Working Hours (Minutes) per Piece of Apron			1.18	

Figure T.2. Average Production Time and Working Hours for Front and Back Apron.

NO.	PRODUCTION PROCESS	NO. OF WORKER	AVG. PRODUCTION TIME (SECONDS)	WORKING HOURS (SECONDS)	DEPARTMENT
1	Cut wood by Circular saw	2	2.458	4.92	Rough Mills
2	Rip wood by Rip saw	2	1.650	3.30	Rough Mills
3	Plane wood by Four side planer	3	1.908	5.72	Rough Mills
4	Cut the length of wood by Cut off saw	1	3.330	3.33	Rough Mills
5	Sand by Wide belt sanding	2	1.786	3.57	Rough Mills
6	Sand the edge by Vertical belt sanding	2	1.776	3.55	Smooth Mills
7	Sand by Horizontal spindle sander	1	2.828	2.83	Smooth Mills
8	Sand by Brush sander	1	5.438	5.44	Smooth Mills
9	Dip wash coat	3	0.000	0.00	Smooth Mills
10	Sand by Brush sander	1	2.532	2.53	Smooth Mills
11	Check the quality by Q.C.	2	2.538	5.08	Smooth Mills
			Total Working Hours (Seconds) per Piece	40.27	
			Total Working Hous (Minutes) per Piece	0.67	

Figure T.3. Average Production Time and Working Hours for Moulding Apron Part.

NO.	PRODUCTION PROCESS	NO. OF WORKER	AVG. PRODUCTION TIME (SECONDS)	WORKING HOURS (SECONDS)	DEPARTMENT
1	Cut two pieces of wood by Circular saw	2	8.810	17.62	Rough Mills
2	Plane wood by Two side planer	2	5.776	11.55	Rough Mills
3	Plane wood by Four side planer	3	4.278	12.83	Rough Mills
4	Cut the size of wood (5 pieces) by Cut off saw	1	19.288	19.29	Rough Mills
5	Sand by Wide belt sanding	2	2.870	5.74	Smooth Mills
6	Saw wood by Radial Arm Saw	2	3.590	7.18	Smooth Mills
7	Spread glue	1	1.872	1.87	Smooth Mills
8	Shoot double nail max	2	9.846	19.69	Smooth Mills
9	Shoot nail max	1	5.896	5.90	Smooth Mills
10	Wipe the glue	3	10.234	30.70	Smooth Mills
11	Saw wood by Radial Arm Saw	1	4.064	4.06	Smooth Mills
12	Shoot the corner block	2	15.666	31.33	Smooth Mills
13	Putty	2	16.806	33.61	Smooth Mills
14	Drill by Vertical boring	1	2.926	2.93	Smooth Mills
15	Sand by Horizontal Sponge sander #1	1	2.876	2.88	Smooth Mills
16	Sand by Horizontal Sponge sander #2	1	6.260	6.26	Smooth Mills
17	Sand by Hand stroke belt sander	1	5.544	5.54	Smooth Mills
18	Sand by Brush Sander	2	14.184	28.37	Smooth Mills
19	Check quality by Q.C.	1	3.524	3.52	Smooth Mills
20	Sand by Brush Sander	2	14.430	28.86	Smooth Mills
21	Check quality by Q.C.	2	12.184	24.37	Smooth Mills
22	Sand by Brush Sander	2	8.078	16.16	Smooth Mills
23	Dip wash coat	3	2.542	7.63	Smooth Mills
24	Sand by Brush Sander	1	7.576	7.58	Smooth Mills
25	Check quality by Q.C.	2	12.632	25.26	Smooth Mills
	Total Working Hours (Seconds) per Piece of Leg			360.73	
	Total Working Hours (Minutes) per Piece of Leg			6.02	

Figure T.4. Average Production Time and Working Hours for LEG Part.

DRAWER					
NO.	PRODUCTION PROCESS	NO. OF WORKER	AVG. PRODUCTION TIME (SECONDS)	WORKING HOURS (SECONDS)	DEPARTMENT
1	Cut wood by Circular saw	2	3.448	6.90	Rough Mills
2	Plane wood by Four side planer	3	1.626	4.88	Rough Mills
3	Double spindle sharper	2	3.454	6.91	Rough Mills
4	Cut the size of wood by Cut off saw	1	3.442	3.44	Rough Mills
5	Drill for shooting screw by Vertical Boring	1	7.430	7.43	Rough Mills
			Total Working Hous (Seconds) per Piece of Drawer	29.55	
			Total Working Hous (Minutes) per Piece of Drawer	0.50	

CORNER BLOCK					
NO.	PRODUCTION PROCESS	NO. OF WORKER	AVG. PRODUCTION TIME (SECONDS)	WORKING HOURS (SECONDS)	DEPARTMENT
1	Cut wood by Circulaw saw	2	0.652	1.30	Rough Mills
2	Rip the wood by Rip saw	2	0.714	1.43	Rough Mills
3	Plane wood by Two side planer	2	0.678	1.36	Rough Mills
4	Saw 45% by Radical arm saw	1	3.062	3.06	Rough Mills
5	Drill the centre by Drilling machine	1	1.826	1.83	Rough Mills
6	Drill for shooting screw by Vertical boring	1	3.268	3.27	Rough Mills
			Total Working Hous (Seconds) per Piece of Corner Block	12.24	
			Total Working Hous (Minutes) per Piece of Corner Block	0.20	

CLEAT					
NO.	PRODUCTION PROCESS	NO. OF WORKER	AVG. PRODUCTION TIME (SECONDS)	WORKING HOURS (SECONDS)	DEPARTMENT
1	Plane wood by Two side planer	0	0.000	0.00	Rough Mills
2	Rip wood by Rip saw	0	0.000	0.00	Rough Mills
3	Cut the size of wood by Cut off saw	1	2.180	2.18	Rough Mills
4	Drill for shooting screw by Vertical boring	1	5.798	5.80	Rough Mills
			Total Working Hous (Seconds) per Piece of Cleat	7.98	
			Total Working Hous (Minutes) per Piece of Cleat	0.13	

Figure T.5. Average Production Time and Working Hours for Drawer, Corner Block and Cleat.

