ITTO Biennial Work Programme 2010-2011

Implementation of Activity 41

"Strengthening the Capacity to Promote Efficient Wood Processing Technologies in Tropical Timber Producing Countries"

Piloting Applicability of the In-house Training Format for Training on Wood Processing Techniques in ITTO Member Countries

Executed by the International Tropical Timber Organization (ITTO) in collaboration with the Governments of Papua New Guinea, Guyana, Myanmar and Malaysia

Yokohama, November 2011

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Acknowledgements

I wish to express my sincere and heart-felt appreciation to Mr. Emmanuel Ze Meka, Executive Director of the International Tropical Timber Organization (ITTO) for granting me the opportunity to take part in the implementation of Activity 41 of the ITTO Biennial Work Programme for the years 2010-2011 titled “Strengthening the capacity to promote efficient wood processing technologies in tropical timber producing countries”. Implementing the activity was truly a challenge for me especially as regards finding the right and effective way to communicate with the training participants given the diverse cultural and occupational background of the participants in different countries. At the same time, it was an opportunity for me to learn more of the technical as well as managerial problems facing the forest industry development in tropical countries which has greatly enriched my knowledge and insight.

I would like to take this opportunity to convey my sincere thanks to Dr. Tetra Yanuariadi, the ITTO Forest Industry Projects Manager, for his untiring assistance in making the necessary arrangements for the implementation of individual in-house training sessions; to concerned forest authorities in Papua New Guinea, Guyana, Myanmar and Malaysia, respectively, for the excellent arrangements of the training and the support granted; to the owners, executives, managers, supervisors, operators and employees of the host forest companies for their cooperation and enthusiasm in learning the various aspects of wood processing technologies. Indeed, the in-house training format had been successfully implemented in Indonesia, where I was heavily involved, and it has been adopted by many forest companies as to date. I have no doubt that similar training format can be replicated and employed in other ITTO member countries without great difficulty even as owned initiative, without having to rely on external resources, except for technological expertise of competent professionals.

With best regards,

Sae Yung Kim
Author

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Strengthening the Capacity to Promote Efficient Wood Processing Technologies in Tropical Timber Producing Countries

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List of abbreviations

AAC	=	Annual Allowable Cut
C & I	=	Criteria and Indicators
EMC	=	Equilibrium Moinsture Content
FAO	=	Food and Agriculture Organization of the United Nations
FIA	=	Forest Industries Association
FMA	=	Forest Management Agreement
FMU	=	Forest Management Unit
GDP	=	Gross Domestic Products
GFC	=	Guyana Forestry Commission
GOG	=	Government of Guyana
GOM	=	Government of Myanmar
GW	=	Global Witness
ITTO	=	International Tropical Timber Organization
ISWA	=	Indonesian Sawmill and Woodworking Association
MMUS	=	Modified Malaysian Uniform System
MTIB	=	Malaysia Timber Industry Board
NTFP	=	Non-timber Forest Products
PFE	=	Permanent Forest Estate
PNG	=	Papua New Guinea
PWC	=	Price WaterHouse Coopers
SFM	=	Sustainable Forest Management
SMS	=	Selective Management System
TQM	=	Total Quality Management
TSA	=	Timber Sale Agreement
WCL	=	Wood Cutting Lease

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1. Introduction

1.1 Activity defined

The activity that has been implemented and is reported herewith is Activity No. 41 of the ITTO Biennial Work Programme for the years 2010-2011 titled “Strengthening the capacity to promote efficient wood processing technologies in tropical timber producing countries”. The activity was implemented in four selected ITTO member countries, namely Papua New Guinea, Guyana, Myanmar, and Malaysia between June 2010 and May 2011 as listed in Annex A.

The activity was built on the lessons learned from the ITTO-assisted project PD 286/04 Rev. 1 (I), with the same title as the activity, that had been successfully implemented in Indonesia by the Indonesian Sawmill and Woodworking Association (ISWA) and completed in 2009. That project of Indonesia aimed to promote efficient wood processing and quality of processed products through conduct of training on technical and managerial skills under in-house training format involving fifty mills and comprising 139 training sessions. The project argued that in-house training mode has several advantages over the conventional, class-room & field-demo format, including (ITTO & ISWA, 2009)**:**

i. To be effective, the conventional training format requires comparable occupational and educational background amongst trainees which is difficult to observe in reality;
ii. Mills are reluctant to host trainees sent by other competing processors simply for business confidentiality reason;
iii. Participants are limited in number for financial reason and usually are confined to lower level employees only;
iv. Individual mills are facing different operational problems in the technical and managerial aspects; while some problems may be common to many mills, other problems are unique, mill specific in nature , thus require specific treatments; and
v. In-house training is a pragmatic format of training as it accommodates large number of participants from the host mills, allows for direct examination of technical and managerial problems on the spot, provides opportunity for demonstration of practical, technical solutions and offers ample time for discussion on any problem encountered.

To implement Activity 41, an International Consultant having accumulated practical knowledge and experience in tropical wood processing over thirty years in Indonesia and other tropical countries, Mr. Sae Yung Kim, was hired. The terms of reference is presented in Annex B.

1.2 Purpose of the activity

Activity 41 was intended to pilot applicability of the in-house training mode that had been successfully employed under the ITTO-assisted project PD 286/04 Rev.1 (I). Application of the training mode in other member countries may require adjustments or modifications to particular training elements to suit the prevailing national forest industry environment. For instance, business confidentiality may not be as an important factor to a particular country as for Indonesia in recruiting host mills in other ITTO member countries. In this case, number of host mills may be reduced through grouping of “similar” ones, offering the opportunity for increasing training hours.

The envisaged scope of the activity encompassed the complete wood processing chains, from logs handling to saw doctoring, from kiln-drying to human resource development. The scope, however, had been narrowed in particular training sessions down in light of the resources available for carrying out the activity.

1.3 Expected outputs

Upon completion of the activity, the following outputs were expected**:**

- Increased awareness and understanding of owners, executives and managers of forest industries as well as governmental training and research institutions for training and research on the importance of improving processing efficiency;
- Improved knowledge, skills and work mentality of forest industry operators; and
- Validated applicability of in-house training format for replication in other ITTO member countries.

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2. Implementation approaches and methods

In light of availability of resources for implementation of the activity, especially level of funding, it was necessary to limit the number of host countries and processing mills in each of the countries.

2.1 Selection of host countries

Four ITTO member countries had been selected as the hosts for piloting applicability of in-house training format: Papua New Guinea, Guyana, Myanmar and Malaysia covering the Peninsular, Sarawak and Sabah States. The criteria used in the host selection were: timely readiness of the countries to receive the ITTO Consultant and his team work, expressed interest of member countries and availability of funds.

2.2 Selection of host mills

The mills hosting the in-house training were solely selected by the host countries, taking into account, among others, scale of operation, product lines, level of technological sophistication, accessibility of mills and availability of resources.

2.3 In-house training defined

In-house training is a format of capacity building endeavor wherein skills of employees are improved through direct involvement in the detection of technical as well as operational problems and in trouble shooting action demonstrated by highly competent professional. As evident by the term “in-house”, the training is specifically devoted to detecting and solving problems facing a particular mill, host of the training. Participants of an in-house training are not limited in number and rank but they are primarily managers and employees of the host mill. In fact, owners and executives are expected to take part in considering their strategic roles in making decision on follow-up action.

During the process of in-house training, managers and operators of a particular process chain will have the opportunity to watch and directly observe the carrying out of activities of the different chains. In this way, understanding on and appreciation of tasks and responsibilities amongst managers and operators in general will improve, leading to better condition of production system. In addition, any problem detected and solution demonstrated can be openly discussed amongst the participants and trainer (s) without having to worry about business confidentiality. In this manner, level of skills of the participants is undoubtedly increasing in general. In other words, the in-house training format generates indirect benefits for the host mills in the form of enhanced production system aside from the technical and managerial skills of individual participants.

2.4 Implementation strategy pursued

For every training session conducted at each of the host mills, the training was normally organized in the following fashion**:**

- Firstly, the training expert or team comprising a professional trainer, accompanying ITTO manager and national counterpart (s) met with the executive (s) and manager (s) of the mill to discuss on purpose and scope of the training, its expected outputs and what would be undertaken during the session in light of available resources;


(1) (2)

Photos 1-2 **:** entry meeting prior to making observation on conduct of wood processing

- After the brief meeting, the team would first pay visit to end products and waste places. Performance of the end products normally provides clues for detecting performance of the process chain (s) responsible for observed non-performing or defected end-products. Likewise, quantity and characteristics of wood waste e.g. dimension, form, etc. are a good hint for tracing back those process chains (s) responsible for the wastage.



(3) (4) (5)

Photos 3-5 : inaccurate dimension of sawn timber due to improper sawing (3)**;** burn mark due to overheating in sawing (4)**;** hairy surface of sawn timber due to damage or dull saw teeth (5)



(6) (7) (8)

Photos 6-8 **:** large volume of wood waste due to in-efficient processing and lack of utilization initiative (6-7)**;** meager volume of wood waste indicating efficient processing (8)

- After obtaining clues from the performance of end products and appearance of wood waste, the team visited the suspected product chain (s). Here, the trainer showed the occurring technical problem and demonstrate how to overcome it. Any suspected process chain was observed, its technical problem pinpointed and its overcoming action elucidated or demonstrated as appropriate. To facilitate discussion, any irregularities encountered at any process chains were documented on camera pictures.

- Observation was not limited to suspected process chains. Subject to time availability, other chains were also observed on random or on purpose. At any chain, the trainer and trainees visually examined appearance of the flowing products produced by the chain, indicated any irregularity of process, identified the sources and demonstrated needed overcoming actions.

(9)

(10)

Photos 9-10 : detecting and discussing technical problems on the spot

- After finishing the process chains, as needed and as necessary, a typical closing meeting was held to discuss with all participants on findings, problems encountered as well as causes and business consequences of the problems. At this meeting the trainer showed the pictures of irregularities taken at observed process chains and compared them to the desired ones that are free of technical irregularity. During this final meeting, the trainer also provided the participants with relevant information on needed resources for trouble shooting in terms of source, price and technical specifications. In addition, as time permits, the trainer also elucidated the intimate link between processing efficiency, product quality, competitiveness and business survival.

(11)

(12)

Photos 11-12 : exit meeting to discuss the problems encountered at process chains

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3. Background information on the forest resources and industries

Unless other source is specifically cited, the information on the forest resources and industries of Papua New Guinea, Guyana, Myanmar and Malaysia was sourced from the reports by FAO (2010) on global forest resources assessment 2010 and by ITTO (2011) on status of tropical forest management 2011. It should be noted, however, that related figures for Malaysia have been updated thanks to the Ministry of Plantation Industry and Commodities for its assistance.

