ITTO Biennial Work Programme 2012-2013

Implementation of Activity PP-A/47-262

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

Executed by the International Tropical Timber Organization (ITTO) in collaboration with the Governments of Cameroon, Ghana, Guatemala, and Mexico

Yokohama, August 2014

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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 PP-A/47-262 of the ITTO Biennial Work Programme for the years 2012-2013 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 in finding the proper and effective strategy 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 also 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 also to take this opportunity to convey my sincere thanks to Dr. Tetra Yanuariadi, the ITTO Forest Industry Projects Manager, for his continued assistance in making the necessary arrangements for the implementation of the in-house training sessions; to concerned forest authorities of Cameroon, Ghana, Guatemala, and Mexico respectively, for the excellent support granted; to the owners, executives, managers, supervisors, operators and employees of the respective host forest companies for their cooperation and enthusiasm in learning the various aspects of wood processing technologies. Indeed, the in-house training format has been successfully implemented and widely adopted by forest industries in Indonesia, where I was heavily involved. I have no doubt that similar training format can be replicated and used in other ITTO member countries without great difficulty as shown by the experience of Papua New Guinea, Guyana, Myanmar, and Malaysia where similar training has been previously implemented.

With best regards,

<u>Sukiman (Kim Sae Yung)</u>
The consultant

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1. Introduction

1.1 Background information

Available information indicates that there has been a lack of efficiency in wood processing in ITTO member countries and resulted in poor value-added of tropical forest resources. Only a small fraction of the tropical timber volume harvested ends up in the value-added products while the rest is lost along the timber utilization processes; about one half of the felled volume remains in the forest while another 25% has become the residues of processing. In view of overcoming the aforementioned problem, i.e. inefficient utilization of tropical timber resources, it is necessary for the timber producers in tropical countries to enhance their capacity to promote efficient wood processing technologies to help reduce wastes and residues and at the same time improve quality of timber products, thus their value. For this purpose, there is an urgent need for convening in-house training at the mill level, a format of training that has been implemented in Indonesia and proved successful in bringing up processing efficiency and product quality.

Activity PP-A/47-262 of the ITTO Biennial Work Programme for the years 2012-2013 entitled “Strengthening the capacity to promote efficient wood processing technologies in tropical timber producing countries” is intended to pilot applicability of the training approach and method developed under ITTO project PD 286/04 Rev. 1 (I) that had been implemented in Indonesia. This completed project employed in-house training approach for enhancing the capacity of Indonesian wood processors to promote efficiency of wood processing and quality of processed wood products; i.e. increased processing efficiency and improved product quality.

The pilot activity are to be undertaken in ITTO producing member countries experiencing problems on low efficiency of wood processing and quality of products. To maximize impacts, the activity needs to be implemented in a participatory manner involving the forest industries, forest industry associations, forestry training and education institutions, representatives of concerned government authorities as well as wood industry owners, executives, managers, operators and, as appropriate, the laborers that are directly involved in processing exercises.

1.2 Scope of the in-house training

Processing activities and the technologies employed vary between mills. In general, scope of the training covered primary, secondary and tertiary process chains, depending on the product lines and existing processing activities of the host mills, which may include:

i. Primary processing
   - Logs handling
   - Band-sawing
   - Air drying and seasoning
   - Cross-cut sawing

ii. Secondary processing
   - Kiln drying
   - Double - planing
   - Single ripping
   - Jointing
   - Cross cutting
   - Sorting

- Etc.

iii. Tertiary processing
   - Moulding
   - End tenoning
   - Sanding
   - Multi ripping
   - Pressing
   - Painting
   - Etc.

iv. Common activities
   - Saw doctoring
   - Quality control
   - Maintenance of equipment and facilities
   - Packaging
   - Mill management
   - Safety of operation
   - Mentality shaping
   - Etc.

Indeed, in-house training activities at a host mill are only those ones that are practiced by that particular mill. Moreover, only selected activities of the mill may be covered due mainly to resource constraint.

1.3 Expected outputs

The scope of the in-house training includes strengthening capacity in common problem areas in the wood based industries, namely: logs stocking and loading, kiln-drying and boiling, saw doctoring, finger-jointing, laminating, packing, waste control, maintenance and arrangement, safety and mentality.
The expected outputs of the in-house training are:

- Awareness and understanding of forest industry managers/owners, government training and research institutions increased on the importance of improving efficiency in forest industries
- Improve knowledge, skill and mentality of forest industry operators
- Validated approaches and methodology of in-house training applicable to be further disseminated and implemented in different places

In order to deliver above outputs, an international consultant, Mr. Kim Sae-Yung has been selected to undertake overall coordination and facilitation of the in-house-in-factory trainings. The international consultant has had 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 tasks of the consultant include:

- To support the organization and implementation of in-house-in-factory trainings
- To undertake in-house-in-factory training in the identified forest industries in selected ITTO member countries (4 countries)
- To prepare in-house-in-factory training reports, including completion report of the activity

2. Implementation approaches and methods

2.1 Efficient wood processing and quality wood products as the essential elements of a competitive wood industry

Efficiency, quality, innovation and customer responsiveness are the generic building blocks of competitive advantage that any company can adopt regardless of its industry or the products or services it produces (see Hill & Jones, 1998). This in-house training concerned only with efficiency of wood processing and quality of wood products, believed to be the two most essential elements of competitive advantage of the tropical forest industries as highlighted below.

The simplest measure of efficiency is the quantity of inputs that it takes to produce a given output; that is, Efficiency = outputs/inputs. The more efficient a company, the lower the inputs required to produce a given output. For example, if it takes Company A 30 hours of employee time to produce one cubic meter of rough sawn timber and it takes Company B 25 hours, then Company B is more efficient than Company A, *ceteris paribus*, and Company B will have a lower cost structure than Company A. Time efficiency helps a company attain a low cost competitive advantage. The most important component of efficiency for many companies is employee productivity, which is usually measured by output per employee. Holding all else constant, the company with the highest employee productivity in an industry will typically have the lowest cost of production. In other words, that company will have a cost-based competitive advantage. This is the very reason why training of employees on efficiency of wood processing is indispensable.

Quality products are goods and services that are reliable in the sense that they do the job they were designed for and do it well. The impact of high product quality on competitive advantage is twofold. First, providing high quality products increases the value of those products in the eyes of consumers; this enhanced perception of value allows the company to charge a higher price for its products. The second impact of high quality on competitive advantage comes from the greater efficiency and the lower unit costs it brings; less employee time is wasted in making defective products and less time to be spent fixing mistakes, which translates into higher employee productivity and lower unit costs. Thus, high product quality lets a company not only charge higher prices for its products, but also at lower costs. That is the very reason why training of employees on quality of forest products is absolutely necessary.

2.2. Selection of host countries and mills

In light of resource availability, especially level of funding and time duration, it was necessary to limit the number of host countries, as well as host mills in each of the selected host country. Four ITTO member countries have been selected as the hosts for piloting applicability of the in-house training model; they are Cameroon and Ghana in Africa region, and Guatemala and Mexico in Latin America region. The criteria used in host country selection were: expressed interest of member countries, timely readiness of the countries to receive the ITTO trainers, and funding availability.

Selection of processing mills hosting the training in each country was made by the respective member countries, taking into account, among others, scale of operation, product lines, ownership and accessibility. Scale of operation may affect efficiency of wood processing in different ways: the larger the scale of operation, management of mill operations tends to be more complicated, especially as regards supervision of processes; and the greater the variety of products manufactured, control of process chains is believed to be more difficult and the level of control employed may affect levels of processing efficiency as well as product quality.