LONG EDGE					
NO.	PRODUCTION PROCESS	NO. OF WORKER	AVG. PRODUCTION TIME (SECONDS)	WORKING HOURS (SECONDS)	DEPARTMENT
1	Cut wood by Circular saw	2	3.130	6.26	Rough Mills
2	Plane wood by Two side planer	2	1.920	3.84	Rough Mills
3	Rip wood by Rip saw	2	1.900	3.80	Rough Mills
4	Plane wood by Four side planer	3	1.700	5.10	Rough Mills
			Total Working Hous (Seconds) per Piece of Edge	19.00	
			Total Working Hous (Minutes) per Piece of Edge	0.32	

SHORT EDGE					
NO.	PRODUCTION PROCESS	NO. OF WORKER	AVG. PRODUCTION TIME (SECONDS)	WORKING HOURS (SECONDS)	DEPARTMENT
1	Cut wood by Circular saw	2	2.970	5.94	Rough Mills
2	Plane wood by Two side planer	2	1.890	3.78	Rough Mills
3	Rip wood by Rip saw	2	1.650	3.30	Rough Mills
4	Plane wood by Four side planer	3	1.680	5.04	Rough Mills
			Total Working Hous (Seconds) per Piece of Edge	18.06	
			Total Working Hous (Minutes) per Piece of Edge	0.30	

Figure T.6. Average Production Time and Working Hours for Long Edge Part.

APPENDIX U

TOOLS AND MAINTENANCE EXPENSES REPORT

TOOLS AND MAINTENANCE EXPENSES REPORT

รายงานการซื้อ วัสดุ - อุปกรณ์ งานซ่อมบำรุง (เร่งด่วนฉุกเฉิน)
ซื้ออะหลั่ยมาเพื่อซ่อมเครื่องจักร / เครื่องมือ/เครื่องใช้ และส่งไปซ่อม
ประจำเดือน กันยายน 2543

TO : คุณสุรพงษ์

วันที่ซื้อ	รายละเอียด			ราคา/บาท		หน่วย	ใช้กับเครื่องจักร		จำนวนพนง.ประจำ	เวลาตั้งแต่แจ้งซ่อม
	NO.	รายการ	จำนวน	@	Total	งาน	ชื่อ	เบอร์	เครื่องจักร (คน)	จนใช้งานได้ (ชั่วโมง)
1/9/43	1	BREAKER [MITSU] 15AMP NF30CP.3P	1	498.20	498.20	SM-3	ขัดสายพาน	# 60	1	3
		BOX FOR NF30CP	1	90.00	90.00					
4/9/43	2	ซ่อม F45	1	50.00	50.00	SM-4	MAX	# 102	1	1.5
4/9/43	3	ซ่อม F32	1	900.00	900.00	SM-2	MAX	# 344	1	1.5
4/9/43	4	ซ่อม TA33R	1	1,110.00	1,110.00	SM-3	MAX	# 60	1	1.5
5/9/43	5	ซ่อมเครื่องตีเล้าเตอร์	1	600.00	600.00	SM-6	3601B	# 374492	1	4
6/9/43	6	ซ่อม MAX F45	1	220.00	220.00	SM-4	F45	# 100	1	1.5
	7	CONTACTOR [TELE] LCI-D2501	2	2,014.00	4,028.00	SM-1	เพลาตังฯ	# 373	1	6
	8	CONTACTOR [TELE] LC1-D1801	1	689.00	689.00	SM-1	เพลาตัง	# 372	1	6
7/9/43	9	จานรองยาง SI-3107 # 43	1	923.40	923.40	SM-3	SHINANO	# 3095	1	0.5

Figure U.1. Tools and Maintenance Expenses Report.