3.1 Papua New Guinea

- FAO estimated the forest area at PNG at 28.6 million hectares in 2010 or 61.77% of the total land area. The forests of PNG are varied, stretching from sea level to an altitude of over 4,000 m; the dominant forest type is lowland rainforest, around 20.3 million hectares in extent. Ninety-seven percent of the land is held as communal or clan commons, while the remainder is under state or individual/private ownership. The area of forest owned by clans is in the order of 25.5 million hectares. FAO (2010) noted that a trend is emerging in PNG where individuals are buying land from tribal/clan groups for their individual use.
- As regards use of ITTO C&I, PNG has been very slow to recognize the importance of C&I as a tool to guide the policy and operational aspects of forest use and management.
- According to the draft national forest plan, the total area of forest classified as production forests is 13.75 million hectares to which could be added reserve forest and salvage forests. FAO (2010) estimated the total area available for production at 8.54 million hectares, comprising production forests and multiple-use forests.
- As of 2010, PNG government had acquired timber rights from customary land owners involving about 12 million hectares of forest. These rights are normally allocated to foreign developers with the necessary financial capabilities. Of the acquired area, an estimated 4.9 million hectares of forest were under active timber extraction licenses in 2007; of this, Rimbunan Hijau or its affiliated companies had logging concessions amounting to 2.55 million hectares.
- For some years, set without the benefit of a national forest inventory, the AAC from natural forests has been set at about 3 million m^3 based on the allowable harvest levels specified under timber permits and FMAs. To meet this AAC would involve the harvest of about 120,000 hectares of natural forest per year. The AAC does not take into account the timber harvested under forest-clearance authorities for agriculture, estimated at about 1.8 million m^3 per year.
- Total industrial log production in PNG was estimated at 2.91 million m^3 in 2009 up from 2.12 million m^3 in 1999. The forest industry is based predominantly on log exports. An estimated 1.93 million m^3 of logs were exported in 2009 making PNG the world's second-largest exporter of tropical logs after Malaysia. PNG earned US$ 172 million in 2009 from timber exports, US$ 141 million of which was from logs.
- Further, yet less updated, information on the PNG's forest industry can be summarized as follows (Price WaterHouse Coopers, 2006)**:**
  - The potential for the forest industry to be a foundation industry in PNG's economy is evident in the development of the industry in other countries. It also evident that for this to occur, robust management of forest resource and support of value-adding downstream industrial is essential.
  - The forestry industry is currently making significant contribution to the PNG economy; in particular, it has significant impact on GDP, formal employment and its ability to benefit many remote communities.
  - International evidence suggests that with careful management of the framework for the forestry industry, greater benefits could be easily achieved. In particular, sustainable practices could be implemented and managed, integrated forest enterprises developed, local formal employment created and technical education improved.
  - In the absence of government support, the presence of the forestry industry in rural areas is usually seen as a proxy for government with communities becoming entirely dependent on the operation to act as the government body and the business entity to provide service to the community.

- Contribution of the forest industry to the PNG economy by end of year 2005 include**:**
  - ✓ The forestry industry contributed around 9.2 percent to total real GDP of PNG, on a par with the importance of mining and quarrying industry
  - ✓ 2.4 percent of total central government revenue, excluding receipts from borrowings; forest products will remain PNG's highest value export outside the minerals sector for the next five years
  - ✓ Existing forest companies in mid 2000s employed over 6.600 staffs; of this, app. 90 percent were PNG nationals, 50 percent were employed in logging operations while the remaining 50 percent are employed in value-adding industries including veneer processing, timber processing, carpentry and supporting services. This level of employment represented approximately 5-7 percent of total formal employment which is only a small fraction of total employment keeping in mind that approximately 85 percent of the labor force were engaged by the informal sector
- Current cost structure of the forestry industry are: 9% in logging, 31% in processing, 18% in transport, 27% taxes and 15% royalties.
- Key drivers for the forestry industry to develop include**:**
  - ✓ A consistent supply of logs, by overcoming restriction of climatic factors
  - ✓ Tapping markets of finished products, e.g. furniture, flooring
  - ✓ Pursue the provision of more value-adding and high-grade sawn wood for specialized domestic and export markets which will require investment in processing equipment and facilities
  - ✓ To survive competition in international markets through lowering cost of production
  - ✓ Efficient use of logs including low-grade and residual logs using modern technology.

3.2 Guyana

- FAO (2010) estimated that Guyana had 15.2 million hectares of natural forests in 2010, which is 71% of the total land area. The GoG recognizes five forest types, namely: dry evergreen forest, mountain forest, swamp forest, mangrove forest, and mixed forest.
- The GoG has classified 13.6 million hectares of the forests as "state forest" although FAO (2010) estimated that actual area of this estate is 12.2 million hectares.
- About 6.85 million hectares of state forest is allocated to commercial use and 1.11 million hectares to research and protection; the remaining forest land is unallocated because harvesting of these forests is economically infeasible at present.
- The bulk of Guyana's forests is owned by the state. Under the Forest Law and national forest policy, the ownership of all forest resources, except those on private property and Amerindian Lands, are vested in the state.
- The GoG reported forest use as of June 2010 on the basis of the Forest Act 1953, since the Forest Bill of 2009 is yet to come into effect, as follows:
  - 25 TSAs (timber sales agreements) had been allocated to local and international companies covering an area of 4.53 million hectares.
  - 2 WCLs (wood cutting leases) had been issued covering a total area of about 30,500 hectares.
  - 386 SFPs (state forest permits) had been granted, covering a total area of 1.35 million hectares.
  - 6 SFEPs (state forest exploratory permits) were in effect on 747,000 hectares to allow the collection of information needed for issuances of a WCL or a TSA.
- As of end 2010, 418 forest licenses in various forms had been issued by the GoG, covering a total area of 6.87 million hectares or 53.4% of the state forest (GFC, 2011).
- Total industrial log production in 2009 was 299,000 m^3, down from 474,000 m^3 in 2006 and 366,000 m^3 in 2004. About 64,000 m^3 of sawn wood were produced in 2009, an increase over the 56,000 m^3 produced in 2004.

- In 2009, Guyana exported 91,000 m^3 of logs, 49,000 m^3 of sawn wood and 17,000 m^3 of plywood with a total export value of US$ 48.1 million, compared with US$ 38.3 million in 2004
- The forestry sub-sector's contribution to Guyana GDP in 2010 was 3.02 %, down from 4.17% in 2006. The decreasing share is not surprising due to the inevitable structural changes in the economy as economic progressing over time.
- The forestry sub-sector in 2010 directly employed 21,958 people in 2010, down from 24, 126 people in 2009 owing mainly to the changes that are occurring in the hiring system.
- Guyana is making good progress towards SFM and the log-tracking system had added transparency to the system. There is overall compliance with GFC principles and management practices across issued forest concessions. On the basis of an estimate provided by GoG, FAO (2010) reported that the entire state forest estate (12.2 million hectares) was under sustainable management.
- Guyana has the great potential to further develop its forest industry in a sustainable manner. The total area of forests that has been allocated for commercial utilization is nearly 7 million hectares but total production of logs was only 299,000 m^3 in 2009. Ample opportunity exists to increase production of logs to feed a viable forest industry in the long-run. The GoG is striving to tap this opportunity through implementation of the policies and strategies summarized below (GFC, 2011)**:**
  - Establishment of primary access roads by concessionaires shall be in accordance with national development strategies,
  - The fundamental objective shall be to promote a financially and economically viable forest industry,
  - The capacity and type of forest-based industries established shall be consistent with the nation's forest extraction potential under SFM,
  - The principles of production efficiency and productivity, enhancing recovery rates through improved processing techniques, promoting down-stream industry development and increasing the production line of value added products shall be developed and applied as priority,
  - Investments in added-value forest product development and promotion shall be encouraged wherein Foreign investment shall prioritize the more capital intensive, higher technology projects utilization of logs in downstream activity,
  - A financially viable local market shall be developed with the emphasis being placed on the promotion and utilization of lesser-used species.
- Profile of existing forest products manufacturing is summarized below**:**
  - Ownership and management is a mixture of foreign ownership, the GoG, several established family firms, and numerous individuals and small groups undertaking chainsaw conversion to lumber at the stump,
  - Domestic distribution is handled by gate sales from sawmills and a network of small entrepreneurs,
  - There is one major plymill, the Barama Co. which accounts for 35% of the national harvest and a number of sawmills that typically have their own forest concessions,
  - A number of manufacturing facilities exist for furniture and builders are serviced by a network of timber dealers,
  - There are also factories for more roofing shingles and other forms of product,
  - The manufacturing of the majority of rough sawn timber takes place at stump, using chainsaws either free hand or fitted to mills; planing mills undertake the task of dressing the timber to specifications,
  - Sawn timber is produced by the static mills who obtain logs from their concessions or others and may fell, extract and transport themselves or use contractors; also sell timber that has already sawn by chainsawyers,
  - Production costs of the chainsawyers are a third of large sawmills and welfare benefits include increased income in hinterland communities and more competitive prices for consumers, and

- In the last decade, there was a rapid rise in the number of mobile chainsaw mills, portable sawmills, cutting sawn timber at the stump because of the low capital investment and simple operation involved. However, wood recovery is only 20 - 30% compared to static mills at 45 - 52% thus the processing system is far from efficient.

3.3 Myanmar

- The total natural forest area in Myanmar is estimated at 30.8 million hectares, which is 45% of the total land area (FAO, 2010). The GoM reported total natural forest area of 35.4 million hectares in 2006 including beach and tidal forests; not all Myanmar's forests are tropical
- Important forest types are mixed deciduous forest (38%), hill evergreen forest (25%), evergreen (16%), dry forest (10%), deciduous dipterocarp forest (5%) and tidal, beach, dune and swamp forests (4%). Of the world's 19 million hectares of natural teak forests, more than 16 million hectares are in Myanmar, occupying the mixed deciduous forest.
- In 2010, the GoM reported its PFE to comprise 15.8 million hectares of production forest and public or unclassified forests, and commercial timber as well as NTFPs may be extracted from both classes. Reserved and public forests constitute the PFE.
- An estimated 19,6 million hectares of forest is allocated for production, and a further 8.7 million hectares is allocated for multiple-use. There are 63 FMUs in Myanmar, of which 41 are dedicated to timber production. Thirty-four FMUs are actively managed for teak and other hardwoods covering an area of about 470,000 hectares
- Timber extraction is encountered on only a few economically important species. This creaming of the forest, if unabated, will lead to devaluation of the forest in the long-run.
- Since 2003/2004 the AAC for teak has been 334,000 m^3 but the actual harvest in the period 2003/04-2006/07 averaged 588,000 m^3 per year. The AAC for other hardwood in that period was 1.6 million m^3 but the actual cut averaged 2.11 million m^3.
- Round wood production in 2005 was estimated at 43.1 million m^3, of which 39.2 million m^3 (91%) was fuel wood. The estimated production of industrial round wood in 2009 was 4.24 million m^3, up from 3.35 million m^3 in 1999.
- The estimated production of tropical hardwood sawn wood in 2009 was 897,000 m^3, down from 979,000 m^3 in 2004 and up from 298,000 m^3 in 1999. An estimated 1.38 million m^3 of tropical hardwood logs were exported in 2009, similar to the volume in 2004, mainly to India, China and Thailand in that order.
- The estimated value of Myanmar's exports of primary timber products amounted to US$ 859 million in 2008, of which logs contributed US$ 716 million (83%).
- Many of Myanmar's forests are becoming degraded due mainly to illegal logging in areas outside the government's effective reach with respect to law enforcement and policy implementation (Global Witness, 2009, in ITTO, 2011), forest creaming practices by FMUs in harvesting and shifting cultivation practiced by the landless poor living in and around the forests.