Ownership of a mill may also affect levels of processing efficiency and quality of products; a community-owned mill for instance, may operate less efficiently than a privately-owned mill as the owners may attach different profit orientation to the business. Accessibility was included as the criterion for mill selection for practical reason: the mill selected as a host should be easily accessible in order to reduce training cost in light of the limited ITTO resource available for the training.

2.3 In-house training vs. conventional training approaches

In-house training is a capacity building approach wherein competence in processing is enhanced through direct involvement of employees at different levels in the detection and fixing up of inefficient or irregular conduct of wood processing under the guidance of highly competent professionals. The training focuses on detection of problems and field demonstration of troubleshooting actions with only trivial lecturing load.

As evident by the term "in-house", the training is specifically designed for internal capacity building and is devoted to detecting and solving operational problems facing the host mills. Theoretical lecturing is practically inexistent but the training is rich in field discussions on troubleshooting. In contrast, a conventional training method allocates significant resources for such general lecturing as the role of efficient processing and quality control in building up competitiveness with limited demonstration on on-ground troubleshooting. As problems are mill specific, a conventional training method is less suitable for solving specific problems.

The activity was intended to promote the lessons learned from the ITTO-assisted Project PD 286/04 Rev. 1 (I) entitled "strengthening the capacity to promote efficient wood processing technologies in tropical timber producing countries". The project had been successfully implemented by the Indonesian Sawmill and Woodworking Association (ISWA) and achieved its specific objective, which was "to improve the national skills and capabilities in wood processing and in product quality management to ensure the efficient and diversified use of tropical timber in Indonesia". This objective was achieved through delivery of three outputs, namely: i) in house training on wood processing, quality management and product marketing conducted involving 50 mills in five major timber producing provinces, ii) technical information on wood properties made available for planning and implementation of training programs and iii) 500 practitioners, managers and supervisors trained in efficient wood processing, quality management and marketing of processed wood products. In fact, 139 in-house training sessions were carried out involving 860 practitioners comprising mill owners, executives, managers and operators, for exceeding the target. These trained practitioners must have directly or indirectly contributed positively to increasing efficiency of wood processing and improving quality of timber products in Indonesia.

Strengthened capacity in wood processing in Indonesia had been achieved by conducting 139 in-house training sessions involving fifty mills and 860 participants in total comprising executives, managers, technicians and laborers. The trainings proved successful in generating immediate positive impacts to mill owners. For examples, one mill in Java was able to reduce cost in the production of particleboard by making adjustment to veneer coating material and laminator position; while another mill in Kalimantan had been able to noticeably increase wood recovery through proper band sawing; yet another mill in Java was able to reduce paint consumption by applying appropriate painting tool.

Table 1: Comparison between in-house training and conventional training methods

No.	Training elements	In-house training	Conventional training
1.	Site of training	Host mill	Classroom
2.	Origin of participants	Host mill only	Many mills
3.	Number of participants	Flexible	Limited
4.	Educational and occupational background of participants	Flexible	Preferably comparable
5.	Cost of training	Lower unit cost	Higher unit cost
6.	Business confidentiality	Secured	Unsecured

The training approach employed by Project PD 286/04 was "in-house training" mode which emphasizes on-site practices instead of class lecturing. That project argues that in-house training mode has several advantages over the conventional training mode as summarized in Table 1.

The information presented in Table 1 indicates that the advantages of in-house training mode include:

- The training is implemented at the host mill where all machineries and facilities are available for demonstration, as needed.
- Participants of the training are own employees of the host mills that are easy to direct and control
- Participants are not limited in number as any employees may take part in
- Employees with different educational and occupational background may take part in the training depending on their tasks in the process chains under consideration.
- Cost of training per employee is reduced due to large number of participants and most training inputs are available at practically no cost
- Business confidentiality in terms of the technologies applied by the host mills is basically secured as participants are own employees of the host mills.

2.4 The methods employed

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

i. A short meeting between the trainer(s) and mill owner(s), executive(s), manager(s) as well as operator(s) was held to discuss on scope, purpose as well as expected outcomes of the training and training processes.

ii. After the short meeting, a quick visit to stock piles of end products was made in order to get a general impression on conduct of processing; appearance of end products provides clues on general level of processing efficiency.

iii. A swift visit was also paid to wood waste piles; quality and characteristics of wood wastes, e.g. dimension, performance, etc. provide good hints for tracing back those process chains responsible for generating the wastes.

iv. After obtaining clues from performance of the end products and appearance of the wood wastes, the trainers and trainees together paid visits to the product chains suspected as the origin of defects or source of irregularities in processing. Any suspected process chains were then carefully examined, their technical problems identified and repairing actions demonstrated.

v. At each of the products chain examined, discussion was held with the respective manager(s), operator(s) and worker(s) as regards causes of the problem, as well as its adverse impact on efficiency and quality if it remains unrepaired. To facilitate fruitful discussion at a later stage, any irregularities encountered at any process chains were documented on camera pictures.

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

vii. After finishing observation of 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. To help clarify the problems discussed at this meeting, the trainer showed, as appropriate, the picture 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 troubleshooting in terms of source, price, and technical specifications. In addition, as time permits, the trainer also demonstrated the intimate link between processing efficiency, product quality, competitiveness and business survival.

The approaches adopted in the implementation of in-house training are summarized in Figure 1.

Above approaches are expected to contribute to increasing awareness and understanding of forest industry owners/managers as well as government training and research institutions on the importance of wood processing efficiency, improving knowledge, skill and mentality of forest industry operators and validating applicability of in-house training for enhancing competitiveness of wood industries in the tropical regions.

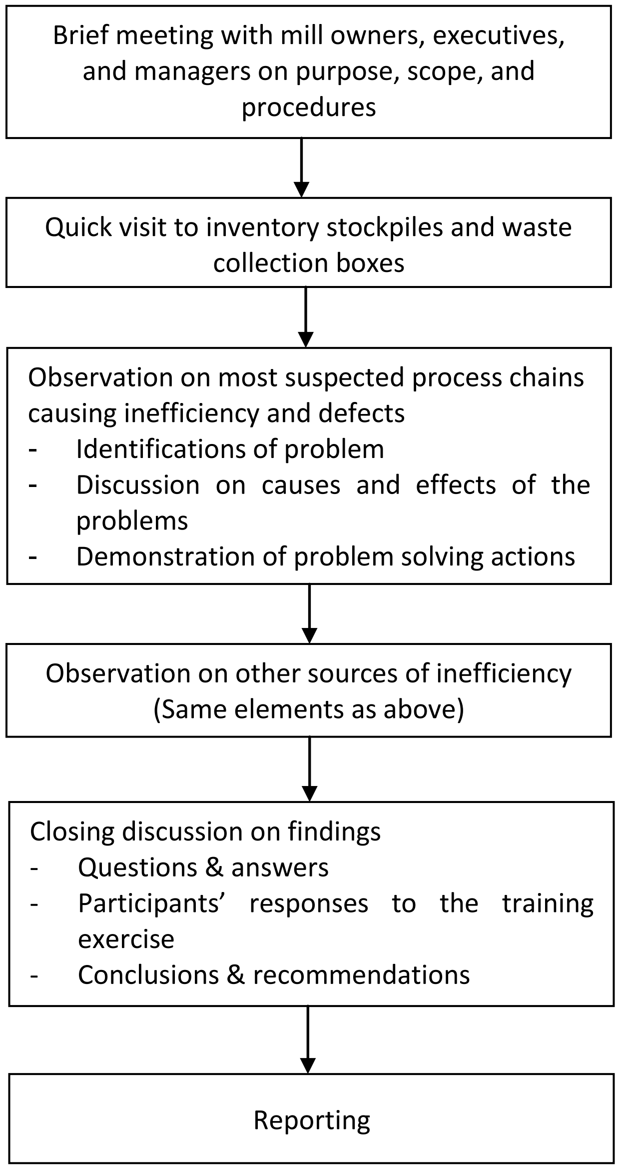

Figure 1: Flow-chart of the conduct of individual in-house training

3. Background information on the forest resources and industries of the host countries

Unless other source is specifically cited, the information on the forest resources and industries of Cameroon, Ghana, Guatemala, and Mexico was sourced from the reports by Blazer, et.al (2011) on status of tropical forest management 2011, published as ITTO technical series no. 38.