วันที่ซื้อ	รายละเอียด			ราคา/บาท		หน่วยงาน	ใช้กับเครื่องจักร		จำนวนพนง.ประจำเครื่องจักร (คน)	เวลาตั้งแต่แจ้งซ่อมจนใช้งานได้ (ชั่วโมง)
	NO.	รายการ	จำนวน	@	Total		ชื่อ	เบอร์		
7/9/43	10	สามทางลง 1/4" * 8 มม 3108-08-13	12	77.35	928.20	SM-1	เพลาตังฯ	# 8เครื่อง	1	1
		ข้องอ 1/4"	6	60.00	360.00					
8/9/43	11	สายพาน A31	2	45.00	90.00	SM-1	เลื่อยสายพาน	# 174	1	0.5
	12	ลูกปืน 7มม * 8มม * 22มม	1	150.00	150.00	VB-2	ยูโรแม็ก	# 169	2	4
	13	ลูกปืน 6004 ZZ/C3	4	98.00	392.00	SM-5	กลึงขาสิงห์	# 7	1	6
	14	สายพาน 9.5 * 1175	2	225.00	450.00	SM-1	เพลาตังฯ	# 377	1	0.5
	15	สายพาน B62	1	112.00	112.00	SM-1	ขัดตัง	# 34	1	0.5
	16	สายพานต่อ S3 [45 * 1700]	1	1,380.00	1,380.00	SM-5	กลึงขาสิงห์	# 7	1	16
9/9/43	17	AIR TUBE # 7 [PAD TUBE]	1	9,000.00	9,000.00	SM-4	ขัดลอดถ้า	# 14	2	24
		RUBBER PLATE WITH ROLLER PINS # 8-9	1	9,000.00	9,000.00					
9/9/43	17	PLATE SPRING #10	1	1,600.00	1,600.00					
		RUBBER PLATE [SHORE 60"/ แข็ง] # 11	1	2,400.00	2,400.00					
		PAD SPONGE ROBBER [20" / นิ่ม] # 11	1	2,400.00	2,400.00					
18/9/43	18	สปริงแท่นเจาะ	2	100.00	200.00	VB-2	เจาะคิงคอง	# 73	1	0.5
	19	ซ่อมเครื่องตีเล้าเตอร์ฮิตาชิ TR12	1	2,200.00	2,200.00	SM-6	HITACHI	#460370	1	16
	20	อุปกรณ์หัวเร้าเตอร์	1	33,000.00	33,000.00	SM-5	เครื่องล้าเตอร์	#158	1	80
		สายพาน เร้าเตอร์	1	3,500.00	3,500.00					

Figure U.1. Tools and Maintenance Expenses Report. (Continued)

วันที่ซื้อ	รายละเอียด			ราคา/บาท		หน่วยงาน	ใช้กับเครื่องจักร		จำนวนพนง.ประจำเครื่องจักร (คน)	เวลาตั้งแต่แจ้งซ่อมจนใช้งานได้ (ชั่วโมง)
	NO.	รายการ	จำนวน	@	Total		ชื่อ	เบอร์		
	21	ข้อต่อนิโต้ 20 PH	3	38.25	114.75	SM-4	ขัดลอดถ่ำ	14	2	2
		สายลมสีเขียว LH6 * 9	15	85.00	1,275.00					
	22	อะไหล่ เครื่องยิงขาเดียว	1	82.00	82.00	SM4	TA 201 / F35 MO	2E+08	1	0.5
	23	อะไหล่เครื่องยิงขาเดียว	1	82.00	82.00	SM4	TA 201 / F35 MO	2E+08	1	0.5
	24	TIMER TB32 "TBC"	1	480.00	480.00	SM-1	เพลาตังฯ	#372	1	8
		SOCKET (OMRON) PF083A-E	1	49.68	49.68					
	25	SELECTOR SWITCH SS-513AL	4	600.00	2,400.00	SM-1	เพลาตังฯ		1	16
20/9/43	26	อะไหล่ MAX คู่	1	270.00	270.00	VB-2	TA 35A / 1022J	#402593	1	0.5
	27	อะไหล่ MAX คู่	1	270.00	270.00	VB-2	TA 35A / 1022J	#311295	1	0.5
	28	สายพาน 45*1700	1	1,380.00	1,380.00	SM-5	กลึงขาสิงห์	#7	1	16
	29	เบเกอร์ 1.5 KA 3 P 30 Am FUJI EA-33	1	486.00	486.00	SM-5	ขัดตัง	#69	1	0.5
		บล็อก EA 33	1	90.00	90.00					
25/9/43	30	CONTACTOR "TELE"	1	360.40	360.40	SM1	เพลาตังฯ	#374	1	4
	31	ลูกปืน UCP 205	2	370.00	740.00	VB-3	ขัตตัง	#31	1	6
		POWER PUSH BUTTON (TEND) TBSN-330	1	178.50	178.50					
	32	ลูกปืน 7010 C	2	260.00	520.00	VB3	โรตารี่ KR 100	#162	2	8
	33	สายพาน 9.5*650	1	146.00	146.00	VB2	ตัดวงเดือน	#73	2	8
26/9/43	34	ลูกล้อฟีดเดอร์	50	105.00	5,250.00	VB-3	ขัดคิ้ว TECNOLEGNO	#20	6	120

Figure U.1. Tools and Maintenance Expenses Report. (Continued)

วันที่ซื้อ	รายละเอียด			ราคา/บาท		หน่วยงาน	ใช้กับเครื่องจักร		จำนวนพนง.ประจำเครื่องจักร (คน)	เวลาตั้งแต่แจ้งซ่อมจนใช้งานได้ (ชั่วโมง)
	NO.	รายการ	จำนวน	@	Total		ชื่อ	เบอร์		
		แกนสลัก + ปลอกบู๊ต	50	105.00	5,250.00					
		หล่อยางล้อฟีดเดอร์	50	130.00	6,500.00					
26/9/43	35	อะไหล่ไขควงลม	1	749.00	749.00	RM-2	VESSEL GT-P6.5 D	#5822	1	0.5
	36	อะไหล่ไขควงลม	1	2,060.00	2,060.00	VB-3	VESSEL GT-P6.5 D	#16053	1	0.5
27/6/43	37	CONTACTOR -MITSU MODEL SN-21	1	768.50	768.50	SM-1	เพลาตัง 2 หัว	#147	1	4
		OVERLOAD-MITSU MODEL TH-N20KP 7-11	1	477.00	477.00					
28/9/43	38	LIMIT SWITCH TZ-8104	1	374.50	374.50	SM-1	เพลาตังฯ	373	1	8
	39	อะไหล่เครื่องมากีต้า 3700	1	1,140.00	1,140.00	VB-3	ตีร่องเล้าเตอร์	383825E	1	0.5
	40	อะไหล่เครื่องมากีต้า 3700	1	1,090.00	1,090.00	VB-3	3700 B	382035E	1	0.5
29/9/43	41	ลูกปืน SKF 6201-2RS1/C3	50	50.00	2,500.00	VB-3	ขัดคิ้ว TECNOLEGNO	#20	6	12
	42	LIMIT SWITCH TZ-8104	1	374.50	374.50	SM-1	เพลาตังฯ	375	1	16
	43	สายลม PU 5*8	5	30.00	150.00	VB-2	เครื่องเจจคิง	#378	3	1
30/9/43	44	ลูกปืน 6206-2RS1/C3	1	160.00	160.00	SM-3	ขัดสป้องดัง	#45	2	8
		ลูกปืน 6205-2RS1/C3	1	118.00	118.00					
รวมค่าใช้จ่ายทั้งสิ้น					112,156.63				62	416