3.4 Malaysia

- Malaysia reports its forests according to three forest types: dry inland forest types dominated by trees of Dipterocarpaceae, peat swamp forest and mangrove forest. Of the 18.48 million hectares of dry inland forests, 5.84 million hectares are in Peninsular Malaysia, 8.23 million hectares in Sarawak and 4.40 million hectares are in Sabah.
- In 2010, the area of natural-forest PFE was 14.61 million hectares. The natural-forest PFE comprises 11.38 million hectares of production forests and 3.23 million hectares of protection forests, a significant portion of which has been demarcated on the ground. Peninsular Malaysia contains 4.92 million hectares of the total natural-forest PFE, Sabah 3.60 million hectares and Sarawak 6.09 million hectares.
- The silvicultural system used for managing Malaysian dry inland forest has changes over the years. In Peninsular Malaysia, the dry inland forests are managed under two management

systems: the MMUS and the SMS. Under the MMUS, the mature crop may be removed in a single felling of all trees down to 45 cm dbh for all species. Under the SMS, the current cutting limit is 65 cm dbh for dipterocarp species and 55 cm dbh for non-dipterocarps while the maximum permitted harvested volume is 85 m^3/hectare. In Sabah, dry inland forests are harvested selectively on a 50-year cutting cycle in which only tree greater than 60 cm dbh may be removed. In Sarawak, the cutting cycle prescribed for dry inland forest is 25 years and the prescribed cutting limits for dipterocarp and non-dipterocarp species are 60 cm dbh and 45 cm dbh, respectively, an average of 7-9 trees are harvested per hectare, and the average volume removed was 54 m^3 per hectare.

- Under the MMUS and SMS system the total AAC in the production PFE of Malaysia was 266,940 hectares for the period 2006-2010 comprising 36,940 hectares in Peninsular, 60,000 hectares in Sabah and 170,000 hectares in Sarawak. The average area harvested annually in the three-year period 2006-2008 was 33,001 hectares in Peninsular, 76,876 hectares in Sabah and 154,694 hectares in Sarawak.
- Malaysian forest policy emphasizes the sustainable management of forests and the balance between protection and production. In Peninsular Malaysia, a forest management plan is developed for each FMU covering a ten-year period with a review in the fifth year; it is designed to act as a master plan for the long-term and is credited with being instrumental in the achievement of SFM. It serves as the basis for the preparation of five-year working plans at the forest district level and annual operating plans at both the district and FMU levels. In Sarawak, each concession has its own forest management plan which is a legal document and an integral part of the forest timber license. It is revised periodically to take into account new information and requirements. The forest management plan sets out how harvesting should be conducted in the concession including the species to be removed, the minimum diameter cutting limit, the annual harvest areas and the volume of timber allowed. It also prescribes the penalties for damaging residual trees and includes a forest engineering plan.
- As of 2009, there were 11 forest management plans in Peninsular Malaysia, one each for the eleven FFUs there, 24 in Sabah and 64 in Sarawak. In total, these 99 forest management plans account for 9.91 million hectares of the PFE.
- All timber harvesting and related management operations are carried out by contractors operating on the basis of either a long-term logging agreement, i.e. 100 years or a short-term license, i.e. 1-2 years. Logging licenses generally stipulate size limits, intensity of extraction, logging sequence, methods of treatment, transport routes, standards of road construction, etc.
- Over the recent years, production of logs from Malaysia's natural forest has been decreasing steadily due mainly to the effective implementation of SFM including the imposition of tighter laws, policies and regulations governing forest harvesting (MTIB, 2011). Total Malaysian industrial production was 18.2 million m^3 in 2009, down from 24.7 m^3 in 2004 (ITTO, 2010) of which 3.7 million m^3 were produced in Peninsular States, 4.1 million m^3 in Sabah and 10.4 million m^3 in Sarawak. Production of natural forest in Malaysia is projected to decline to 11.5 million m^3 per year in 2016-2020 (ITTO, 2010); most of the projected decline would be occurring in Sarawak.
- In 2010, there were 3,901 wood processing mills operating in Malaysia, distributed 2,676 units in Peninsular States, 548 units in Sabah and 767 units in Sarawak; mainly in sawmilling, wood-based panel products making, wood molding and furniture manufacturing (MTIB, 2011).
- The contribution of wood-based products to export earnings is significant; the total value of all wood-based product exports from January–July 2011 was US$ 3.7 billion with furniture, plywood and sawn timber, in that order as the main export items. Logs contributed only US$ 0.4 billion to export earnings.
- The timber industry provided direct employment for 276,000 people or 2.3% of the nation's workforce in 2010 (MTIB, 2011) and contributed about US$ 2.88 billion to the Malaysia economy or to 1.3% of GDP in 2008 (ITTO, 2010).
- The objectives of the National Timber Industry Policy (NATIP) are to (MTIB, 2011)**:**
  - Provide the policy direction for the timber industry in Malaysia
  - Ensure synergistic development of the up-stream and down-stream activities in the timber industry; and

- Enhance the industry's competitiveness to meet the challenges of globalization and liberalization.
- The NATIP targets are export value by 2020 at RM 53 billion or about US$ 17 billion and 6.4 % annual export growth.

3.5 Efficient forest industry vs sustainable forest management

The information on the forest resources owned by the countries presented in the previous sections indicates that:

- Malaysia, with about 14.6 million hectares of natural forest PFE, is utilizing its forest resources at nearly full rate yet sustainably. The AAC area under the MMUS and SMS is 266,940 hectares of which only 264,571 hectares are harvested in the recent years, capable of producing 18.2 million m^3 of logs in 2009; around 90% of log production are used to feed its national forest industry.
- PNG, with around 13.75 million hectares of forest allocated as production forest, of which about 12 million hectares are now available for timber production, produced only 2.91 million m^3 of industrial logs in 2009 of which an estimated 1.93 million m^3 were exported. In other words, only around one million m^3 of logs are used to feed the national forest industry.
- Guyana has allocated 6.85 million hectares of its forest to commercial use. The production of logs in 2009 was 291,000 m^3, of which only around 200,000 m^3 were consumed by the national forest industry.
- In Myanmar, an estimated 19.6 million hectares of forest is allocated for production. The total AAC of the forests is 1.93 million m^3 but realized harvest in 2009 was 4.24 million m^3 of which around 2.86 million m^3 were consumed by the national forest industry.
- Strictly based on the volume of logs produced and fed to the forest industries, the forest industry of Malaysia is obviously the largest in terms of production capacity compared to Papua New Guinea, Guyana and Myanmar. At the current rate of forest utilization, what is needed most by Malaysia is not capacity expansion but to strengthen competitiveness of its forest industry through improved processing efficiency and product quality, innovative product development as well as effective marketing strategies.
- On the other hand, Papua New Guinea, Guyana and Myanmar appear to have ample opportunity to considerably expand capacity of their respective forest industries as logs are still abundant and untapped. In expanding the capacity, however, wise and efficient utilization of the "abundant" logs is imperative in view of sustaining the forest resources and industries. Experience has shown that unwise and inefficient utilization of once abundant logs by a few tropical countries has led to dwindling supply of natural logs and shrinking production capacity of the forest industries at much earlier time than originally expected.

Land, capital and labor are the essential inputs to produce any desired output. To produce any desired wood products, any forest industry requires land, capital and labor. In terms of "land", or logs raw material, all four countries appear to have no problem with it; while Malaysia has almost reached the limit of sustainable level of production, the other three countries namely Papua new Guinea, Guyana and Myanmar have abundant logs untapped in the forests and these countries are currently striving to increase the rate of utilization of their respective forest resources. However, it is critical to safeguard the abundant forest resources in the-long run in order to sustain the forest industries and their benefits to society, to avoid a situation of "surprising running out of logs" at one point time in the future like that already experienced by a few tropical countries. This can only be realized through control of realistic AAC, use of suitable and applicable technical guidelines and manuals on conduct of harvesting, tending of residual stands, and enrichment planting as well as adoption of policy that penalizes in-compliances and rewards compliances.

As regards the capital needed by the forest industry in particular country, its investment level is dependent on many forces. One of the most critical forces is business environment that is largely shaped by effected policies at the different levels of government. The nature of business environment may attract investors to bring in needed capital to the forest industry; unfavorable business environment is not attractive for potential investors.

Labor is another essential factor of production in terms of technical and managerial skills. Operational efficiency of a forest industry is determined, to a larger extent, by availability and suitability of logs raw material, appropriateness of processing technologies in use and skillfulness of the “labor” that operate the technologies. Given quantity and characteristics of logs to be processed with installed technologies, quantity and quality of processed products will be mostly dependent on the “labor” involved in operating the technologies.

The primary concern of Activity 41 is skillfulness of labor focusing on their technical skills; it also paid attention to managerial skills, understanding on and commitment to efficiency and quality, and mentality of work in all the host countries regardless of the size of the forest industries and their stage of development.

Performance of a national forest industry is very much dependent on the performance of its individual constituents. The larger the number of processing mills that perform efficiently, the better is the performance of the national forest industry in terms of profitability and competitiveness. At the mill level, performance is very much dependent on processing efficiency and product quality whose level is largely determined by skillfulness of the “labor” involved in wood processing and mill management. It is therefore plausible to conduct training directly at the mill sites in the form of in-house training as designed under Activity 41.

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4. Results of the in-house training

In total, sixteen wood processing mills were involved in the in-house training on wood processing comprising five sawmills (two in Papua New Guinea and three in Guyana), three plymills (one each in Papua New Guinea, Myanmar and Malaysia) and eight woodworking and furniture mills (two in Guyana, two in Myanmar and four in Malaysia).

Overall results of the in-house training are presented below by group of process chains. The weaknesses observed for instance are not identified with name of the mill (s) committed with the weaknesses. The main purpose of implementing Activity 41 is to assess replicability and applicability of in-house training format in ITTO member countries, using the lessons learned from Indonesia where in-house training format was successfully implemented. Therefore, no attempt was made to compare level of wood processing efficiency across the host mills nor between the host countries. Accordingly, it was thought more meaningful and fair to present results of the training by type of product lines, group of activities or value-adding chains. The sections that follow present general results of the in-house training.

