FPRDI-DOST

UTILIZATION OF SMALL DIAMETER LOGS FROM SUSTAINABLE SOURCE FOR BIO-COMPOSITE PRODUCTS PROJECT CODE: CFC/ITTO 62 – PD 40/00 REV 4(1)

ADDRESS TECHNICAL GAPS IN PRODUCING BIO-COMPOSITE PRODUCTS

ACTIVITY 2.3.1 Work with mills to identify issues when incorporation of small diameter logs into the production process

By

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INTRODUCTION

It was mentioned in the previous report that one of the pressing problems in the utilization of small diameter logs (SDL) is converting them into conventional products such as lumber and veneer. Most of the present primary processing equipment of the wood industry are designed for large-diameter logs (Rojo 1990). The use of inappropriate equipment for processing entails low mill recovery, low productivity and high processing costs. Also as mentioned, plywood and fiberboard are the two most important bio-composite products in the Philippines but with a dwindling supply of traditional lauans (*Shorea spp.*), the industry is utilizing mostly plantation species which are smaller and lower in quality. Other non-commercial species are also utilized depending on supply and availability.

To address the issues on the use of SDL in the production of bio-composite products, actual visit to various processing plants in several provinces of the Philippines was done. Five (5) plywood mills, four (4) blockboard plants, one particleboard plant, one fiber board plant, one wood wool cement board plant and one abaca fiber cement board plant were considered in the study. Except the particleboard board plant, all the processing plants visited were affected by the issuance on February 3, 2011 of Executive Order 23 (EO 23) on Partial Log Ban. (DECLARING A MORATORIUM ON THE CUTTING AND HARVESTING OF TIMBER IN THE NATIONAL AND RESIDUAL FORESTS AND CREATING THE ANTI-ILLEGAL LOGGING TASK FORCE). The total log ban however does not cover plantation species thus it is very timely that incorporating SDL in the production process is necessary. Industrial tree plantations however are not that extensive thereby shortage of raw materials is still a problem.

The methods used to develop this study are based on literatures, previous technical papers and actual visit to plywood mills, particleboard plant, cement-bonded board plant and fiber cement board plant.

A. Veneer and Plywood

AJ Wood Manufacturing, Cagayan de Oro

AJ Wood Mfg. Produces blockboard and lumber using 95% falcata (*Paraserianthes falcataria*) as raw material at a price of PhP 4,000.00 to PhP 5,000.00 per cubic meter. The age of the falcata is 4 years old and up with an average diameter of 30 cms. These are sourced from Agusan del Norte and Surigao del Sur provinces approximately 250 kms from the plant. At present, it imports veneer from China and USA (oak) which are used as face veneers. It exports blockboard to USA, Japan and UK. Its export to China which is 60% of production output has stopped due to price competition.

Sorting of wood blocks

Glue application

Loading onto the composer

Blockboard corestock

Overlaying with veneer

Hydraulic press

At present, the company is beset with problem on raw material supply and is opting to import kiln dried lumber (Alder and Hemlock) from USA which according to them is much cheaper than buying from local sources. The price offer is PhP 18.30 per board foot. However, if the company imports lumber from the USA, it will lay off 70% of its workforce and also cut in the use of its machineries by 70%. The company employs 1,000 personnel (labourer, machine operators and office staff).

The company is equipped with 2 units semi-automatic block board composer; 2 units hydraulic press; 2 units boiler; several units of planer; circular saw and other peripheral equipment. It has also a slicer intended for lauan but due to unavailability of lauan, the slicer has been idle for months already.