Figure U.1. Tools and Maintenance Expenses Report. (Continued)

APPENDIX V

MACHINE PARTS, TOOLS, SUPPLIES AND MAINTENANCE EXPENSES REPORT

MACHINE PARTS, TOOLS, SUPPLIES AND MAINTENANCE EXPENSES REPORT

FOR SEPTEMBER 2000 (BANGKOK FACTORY)

Description	QTY	Price @	Price Total	Dept	# of Worker Per Machine	Waste Time (Hour)	Opportunity Cost (Baht)	Total Cost
CONTACTOR [TELE] LCI-D2501	2	2,014.00	4,028.00	SM-1	1	6	121.50	4,149.50
CONTACTOR [TELE] LC1-D1801	1	689.00	689.00	SM-1	1	6	121.50	810.50
THREE JOINT 1/4" * 8 MM. 3108-08-13	12	77.35	928.20	SM-1	1	1	20.25	948.45
JOINT 1/4"	6	60.00	360.00				-	360.00
BELT A31	2	45.00	90.00	SM-1	1	0.5	10.13	100.13
BELT 9.5 * 1175	2	225.00	450.00	SM-1	1	0.5	10.13	460.13
BELT B62	1	112.00	112.00	SM-1	1	0.5	10.13	122.13
TIMER TB32 "TBC"	1	480.00	480.00	SM-1	1	8	162.00	642.00
SOCKET (OMRON) PF083A-E	1	49.68	49.68				-	49.68
SELECTOR SWITCH SS-513AL	4	600.00	2,400.00	SM-1	1	16	324.00	2,724.00
CONTACTOR "TELE"	1	360.40	360.40	SM1	1	4	81.00	441.40
OVERLOAD "TELE"	1	424.00	424.00				-	424.00
CONTACTOR -MITSU MODEL SN-21	1	768.50	768.50	SM-1	1	4	81.00	849.50
OVERLOAD -MITSU MODEL TH-N20KP 7-11A	1	477.00	477.00				-	477.00

Figure V.1. Machine Parts, Tools, Supplies and Maintenance Expenses Report.

Description	QTY	Price @	Price Total	Dept	# of Worker Per Machine	Waste Time (Hour)	Opportunity Cost (Baht)	Total Cost
LIMIT SWITCH TZ-8104	1	374.50	374.50	SM-1	1	8	162.00	536.50
LIMIT SWITCH TZ-8104	1	374.50	374.50	SM-1	1	16	324.00	698.50
F32	1	900.00	900.00	SM-2	1	1.5	30.38	930.38
BREAKER [MITSU] 15AMP NF30CP.3P	1	498.20	498.20	SM-3	1	3	60.75	558.95
BOX FOR NF30CP	1	90.00	90.00				-	90.00
TA33R	1	1,110.00	1,110.00	SM-3	1	1.5	30.38	1,140.38
RUBBER PAD SI-3107 # 43	1	923.40	923.40	SM-3	1	0.5	10.13	933.53
BALL BEARING 6206-2RS1/C3	1	160.00	160.00	SM-3	2	8	324.00	484.00
BALL BEARING 6205-2RS1/C3	1	118.00	118.00				-	118.00
F45	1	50.00	50.00	SM-4	1	1.5	30.38	80.38
MAX F45	1	220.00	220.00	SM-4	1	1.5	30.38	250.38
AIR TUBE # 7 [PAD TUBE]	1	9,000.00	9,000.00	SM-4	2	24	972.00	9,972.00
RUBBER PLATE WITH ROLLER PINS # 8-9	1	9,000.00	9,000.00				-	9,000.00
PLATE SPRING #10	1	1,600.00	1,600.00				-	1,600.00
RUBBER PLATE # 11	1	2,400.00	2,400.00				-	2,400.00
PAD SPONGE ROBBER # 11	1	2,400.00	2,400.00				-	2,400.00
COUPLE 20 PH	3	38.25	114.75	SM-4	2	2	81.00	195.75
AIR HOSE LH6 * 9	15	85.00	1,275.00				-	1,275.00

Figure V.1. Machine Parts, Tools, Supplies and Maintenance Expenses Report. (Continued)