4.1 Logs handling at logyard

Weaknesses observed

xi. Logs were stacked in open area without shading or cover
xii. Logs were piled directly on earth without using tiles or concrete
xiii. Cracked or split logs were not attended using S-hook, end-coating was not common
xiv. Logs were left with inadequate treatments for prevention of quality down-grading
xv. Many logs were dirty when loaded to log carriage for sawing

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Photos 13-15 : logs piled directly on muddy earth without cover (13); dirty logs loaded for sawing (14); cracked log without S-hook application (15)

Recommended/demonstrated action

In order to prevent quality down-grading of logs at logyard**:**

i. Logs must be protected from direct exposure to rain and radiation by applying appropriate cover on top of logs pile
ii. Logs shall not be stacked in direct contact with earth but on top of wooden or concrete tiles
iii. To prevent propagation of cracks, S-hook must be applied to cracked logs
iv. To minimize cracking or splitting, logs need to be watered frequently; apply end-coating using appropriate substance
v. Prior to loading logs to carriage, logs must be washed with water to ensure cleanliness and minimize damage of band saw due to solid materials such as sands and to avoid attack of pest and disease, logs need to be attended by periodic fumigation.

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(18)

Photos 16-18 **:** logs are watered to preserve moisture (16)**;** cracked log attended with S-Hook (17)**;** logs pile with cover to minimize cracking (18)

1.1 Sawmilling

1.1.1 Log carriage

Weaknesses observed

- Improper setting, operation and maintenance of log carrier resulted in uncontrolled dimension of sawn timber. e.g. collapsed rail foundation, poor lubrication of bearings, dirty rail, etc.

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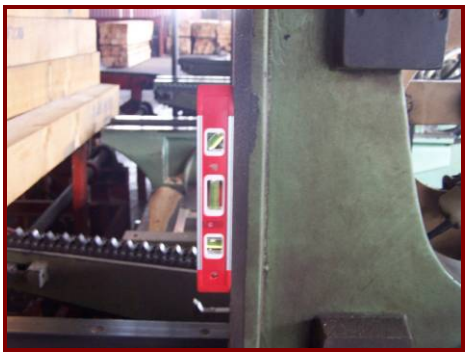
(21)

(22)

Photos 19-22 **:** broken rail (19); dirty rail (20)**;** poor maintenance of log carriage (21)**;** poor greasing of bearing (22).

Recommended/demonstrated action

- In order to ensure proper sawing of logs:
  - A log carriage must travel in a straight line and in a single plane thus the tracks must be straight, parallel to each other and level with each other, the wheels of carriage must be mounted on a dead axle with antifriction bearings; and
  - The log carrier must be routinely cleaned of sawdust pitch and other debris and the bearings greased with high temperature grease



(23)

(24)

Photos 23-24 **:** proper setting of band saw and fork (23); carriage wheels equipped with sawdust scraper (24)

(25)

Photos 25 **:** straight and level rail

1.1.1 Breakdown and pony sawing

Weaknesses observed

i. Improper setting of fly band wheels, band saw blades, tables and stoppers
ii. Uncommon use of laser marker or back mirror in sawing operation
iii. Inappropriate cooling system
iv. Inadequate maintenance

(26) (27)

Photos 26-27 **:** poor greasing of bearing (26); improper position of break down sawing (27)

(28) (29)

Photos 28-29 **:** improper setting of band saw on wheel (28); band saw is not perpendicular with fork (29).

Recommended/demonstrated action

i. Proper setting of band wheels, band saw blades, tables and stoppers**:**

- The lower band wheel must be vertical and at the right angles to the feed direction; the upper wheel must be mounted vertically and in the same plane as the lower wheel
- The lower and upper wheels must be adjusted until the lines touch both wheels at all the points (1-2-3-4 and 5-6-7-8 in Figure 1)

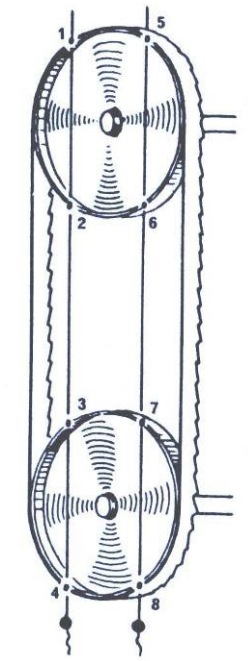


Figure 1**:** Setting up lower and upper band wheels

- The lower band wheel shaft must be parallel to the guide rail and perfectly level; the upper wheel shaft must be parallel to the lower wheel shaft
- The band wheels must be plumb at the front edges and on the faces next to the log carriage and the knees on the carriage must be in line with the saw
- The skids on the carriage bed must be square with the saw and the knees while the slack must be taken out of knee drive
- Wheel scrapers must be installed to prevent the build-up of sawdust and pitch; better use a wooden scraper in order not to wear the wheels excessively

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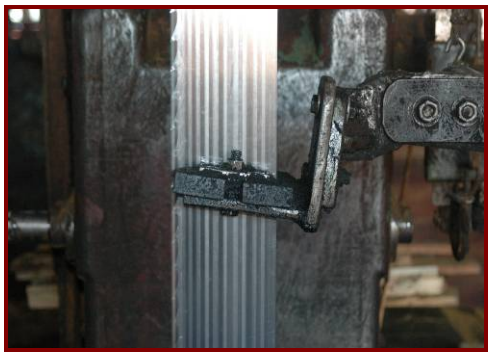
(31)

Photos 30-31 **:** proper placing of band saw on wheel (30); sawing operation aided by mirror (31)



(32) (33)

Photos 32-33 : use of sawdust scrapper

ii. To assist in proper and efficient sawing, the operator must make use of available tool either laser marker or mirror, not just rely on intuition or feeling especially by in–experienced operators.

iii. Use a mixture of water and detergent in proportion of 5 liters and 5 grams, respectively as the coolant for band saw for hard-texture wood; for band saw of soft-texture wood use mixture of water (20 liters), solar (0,25 liters) and detergent (5 grams); or else, use cooling liquid called “cutting oil” which is recently available in many markets

iv. The bearing system must be regularly greased using the right quality of grease that can bear temperature up to 260 $^{\circ}$C or above

(34) (35)

Photos 34-35 : bearing is greased using the right grease type

1.2 Plymilling

Weaknesses observed

vii. Many knives were rough, dull or damaged thus required grinding for their sharpening
viii. Improper log bucking resulted in wood wastage
ix. The rotary machines in use are old fashioned
x. Improper setting of knives on rotary machine
xi. Hydraulic leakage on cold press
xii. Inadequate boiling of logs
xiii. Improper stacking of veneer sheet

Photos 36 **:** use of old fashioned rotary resulting in large cores

(37) (38)

Photos 37-38 **:** use of dull or damaged knives causing veneer to tear (37); unmacthed speed of peeling and veneer rolling (38)

Recommended/demonstrated action

iv. Knives must always in sharp condition at all times thus periodical sharpening is a matter of necessity

(39) (40)

Photos 39-40 **:** sharpening of dull knife (39); sharp knives bring about quality veneer (40)

v. The logs used in plywood making were cut at 2,600 mm length while the length of plywood sheets produced was 2,440 mm; to minimize wood waste, length of the allowance can be reduced by cutting logs at 2,540 mm

vi. To minimize wood waste, use spindle-less rotary machine which ensures small diameter peeling residual (core).

vii. Knives must be properly installed to the rotary machine body

- The mouth, space between knife surface and machine body, must be equal in width at the right side and left side to ensure the same thickness of the veneer produced

- The mouth must not be too narrow to allow easy out-flow of veneer sheet to be cut or trimmed
- Position of a knife must be firm to avoid shaky cut thus unequal width as well as length of veneer sheets at both sides

viii. Hydraulic oil leakage during cold pressing work must be avoided from happening through sufficient maintenance and periodic replacement of seals

ix. Logs boiling

- Logs squares must be neatly stacked and completely soaked in the boiling pond
- The upper part of logs must be provided with a weighing load to make sure that the entire logs are submerged in the boiled water
- The boiling temperature and duration must correspond to wood properties
- Use caustic soda in logs boiling

i. In stacking of veneer sheets, the size of pallet used must correspond to the size of veneer to avoid veneer damages especially at the end or side parts; do not stack too large volume of veneer as on bundle

1.3 Sawn timber conditioning/air drying

Weaknesses observed

i. Improper position of wood and use of wooden sticks

ii. Improper stacking of timber in terms of position and distance

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Photos 41-42 **:** improper stacking of timbers blocks air flow

Recommended/demonstrated actions

i. Proper timber positioning and use of sticks

- Place timber pile perpendicular to the direction of wind blow so that air circulates smoothly; circulation of air accelerates the conditioning process.
- Make sure that a conditioning site is clean either indoor or outdoor.
- Use wood sticks of different species from the timber species under treatment.
- Observe distance between the wood sticks: a too far distance will cause many timber bowed or curved or even broken (ruptured) while a too near distance will hinder air circulation thus slowing down conditioning process.
- Make sure that dimension of the sticks in use is similar to each other to prevent timber from bowing, curving, etc.

ii. In stacking of timber, the following procedures must be observed

- The supporting material or wood sticks must be of hard-texture wood having moisture content lower than that of the timber to be dried and must be free of defects
- The stickers must be painted with different colors, each color is to be used for a group of piles of the same species, dimension, etc.
- The timber to be dried should not be defective, e.g. bowed, attacked, by molds or fungi, etc.
- The timber to be dried should not contain bark or covered with sawdust, dirt or dust
- Different species of timber should not be mixed in one pile
- Begin stacking by first placing sticks at the ends of wood and towards the center of stacking layer at appropriate distance then continue upwards that at the end the sticks shall look like a vertical line

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Photos 43-45 **:** proper stacking of timber facilities smooth air flow

1.4 Kiln-drying

Weaknesses observed

i. Construction of chambers did not facilitate efficient drying process due mainly to rectangular shape of chamber, rough or damaged floor or wall that obstructed an even air flow and inappropriate clearance arrangement

ii. Inappropriate arrangement of timbers in the chamber

iii. Poor documentation of drying process

iv. Neglected calibration of electrical censors

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Photos 46-48 **:** rectangular shaped chamber (46) and leaking chambers (47-48) do not facilitate efficient wood drying

(49)

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Photos 49-52 **:** too tall stacking (49-50)**;** wrong random stacking (51); stacking without top weight causes timber to bow (52)

Recommendation/demonstration actions

i. Construction of chambers can be improved as follows**:**

- The four sided wall is best shaped in a curving fashion in order to facilitate an even and smooth air flow
- Make sure that wall and floor of a chamber are smooth or constructed of smooth material, e.g. aluminum, zinc, to facilitate a smooth air flow
- The proper sub-ceiling is the one with even surface and provided with folded part that functions to direct wind in the right direction and speed when fan is in operation
- The distance between edge of sub-ceiling and chamber should not be too wide

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Photos 53-55 **:** curve shaped chamber facilitates smooth air flow (53-54)**;** door of chamber equipped with rubber seal prevents leakage (55)

ii. In stacking timbers inside a chamber, observe the following procedures**:**

- Use wood sticks of similar thickness, e.g. 25-30 mm, of higher density and of lower moisture content than the woods to be dried and free of defects
- Paint the stickers with different colors, each color is to be used for a group of piles of the same species, dimension, etc.
- Begin stacking by placing stick first at the ends of woods towards the center of stacking layer at appropriate distance then continue upwards, that at the end all sticks shall look like a vertical line
- Different species or dimension should not be stacked in the same pile
- Distance between sub-ceiling and upper surface of pile is 50 cm, between pile and lift-right walls 50 cm and between pile and rear-front walls 50 cm
- Stack wood of the same length in a zig-zag patern; for uneven length woods, place the fixed size ones at the center and random size ones at the outer piles
- Horizontal distance between woods is around 20 mm
- Use load or spring on top of a pile to reduce bowing, curving or splitting of woods