VICMAR Plywood Mfg., Cagayan de Oro

VICMAR manufactures plywood and blockboard. The company holds an Integrated Forest Management Agreement (IFMA) planted with 100% fast growing species that are already 30 years old. IFMA is a production sharing contract entered into by and between the Department of Environment and Natural Resources (DENR-Philippines) and a qualified applicant wherein the DENR grants the latter exclusive right to develop, manage, protect and utilize a specified area of forest

Logs of umbrella tree *(Musanea cecropiades)*

Rotary lathe

Big diameter log core

Spindleless lathe

Falcata log core

Core builder

Core veneer

Blockboard

Finger jointer

land and forest resources therein for a specified period consistent with the principle of sustainable development and in accordance with an approved Comprehensive Development and Management Plan (CDMP). However, due to EO 23 (Log Ban), it can harvest only planted species which is about 10% of its annual allowable cut. At present, it gets raw materials from Surigao and Bukidnon at a price of PhP 140,000 – 150,000 per truck load (35 – 40 cu m). During the visit, it is using 70% payong-payong or umbrella tree (*Musanea cecropiades*) as raw material which is abundant and much cheaper than falcata. The recovery from *M. cecropiades* is 40% while for falcata is 60-70%. The problem with *M. cecropiades* or umbrella tree is its very soft texture. It is difficult to dry and has high drying shrinkage. VICMAR does not use *A. mangium* and *G. arborea* due to technical difficulties in processing and high freight cost although abundant in the area.

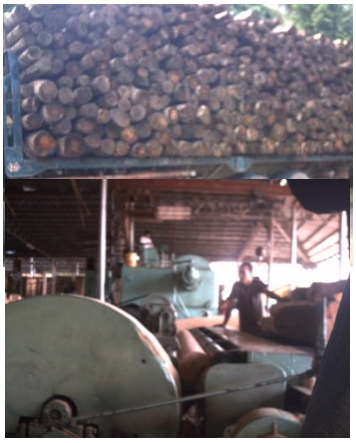
VICMAR is equipped with 1 unit spindleless lathe; 2 units rotary veneer lathe; 2 units core builder; 8 units cold press but only 4 are operational; 2 units hot press; 5 units glue spreader but only 2 are operational; 4 units roller type dryer but only 2 are operational; 1 unit finger jointer; 6 units kiln dryer for drying lumber; several units of planer and peripheral equipment used in the production of blockboard and plywood. The company will acquire 2 more units spindleless lathe to augment production and accommodate small diameter logs. The company also considers acquiring a steamer to be used in softening wood species that are hard to veneer. In general, only 70% of the machineries is operational due to old age. Some machineries are 25 years old. Present lathe can only process to a minimum diameter of 14 cm.

The company employs 1,200 personnel (labourer, machine operators and office staff) but will go on one shift operation due to problems on raw material supply and market. Importation from China has adversely affected the local market.

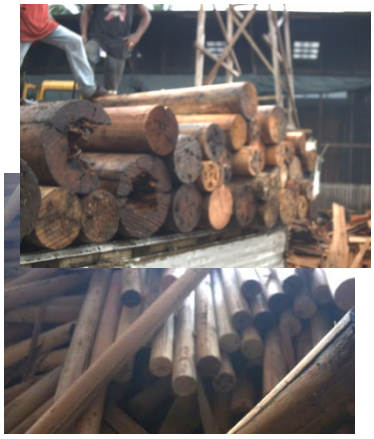
<u>CORONET Wood Industries Inc., Hinatuan, Surigao del Sur</u>

CORONET started in 2000 as mini sawmill and veneer producer in 2002 and finally as plywood manufacturer in 2007. It uses 80% falcata as raw material while the remaining percentage is miscellaneous species/fruit trees (e.g. durian).

Recovery from green to plywood is 60%., that is, 100 cu m of logs > 75 cu m dry veneer > 60 cu.m. plywood. Raw material input is 200 – 300 cu m per day. The cost of one truckload (approximately 35 cu m) of falcata in the area is PhP 80,000 – 85,000. The cost of falcata in the area is much cheaper than in Cagayan de Oro because of its proximity from the source. *A. mangium*, although available, is not used due to long drying time and brittle when dried. The company does not buy logs with diameter of more than 50 cm due to easy dulling
of knives.



