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PRODUCTIVITY AND EFFICIENCY OF PLYWOOD PEELING: A CASE STUDY

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PRODUCTIVITY AND EFFICIENCY OF PLYWOOD PEELING : A CASE STUDY

by

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ABSTRACT

In the wood based industries, the veneer and plywood manufacturing is the second largest contributor to the Malaysian economy. The process of the improvement of plywood peeling involves increasing the productivity of mill and efficiency of resource use. Productivity implies the utilization of our resources efficiently and effectively. Thus, the objectives of this study is to determine the time consumptions, recovery rate, productivity and relationship between output and input of three types of lathe of an integrated plywood factory in Peninsular Malaysia. Productivity was defined as the ratio of output to input. Recovery was defined as the ratio of green veneer output to the volume of log input. Time consumption is the time consumed by individual processing elements and total cycle time.

Three peelers (9 feet lathe, 5 feet lathe and 5 feet aristo lathe) were studied during the 14 days of peeling activities from 19 May to 4 June 1990. Data were collected from the three types of peelers and on four input factors (log input, capital, utilities and labour cost). The study measure the time spent in the peeling process of peelers and total input value consumed by the peelers. Time data were collected on the peeling process namely charging, loading to the lathe, rounding-up, peeling, reeling, removing core, cleaning the knife and delay. Volume, value of veneer and four input factors were also recorded throughout this study. The regression analysis was used to determine relationship between output and input as factor production of veneer.

The results showed that productivity per hour of 9 feet lathe, 5 feet lathe and 5 feet aristo lathe were 6.87 m^3, 3.99 m^3 and 4.20 m^3 respectively. Time required to produce one m^3 of green veneer by using 9 feet lathe, 5 feet lathe and 5 feet aristo lathe were 8.74 minutes, 15.04 minutes and 14.28 minutes respectively with the recovery rate of 69.10%, 67.07% and 79.77% respectively. Total productivity of 9 feet, 5 feet and aristo lathe per M$ 1,000 were 2.62 m^3, 2.55 m^3 and 3.58 m^3 respectively and total productivity in ratio of output value per all inputs value were 1.2013, 1.1664 and 1.6414 respectively.

The increasing costs of labour and utilities are not influenced by the production of veneer. The green veneer production increases 0.8 percent with the increase 1 percent of log input to the peeler. The increase of 1 percent of capital, the green veneer production will increase 0.07 percent. Log input variable has the greatest influence to the production of green veneer.

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CHAPTER 1.

INTRODUCTION

1.1. Background

The wood based industries play a very important role to the Malaysian economy. In 1988, the export of timber products from Malaysia, amounted to more than M$ 2,942 million excluding chip boards, an increased of 15 percent compared with 1987. In term of volume the export totaled more than 4.5 million m^3 excluding chip boards, a decreased of 14 percent compared with 1987. The increase of value of the export with the previous year was due to the increase in the export of plywood and the price of sawn timber. Only the export of veneer was constant, but export of sawlogs was decreased (MTIB, 1989/1990). The timber product concerned consist of sawn timber, veneer, plywood, moulding and chip board.

In the timber industries, the veneer and plywood manufacturing sector is the second largest contributor to the national economy after sawn timber. Historically, the first two plywood mills were erected in the West Coast States (Lew, 1977). Since then the industry had developed vigorously and to date there are 54 plywood mills

throughout the country, where 38 mills were located in Peninsular Malaysia. Total installed capacity of the mills stood at around 1.9 million m^3 per shift per annum. The main timber species used were Keruing, Mengkulang, Red Meranti and Kedondong. The two popular types of plywood produced are Moisture Resistant (MR) which uses Urea Formaldehyde (UF) glue and Weather Boiled Proof (WBP) which uses Phenol Formaldehyde (PF) glue. Other types include plywood overlaid with plastic products such as Melamine, PVC or Polyester, printed plywood, colour coated plywood, decorative plywood, laminated ply flooring and form pressed panels.