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Photos 56-58 **:** proper stacking (56-57) and stacking using iron spring in place of top weight (58) facilitate efficient wood drying

iii. Documentation of drying process needs improving**:**

- A drying schedule for each chamber showing wood species, dimension, duration of heating up, drying process, and conditioning, initial condition as well as final conditions of wood
- Wood defects per chamber at the beginning and end of drying process must be documented to allow assessment of the drying schedule in use

iv. Calibration of electrical censors must be done periodically to ensure accuracy of function otherwise the censors may be misleading and result in technical problems

1.5 Further processing

4.6.1 Planing

Weaknesses observed

- Incorrectly positioned cutter block and planing table causing unsmooth, unproductive and wasteful planing while planing knife was easily got dull
- Use of broken or damaged knives caused the occurrence of lines on planed wood
- Many rubber rollers in use were damaged, their hardness did not meet the required standards causing the roller did not strongly press the panel and got damaged
- Use of rubber and iron rollers, brought about different pressure on simultaneous panel surface, inefficient operation and occurrence of press mark on the planed panel
- Some measuring devices were damaged and difficult to read causing the operator unable to control the pressure and speed required for different wood species as well as appearance of press mark and snapping

- Operators fed wood to the planning machine by force or intermittently rendering the machine easily got damaged and appearance of snapping on planed wood
- Sawdust and wood particles accumulated on planing machine resulting in defective planing results

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Photos 59-61 **:** damaged knives (59)**;** cutter block is not positioned higher than planing table (60); dirty machinery and equipment (61) cause snapping and roller mark to occur

Recommended/demonstrated actions

- Cutter block must be positioned firmly and higher than the planing table to ensure stability during high speed operation
- Rubber rollers must be kept in good condition and their hardness meets the required standards to stand with high speed rotation

(62)

Photo 62 **:** proper positioning of rubber and iron rollers

- Knives on cutter block must have the same height and weight, sharp at all time and suitable for the wood species to be planed

- If simultaneous use of rubber and iron rollers is needed, place the iron roller at the front and the rubber roller at the rear
- Repair or replace damaged gauging devices of feeding pressure and feeding speed without delay
- Do not force feeding wood into a planing machine nor feed the machine in intermittent fashion
- To ensure a smooth planing operation, use sawdust sucker with flexible hose to avoid accumulation of sawdust and wood particles on the planing machine which can cause snapping and roller mark to occur, fast dull of knife and fire disaster

1.5.1 Molding

Weaknesses observed

iv. Some machines were old fashioned, poorly maintained with several tools damaged

v. Inappropriate pressure on molder machine resulted in snapping; inappropriate feeding speed brought about cutter marks; position of roller and machine table was inappropriate that the roller did not function well

vi. Panel was forcedly-fed or intermittently fed into machine causing damage to the machine and occurrence of snapping on the panel

vii. Poor maintenance as evidenced by damaged roller, dull knife, lack of greasing and absence of rubber roller on machine molding spindle

viii. Low capacity of ducting system resulted in accumulated sawdust

ix. There was a lack of attention to molding pressure, feeding speed, molding techniques and product assembling; some feeding-pressure and feeding-speed gauges were damaged and difficult to read causing problem on control of press mark and snapping.

x. The height of molding knife blade was unequal, blade was dull or damaged, machine shuddered during grooving process and resulted in tounge break or rupture and occurrence of broken joints, and size of male and female molding knives were inaccurate causing difficulty in jointing or assembling

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Photos 63-65 **:** poor maintenance of machine causes snapping and press mark (63-64)**;** dirty iron roller causes irregular rotation and snapping (65)

Recommended/demonstrated actions

i. It is strongly advisable to replace old fashioned machines to facilitate higher productivity and better quality of products

ii. Use molding machine pressure of 2 kg/cm^2; feeding speed of 14 m/minute; and adjust the roller position to 0.2 mm higher than the machine table

iii. Do not force to feed a panel into the machine; panels shall be fed into the machine in a continuous manner

iv. Molding machine and related tools and facilities must receive due attention to routine maintenance while knives must be replaced on time, without delay.

v. For normal molding machine use ducting capacity of 28 m/sec and for high speed machine use capacity of 30 - 32 m/sec

vi. Damaged gauging devices must be replaced immediately to ease control of molding process

vii. Adjust height of molding knife and do not use dull or damaged knives to avoid hairy products

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Photos 66-67 : checking of rubber roller hardness using hardness tester (66); iron roller is correctly positioned higher than table (67)

1.5.2 Gluing

Weaknesses observed

i. Use of glue and hardener

The mixing of glue and hardener was done manually during the gluing process resulted in unevenly mixed hardener, different drying time, weak and easily loose gluing bond and excessive consumption of hardener.

ii. Polishing of glue using spreader and brush:

- Use of damaged tube/container of glue spreader caused uneven spread of glue on the panel, thickened glue at damaged spots and wasted a lot of glue
- Use of a brush caused excessive consumption of glue and unevenly spread of glue due mainly to the horizontally positioned panel, inappropriate brush construction and excessive dipping of brush into glue

iii. Hand glue spreader

Too much use of glue brought about the situation where the outer part of the glue would dry but the inner part remained wet resulting in weakened glue strength and problem with planing as well as sanding works.

i. Position of cold press was not flat and caused uneven spread and unnecessarily high consumption of glue and use of incorrect type of hand roller.

ii. Glue and hardener were not properly stored

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Photos 68-71 **:** excessive or too thick application of glue on machine and manual spreaders (68-70) and dirty glue spreader (71) cause inefficient use of glue

Recommended/demonstrated actions

i. Use of glue and hardener
   - Manual mixing of glue and hardener must be completed before the gluing process to ensure a perfectly mixed solution and efficient consumption of glue

ii. Polishing of glue
   - The tube of glue spreader must always be in good condition, clean and not damaged
   - To efficiently use glue, position the panel to be glued vertically and polish only 2/3 of the surface area by adjusting the tube position
   - Use a suitable form of brush with plastic hair to facilitate evenly and thinly spread of glue

iii. Hand glue spreader
   - Use a hand roller commonly used in house wall painting to ensure easy and even spread of glue without excessive dipping of roller

iv. Position of cold press must be flat and use the merchant-type hand roller to evenly spread glue on the entire panel surface

v. Store glue and hardener in a cool place to avoid drying process

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Photos 72-75 **:** glue spreader equipped with scraper (72); clean and well maintained glue spreaders (73-74); proper storage of hardener (75)

1.5.3 Sanding

Sanding signifies the latest process of wood processing in order the product surface is as smooth as possible

Weaknesses observed

i. Pressure-measuring gauge was damaged thus less useful for controlling the steady level of pressure and resulted in low quality of work
ii. Conveyor was covered by a lot of glue causing unequal height of panel at the conveyor thus uneven sanding results
iii. Damaged, rusty or passing roller tore the sanding paper resulting in in-efficient use of sand paper
iv. Improper position of illumination lamp
v. Improper storage of sand paper caused sandpaper easily damaged or torn apart

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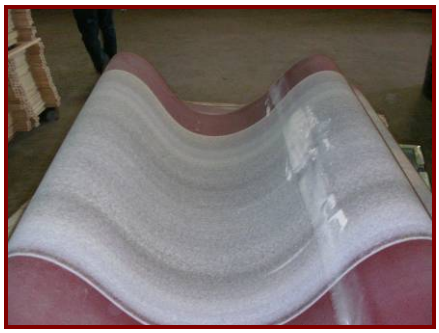

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Photos 76-79 **:** dirty roller sand paper (76)**;** improper placing of illumination lamp (77)**;** improper storage of sand paper (78); dirty sanding paper causes inefficient sanding (79)

Recommended/demonstrated actions

i. Repair or replace damaged pressure gauge to facilitate control of the essentially needed steady pressure
ii. Make sure that conveyor is free of glue
iii. Repair or replace damaged sanding-paper roller and passing roller to facilitate efficient use of sandpaper
iv. Position of an operator should be in the opposite direction to that of the illumination lamp noting that the lamp ray does not directly hit the operator's eyes
v. Prepare a hanging cupboard for storing and paper which must be kept closed and equipped with a 150 watt lamp to keep suitable level of humidity

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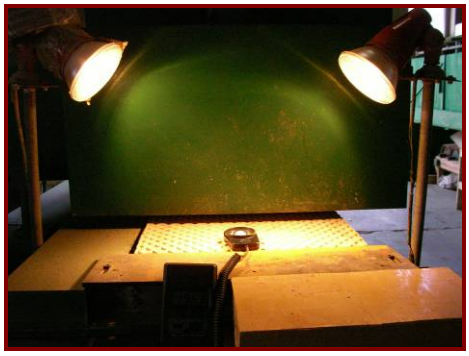

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Photos 80-83 **:** proper positioning of illumination lamps (80-82); proper storage of sand paper (83)

1.1 Saw doctoring

4.7.1 Saw doctoring room

Weaknesses observed

v. Rooms were dirty, dusty and dimmed

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(86) (87)

Photos 84-87 **:** dirty, messy, sloppy saw doctoring rooms

vi. Untidy storage of saw doctoring equipment and tools
vii. Unorganized placing of knives
viii. Missing or incomplete equipment and tools for adequate saw doctoring

Recommended/demonstrated actions

a. Make sure that saw doctoring room is clean at any time and is well illuminated at around 250 lux
b. Store equipment and tools neatly in a special spot to ease caring and locating
c. Knives must be stored in a specific site and placed in accordance with knife type
d. Make sure that any equipment and tools that are essential for performing adequate saw doctoring are available


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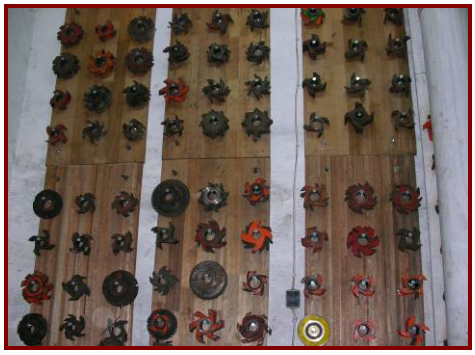


(90) (91)

Photos 88-91 **:** clean and spacious saw doctoring room (88); neat storage of band saws (89); and knives (90); well organized placing of tools and equipment (91)

1.1.1 Maintenance of band saw blades (tensioning, leveling)

Weaknesses observed

i. Inadequate tensioning of band saw blades due mainly to lack of equipment and tools and weak technical skills

ii. Improper leveling procedures due mainly due to lack of technical skills and inappropriate equipment and tools

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Photos 92-94 **:** poorly maintained stretching machine (92)**;** mis-placing of illumination lamp (93)**;** position of leveling table checked with water pass (94)