Description	QTY	Price @	Price Total	Dept	# of Worker Per Machine	Waste Time (Hour)	Opportunity Cost (Baht)	Total Cost
MAX F PARTS	1	82.00	82.00	SM-4	1	0.5	10.13	92.13
MAX F PARTS	1	82.00	82.00	SM-4	1	0.5	10.13	92.13
BALL BEARING 6004 ZZ/C3	4	98.00	392.00	SM-5	1	6	121.50	513.50
FLAT BELT S3 [45 * 1700]	1	1,380.00	1,380.00	SM-5	1	16	324.00	1,704.00
ROUTER PARTS	1	33,000.00	33,000.00	SM-5	1	80	1,620.00	34,620.00
ROUTER BELT	1	3,500.00	3,500.00				-	3,500.00
BELT 45*1700	1	1,380.00	1,380.00	SM-5	1	16	324.00	1,704.00
BREAKER 1.5 KA 3 P 30 Am FUJI EA-33	1	486.00	486.00	SM-5	1	0.5	10.13	496.13
BLOCK EA 33	1	90.00	90.00				-	90.00
Router part	1	600.00	600.00	SM-6	1	4	81.00	681.00
HITACHI ROUTER PARTS TR12	1	2,200.00	2,200.00	SM-6	1	16	324.00	2,524.00
BALL BEARING 7MM. * 8MM. * 22MM.	1	150.00	150.00	VB-2	2	4	162.00	312.00
SPRING	2	100.00	200.00	VB-2	1	0.5	10.13	210.13
DOUBLE MAX PARTS	1	270.00	270.00	VB-2	1	0.5	10.13	280.13
DOUBLE MAX PARTS	1	270.00	270.00	VB-2	1	0.5	10.13	280.13
BELT 9.5*650	1	146.00	146.00	VB2	2	8	324.00	470.00
AIR HOSE PU 5*8	5	30.00	150.00	VB-2	3	1	60.75	210.75
BALL BEARING UCP 205	2	370.00	740.00	VB-3	1	6	121.50	861.50

Figure V.1. Machine Parts, Tools, Supplies and Maintenance Expenses Report. (Continued)

Description	QTY	Price @	Price Total	Dept	# of Worker Per Machine	Waste Time (Hour)	Opportunity Cost (Baht)	Total Cost
POWER PUSH BUTTON (TEND) TBSN-330	1	178.50	178.50				-	178.50
BALL BEARING 7010 C	2	260.00	520.00	VB3	2	8	324.00	844.00
FEEDER	50	105.00	5,250.00	VB-3	6	120	14,580.00	19,830.00
SPANDLE FEEDER	50	105.00	5,250.00				-	5,250.00
FOUNDED FEEDER	50	130.00	6,500.00				-	6,500.00
VESSEL PARTS	1	2,060.00	2,060.00	VB-3	1	0.5	10.13	2,070.13
MAKITA PARTS 3700	1	1,140.00	1,140.00	VB-3	1	0.5	10.13	1,150.13
MAKITA PARTS 3700	1	1,090.00	1,090.00	VB-3	1	0.5	10.13	1,100.13
BALL BEARING SKF 6201-2RS1/C3	50	50.00	2,500.00	VB-3	6	12	1,458.00	3,958.00
VESSEL PARTS	1	749.00	749.00	RM-2	1	0.5	10.13	759.13
TOTAL EXPENSES			112,580.63		62.00	416.00	22,923.00	135,503.63

Figure V.1. Machine Parts, Tools, Supplies and Maintenance Expenses Report. (Continued)

APPENDIX W

MAINTENANCE NOTICE

MAINTENANCE NOTICE

Panda Thai Wood Product Co., Ltd.

ใบแจ้งซ่อม
Maintenance Notice

แผนกซ่อมบำรุง (Maintenance Department)

☐ บางชัน (Bangchan) ☐ ชลบุรี (Chalburi)

วันที่ __/__/__ (Date) เลขที่ __/__ (no.)

หน่วยงานที่แจ้งซ่อม (Problem areas)

หน่วยงาน (Section) _____ หน.หน่วยงาน (FM) _____ หน.กลุ่มงาน (CW) _____

จำนวนเครื่องจักรที่ขัดข้อง _____ เครื่อง (No. of default machine) รุ่น (Model) _____

ชื่อเครื่องจักร (Name) _____

รายละเอียดปัญหา/อาการขัดข้อง (Detailed Problems

_____

_____

_____

หัวหน้าหน่วยงาน (FM) _____ (__/__/__)

ผู้จัดการฝ่ายผลิต (MGR) _____ (__/__/__)

การตรวจสอบและวิธีแก้ไข (Checking & Solutions)

_____

_____

_____

_____

ระยะเวลาในการซ่อม _____ วัน

กำหนดวันที่ซ่อมเสร็จ (__/__/__)

จนท.แผนกซ่อมบำรุง _____ (__/__/__)

หัวหน้าแผนกซ่อมบำรุง _____ (__/__/__)

รายละเอียดค่าใช้จ่ายที่ต้องเปลี่ยน/ซ่อม (Detailed Expenditures)

ลำดับ	รายการ	@	จำนวน	รวมเงิน (บาท)		หมายเหตุ

ฝ่าย PPC : _____

_____

_____

ลงชื่อ _____ (__/__/__)

Figure W.1. Maintenance Notice.