In addition there are also other related enterprises such as timber preservation plants, prefabricated housing factories and particle board plants.

In term of production, the bulk of Malaysia's plywood production is in Peninsular Malaysia. Expansion in the production of plywood has been very rapid since the 1970's reflected by the increasing number of licence plywood/veneer processing mills from 20 mills in 1970 to 38 mills in 1988, utilizing about one million m^3 of logs annually. In 1988 Malaysia's plywood production increased about 5.6% to 904,000 m^3 from 857,000 m^3 in 1987. Of this total, 657,000 m^3 were produced in Peninsular Malaysia.

In the case of veneer, production also increased by 16.6% from 259,467 m^3 in 1986 to 302,610 m^3 in 1987, where Peninsular Malaysia produced 162,610 m^3.

In term of employment about 50,000 people are engaged in the timber industries in this country. There is no doubt that the industry brings about significant employment to both rural and urban areas. Pahang was the biggest state employer in the plywood industry, followed by Johore and Perak (MTIB, 1975).

Malaysia's plywood export in 1987 continued to perform remarkably well due to the strong demand from major markets such as Singapore, United Kingdom and Hong Kong. In addition the move by major supplying countries to avoid over flooding the plywood market has a stabilizing effects on the market. As a result, plywood prices have recovered substantially from the very low level in 1985.

Export plywood from Peninsular Malaysia which constituted almost 84% of Malaysia's total export in 1987 performed favourably, with an increase of 53.5% and 64.8% in terms of volume and value respectively. The f.o.b. unit value for plywood registered an increase of 6.5% to M$ 665 per m^3 in 1987 from M$624 per m^3 in 1986. In 1990 the price of plywood is expected to remain stable at the current level in view of the continued supply management measures undertaken by major supplying countries.

The export of veneer from Peninsular Malaysia increased 11.2% in volume form 39,500 m^3 in 1986 to 44,200 m^3 in 1987 and 13.7% in value from M$ 20.5 million to M$ 23.3 million. The average f.o.b. unit value for veneer showed a slight improvement registering at about M$206 per m^3 in 1987, an increase of 7.8% from 1986.

Mida (1985), predicted that even with supplementary production from plantation forest and rubber trees, the total volume of log production will decline to around 29 million m^3 in the 1990's. In view of the projected decline in log supply, the timber industry will inevitably lose its significance in the national economy unless proper and concrete development strategy is effected with an objective to increase the volume and value of timber product output.

This study aims at the analyzing the productivity and technical efficiency of plywood peeling system of a plywood mill in Pahang, Peninsular Malaysia. Especially, it will determine machine productivity, relationship between output and input as factors of production (labour, capital, log input, and utilities) and elasticity of veneer production.

1.2. Statements of Problem

The wood based industries, especially plywood manufacturing are faced a numerous of internal weaknesses and problems. Some of these problems were highlighted by MIDA (1985) as follows :

1. Decreasing in supply of prime logs in the 1990's due to international demand for high quality logs and the unplanned growth of the timber industry in relation to the resource base (i.e. potential log). It's also due to implementation of government policies on land development in early 1990's which resulted in rapid clearance of low land forest. Failure in securing quality logs results in unutilized production capacity.

2. The skilled of personal are still lacking in the plywood manufacturing section in Malaysia. The reasons are lack of interest training courses do not meet trade requirement, lack continuity and often organized on an adhoc basis.

3. The cost of labour and transport are increasing, so these factors influence production cost. Besides that, three main factors such as mill capacity, recovery rates, and utilization rate of mill capacity influence production cost.

This study will specifically look into the three main factors highlighted namely: mill capacity by studying the lathe which its utilization rate and its recovery.

1.3. Objectives of The Study

The objectives of this study are :

(i) To determine the time consume and recovery rate;
(ii) partial and total productivity and
(iii) relationship between output and input of three types of lathe of an integrated plywood factory in Peninsular Malaysia.