Recommended/demonstrated actions

i. Proper tensioning of band saw blades

- Blades wider than 60 mm need tensioning to offset the lengthening of the toothed edge caused by punching and later by heating when cutting wood; and to position the blades properly on the band saw wheels during operation. Tensioning procedures are as follows**:**
  - Run a blade through the stretching machine a number of time based on the width of the saw following a definite pattern and marking the blade with the pass number; the distance between passes varies with the blade width and is usually 10 to 20 mm
  - A band saw is to be tensioned in accordance with**:**
    - Width of the blade**:** wide blade needs more tension than a narrow one
    - Thickness of the blade**:** thin blades need more tension than thick
    - Diameter of the wheel**:** wide-wheel requires more tension than narrow
    - Crown on the wheel face**:** the greater the crown the greater the tension need

ii. Proper leveling of band saw blades

- After tensioning a band saw, it must be leveled because it may be out of level either in the lengthwise direction or in the crosswise direction**:**

- Locate local lumps, ridges or dents by laying the saw on the bench in the level position and checking with a straightedge held in a perpendicular position
- Move the straightedge back and forth and at various angles to the edge of the blade
- Accurately mark with chalk or crayon the location and direction of located lumps and ridges

- Remove lumps and ridges through hammering as follows**:**
  - Use a 1.1 and 1.4 kg of hammer with a smooth rounded surface without edges or abrupt contours that will cause dents
  - Hammer the lump just enough to remove it and level the plate without making a dent that will put a bump on the opposite site
  - Use light blows and strike the plate only where the lump is, working from the center of the lump or ridge to the defect edge
  - Constantly check the work with a straight template held perpendicularly
  - When the light shining beneath the template around the bump disappears, the hammering is completed

1.1.2 Maintenance of saw teeth

Weakness observed

i. Grinding for sharpening of saw teeth was not properly or not timely performed that many teeth were damaged; lack of dressing of grinding stone and sharpener

ii. Many gullets were to small in area

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Photos 95-98 **:** damaged sharpener needs dressing (95)**;** gullet angle measured with protactor (96)**;** grinder calibration using straight edge template (97)**;** broken tooth needs welding and sateliting (98)

Recommended/demonstrated actions

i. Proper grinding for sharpening of saw teeth**:**

- First, select the proper grinding wheel; wheel shape must fit the tooth profile; the wheel must be dressed frequently to maintain the correct shape: hard wheels require less frequent attention than soft ones; the wheel thickness should be chosen, about one-half the length of the tooth pitch;
- The bonding agent used in the wheel must be soft enough so that as the wheel gets dull the grit will break away and expose the sharp grit beneath. If the bond is too dull the grit will break away while still sharp, wasting the wheel and slowing the work; if the bond is too hard, the wheel will load up and burn the saw. Hence, a soft stone is always preferable to a hard one even though more frequent dressing of the soft stone is required and it will wear away faster;
- Run the stone not faster that the recommended speed, normally at 5,000 to 6,000 rpm surface speeds to avoid a fatal consequences. If run too slowly, the grit is broken away without doing much work; if run too fast, the saw is likely to be burned or the stone may break, which is dangerous;
- Overheating and burning of the steel during grinding is a common problem which is indicated by appearance of the saw of any tempering color at all, including barely visible light brown. This tells the operator that the grinding has been too severe which can cause several difficulties including reduced hardness of the metal causing the saw to dull faster, decreased elasticity of the saw, and overheating in the gullet at the tooth root causing brittleness and cracking. Once this condition present, it can not be corrected and the life of the saw will be shortened. Causes of overheating during grinding include a stone that is too hard, a dirty or loaded stone, a stone that is run too fast, feeding with too much pressure and too heavy a cut and must be observed in carrying out grinding work. Avoid coarse grinding, notches and scratches since these will cause cracking too. It is a good practice to deburr the gullet and remove scratches and notches especially on thin and narrow saws.

ii. The gullet is that portion of the tooth into which the chip falls and is compacted and carried. A change in tooth height, tooth width, tooth shape, or plate thickness will change the quantity of chips that can be carried. If the tooth height is too great for the pitch, the teeth will flutter, causing vibration, wide kerf, and snake.

- Recommended tooth heights are:
  - 1/3 of pitch when pitch is 50 mm or less for swaged band saws
  - ¼ of pitch when pitch is greater than 50 mm for swaged band saws
  - ¼ of pitch width for spring tooth band saws of less than 50 mm pitch, and 1/5 for those greater than 50 mm
  - ½ of pitch may be used to get greater gullet capacity for higher feed rate and deeper cuts

- Observe the standards in Annex D when performing maintenance of saw teeth for sawing different wood species

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Photos 99-100**:** dressing of sharpener (99)**;** dressing of grinder (100)

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(102)

Photos 101-102 **:** measuring temperature before satelliting (101)**;** calibration of grinder for gullet shaping (102)

1.1.3 Grinding and sharpening of knives

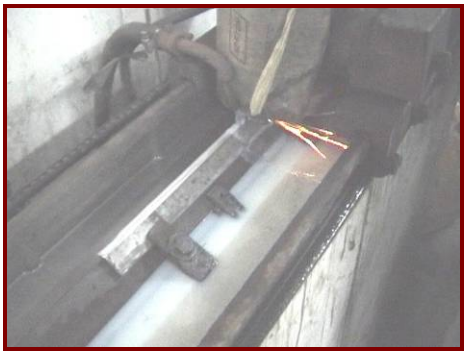
Weaknesses observed

i. Use of incorrect type of knife

ii. After grinding, a knife was not sharpened using honing stone in order to smooth black color (grains) and iron grain (burr) on the edge of knife blade and the knife became less sharp

iii. The way of sharpening knives using machine was inappropriate

iv. A knife became hot during sharpening process due to improper use of coolant



(103)

Photo 103 **:** knife sharpening without coolant causes overheating and occurrence of burr

Recommended/demonstrated actions

i. Selection of knives

- Select the right type of knives to use: HSS knives for soft-texture wood and TCT knives for hard-texture wood
- In their use, the blade angle of knife also differs: for HSS knives, use angle 41°-42° while for TCT knives use blade angle of 45°
- Use protactor to accurately measure a knife-blade angle
- Better use double-bevel knives for hard-texture wood because they are stronger, sharper and lasting longer compared to single-bevel knives
- Blade of knife with double-bevel has two angles with lower sloping and the sharpening is to be done with hand sharpener stone

ii. Sharpening a knife after grinding

- Sharpen a knife with hand-held honing stone as follows:

- The sharpening tool is turned in clock wise direction with at least three replications at the knife blade beginning with the rough sharpening stone until finally the very smooth stone
- The back part of knife is also sharpened in the same way as that of knife blade
- Already dull or broken off knife should be leveled out at its blade surface prior to sharpening
- A broken off knife with the depth over 5 mm is better not used any longer

iii. In sharpening a knife using machine, pay attention to the surface of sharpening stone: it should be even or leveled out, not concave nor convex
- If the stone surface is not even, it should be dressed with a dressing stone
- Rotating direction of a honing stone should be clockwise or in up-cutting direction

iv. Use of coolant
- A heated knife during sharpening must be cooled using the right cooling agent; proper use of coolant in terms of proportion and condition will avoid overheating of the knife
- Use coolant that contains chemical and water with proportion of coolant and water at 25:100. Example of such coolant is the so called “kurecut”
- Pay attention to the coolant condition: when the coolant becomes white in color and turbid, it is already expired; conversely, when the coolant is still green in color, it is still worth using

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Photos 104-107 : knife sharpening with coolant (104); measuring angle of a knife using protactor (105); honing and sharpening of a double-bevel knife (106); sharpening of knife to eliminate burr (107)

1.1.4 Installing satellite

Weaknesses observed

i. Improper installment of satellite causing shaky cutting

ii. Welding temperature was determined artificially causing low welding work quality

(108) (109)

Photos 108-109 **:** incorrect positioning of saw blades in satelliting process

Recommended/demonstrated actions

i. Install satellite properly in the following manner:
   - The technician installing a satellite must be in a sitting position to avoid shaking of the saw blade
   - After reaching the right temperature level, install satellite using blue flame color with the proportion of 3 red-color flame and 1 blue-color flame
   - After the satellite welding, the saw tooth must undergo grinding and sharpening on the foremost front part of the saw tooth using grindstone wheel; the edge part is to be sharpened using double-side sharpener

ii. Welding temperature
   - Use 450 °C temperature for welding: when the temperature is less, the satellite will be easily loose and fall-off the tooth while when it is greater the tooth will be easily damaged
   - The right temperature is reached when the crayon scratched at the tip of saw tooth to be welded melts under torch red-color flame

(110) (111)

Photos 110-111 **:** identifying the right flame for welding (110); installing satellite using blue and red color flame (111)

1.1.5 Grinding stone wheels

Weaknesses observed

i. Scratchy and craggy grinding wheels affected badly the shape and size of gullet resulting in unequal height of saw teeth, less sharpness and easily broken off

ii. Improper angle of grindstone wheel brought about unequal height as well as width of saw teeth as evidenced by the color of grinding stone surface: white color indicates that the surface of double-side sharpener does not touch the saw teeth while the part that touches it reveals black

color; improper setting of grindstone wheel caused the tallest saw teeth easily broken off or ruptured, during sawing operation the band saw vibrates causing irregular size and saw marks on the surface of sawn products

iii. Mis-positioned of illumination lamp

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Photos 112-113 **:** damaged diamond wheel (112) causes damage on circular saw teeth (113)

Recommended/demonstration actions

i. A grindstone wheel must undergo regular dressing using dressing stone in order to avoid scratchy, craggy, round-shaped and rough surface

ii. A grind stone wheel must be installed at the right angle; use double-side sharpener for grinding and sharpening of the edge part of saw tooth to help shape the left-right sides and upper side of saw tooth. The width of saw tooth on left and right sides should be less than half the width of band saw blade which can be achieved by regulating the angle of grindstone wheel at the double-side sharpener

iii. Place illumination lamp properly for acquiring appropriate light that is crucial for the control of the double-side sharpener operation

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Photos 114-116 **:** plate of diamond wheel must be level (114)**;** dressing of diamond wheel (115)**;** lapping of diamond wheel with diamond powder (116)

4.7.7 Maintenance and storage of band saws and circular saws

Weaknesses observed

i. Lack of attention to maintenance and storage of band saw may shorten service life time due to twisting, stretching, elongating, and rusty among others

ii. Surfaces of circular saws were cleaned using strong NaOH which damaged the protecting metal thereby accelerating rust and triggering hole-shaping on the saw surface

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Photos 117-120 **:** dirty, rusty circular saw may cause burn mark (117)**;** overheating causes twisted circular saw (118)**;** improper storage of band saws (119-120)

Recommended/demonstration actions

i. Store band saws in dry and clean place

- To avoid twisting, a band saw must be stored like a belt or ribbon and its center part is weighted with a weighting load
- To avoid elongation and rust, a band saw must be hung, but a support is provided at its base; hung band saws must not be touching one another
- To avoid rust more effectively, lubricate surface of band saw with oil or grease before hanging
- Similarly, lubricate knives with grease or oil, covered with oily paper or other paper before placing them neatly on a special shelf not in contact with each other

ii. To clean surface of a circular saw, use kerosene, “pay-off” solution, or “larzip-15” solution

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Photos 121-124 **:** proper storage of circular saws and cutter blocks (121-122), band saws (123), knives and circular saws (124)

1.2 Packaging

Packaging signifies the early step to get buyers interested in buying the products made by a mill for sale. Packaging implies securing wood products from its origin or mill storage room till they reach its destination, the buyers. The tools and materials that needed for packaging include, among others, pallet, bundle clamp, steel or plastic binder, trolley, label, paper or plastic sheets to cover and protect the product from any damage during storage and transportation.