3.1 Cameroon

<u>Forest resources and types</u>

- Cameroon has a land area of 47.5 million hectares, stretches between latitudes 2° and 13° north from the Gulf of Guinea to Lake Chad. The southern plateau, the site of Cameroon's major closed-forest area, is 500-800 m in altitude and the central Adamaoua high plateau is generally 1,000 m or more above sea level.
- Depending on the source, estimates of forest area vary from 19.7 million to 27.2 million hectares, 21.2 million hectares according to the Government of Cameroon. Cameroon's forests are mainly tropical rainforests of two predominant types: lowland evergreen (54% of total forest area) and lowland semi-deciduous (28%) which are rich in commercial species of Meliaceae such as *Entandrophragma cylindricum* (sapelli) and *E. utile* (sipo).
- The evergreen forests can be divided into two broad categories: the Biafran forests, forming an arc around the Gulf of Guinea and the Congo Basin forests in Cameroon's south and northeast. The Biafran forests which formerly covered the entire coastal lowland, has been largely cleared and currently consists of secondary and degraded primary forests characterized by such species as *Lophina alata* (azable) and *Sacaglottis jabonensis* (ozouga). The Congo Basin forests are characterized by such species as *Gilbertiodendron dewevrei* and *Bailonella toxisprema* (moabi). Mangroves are found along most of the Cameroonian coast with a total area of about 120.000 hectares while inland semi-evergreen lowland forest gives way to a mosaic of degraded rainforest and secondary grassland.

<u>PFE area</u>

- The forest law of Cameroon divides the forest area into permanent and non-permanent forest areas. The permanent forest includes the categories: forest reserves, protected areas and council forests, while non-permanent forest includes community forest and private forest. The government of Cameroon estimated that there is 12.8 million hectares of natural forest PFE, comprising 7.6 million hectares of production forest and 5.2 million hectares of protection forest. The PFE in Cameroon belongs to the state, although 414.000 hectares of it has been transferred to local communes under certain rights, while in the non-PFE, a process for the allocation of tenure and user rights is underway. Stakeholder disputes over forest ownership and the demarcation of boundaries are common.
- The salient features of timber production and trade are outlined below:
  - The total annual round production in 2005 -2009 was about 14 million m³, of which 9.5 – 12 million m³ was fuel wood
  - Average annual sawn wood production in 2007 – 2009 was about 773,000 m³, compared with 702,000 m³ in 2004 and 600.000 m³ in 1999

- Plywood production was estimated at 24.000 m^3 in 2009, down from 36,000 m^3 in 2004 and 42,000 m^3 in 1999
- An estimated 79,000 m^3 of veneer were produced in 2009, up from 43,000 m^3 in 2004 and 53,000 m^3 in 1999
- Around 70% of timber is used domestically and the informal domestic market also provides timber to neighboring countries
- Cameroon is now the tenth-largest tropical timber exporter and is still the second-largest timber exporter among African ITTO producer countries after Gabon
- Forest products are a principal source of export income in Cameroon; the export value of timber was about US$ 650 million in 2004, up from US$ 210 million in 2001
- Forest concession holders must link their concessions with industrial processing units, thus providing stable employment in remote rural communities and revenue flows for the state
- The total forest-based employment of the domestic wood sector in 2009 was estimated at 45,000 jobs
- The total tax revenue in 2005, steadily increasing over the years, was about US$ 26 million with harvesting taxes as an important source of revenue stream

3.2 Ghana

<u>Forest resources and PFE</u>

- The land area is 23.9 million hectares of which 4.68 million hectares were natural forest. Around 8 million hectares of the land located in the south are categorized as a high-forest zone that comprises several forest types: wet evergreen, moist semi-deciduous (southeast & northwest), dry semi-deciduous (inner zone), dry semi-deciduous fire zone, upland evergreen, southern marginal and southern outlier.
- The semi-deciduous and evergreen forests constitute the main timber-producing areas. The main species in the semi-deciduous forests are: *Triplochiton scleroxylon* (wawa), *Mansonia altissima* (mansonia), *Nesogordonia papaverifera* (danta) and *Khaya ivorensis* (mahogany) while in the evergreen forests the main species are *Guarea cedrata* (guarea), *Tieghemella heckelii* (makore), *Tarrietia utilis* (niangon) and *Uapaca spp.* (assam).
- Ghana's PFE is estimated at 1.43 million hectares, which is the area of forest in forest reserves plus the area of planted forests and the area of forest in protected areas. With recent activities to revise and write new management plans for globally significant biodiversity areas, some areas that were previously not demarcated or measured have now been demarcated.
- In Ghana, forest are owned by communities vested in traditional authorities, held in trust for them by the state, and logged by private contractors. Traditionally owned forest lands are known variously as "stool land" or "skin land"; however, the Government of Ghana reports that forests are entirely in public ownership since they are held in trust by the state.

Forest for production

- Under the newly introduced system, there are two types of permit for production forest utilization: competitive bidding and administrative permits.
- Under the competitive bidding, forest resources are allocated through competitive-price bidding for timber rights, which is a fundamental feature of the 1994 Forest and Wildlife Policy that calls for the award of timber rights on the basis of competitive bidding and periodic audit of forest utilization operations to ensure compliance with forest management specifications and environmental protection standards.
- There are two types of administrative permits: Timber Utilization Permits (TUPs) and Salvage Felling Permits (SFPs). A TUP is issued based on an application by a district assembly, town committee, rural community group or an NGO and subject to such conditions as the Forestry Commission may determine.
- A SFP may be issued for the salvage of trees from an area of land undergoing development such as road construction, expansion of human settlement or the cultivation of farms but such permit cannot be issued in respect of land under a TUC (Timber Utilization Contract).

Timber production and trade

- Total industrial roundwood production in 2009 was 1.32 million m^3, slightly went down from 1.37 million m^3 in 2004. Sawnwood production was 532,000 m^3 in 2009, compared with 490,000 m^3 in 2004. About 191,000 m^3 of plywood was produced in 2009, went up from 140,000 m^3 in 2004. About 274,000 m^3 of veneer was produced in 2009, compares with 301,000 m^3 in 2004.
- The estimated export value of primary timber products was US$ 207 million in 2009 comprising logs at US$ 17.3 milllion, sawnwood at US $ 70.0 million, veneer at US$ 63.4 million and plywood at US$ 56.0 million.
- The export of round and square logs, other than plantation teak, has been banned since 1997 and levies imposed on exports of air-dried timber of nine important species. In 2008, Ghana reported exports of 191,000 m3 of sawnwood, 69,700 m^3 of veneer and 87,100 m^3 of teak logs to different such countries as the USA, Germany, Italy and India.