APPENDIX X

INSPECTION REPORT

INSPECTION REPORT

PANDA THAI WOOD PRODUCT Co.,Ltd.
23/1 Moo14 Serithai Rd. Minburi, Bangkok 10510 THAILAND
Tel. (662) 517-9001-7 Fax. (662) 517-1870 E-mail. qc@pandathai.com

INSPECTION REPORT

CUSTOMER NAME : _____ DATE : _____

P/O# : _____ CUSTOMER MODEL : _____

Q'TY : _____ PANDA MODEL : _____

Q'TY RANDOM : _____

INSPECTION DESCRIPTION	SIZE	QUALITY LEVEL					COMMENT
		1	2	3	4	5	
1) ชิ้นส่วน							
หน้าโต๊ะ							
1. ตรวจเช็คขนาดบอร์ด (MDF, CB)							
2. ตรวจสีและความขาวดำ							
3. ตรวจเช็ครอยต่อของหน้าโต๊ะ							
หน้าโต๊ะสำเร็จ							
1. ตรวจเช็คขนาดสำเร็จ							
2. ตรวจเช็คงานวีเนียร์ (ขัด, รอยต่อ)							
3. ตรวจเช็คงานสีหน้าโต๊ะ (ขัด, ลายไม้, รอยต่อ งอ)							
แผ่นข้าง							
1. ตรวจเช็คขนาดสำเร็จ							
2. ตรวจเช็คงานวีเนียร์ (ขัด, รอยต่อ)							
3. ตรวจเช็คงานเกา, เจาะ							
พนัง							
1. ตรวจเช็คขนาดสำเร็จ							
2. ตรวจเช็คระยะเจาะ, เกา							
ขา							
1. ตรวจเช็คความชื้นไม้ (8-12%)							
2. ตรวจเช็คงานประกอบไม้							
3. ตรวจเช็คขนาดสำเร็จ							
4. ตรวจเช็คงานเจาะ บอก, เจาะ							
5. ตรวจเช็คงานสีขัด							
หน้าลิ้นชัก							
1. ตรวจเช็คขนาดสำเร็จ							
2. ตรวจเช็คงานเจาะ, บาก							
3. ตรวจเช็คงานสีขัด							
กล่องลิ้นชัก							
1. ตรวจเช็คขนาดสำเร็จ							
2. ตรวจเช็คงานเดือยร่อง, เจาะ							
3. ตรวจเช็คงานประกอบกล่อง							
ดอมแมอร์ะล็อก							
1. ตรวจเช็คขนาดสำเร็จ							
2. ตรวจเช็คงานเจาะ, ยึดตา							
รางลิ้นชัก							
1. ตรวจเช็คขนาดสำเร็จ							
2. ตรวจเช็คการปิดงอ, ตาล่า							

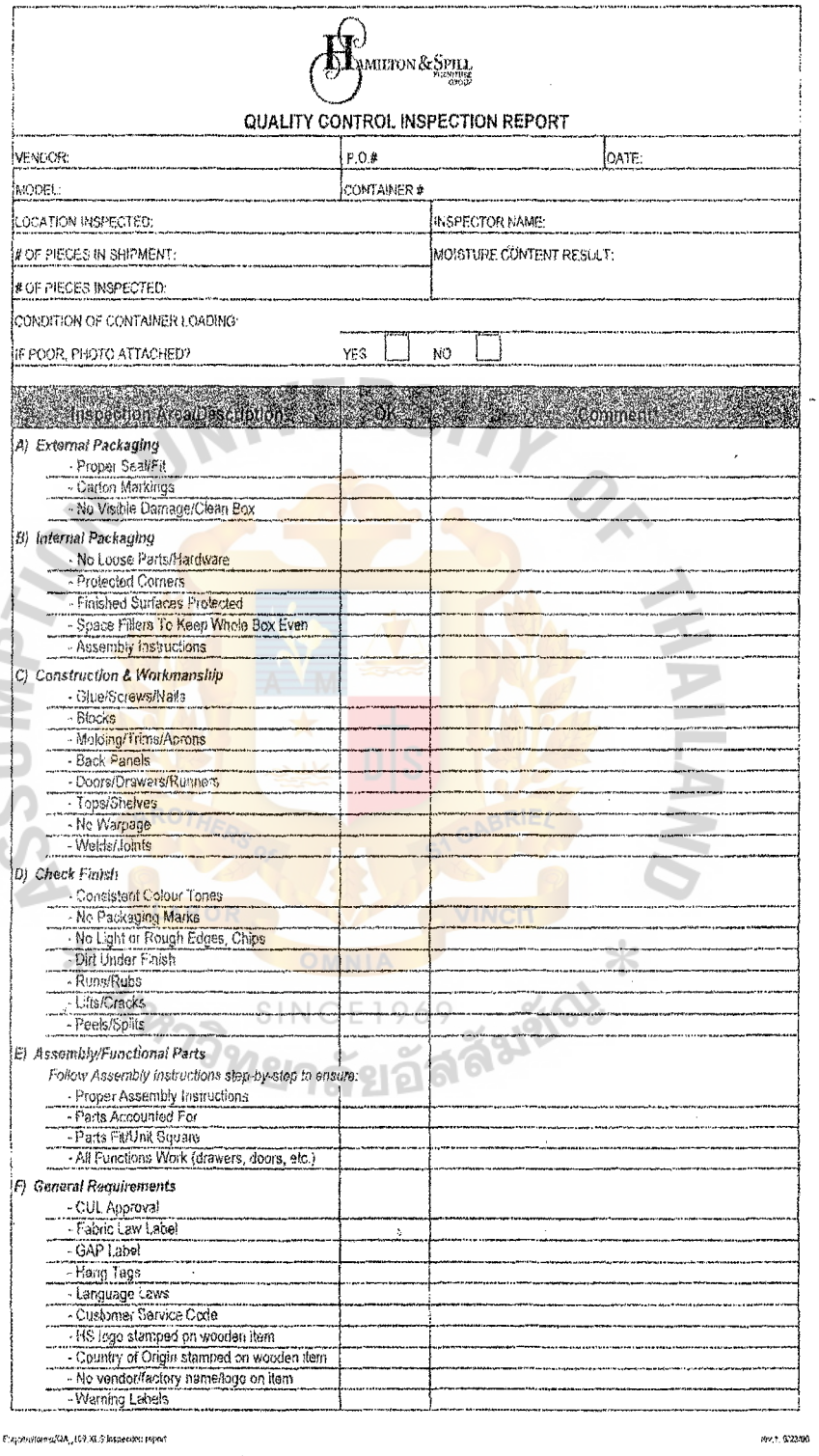
1=ไม่ผ่าน, 2=ผ่าน, 3=ดี, 4=ดีมาก, 5=เลิศเลอ

Figure X.1. Inspection Report.