Common weaknesses observed

- Some mills used low quality pallet in terms of strength and performance which might not fully protect the products during loading, transport and unloading; improper packaging occurred rendering the products easily damaged prior to reaching destination and consequently subject to rejection by buyers; and
- Unattractive appearance of the package makes a product less eye-catching to potential buyers.

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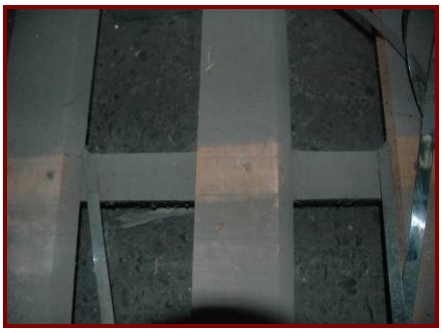

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Photos 125-128 **:** use of cheap materials in packaging (125)**;** use of low quality wrapping materials (126)**;** use of dirty and breakable pallet (127)**;** unattractive and sloppy package (128)

Recommended/demonstrated actions

- Use performance, strength, safety and material cost as the primary criteria in designing and constructing packages
- To the extent possible, appearances of any product packages should be eye-catching to potential buyers

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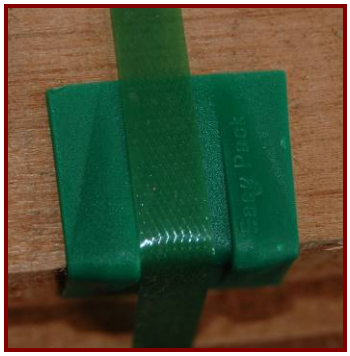

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Photos 129-133 **:** quality and attractive packages of products (129-132); quality and clean pallet (133)

1.3 Mill management

Weaknesses observed

i. Weak inventory management

- Some mills held large quantity of products which resulted in considerable financial burden and entailed high risk in case of fire

- Products were stacked improperly with insufficient labeling and protection and resulted in quality downgrade

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Photos 134 **:** holding big volume of inventory is expensive and risky

ii. Weak quality control

- Some mill managers, supervisors and operators lacked of attention to the critical role quality plays in determining product unit price as evidenced by the rare posting of quality control procedures at individual process chain sites

iii. Wood waste utilization

- Volume of wood waste was appreciable but few mills had the initiative in utilizing

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Photos 135-136 **:** lack of initiative to utilize wood waste

iv. Safety and work condition

- Operators did not put on necessary uniform, safety shoes, etc.
- Ripsaw machine was in operation without protection
- Mill floor was dirty with poor lightning and less organized arrangements of wood products

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Photos 137-138 **:** poor work safety in sawing operation and sawdoctoring room

v. Human resource

- Mentality of work and work attitude of employees appeared to be inappropriate to support efficient mill operation due mainly to weak motivation and lack of commitment
- Supervision at mill level appeared to be weak

vi. Inadequate accounting of wood processing

- Data on wood process inputs and outputs were not well documented that exact wood recovery was rarely known

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Photos 139 **:** dirty mill floor is unhealthy work environment

Recommended/demonstration action

ii. Inventory management:

- Processed products must be stacked neatly on top of supporting tiles
- Individual products must be appropriately labeled to show species, name, dimension, grade, origin and destination
- Products must be protected from any damages by applying cover, fumigation or EMC control

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Photos 140 **:** proper labelling of products by indicating product name, species, dimension and grade

iii. Quality control:

- Apply TQM system to guide mill operation; use of control card as a tool for controlling performance of operators is strongly advisable
- Executives must take the initiative to routinely discuss with mill managers and supervisors on the critical role processing efficiency and product quality play in competitiveness and business and survival

iv. Wood waste utilization

- To the extent possible, volume of wood waste must be minimized; at the same time, it is critical to wisely utilize existing waste for making valuable such products as finger joints, laminating board and packaging material
- Wood waste is best stored in an open box and placed at mill entrance that any one can see and comment on its presence

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Photos 141 **:** placing waste box at strategic spot helps picturing levels of processing efficiency and waste utilization

v. Safety and work condition

- Operators and helpers are to be strictly required to observe work safety procedures; particular machines such as ripsaws must operate with special protection
- Mill floor must be kept clean at all times and free of messy placing of materials or products

vi. Human resource development

- Mentality and attitude of work should be improved through planned, frequent gathering and organized, healthy communication
- Provide opportunity for directly discussing new ideas, initiatives and any problems

vii. Accounting of wood processing

- Data on inputs and outputs of wood process must be documented at all times in an accurate manner
- Availability of reliable data on inputs and outputs of the process facilitates assessment of process efficiency level and aids decision making

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5. Discussions

5.1 Weaknesses observed vs opportunities ahead

The weaknesses observed and summarized in the preceding chapter are sources of in-efficiency thus clearly indicate that the mills hosting the training are committed to in-efficient operation though at different levels. One mill was found weak in log handling, another mill was weak in breakdown sawing, yet another mill was weak in kiln-drying. In fact, none of the host mills has exhibited satisfactory level on efficiency of operation.

The weaknesses observed clearly tell the training participants that there are plenty of technical and managerial irregularities that are occurring and requiring fixing up. What is critical is that the participants need to fully comprehend the consequences of such weaknesses and irregularities; that the weaknesses directly affect cost of production, level of competitiveness and thus business survival. This comprehension amongst executives and employees is the strongest motivating force to take action for overcoming the weaknesses and fixing up irregularities in wood processing operation. To this end, it is strongly advisable that executives and employees of the host mills together take concerted follow-up actions to the in-house training which should include**:**

- To further learn and discuss on the weaknesses and irregularities observed during the training;
- To elaborate main causes and business consequences of these weaknesses for purpose of comprehension;
- To identify needed and applicable measures and actions to overcome the weaknesses;
- To develop a short-run processing efficiency development plan showing who is responsible for doing what measure or action and when; and
- To prepare an internal monitoring plan for assessment of progress in implementation of the efficiency development plan.

Surely, role of the executives is critical for the aforementioned follow-up actions to happen. This is especially true when re-tooling or re-hiring that requires capital investment is urgently needed. Moreover, strong leadership is indispensable for bringing together all the employees of different levels to actively take part in the endeavor. Readiness and willingness of the executives and employees to take concerted actions on fixing up irregularities in the conduct of wood processing are prerequisite to moving forward to improving performance. Beneath the weaknesses observed during the in-house training, in fact, lies opportunities ahead for improving efficiency level of operation, as a matter of collective action and business survival.

5.1 Response to conduct of the in-house training by the participants

Response of the participants to the conduct of the training is critical for assessing applicability of the in-house training model. This response was obtained from selected participants of individual training sessions by asking them to fill out an evaluation sheet at the conclusion of the sessions. The respondents include mill executives, general managers, managers, supervisors and operators of the various processing chains totaling thirty-seven in number. The response given by the participants are summarized in Table 1.

The information in Table 1 reveals that**:**

- Majority of the respondents agreed and strongly agreed with the parameters of the in-house training;
- Majority of the respondents rated quality of the in-house training as good or excellent.

In addition to the information in Table 1, comments of the participants were also received during individual discussions held during the course of or at the completion of individual training sessions which can be summarized as follows**:**

- Expertise of the Consultant is excellent;
- Conduct of such training will support SFM;
- Useful and fruitful training but needs longer time for discussion and comprehension of the problems and solutions;
- Provides opportunity to share knowledge on wood processing technologies amongst the private and government sectors and amongst executives and employees;
- Such training should be continued with the necessary adjustments;
- Such training should provide immediate effects on performance by practicing the advices given by the Consultant;
- A series of training are needed to allow assessment of progress made in performance;
- Extending duration of the training to 3 or 4 days per mill is strongly advisable;
- Larger number of mills should implement in-house training;
- The in-house training provides ample opportunity for participants to understand causes and consequences of in-efficient wood processing;
- Needs more technical advice on saw doctoring and maintenance of machinery; and
- Needs longer time to allow discussion on process lay-out, understanding on machine operation and digestion of the advices given by the Consultant.

Table 1. Number of participants (%) voting to agree or disagree with various parameters of the in-house training

No.	Element	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1.	Training met expectation	35.1	59.5	5.4	-	-
2.	Able to apply learned knowledge	24.3	70.3	5.4	-	-
3.	Training objective identified and followed by topic	16.2	78.4	2.7	-	2.7
4.	The methods applied were acceptable and easy to follow	27.0	54.5	13.5	-	-
5.	The trainer was knowledgeable	62.2	37.8	-	-	-
6.	Quality of the instruction was good	29.7	62.2	8.1	-	-
7.	The trainer met the training objectives	40.5	54.1	5.4	-	-
8.	Participation and interaction were encouraged	21.6	75.7	2.7	-	-
9.	Adequate time provided for question and discussion	8.1	64.9	27.0	-	-
Average		29.4	62.5	7.8		0.3
10.	Overall quality of the training: Excellent Good Average Poor Very poor Total	 27.0 62.2 10.8 - - 100.0				

Above information clearly acknowledge usefulness of in-house training in technology transfer, effectiveness of such training in enhancing processing capacity within a relatively short-time duration and the opportunity the training offers to the participants for mingling, interacting and working together.

The forest authorities, host mills and participants in all four host countries strongly recommended implementation of in-house training. To increase its effectiveness in achieving the intended training objectives, it is desirable to make some modifications as follows**:**

- To extend duration of visit to one mill to 3 - 5 days, depending on scale of operation and product lines;
- To conduct a series of training periodically to allow assessment of progress made in performance;
- To strongly encourage owners and executives to take part in order to ease follow-up decision making and better motivate employees in learning; and
- To establish composite index of performance prior to implementing a training taking the various elements of wood processing into account to allow objectively compare performance over time

5.2 Achievements of Activity 41 piloting

The piloting of Activity 41 at sixteen wood processing mills in four ITTO member countries was attended by executives, managers, supervisors and operators of the mills. The attendants were actively involved in the in-house training programmes and observed themselves the various weaknesses and irregularities taking place at different value-adding processes spotted by the Consultant. The causes of each weakness or irregularity was shown and elucidated; aside from causes, consequences of each of the weakness or irregularity were also clarified and brought to light. For instance, it was made clear by the Consultant that the uncontrollable dimension of sawn-timber was caused mainly by the improper setting of band saw wheels and blades which had resulted in in-efficiency brought about by the need for re-sawing and lower wood recovery then otherwise thus higher than necessary unit production cost.