Spindleless lathe



Log core from spindleless lathe

Truckload of falcata

Log core from rotary lathe

Rotary lathe

Plywood for shipment

The company which is designed for processing small diameter logs is equipped with 3 units boiler (3 ton cap. each with 30 – 40 cu m wood requirement as fuel); 2 units rotary lathe; 2 unit spindleless lathe that can veneer until 6 – 7 cm ø; 4 units rotary dryer; 2 units core builder; 3 units cold press; 3 units hot press; and 3 units glue spreader. In general, machine efficiency is 60%.The plant operates at 2 shifts per day. Production output is 2000 panels/day of 5 mm thick although the plant capacity is 6,000 to 7,000 panels/ day. The company markets its products locally. The company employs 500 personnel.

<u>EMCO Plywood Corp., Magallanes, Agusan del Norte</u>

EMCO, formerly Sta. Ines Plywood, is the largest producer of plywood in the Philippines and started operating in 1988. At present, it produces blockboard and plywood. It uses falcata as raw material for core material. The price of falcata is PhP 100,000.00 per truck load (30 – 35 cu m). The company imports 0.35, 0.50 and 0.60 mm thick face veneer from China. There is a reduction of production

from 11,000 cu m per month to 7,000-8,000 cu m per month due to shortage of raw material.

Falcata logs

Rotary lathe

Spindleless lathe

Falcata veneer

Log core

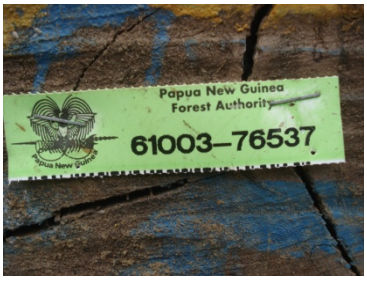
Quality control

The company is equipped with 3 units debarker, 3 units spindleless lathe, 4 units rotary lathe that can peel logs to 5-inch diameter and 2 units rotary lathe that can process logs to 9-inch diameter. It has 5 units roller dryer (only 4 are used) and 3 units continuous dryer (only 1 is used). There are 4 units boiler – 3 of which are biomass fed while the other one uses bunker oil as fuel. Machine efficiency is 80%. It plans to acquire three more spindleless lathe (52" and 58") and scuff jointer to increase recovery. The company operates on two shifts and employs 1,000 personnel.

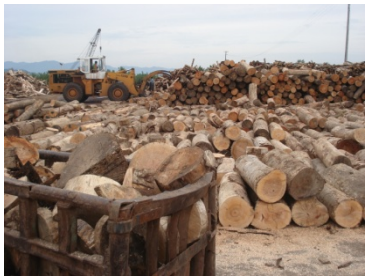
<u>Philippine Softwood Producers Inc. (PSPI), Magallanes, Agusan del Norte</u>

PSPI uses falcata (90%), *A. mangium* (5%) and *E. deglupta* (5%) as raw materials for the production of plywood and blockboard. The use of A. mangium and *E. deglupta* is limited due to problems in veneering and drying. *E. deglupta* and *A. mangium* are used for back. For falcata, recovery is 68% from logs to lumber and 54% from logs to plywood. The company also imports logs from Papua New Guinea. The company requirement for log diameter is 30 cm and up. Recovery from imported log is 68% for lumber and 54 % for plywood. It was mentioned that wood is 70% of production cost.