CHAPTER 2.

LITERATURE REVIEW

2.1. Plywood in General

The principal disadvantage of solid wood as structural material are its heterogeneity and anisotropy and its absorptive capacity for water and vapors (and therefore its low dimensional stability). It is possible to overcome this disadvantage by crosbanding to a large extent such as plywood. The properties of plywood are high elasticity, low thermal conductivity and practically it is not influence of notches. The new terminology for plywood is panel consisting of an assembly of plies bonded together with the direction of the grain, in alternative plies usually at right angles. Veneer plywood is a panel which all the plies and possibly the core are made of veneers oriented parallel to the plain of the panel (Kollmann, et.al. 1975).

Some advantages of plywood are as follows :

1. Almost unlimited market availability and possibility of their in-plant conversion into secondary products by panel manufactures them selves.
2. Large surface dimension and adapted to consumer requirements

3. Dry construction methods
4. Moisture resistance better than that of solid wood
5. Dimensional stability better than solid wood
6. Greater isotropy and homogeneity than solid wood
7. Easy work ability with a hand tools and machines
8. Wide range of densities, thicknesses, structural strength and weights per unit area, meeting most practical requirements
9. Greater stiffness, rigidity, resistance to buckling, strength, hardness, abrasion resistance may be imparted if desired.
10. Low thermal conductivity at right angle to the panel surfaces
11. Adequate acoustical properties, sound absorption improved in special acoustic boards by holes or slits.
12. Possibility of gluing and fastening by nails, screws, and other connectors
13. Paintability
14. If desired fire resistance for specific building requirements
15. Generally aesthetic appearance
16. Reasonably priced.

Due to some advantages of plywood properties were utilized for different uses, therefore its possible to list the most important uses :

1. Furniture (cabinets, tables, desks, bedsteads, bars, certain types of chairs, auditorium seating, etc.)
2. Residential construction, especially parts for prefabricated houses, roofs, ceilings, partitions, sub flooring, wall paneling, shopfitting, stage and studio joinery
3. Engineering construction (e.g. structural members, curved shell roofs, hollow tubes for antennas, etc.)
4. Doors (flush doors, panel doors)
5. Concrete shuttering
6. Musical instruments (pianos, cabinet organs, stringed instruments, radio and television cabinets, instrument cases)
7. Means for land transportation (trucks, station wagon, passenger cars, bus interiors, trailers, freight cars, railway passenger cars, unit carries)
8. Boats and ships, built in equipment for large vessels (with consideration of fire safety requirements, especially partitions and bulk heads in passenger-carrying vessels), rescue boats, pontoons;
9. Aircraft construction (e.g. small sport and training planes, gliders, propellers, helicopter blades);
10. Containers (packages for shipping, storage and distribution), pallets, crates, export cases, tool chests, drums, boxes and barrels, trunks, bags and suitcases, trays, reels for electrical cables and wires;

11. Coffins and caskets;
12. Sporting goods (tennis rackets, laminated skis, sleds, toboggans, paddles, etc.);
13. Miscellaneous uses, such as pattern for foundries, forming dies, handles for tools, silent gears, parts for equipment in chemical factories (for example tubes, vats and vessels, fiber frames, etc.), toilet seats.

2.2. Veneer

Veneer is produced from a great variety of hardwood and softwood species. Normally the face veneer consist of valuable woods. The form of tree stems and their dimensions must be suitable for veneer manufacturing. The grain should be straight; deviation are permitted only within fixed by economic considerations (yield) and quality requirements. Kollmann, et.al. (1975) in principles of wood science and technology the manufacturing of veneer was divided into three major methods, such as veneer sawing, veneer slicing, and veneer rotary peeling. At present 95% or more of the veneer is produced by rotary-peeling. Modern rotary peelers must be very sturdy and well bedded so that shocks or vibrations are avoided. This is necessary since different wood species with vari-