There is no doubt that the participants of the training have gained awareness and understanding on the importance of improving wood processing efficiency, the first expected output. This gain in awareness and understanding was confirmed by the responses of the participants at the end of individual training sessions. It was unfortunate that none of the owners was seen taking part in the training sessions. Considering the strategic role the owners and executives play in needed follow-up actions, especially when the action requires additional investment, it is strongly advisable that they take part in similar future in-house trainings. Beside, attendance of owners and executives should motivate other participants to learn harder about processing efficiency for simple reason that “bosses are also here with us learning”.

The second expected output of Activity 41 piloting is improved knowledge, skills and work mentality of forest industry operators. This output is, without any doubt, has been achieved. Operators of individual value-adding processes fully followed and listened to the Consultant during the course of the training. In fact, what happened was that an operator did not only learn the correct operating procedures and techniques for his own value-adding process but also, to some degree, other processes. In this way the operators were able to improve and broaden knowledge and skills including understanding on interdependence between value-adding chains in the making of final wood product. The operators were also exposed to the cause-effect relationship of an improper conduct of wood processing which can be expected to change their work attitude from less cost sensitive to efficiency-quality oriented operators, though at its initiatory stage.

As regards the third expected output “validated applicability of in-house training format in other ITTO member countries”, it has been achieved and confirmed in the preceding chapter. As all three expected outputs have been delivered, it is reasonable to conclude at this juncture that the primary purpose of piloting Activity 41 has been fully achieved.

5.3 Expected immediate effects of in-house training

As has been touched upon elsewhere, the Consultant and participants are working together on the spot in locating process weaknesses and process irregularities, in identifying causes and consequences, in demonstrating and learning of relevant procedures and techniques for trouble shooting. In the process, several immediate effects can be expected to materialize including improved skills of the participants, deep understanding amongst participants on the weaknesses of wood

processing operation as well as their causes and consequences and enhanced capability of overcoming weaknesses consistent with the action recommended or demonstrated by the Consultant, and changing attitude and mentality of employees.

Short-run economic gains can also be expected from the in-house training provided that the advices of the Consultant are consistently implemented by concerned managers, supervisors and operators. Many wood processors in Indonesia had experienced such economic gains which took various forms including increased wood recovery, reduced lumber defects, decreased production cost, shortened product flow time and reduced wood waste which all translated to significantly lower production cost, stronger competitiveness and higher profitability. Indeed, the short-run economic gains have served as the strong incentive for Indonesian processors to continue practicing the technical as well as managerial skills they once learned from the expert of the in-house training. In itself, the economic gains are indeed sustaining the efforts of the processors in improving efficiency of wood processing using internal resources.

5.4 Future strategy for implementation of in-house training

Individual mills should strive, as owned initiative, to organize future in-house training using their own resources without having to rely on external resources. For reason of short-run as well as long-run economic gains, the wood industries in ITTO member countries should struggle to implement in-house training on wood processing in view of improving level of efficiency and product quality by taking the necessary steps as follows**:**

- Make sure that executives, managers, supervisors, and operators recognize and understand the role of processing efficiency and product quality in building up competitiveness;
- Hire an experienced expert or team of experts to assess current level of performance by carefully looking at existing weaknesses and irregularities of processing operations;
- Conduct a series of in-house training in appropriate time interval and consistently practice the advices given by the expert (s) during the first and subsequent training sessions; and
- The cost of experts involved in the in-house training can be borne by the host mill as component of training for management cost.

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6. Conclusions and Recommendations

After piloting Activity No. 41 of the ITTO Biennial Work Programme for the years 2010-2011 titled “Strengthening the capacity to promote efficient wood processing technologies in tropical timber producing countries” at sixteen wood processing mills of different product lines and scales of operation located in four ITTO member countries namely Papua New Guinea, Guyana, Myanmar and Malaysia, following are the conclusions drawn and recommendations made as regards applicability of in-house training mode.

1.1 Conclusions

i. The advantages of in-house training mode over the conventional training format i.e. class room lecturing plus field visit and demonstration, as claimed by completed ITTO project in Indonesia, PD 286/04 Rev. 1 (I), were observed, which include**:**

- Class lecturing, while undertaken, was used to debrief participants in the objective and scope of the training thus consumed only a meager time resource;
- Large number of participants, ranging from the executives to managers, supervisors, operators and general employees, averaging no less than twenty persons, was accommodated in every single training sessions practically without additional cost to the host mills;
- Identification of technical as well as managerial problems and discussions on causes, consequences of the problems as well as the recipes for problem solving could be undertaken openly and transparently without having to worry about business confidentiality;
- As technical as well as managerial problems are company specific in nature, work programme of individual training session could be easily tailored to the need of individual mills; and
- The Consultant and training participants could work together on the spot in identifying weaknesses and irregularities of wood processing operation as well as their causes and consequences and in elucidating or demonstrating needed actions to resolve or overcome the weaknesses and irregularities encountered.

ii. The format of the training and the training programme of each session were favorably responded by the participants as evidenced by the written and oral responses given by them during the course and at completion of individual sessions which can be summarized as follows:

- Majority of the participants welcomed implementation of the training under in-house training format and expected more frequent conduct of such training in the future;
- Majority of the participants positively responded to the various parameters of the training including the degree to which the training met their expectations, future applicability of the knowledge they learned, achievement of training objectives, suitability of training methodology employed, professional quality of the trainer to realize intended objective of the training, degree of participation and interaction, and availability of time for discussion; and
- Majority of participants rated quality of the training as good to excellent

iii. Concerned forest authorities also welcomed the in-house training and proposed that ITTO will consider implementing such training in the future in view of improving level of efficiency in wood processing and quality of processed wood products

iv. In essence, training on efficient wood processing techniques under in-house training format was applicable at sixteen wood factories in Papua New Guinea, Guyana, Myanmar and Malaysia; and there is no doubt on its applicability to other ITTO member countries, possibly with some adjustments to its present features in order to better suit the prevailing national environment in a particular country.

1.2 Recommendations

i. Executives of wood processing mills in ITTO member countries should strive to make efficiency and product quality as the heart of wood processing operation. To this end, the executives need to tell the employees from time to time the role efficiency and quality play in building up competitive advantage, profitability and business survival, at any periodically scheduled mingling or thronging events. In this way, less desirable work mentality and attitude of employees should also change for better over time.

ii. Building up competitiveness necessitates a company to continuously enhance capacity of its employees to work efficiently by conducting in-house training on wood processing periodically. This training should become owned initiative of the company with internal funding, without having to rely on external resources, except for competent professional on wood industry development, as associated costs can be justifiably regarded as management or operational expenditures.

iii. To improve effectiveness of in-house training, adjustments to established modalities may be needed including extension of time duration to 3 or 4 days per session, encouragement of owners and executives to take part in, time interval between successive trainings is better no more than six months, and application of a robust monitoring system to accurately keep track of progress over time.

iv. As experienced by Indonesia, the in-house training generated short-run as well as long-run economic gains to the hosting companies in various form including increased wood recovery, reduced lumber defects, decreased production cost and reduced wood waste. Such economic gains should become the driving force and strong incentive for wood processing companies in other ITTO member countries to conduct in-house training periodically and sustainably even without the initiative and assistance of ITTO.

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Annex A. List of the wood processing mills hosting the in-house training

Country/mill name	Date	Mill type	Site
5. Papua New Guinea	16-21 June 2010		
1.1 Cloudy Bay SF Ltd.	16 June 2010	Sawmill	Central Province
1.2 Wawoi Guari Timber Co. Ltd.	17 June 2010	Sawmill	Kamusie
1.3 Panakawa Veener and Plywood	18-19 June 2010	Playmill	Kamusie
6. Guyana	19-25 July 2010		
6.1 Bacchus Sawmill	20 July 2010	Sawmill	Rotterdam, East Bank Berbice
6.2 Shiva's Woodworking	21 July 2010	Woodworking, furniture	Enmore Demerara
6.3 Sukhran & Son Sawmill	22 July 2010		Hubu, East Bank Essequibo
6.4 Jetto Lumberyard & Sawmill	23 July 2010	Sawmill	Coverden, Public Road, East Bank, Demerara
6.5 Precision Woodworking	21 July 2010	Woodworking, furniture	East Bank, Demerara
7. Myanmar	16-18 August 2010		
7.1 Bacchus Sawmill	16 August 2010	Plymill	
7.2 Shiva's Woodworking	17 August 2010	Woodworking, molding	
7.3 Sukhran & Son Sawmill	18 August 2010	Woodworking	
8. Malaysia	23-28 May 2011		
8.1 Fungsi Hebat Sdn. Bhd	23 May 2011	Woodworking, furniture	Kota Kinabalu, Sabah
8.2 Manuply Wood Industry Sdn. Bhd	24 May 2011	Plymill	Bintulu, Sarawak
8.3 Kion Kok Industries Sdn. Bhd	25 May 2011	Woodworking	Kuching, Sarawak
8.4 Hasro Furniture Gallery Sdn. Bhd	26 May 2011	Woodworking	Malaka, Peninsular Malaysia
8.5 Konsortium PEKA	27 May 2011	Woodworking, furniture	Pahang, Peninsular Malaysia

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Annex B. Terms of Reference of the Consultant

An international consultant will be selected to undertake overall coordination and facilitation of the in-house-in-factory trainings. The international consultant shall have an extended track record in tropical forestry and proven experience in the implementation of sustainable forest management, including the development of efficient forest industry. The specific task will include**:**

a) Support the organization and implementation of in-house/in-factory trainings.

b) Undertake in-house/in-factory training in the identified forest industries in selected ITTO member countries.

c) Prepare in-house/in-factory training reports, including completion reports of the activity.

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Annex C. Recommended standards for the construction of saw teeth

Band saw (inch)	Saw length (m)	Saw width (inch)	Pitch (°)	Clearance angle (mm)	Gullet depth (mm)	Sharpness angle (°)	Saw thickness (mm)	Tooth width (mm)	Tooth sides (mm)	Spring Set (mm)	Hook angle (°)	Teeth number
	1	2	3	4	5	6	7	8	9	10	11	12
60”-I	10.58	8	37	25	12	49	1.25	2.4	0.575	0.8	22	I 283
60”-II	11.10							2.7	0.725			II 292
48”-I	8.19	7	37	25	12	49	1.25	2.4	0.575	0.8	22	I 215
48”-II	8.94											II 253
44”	7.98	6	36	25	10	49	1.25	2.4	0.575	0.5	22	224
43”-II	7.34	6	36	29	10	49	1.25	2.4	0.575	0.5	22	212
43”-II	7.34											
42”-II	7.54	6	36	29	10	49	1.25	2.4	0.575	0.5	22	199

Notes:

1) Saw tooth width for different wood species
   - Keruing 2.4 mm
   - Nyatoh 2.4 mm
   - Ulin 2.4 mm
   - Sinker 2.4 mm
   - Meranti 2.7 mm
   - Agathis 2.7 mm

2) The number of saw teeth listed in column 12 is not strictly to be adhered to

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