Imported logs

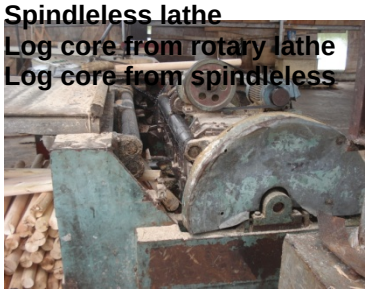


From Papua New Guinea



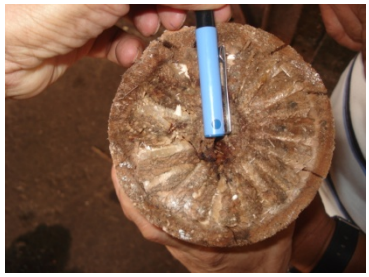
Acacia mangium logs

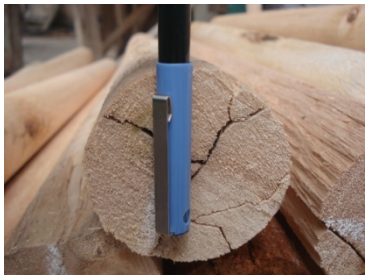
Spindleless lathe



Log core from rotary lathe

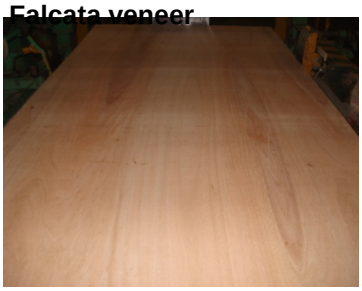
Log core from spindleless





Acacia mangium veneer

Falcata veneer



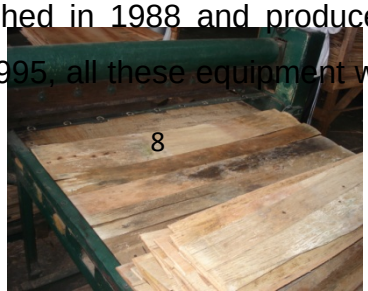
Quality control

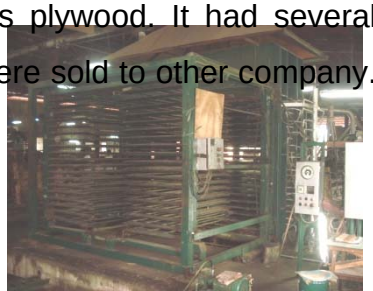
PSPI produces 18,000 panels/day of 5-mm thick or a volume of 300 – 350 cu m per day. At present, PSPI operates 4 days a week from the previous 6 days a week due to high cost of electricity and poor market. The cost of electricity per month is PhP 4M plus. From 1,800 personnel, the company presently employs 1,200.

The company is equipped with 3 units rotary lathe; 4 units splindleless lathe; 4 units glue spreader but only 3 is operational; 4 units roller dryer; 2 units continuous dryer; 2 units 12 daylight opening hot press; and 2 units 20 daylight opening hot press.

<u>Mount Banahaw Plywood Industries, Inc., Sariaya, Quezon</u>

The company was established in 1988 and produces plywood. It had several units of rotary lathe but in 1995, all these equipment were sold to other company.

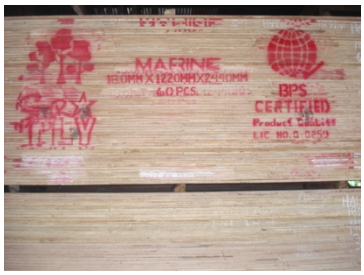




At present, the company simply buys veneer from its supplier. Most of the veneers supplied are mixed species imported from China with

Imported veneer 20 daylight press

Ordinary plywood



Marine plywood

Veneer with stain

Plywood with knots

a thickness of 0.45 – 0.55 inch, although a few is locally procured such as falcata from Palawan, Philippines. Just recently, the company imported 45 pallets of veneer from China and 32 pallets were rejected due to the presence of moulds and uneven thickness. The company produces 1,000 panels per day of 5-mm thick. Plywood production of 11-mm and 18-mm plywood is on a per order basis.

At present, it employs 150 workers but production, which heavily relies on the supply of veneer, is not continuous. Equipment/machineries available are only designed for one production line. There is neither a plan of increasing its production nor acquire new equipment/machineries.