Socio-economic aspects

- Forests accounted for 6% of GDP in 2004, with a total value of US$ 520 million, and export of timber products were worth an estimated US$ 186 million in 2008.
- The formal forest sector employs about 120,000 people including about 50,000 in the wood-products industry.
- About 70 companies are involved in timber harvesting, 70 are involved in primary processing, 127 are involved in secondary processing and 1,650 are involved in tertiary processing.
- Chainsaw milling, although illegal, provides jobs for about 130,000 Ghanaians and livelihood support for about 650,000 people.

3.3 Guatemala

Forest resources and types

- Guatemala has a land of about 10.9 million hectares, which can be divided into three main bio-geographical regions:
  - The highlands made up of several mountain chains stretching from the border with Mexico southwards to the border of Honduras where most of the population lives and main conifer forests grow
  - The pacific plain stretching along the Pacific coast, which is characterized by rich volcanic soils and highly developed agriculture
  - The Peten, a flat low-lying region in the north, bordering Mexico and Belize that is covered with dense humid tropical forests, swamps and grasslands
- Recent estimates of Guatemala's forest area based on 2003 satellite cover interpretation range from 3.66 to 4.55 million hectares; the forests are classified as conifer forests, broadleaved forests, mixed forests and mangrove forests with the following main features:
  - Closed natural pine forest in the highlands, about 300,000 hectares in extent, dominated by one or several pine species, *Abies guatemalensis* (pinabete), *Cupressus lusitanica* (cypress), *Taxodium mucronatum* (saleino) or *Juniperus comitana* (juniperus) with *Pinus oocarpa* being the most commercially important species
  - Broadleaved forest, about 3 million hectares in extent, mostly occupies the Peten area and is composed more than 300 tree species with two predominant genesa: *Dialium* and *Brosimum*
  - Mixed hardwood and pine forest, about 600,000 hectares in extent, mostly found in Quiche, Alta Verapaz, Huehuetenango, Chiquimula and Zacapa, composed of two main tree associations: pine-oak and liquidambar
  - Relicts of mangrove forest cover about 17,700 hectares on the Pacific coast particularly in estuaries and lagoons
- The estimated total area of PFE is 2.46 million hectares comprising 1.14 million hectares of production forest, 1.24 million hectares of protection forest and 85,000 hectares of planted forest, encompassing different forest types: 1.7 million hectares of tropical hardwood forest, 100,000 hectares of conifer forest, 130,000 hectares of mixed hardwood and pine forest, and at least 500,000 hectares of open woodlands and secondary forests.

Forests for production and utilization

- Forest management goals vary throughout the country: i) the community forests in the highlands consist mainly of coniferous or mixed forests and principally produce fuelwood and construction wood for household consumption and the domestic market, and ii) community forest operations in the tropical broadleaved forests of the Peten produce timber from both high-value and lesser-known species for national and international markets, as well as NTFPs.
- The most serious problem in forest management is extensive small-scale illegal logging of single trees with *Swietenia macropylla* (caoba) and the various species of *cedrela* in the tropical hardwood forests as well as *pinabete* and *cypress* in the highlands as the most targeted species.

- The commonly harvested species for industrial roundwood are: i) *caoba*, 50% of total export value in 2008 and 17% in volume, ii) *manchiche*, mainly for domestic use, iii) *santa maria*, mainly for domestic use, iv) *puote*, exported for flooring and parqueting, and v) *tajibo*, most important timber for domestic use.

Socio – economic aspects

- Guatemala's forest sector is estimated to contribute approximately 2.5% of GDP through the production of timber and $NTFP_S$, and generates about 37,000 jobs involving about 1.5% of the economically active population.
- Hunting and gathering of edible plants have been of great importance for the Maya culture for centuries; in the humid forest zone, both indigenous communities and colonists use such forest products in their households as fibres of bayal (*Desmoncus spp.*) and sabal (palm leaves) for housing.

3.4 Mexico

Forest resources

- The land area of Mexico is 194.2 million hectares, the third-largest country in Latin America after Brazil and Argentina; the country is mainly mountainous, with more than half of its land area above 1,000 m.
  - The northwest of the country supports dry, open forest.
  - Tropical moist forests are found further south where rainfall is higher.
  - The southern highlands are composed of a number of steep mountain ranges, deep valleys and dry plateau, including the Chiapas highlands that constitute an important forest zone.
- The total forest area was estimated at 64.8 million hectares in 2010, of which 31.4 million hectares are in the tropics

Forest types and PFE area

- Mexico's eco-climate zones can be divided into three approximately equal areas: tropical in the south and southeast, sub-tropical/temperate and semi-arid/arid. The tropical region includes rainforests, which originally covered about 6 % of the country; the major forest type in the temperate region is Quercus forest which may be pure or mixed with other temperate-climate broadleaved species such as *Liquidambar styraciflua* (sweet gum) and *Fagus mexicana* (beech).
- The tropical forests can be divided into three major types: high forests with a canopy height of 30 m and above with a large variety of species, medium forests with a canopy height of 15-30 m with less variety of species and low forests with a height of 4-15 m with further less variety of species.
- Mangroves, about 770,000 hectares in extent, occur in a considerable variety of settings and formations on both the Pacific and Atlantic coastlines and in conditions that range from arid to wet tropical.
- Mexico does not have a formally allocated PFE.

Timber production and trade

- Total roundwood production in 2008 was estimated by the Government of Mexico at more than 40 million m³ of which about 495,000 m³ were tropical industrial roundwood or 7.3 % of total roundwood production, of which 37,683 m³ were of the noble species of *cedro rojo* and *caoba* while the remainder were of common hardwood species.

- A total of 942,000 m^3 on-coniferous tropical industrial roundwood was reported by ITTO in 2008
- There are differing estimates of tropical hardwood production

- Nearly the entire volumes of industrial roundwood production is for internal consumption; the area of *cedro, caoba* and *teak* plantations is increasing to help satisfy demand for high-quality hardwoods.

Socio- economic aspects

- The direct contribution of the tropical timber sector to employment could be as high as 90,000 jobs but a considerable number of people employed in the sector work informally and are not counted in official statistics.
- The contribution of the national forest sector to GDP in 2007 was about US$ 2 billion (1,5 % of total GDP) up from 1% share in 2003.
- In 2009, about 26% of the national consumption of wood products was produced domestically and the remainder was imported, valued at more than US$ 5 billion.
- It is estimated that 12 -13 million people live in forest areas, about 5 million of whom are indigenous; most forest-dependent indigenous people live in conditions of extreme poverty with limited access to education, public services and labor.
- Tropical forests of Mexico are nearly entirely owned by “ejidos” and forest management for timber and NTFPs generates a significant part of family livelihood.

4. Results of the in-house training

4.1. Logs handling at logyards

The weaknesses commonly observed:

- Logs piled in open area without due shading or covering
- Logs piled directly on earth without using tile or concrete as the base
- Cracked or splits logs unattended using S-hook or end-coating material
- Dirty logs loaded to carrier without cleaning
- Improper log trimming, e.g. un-squared cuts, damaged chain saw, etc.

(1)

(2)

(3)

(4)

Photos 1-4 (by Kim): logs piled directly on muddy earth (1), on sandy soil (2), unattended cracked log (3), and use of steel S-hook (4)

Observed/potential consequences of the weaknesses:

- Downgrading of log quality
- Reduced wood recovery
- Perhaps lower product quality of processed products
- Reduced life cycle of band saw

Procedures and techniques for overcoming the weaknesses:

- Water spraying or canvas covering of logs especially of expensive, fancy species
- Using S-hook to avoid split propagation; plastic S-hook is preferable to steel S-hook
- Keeping logs at distance with earth using beam or concrete as the base
- Logs cleaning from dirt and barks

- Periodic fumigation of logs to avoid attack by pests and disease
- Proper trimming of logs based on desired length and presence of defects

(5)

(6)

(7)

(8)

Photos 5-8 (by Kim): logs covered with tent (5), logs water-sprayed to preserve moisture (6), cracked logs unattended using plastic S-hooks (7-8)

4.2. Breakdown sawing

<u>The weaknesses commonly observed:</u>

i. Improper setting, operation and maintenance of log carrier, e.g. improper square between band saw table and stopper, damaged rail foundation, dirty rails, poor lubrication, etc.