APPENDIX Y

QUALITY CONTROL INSPECTION REPORT

QUALITY CONTROL INSPECTION REPORT



HAMILTON & SPILL

QUALITY CONTROL INSPECTION REPORT

VENDOR:	P.O.#	DATE:
MODEL:	CONTAINER #	
LOCATION INSPECTED:	INSPECTOR NAME:	
# OF PIECES IN SHIPMENT:	MOISTURE CONTENT RESULT:	
# OF PIECES INSPECTED:		
CONDITION OF CONTAINER LOADING:		
IF POOR, PHOTO ATTACHED?	YES ☐ NO ☐	

Inspection Area/Description	OK	Comment
A) External Packaging		
- Proper Seal/Fit		
- Carton Markings		
- No Visible Damage/Clean Box		
B) Internal Packaging		
- No Loose Parts/Hardware		
- Protected Corners		
- Finished Surfaces Protected		
- Space Fillers To Keep Whole Box Even		
- Assembly Instructions		
C) Construction & Workmanship		
- Glue/Screws/Nails		
- Blocks		
- Molding/Trims/Aprons		
- Back Panels		
- Doors/Drawers/Runners		
- Tops/Shelves		
- No Warpage		
- Welds/Joints		
D) Check Finish		
- Consistent Colour Tones		
- No Packaging Marks		
- No Light or Rough Edges, Chips		
- Dirt Under Finish		
- Runs/Rubs		
- Lifts/Cracks		
- Peels/Splits		
E) Assembly/Functional Parts		
Follow Assembly Instructions step-by-step to ensure:		
- Proper Assembly Instructions		
- Parts Accounted For		
- Parts Fit/Unit Square		
- All Functions Work (drawers, doors, etc.)		
F) General Requirements		
- CUL Approval		
- Fabric Law Label		
- GAP Label		
- Hang Tags		
- Language Laws		
- Customer Service Code		
- HS logo stamped on wooden item		
- Country of Origin stamped on wooden item		
- No vendor/factory name/logo on item		
- Warning Labels		

Figure Y.1. Quality Control Inspection Report.