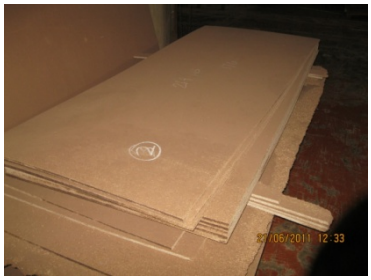
Philippine COMPAK BOARDS, Inc., Clarin, Misamis Occidental

PHILCOMPAK which was established in 1995 produces fibreboard from wood wastes using methyl diisocyanate as binder. During its first two years of operation, it produced boards using rice straw as raw material. It then tried using sugarcane bagasse as raw material and finally wood wastes. There was a problem in the sustainable supply of rice straw whereas for bagasse, cost to transport from the nearest island was not economical. So far, the company experienced no problem with the supply of wood wastes as raw materials. As quoted by the chief executive officer of the company, “EO 23 on Log Ban is advantageous to them” which is somewhat ironical to the other companies. It

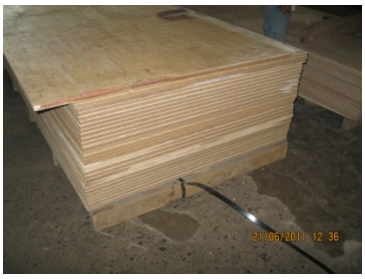
however intends to use coco coir fiber due to shortage of raw materials. In fact, it has produced sample coco coir boards using MDI as binder.

Woodwastes (coarse)

Woodwastes (fine)



Unsanded particleboard



Veneer overlayed particleboard

Sanded particleboard

Finished products

The company also markets veneer overlay particleboard. Veneer overlaying is sub-contracted with a plywood mill near the area. It has plans of exporting this to Japan provided that the minimum requirements for the basic properties of the standards are met. The boards produced comply with the formaldehyde emission requirement but still needs some improvements in order to conform to the other basic property requirement.

The technology of Compak Systems was from United Kingdom. Production line runs on a continuous process to include gluing, forming station, pre-pressing and hot-pressing. The company is also equipped with a chipper, mill, drum sander, panel saw and other equipment that complement particleboard production. It intends to invest on new equipment in order to produce coco-coir boards. A specially designed mill is needed to process coconut husks to produce short fibers. It employs 50 workers/machine operators

<u>New Southstar Fiberboard Mfg., Butuan City</u>

The plant which was established in 2001 is designed to produce 4,000 panels per day with a thickness of 2.7 – 2.8 mm at 0.80 g/cm^3 density. The raw materials are woodwastes (*falcata*, *G. arborea* and *A. mangium*) supplied by lumber producer and mini sawmill. The size of wood that the chipper can process is limited to 4 inches thus the company could not absorb all materials supplied to them. Raw material requirement is 60 tons/day but the average is less than 20 tons per day.

The company is suffering from poor market, shortage supply of raw materials and

Mat forming machine

Belt

Finished products

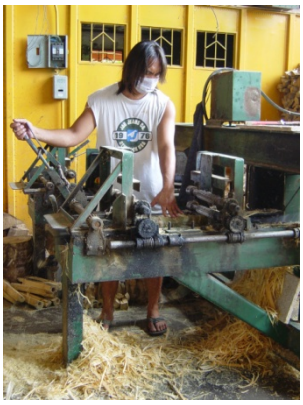
increase in production cost. The price of fibreboard is PhP 150.00/panel while plywood is PhP 250.00 per panel. But still, the number one market competitor is plywood which according to them, the price of fibreboard should be 60% lower than plywood in order to compete.

The company is equipped with a 5-ton capacity chipper, defibrator, 20-daylight opening hydraulic press, mixer, forming station and other peripheral equipment used in fibreboard production.
There has been no production for the past few weeks due to unavailability of raw materials. It employs 150 personnel.