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Photos 9-11 (by Kim): poorly greased bearing (9), broken rail (10), poorly maintained log carriage (11)

ii. Improper setting of upper and lower wheels as well as position of band saw on wheels, deficient cooling system and inappropriate saw balancing

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Photos 12-14 (by Kim): improper position of breakdown saw causing un-squared cut (12), band saw is not perpendicular with fork (13), improper setting of band saw on wheel (14)

Observed/potential consequences of the weaknesses:

- Uncontrolled dimension of sawn timber
- Larger wood waste
- Frequent breakdown of operation thus increased cost of production
- Reduced life cycle of band saw due to teeth damages by solid substances

Procedures and techniques for overcoming the weaknesses:

i. Proper operation and maintenance of log carrier
   - The carrier must travel on straight, parallel and leveled to each other rails
   - Carriage wheels must be mounted on a dead axle with anti-friction bearings
   - Carriage must be routinely cleaned of sawdust, pitch and other debris and the bearings greased with high temperature grease

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Photos 15-17 (by Kim): well maintained log carriage (15), carriage wheels equipped with sawdust scraper (16), straight and leveled rails (17)

ii. Proper setting, operation and maintenance of band saw

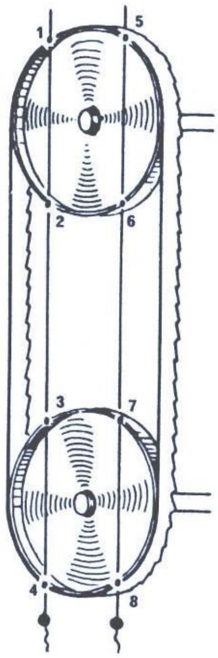

Figure 1: Setting up lower and upper band wheels

- The lower band wheel must be vertical and at the right angle to feeding 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)
- 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.
- Wheel scrapers must be installed to prevent the build-up of sawdust and pitch; better use a wooden scraper in order not to excessively wear the wheels.

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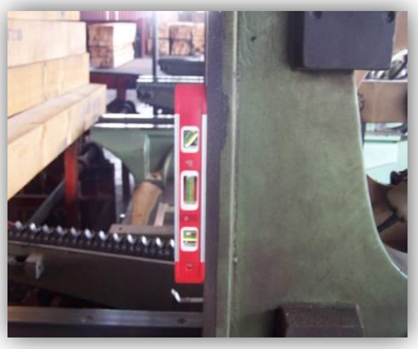

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Photos 18-21 (by Kim): proper placing of band saw on wheel (18), use of metal scraper (19), leveling gauge shows that stopper is perpendicular with fork (20), sawing operation aided by a mirror at the front-end (21)

4.3. Cross-cutting

<u>The weaknesses commonly observed:</u>

- Improper square of rear stopper and saw blade.
- Poor saw blade (twisted, dirty, etc.) and teeth condition (sharpness, angle, broken, etc.)
- Height of saw table does not match the operator's
- Lack of safety cover

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Photos 22-25 (by Kim): improper square between saw blade with table (22-23), with stopper (24), un-squared cut from improper positioning of saw blade, table, and stopper (25)

Observed/potential consequences of the weaknesses:

- Rough surface of cross sections
- Burnings
- Un-squared cuts
- Irregular dimension

Procedures and techniques for overcoming the weaknesses:

- Ensuring a proper square between rear stopper and saw blade
- Using sharp circular crosscut saw
- Installing washer maintenance and squared motor axle and saw blade
- Removing dirt such as resin from the saw blade using heating solution, e.g. carbonic potassium
- Using a safety cover for circular saw
- Matching height of saw table with the operator's

4.4. Kiln-drying

The weaknesses commonly observed:

- Inappropriate stacking of timbers inside the chambers
- Heat leaking through the chamber doors
- Inappropriate air speed and flow
- Drying schedule not based on wood species nor timber characteristics and chamber capacity
- Lack of temperature sensor calibration
- Weak process monitoring

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Photos 26-30 (by Kim): heating pipe leakage (26) improper door setting causing leakage (27), stacking without top weight and stickers causing timber bowing (28), door leaking (29), too close stacking to wall causing disruption of air flow (30)

<u>Observed/potential consequences of the weaknesses</u>:

- Different defects and big loss in volume and quality of dried timbers which include crack, split, honeycomb, twist, check, blue stain, over dried timbers, etc.

<u>Procedures and techniques for overcoming the weaknesses</u>:

- Do appropriate stacking as follows: bottom stacking at 8-10 cm height from the floor, side wall clearance of 20 cm, front and rear clearance at least 80 cm and use weight press on top of stacking to prevent bending
- Prevent heat leaking through doors using appropriate rubber seals
- Check air speed using anemoscope and maintain it at 3m/sec at the minimum

- Install screen on ceiling to control air flow
- Develop a kiln schedule based on wood species, thickness, initial moisture, and chamber capacity, e.g. air speed, spray water, steam, etc.
- Calibrate temperature sensor regularly

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Photos 31-35 (by Kim): curve-shaped chamber facilitates smooth air flow (31), door with rubber seals prevents leakage (32), proper stacking (33-34), stacking equipped with steel spring prevents bending (35)

4.5. Finger jointing

The weaknesses commonly observed:

- Abundant glue spillover
- Improper application of glue on spreader
- Lack of molding precision
- Dirty glue spreader
- Improper pressure

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Photos 36-38 (by Kim): excessive use of glue causing spillovers (36), improper application of glue on spreader (37), lack of finger jointing precision (38)

Observed/potential consequences of the weaknesses:

- Dirty mill floor
- Large waste of glue
- Reduced quality of products

Procedures and techniques for overcoming the weaknesses:

- Properly apply glue on spreader to avoid spillover
- Increase precision of molding components
- Use clean spreader
- Properly set pressure

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Photo 39 (by Kim): clean spreader equipped with scraper reduces glue consumption (39)

4.6 Laminating

<u>The weaknesses commonly observed:</u>

- Uncontrolled use of glue
- Improper storage of resin and hardener
- Inappropriate resin viscosity
- Unchecked hardness of glue spreader roller

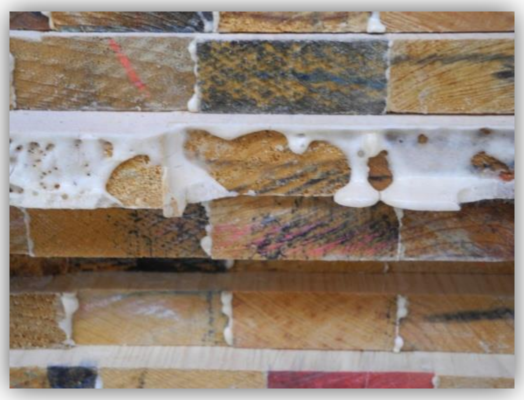

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Photo 40 (by Kim): excessive use of glue causing spillover (40)

<u>Observed/potential consequences of the weaknesses</u>:

- Increased glue consumption
- Damaged resin and hardener
- Reduced product quality

<u>Procedures and techniques for overcoming the weaknesses</u>:

- Control hourly use of glue
- Keep resin and hardener in cool place
- Use colored glue to ease application
- Check hardness of spreader roller using hardness gauging device

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Photo 41 (by Kim): proper application of glue (41)

4.7 Gluing

<u>The weaknesses commonly observed:</u>

- Use of glue and hardener
  The mixing of glue and hardener was done manually during the gluing process causing unevenly mixed hardener, different drying time, weak and easily loose gluing bond and excessive consumption of hardener.
- 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
- Hand glue spreader

  Too much use of glue brought about a 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.
- 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
- Glue and hardener were not properly stored

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Photos 42-45 (by Kim): uncontrolled manual gluing consumes excessive glue (42), spreader without scraper (43) causing uneven thickness of glue on panels (44), dirty glue spreader causing uneven spread of glue (45)

Observed/potential consequences of the weaknesses:

- Unevenly mixed hardener
- Different drying time of glue
- Weak gluing bond
- Excessive consumption of glue and hardener
- Uncontrolled spread of glue

Procedures and techniques for overcoming the weaknesses:

- 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.