APPENDIX Z

PICTURE OF MACHINE

BACK KNIFE TURNING LATHE MACHINE

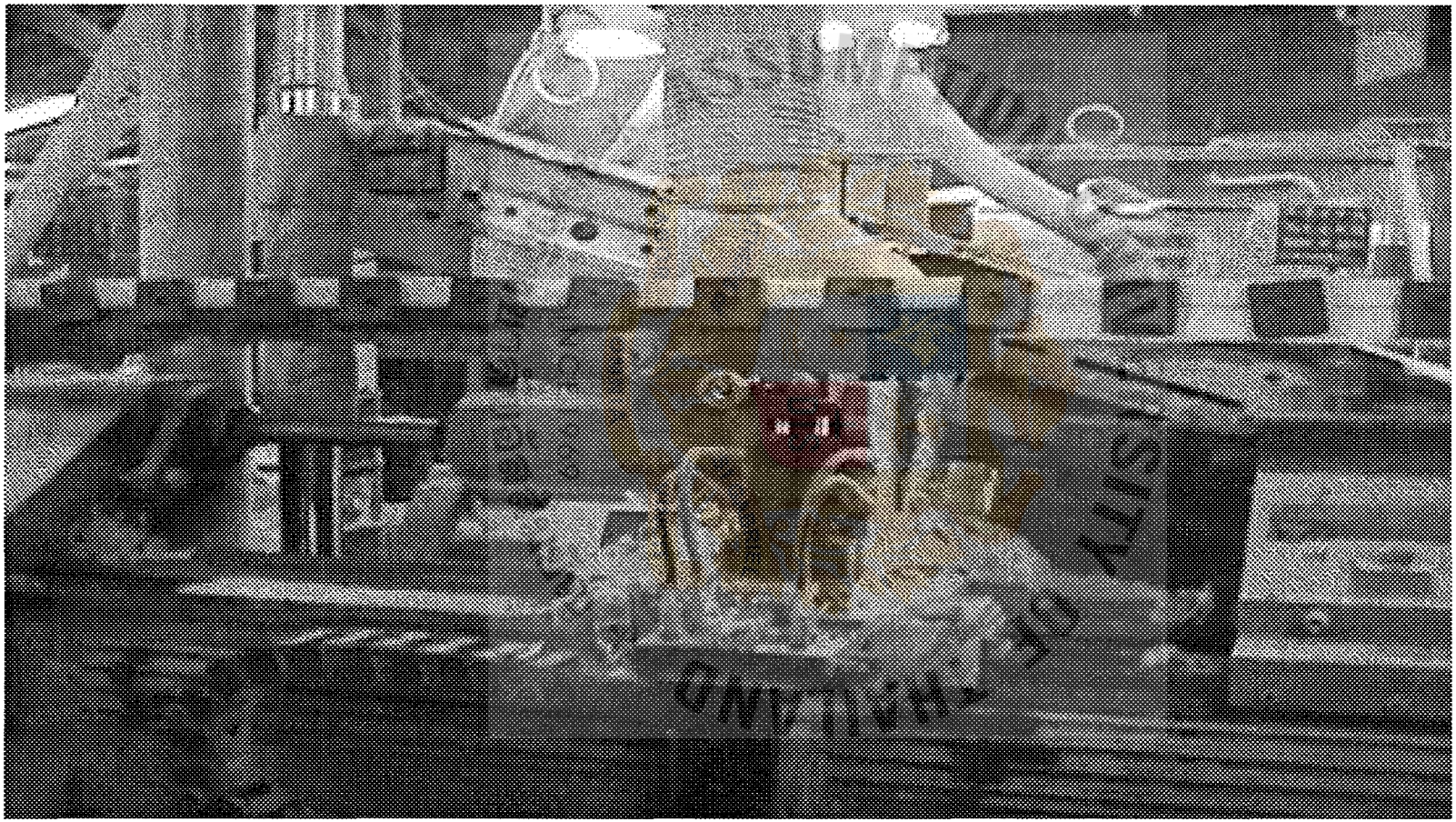


Figure Z.1. Back Knife Turning Lathe Machine.

LAMINATE MACHINE

Figure Z.2.   Laminate Machine.

CUT OFF SAW MACHINE

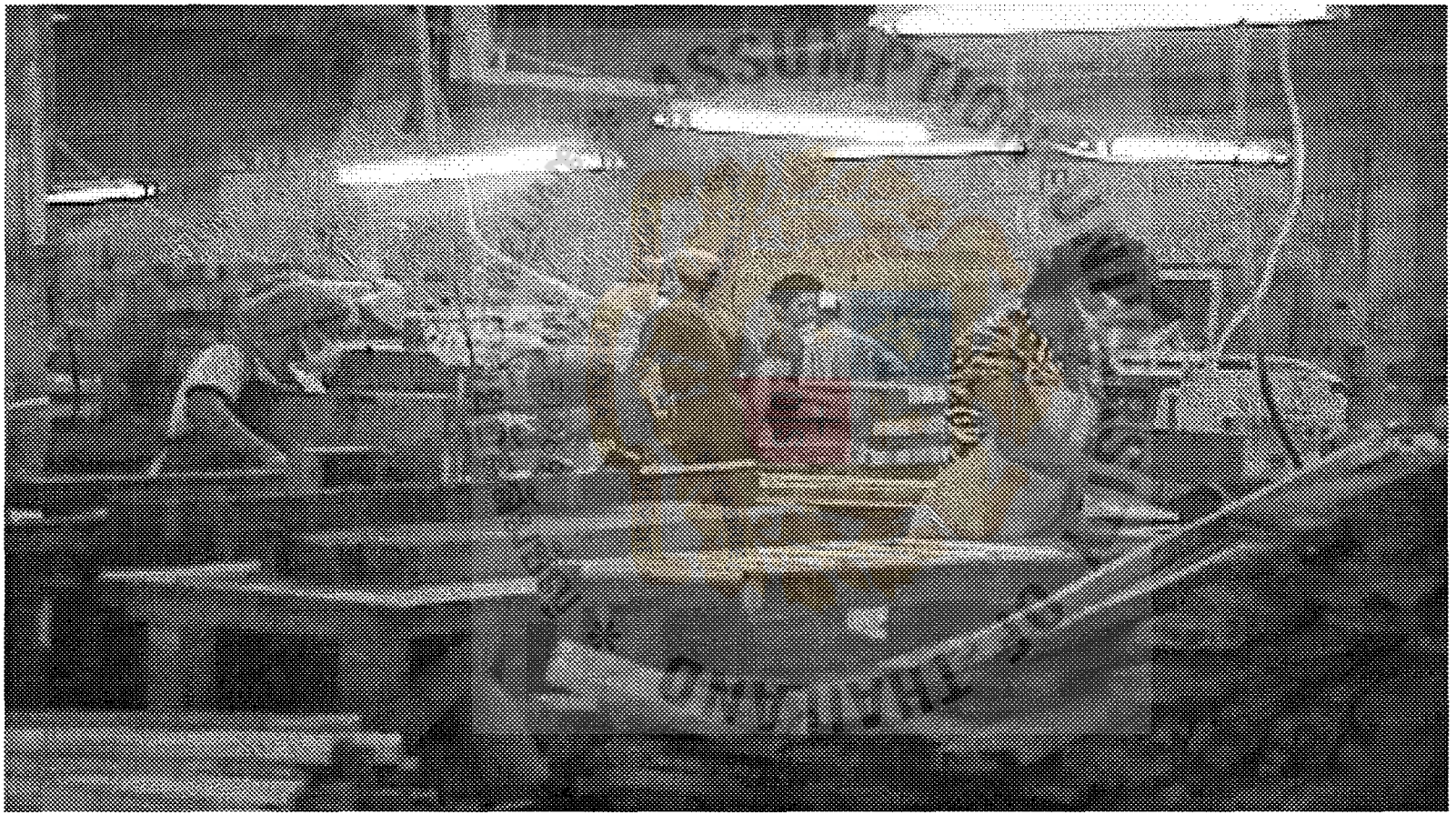


Figure Z.3. Cut Off Saw Machine.

TERMINOLOGY

AS	Assembly
BOM	Bill of Material
FIFO	First In First Out
FN	Finishing
FOB	Free on Board
JIT	Just-In-Time-System
MRP	Material Resources Planning
PK	Packaging
PO	Purchase Order
PPC	Production Planning Control
PTW	Panda Thai Wood Product Company Limited
QC	Quality Control
R&D	Research and Development
RM	Rough Mill
SM	Smooth Mill
VB	Veneer & Board

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