<u>EARN Corporation Wood Wool Cement Board, Bay, Laguna</u>
EARN Corporation is a manufacturer of wood wool cement board. At present, it is the only remaining WWCB manufacturer among the more than five (5) plants established in the 1990s listed below:

1. ZAMBOARD Mfg., Pamucutan, Zamboanga City
2. PANELCORP, Zamboanga City

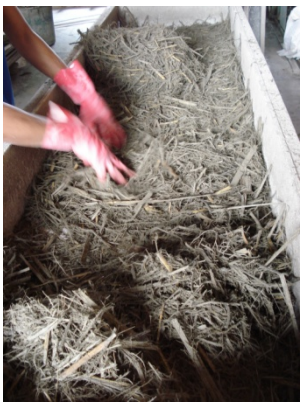
3. CRUZAYCO, Kabankalan, Negros Occidental
4. Mr. Val Chu, Marvel, South Cotabato
5. WWCB Plant, Solana, Cagayan Valley
6. WWCB Plant, Angeles City



Shredding of wood

Air-drying of wood wool

Mixing wood wool, cement and water



Manual mat forming

Pressing by batch

Curing and conditioning of boards

EARN Corp. is equipped with a complete production facilities used in the production of WWCB. These are horizontal type shredder, rotary type shredder, mixer, hydraulic press, lifter, multiple circular saw, etc. It employs 6 regular employees and more than 5 on call basis depending on the production. It produces WWCB of various thicknesses and densities depending on the end-use requirement.

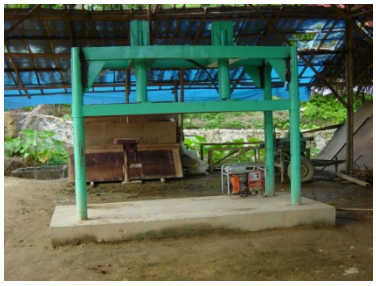
The company started using 100% *G. arborea* as raw material. But in the latter years of 2000, it has decided using any available small diameter logs or even fruit trees provided that it is compatible with cement. Recently however, it again focused in using 100% *G. arborea* because of the difficulty in getting other wood

species. They have considered using bamboo but it is not very abundant in the vicinity.

ADCo Cement Bonded Board, Baras, Catanduanes

ADCo is a cement bonded board plant that uses abaca fiber wastes as raw material. Catanduanes, an island in the southern part of Luzon, is one of the producers of abaca fiber thus abaca waste is readily available. The plant is equipped with a mixer, hydraulic press and other equipment used in the production of abaca cement bonded board. It has no intention of using wood as raw material as it will incur additional investment. Presently, the plant is not operational but intends to resume production before the year ends.

Mixer



Hydraulic Press

Abaca-Cement Mixture

Mat ready for pressing

Finished products

Product application

Conclusion and recommendation

1. Bio-Composite Products industry, particularly the plywood industry, is experiencing problems on raw material supply due to Executive Order 23 – Log Ban;
2. The raw materials available is limited only to plantation species although not all are suited for the production of plywood e.g. *Gmelina arborea*;
3. The use of spindlelesss lathe is one of the solutions to accommodate small diameter logs and to improve recovery;

4. Producing plywood locally is more costly than importing from China thus there is an influx of imported plywood although the quality is inferior;
5. Product testing of imported plywood and other composites should be done before these are distributed in the local market;
6. Expansion of raw material base for the production of resin bonded and cement bonded composites has to be considered in order to compete with the price of imported MDF, particleboard, cement bonded board and other bio-composite boards.

Acknowledgement

The authors would like to thank the following companies for allowing them to document the production process/equipment/raw materials/products, for providing them technical information and for giving them the opportunity to work closely in the production line.

1. AJ Wood Manufacturing, Cagayan de Oro
2. VICMAR Plywood Mfg., Cagayan de Oro
3. CORONET Wood Industries Inc., Hinatuan, Surigao del Sur
4. EMCO Plywood Corp., Magallanes, Agusan del Norte
5. Philippine Softwood Producers Inc., Magallanes, Agusan del Norte
6. Mount Banahaw Plywood Industries, Inc., Sariaya, Quezon
7. Philippine COMPAK BOARDS, Inc., Clarin, Misamis Occidental
8. New Southstar Fiberboard Mfg., Butuan City
9. EARN Corporation Wood Wool Cement Board, Bay, Laguna
10. ADCo Cement Bonded Board, Baras, Catanduanes

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