- 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

- 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.

- Position of cold press must be flat and use the merchant-type hand roller to evenly spread glue on the entire panel surface
- Store glue and hardener in a cool place to avoid drying process

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Photo 46 (by Kim): cleaned glue spreader economize glue consumption (46)

4.8 Sanding

<u>The weaknesses commonly observed:</u>

- Pressure gauge was damaged or not properly used causing unstable pressure level during the sanding process and sand paper is not evenly applied
- Conveyor was covered by a lot of glue causing un-levelled position of panels thus uneven sanding results
- Damaged, rusty or dirty roller tore sanding paper resulting in inefficient use of sand paper
- Improper position of illumination lamp causing weak quality control
- Improper storage of sandpaper causing sandpapers easily damaged or torn apart
- Sanding speed not properly set up

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Photos 47-49 (by Kim): dirty head roller (47), improper storage of sand paper (48), improper position of illumination lamp (49)

Observed/potential consequences of the weaknesses:

- Defective sanded panels
- Inefficient use of sand paper

Procedures and techniques for overcoming the weaknesses:

- Continuously apply a pressure gauge to facilitate control of steady pressure
- Make sure that conveyor is clean, free of glue
- Repair or replace damaged sanding paper roller and passing roller to facilitate efficient use of sandpaper
- Position of an operator must be in the opposite direction of the illumination lamp noting that the lamp ray does not directly hit the operator's eyes
- Prepare a hanging cupboard for storing sand paper which must be kept closed and equipped with a 150-watt lamp to keep suitable level of humidity
- Sanding speed must be adjusted to suite timber species and surface condition

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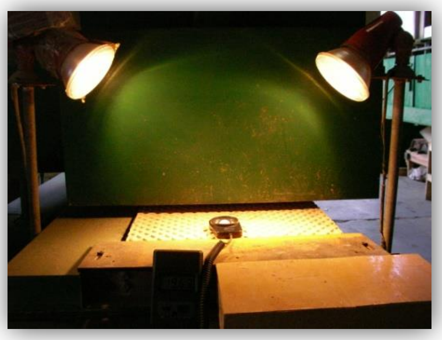

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Photos 50-52 (by Kim): proper placement and use of illumination lamps allowing better control (50-51) and proper storage of sand paper (52)

4.9 Slicing

The weaknesses commonly observed:

- Hard fancy timber was not treated properly prior to slicing
- Sliced veneers were not properly attended causing unnecessary damages
- Thickness of veneers was not properly controlled
- Rust contamination occurred

Observed/potential consequences of the weaknesses:

- Low quality of veneers
- A lot of damaged veneers

Procedures and techniques for overcoming the weaknesses:

- Boil the logs with water or steam for about 24 hours
- Saw the log into squares before feeding it into the slicer
- Slicing machine must be stationed firmly and stable
- Knife must be sharp and properly positioned
- Thickness of veneer must be consistently monitored by quality controller
- Apply caustic soda to prevent rust contamination
- In stacking veneer sheets, dimension of pallet used must correspond to the size of veneer in order to avoid damages especially at the end and side parts and do not make a too large bundle of veneer

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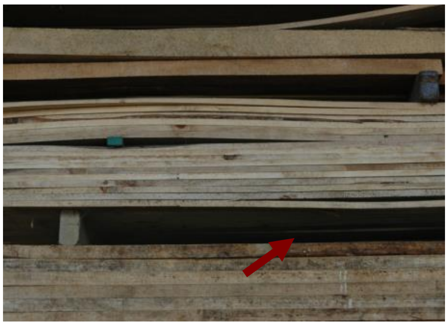
Photos 53-54 (by Kim): proper bundling of veneers (53) and proper pressing process of veneers (54)

4.10 Stacking of lumber

The weaknesses commonly observed:

i. Improper position of timbers and use of wooden sticks

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



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Photos 55-56 (by Kim): no sticker at the end of boards (55), improper sticking (56)

Observed/potential consequences of the weaknesses:

- Occurrence of different unnecessary defects, e.g. bowing, cupping, twisting, etc.

Procedures and techniques for overcoming the weaknesses:

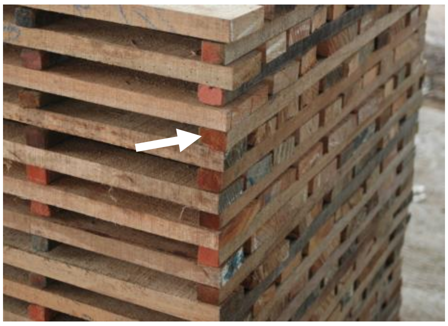
i. Proper timber positioning and use of sticks

  - 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 the stacking 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.
- Consider to use aluminum or groovy stickers with 3 cm of thickness

ii. In timber stacking observe the following steps:

- 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, damaged 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 57-58 (by Kim): proper stacking techniques (57-58)

4.11 Packaging

Packaging signifies the first 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 the destination, the buyers. The tools and materials 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.

The weaknesses commonly observed:

- Use of low quality pallet in terms of strength and performance
- Use of inappropriate material, e.g. valuable timber, steel band, etc.
- Lack of technical skills on product bundling

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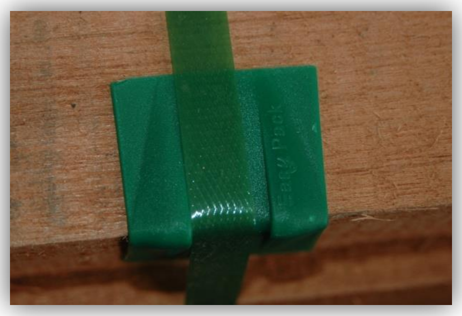
Photos 59-61 (by Kim): improper plastic wrapping of panel bundles (59), improper use of steel band causing cracks (60), unattractive and sloppy packaging (61)

Observed/potential consequences of the weaknesses:

- Damages to products before reaching shipping destination
- Less eye catching appearance
- Wasting of valuable wood

Procedures and techniques for overcoming the weaknesses:

- Use strength, safety and material cost as the primary criteria for designing and constructing packages
- Consider to use auto packing machine and plastic band in place of steel band
- Do not use valuable wood in order to reduce material cost
- Ensure that appearance of any package is eye catching



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Photos 62-64 (by Kim): use of plastic protector in packaging to avoid edge cracking (62), clean and attractive packages (63-64)

4.12 Saw doctoring

4.12.1 Knife grinding

The weaknesses commonly observed:

- Use of incorrect knife type
- After grinded, a knife is not sharpened using honing stone in order to smoothen black color (grains) and iron grains (burr) at the edge of knife blade that the knife is not fully sharp
- Inappropriate sharpening technique
- Improper use of coolant during grinding process

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Photo 65 (by Kim): knife grinding without coolant (65)

Observed/potential consequences of the weaknesses:

- Less sharp knife blades
- Low quality of sliced product

Procedures and techniques for overcoming the weaknesses:

- The sharpening tool is turned in clockwise 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.
- 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.
- 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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Photo 66 (by Kim): knife grinding with coolant (66)

4.12.2 Maintenance and storage of saw blade

The weaknesses commonly observed:

- Lack of attention to maintenance and storage of band saw may shorten service life time due to twisting, stretching, elongating, and rusty many others
- 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 67-68 (by Kim): improper storage of saws: circular saws lumped together (67) and band saw blade rolled and kept on the floor (68)

Observed/potential consequences of the weaknesses:

- Shortened service life time of the saws
- Inappropriate functioning of saws

Procedures and techniques for overcoming the weaknesses:

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. Clean surface of a circular saw using kerosene, “pay-off” solution or “larzip-15” solution

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Photos 69-70 (by Kim): proper storage of saws: circular saws kept at distance (69) and band saw stored like belt in the shelf (70)

4.13 Waste control

<u>The weaknesses commonly observed:</u>

- Large volume of wood waste at most mills
- Lack of initiative to utilize wood wastes

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Photos 71-74 (by Kim): large volume of wood waste has the potential to be used for making different products (71-74)

Observed/potential consequences of the weaknesses:

- Reduced wood recovery/inefficient use of wood raw material
- Increased production cost

Procedures and techniques for overcoming the weaknesses:

- Locate waste boxes or containers at the entrance gate or at center of the factory to ease monitoring by anyone especially the managers
- Do not throw away any wood pieces without confirmation by the inspector
- Boiler man or shredding operator has to select wood pieces that are still acceptable for processing
- Every process chain must measure how much wood waste it produces per day
- Operational manager must monitor recovery ratio every month
- Quality controller has to actively check on over-sized wastes
- Wood waste have to be utilized to the extent possible for packaging material, pellet, flooring, finger jointing, laminating, etc.

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Photos 75-78 (by Kim): wood waste in a container placed at the center of a mill to ease inspection (75), laminated panel made of wood waste (76), pellet made of wood waste (77), damaged veneers are properly stacked for use in making wood products

4.14 Maintenance

The weaknesses commonly observed:

- Lack of proper maintenance of air compressor, sander and molder equipment

Observed/potential consequences of the weaknesses:

- Improper functioning of equipment
- Defective products

Procedures and techniques for overcoming the weaknesses:

i. Air compressor

- Drain air tank of water
- Clean air filter to avoid condensation process
- Continuously check any air pipe leakage
- Install air pressure gauge and water separator

ii. Sander

- Set pressure on roller papers to be equal using ampere meter
- Width of wood panel must be the same as the sanding paper
- Panel wood conveyor and sanding paper must be free of glue or clean
- Position of the light should be opposite to the operator's

iii. Molder

- Air pressure on every feeding roller must be equal to 20 psi
- Set idle roller 2 mm higher than the table to ease smooth flow of feeding and avoid snapping
- Grease universal axle periodically
- Set air speed on suction tube at 30 m/sec
- Set hardness of push rubber roller at 60%

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Photos 79-81 (by Kim): sanding marks caused by dirty sand paper or unsteady feeding speed (79), unequal pressure of rollers causing defects (80), dirty sand paper (81)

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Photos 82-83 (by Kim): clean head roller (82) and ampere meter to gauge pressure (83)

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Photos 84-85 (by Kim): press mark caused by over pressure (84), snapping due to unsteady feeding process (85)

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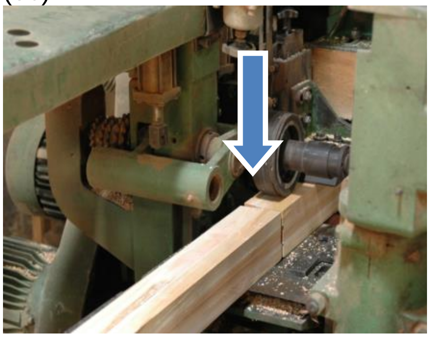

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Photos 86-88 (by Kim): setting hardness of rubber roller (86), setting height of feeder 2 mm higher than the table (87), proper feeding process (88)

4.15 Quality control, inspection and repair

The weaknesses commonly observed:

- Wrong setting of machineries, e.g. pressure, speed, vibration, etc.
- Poor skills of operator
- Poor working condition (dirty, hot, dark, dusty, noisy, etc.)
- Improper kiln-drying process
- Low quality of filling material, e.g. glue, putty, etc.
- Poor sharpening of knives, saw teeth, etc.
- Poor setting of knives and saws
- Inappropriate lighting for inspection
- Incomplete measuring/gauging devices, e.g. ampere meter, anemoscope, etc.

Observed/potential consequences of the weaknesses:

- Low productivity
- Defective product
- Inefficient wood processing

Procedures and techniques for overcoming the weaknesses:

- Install, operate and maintain machineries in compliance with the respective technical manuals
- Continuously improve skills of operator through training
- Provide comfortable working condition to facilitate high productivity
- Develop kiln-drying schedule based on timber species and initial condition
- Use quality filling materials

- Enhance competence in saw doctoring
- Provide sufficient gauging devices to ensure proper machinery operation
- Provide sufficient lighting to facilitate adequate quality control
- Apply TQM system to guide mill operation
- Use control card as a tool for controlling performance of operators and maintenance of machines

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Photos 89-90 (by Kim): careful repairing defective product to reduce waste (89-90)

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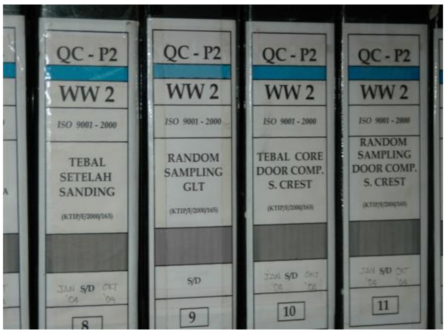
Photos 91-92 (by Kim): controlling operations with the aid of gauging devices (91-92)



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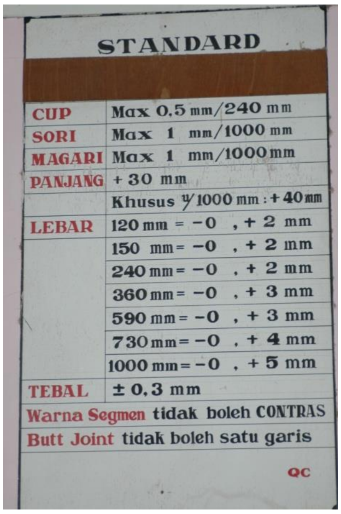

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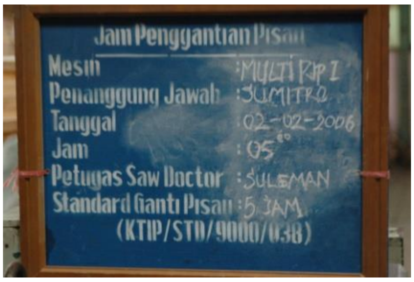

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Photos 93-95 (by Kim): controlling operations with the aid of control cards (93-95)

4.16 Mill management

The weaknesses commonly observed:

i. Inventory management
   - Some mills held large quantity of processed products which entail high financial cost and risk
   - Products were stacked improperly causing quality down grading

ii. Human resource development
   - Work productivity is low due to inappropriate mentality and work attitude of employees
   - Weak supervision at the mill level
   - Lack of training on technical skills

iii. Safety and work condition
   - Many operators did not put on required dress uniform, safety shoes, helmets, etc.
   - Rip saw machines were in operation without protection
   - Mill floor was dirty with poor lighting and less organized arrangements of wood materials

Observed/potential consequences of the weaknesses:

- Poor performance of many process chains resulting in low productivity, efficiency, and product quality

Procedures and techniques for overcoming the weaknesses:

i. Inventory management
   - It is best to hold small quantity of inventory in order to reduce financial burden and risk
   - Individual products must be appropriately stacked and labeled to show species, name, dimension, grade, destination, etc.
   - Products must be protected from any damages by applying cover, fumigation, etc.

ii. Human resource development
   - Mentality and attitude of work should be continuously improved through healthy communication and intensive supervision
   - Provide opportunity for discussing new ideas and initiatives of employees

iii. Safety and work condition
   - Operators and helpers must be required to strictly observed work safety procedures

- Particular machines such as rip saws must operate with special protection
- Mill floor must be kept clean at all times and free of messy materials

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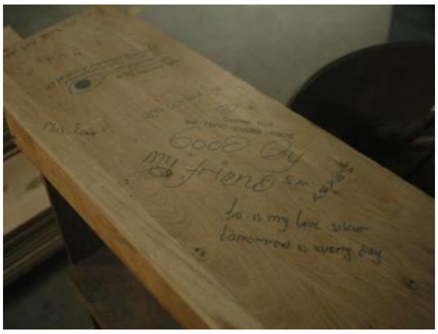

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Photos 96-101 (by Kim): unsafe operation of circular saw (96), vandalism on products (97), undesirable attitude of employees: sleeping (98) and chatting (99) at the mill, dirty floor (100), employees without safety shoes (101)

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Photos 102-103 (by Kim): circular saw with protector (102), employees wearing uniform and helmet (103)

5. Discussions

5.1 Achievement of the in-house training

Achievement of the in-house training that has been implemented in four countries involving twenty-four wood industries is assessed in light of the pre-defined expected outputs of the activity which are:

i. Awareness and understanding of forest industry managers/owners, government training and research institutions increased on the importance of improving efficiency in forest industries
ii. Improved knowledge, skill and mentality of forest industry operators
iii. Validated approaches and methodology of in-house training applicable to be further disseminated and implemented in different places

The indicators of achievement of the pre-defined outputs were inadequately defined and quantitatively not measurable. Therefore, assessment of achievement of the training activity is only possible to be performed in a descriptive manner, relying heavily on common sense and observed processes as well as responses of the participants.

As regards awareness and understanding of forest industry owners/managers as well as government training and research institutions on the importance of improving efficiency of forest industry operations, there is no doubt that such awareness and understanding have generally been increased through the training implemented. Indications of increased awareness and understanding observed during the training processes, among others are:

- The number of employees of different levels taking part in every training session was satisfactory, on average no less than 30 employees per host mill depending on scale of operation; in addition, owners and executives of some mills also took part in the training, at least during the opening and closing discussions
- The enthusiasm demonstrated by the participants at every single process chain is evident by the number of questions raised as regards the problems identified, the causes and consequences of the problems as well as the trouble shooting actions
- The expressed expectation of the participants is to have similar training continuously implemented in the future yet with a longer time duration

With respect to improved knowledge, skills and mentality of forest industry operators, all that can be said is that the in-house training has contributed to it for similar reasons as outlined above. It was emphasized during every single training session that technical competence is a requisite to build up competitive advantage of any wood industry, yet mentality of the employees is a sufficient condition for success. Mentality concerns with sense of belonging, responsibility and team work efforts; that survival of the company is not only the task and responsibility of owners and executives but also the entire employees as a company teamwork.

As regards applicability of the in-house training mode, there is no doubt that it has been validated. The training sessions have been implemented without any major difficulties and the participants generally expressed satisfaction with the training processes and results.

Therefore, it may be reasonable to conclude at this juncture that the in-house training has successfully achieved its expected outputs noting that the exact degree of achievement is not definable in a quantitative manner. For future in-house training it might be useful to develop some kind of composite index of efficiency of a particular mill before conducting an in-house training; the elements of such an index should be clearly defined and measurable indicators identified to allow for comparing efficiency levels before and after the training thus assessing impact of the training in a more precise manner.

5.2 Assessing efficiency of processing and quality of processed wood products

The weaknesses observed at twenty-four mills hosting the in-house training as presented in the preceding sections clearly indicate that the mills have not been operating at an efficient manner; individual mills are operating at different levels of efficiency and performing operation with various weaknesses. Some mills were found very weak in log handling at logyards, some mills were weak in breakdown sawing, some mills were weak in kiln-drying, yet some other mills were weak in saw doctoring. In fact, none of the host mills has exhibited satisfactory level of operational efficiency.

The technical irregularities at different process chains are clearly the source of inefficiency that have resulted in larger volume of wood waste than normal, larger number of product defects, longer product cycle, etc., all of which have brought about higher average unit cost thus reduce competitiveness. A one percentage reduction in overall wood recovery for instance, translates to a large magnitude of total production cost; defective processed products will require fixing up or total re-doing of works that need extra inputs thus increase cost of production.

In essence, the inefficient processing will raise unit cost of production and reduce competitiveness of the mills involved. Therefore, it is imperative for the mills to remove the weaknesses in view of increasing level of efficiency and improving quality of products thus enhancing level of competitiveness. The weaknesses identified at individual host mills, their causes and consequences have been, to the extent possible, made clear to the participants. Deep understanding and comprehension of the weaknesses are prerequisite to defining effective efforts for removing the weaknesses, not only by the mills managers and operators but also by owners and executives.

To remove the operational weaknesses, it is strongly advisable for the owners, executives and employees of individual mills, as appropriate, to take concerted follow-up actions that include:

- To fully understand any weaknesses, their causes and consequences through organized and informal discussions
- To identify needed measures and actions to remove the weaknesses
- For the owners, to provide the necessary inputs to implement the actions
- For the executive(s) to develop a mid-term training program on processing efficiency and quality control
- To closely monitor the progress made using measurable indicators of competence

Indeed, role of the owners and executives is critical for a successful implementation of any envisaged training program. This is particularly true when capital investment is an indispensable input for implementing a particular action. Moreover, strong leadership is a requisite for bringing together all the employees of different levels to actively get involved in the training process. Readiness and willingness of owners, executives, and employees to take concerted actions on removing the weaknesses in operation is prerequisite to moving forward on building up competitive advantage.

It should be emphasized at this juncture that the operational weaknesses observed are a big challenge for the wood industries but also an opportunity at the same time. The current level of operational efficiency observed is surely a reflection of the weaknesses; removing the weaknesses will surely increase the level of operational efficiency. That is to say that beneath the weaknesses lies the opportunity for increasing processing efficiency and improving product quality. If so, removing the weaknesses is truly indispensable; and it can be accomplished only by consistently conducting training of the employees and providing the essential inputs to processing chains in particular and to mill management operations in general.

5.3. Future implementation of in-house training

The participants of the in-house training at all host mills generally expressed expectation for continued conduct of similar training in the future. To be more fruitful and effective, participants made the following recommendations for the conduct of future trainings:

- To extend duration of training to 3-5 days per mill, depending on scale of operation and product lines
- To conduct a series of training periodically to allow for incremental gain in knowledge and skills and assessment of progress made in performance
- To strongly encourage owners and executives to take part in, in order to ease decision making on follow up actions
- To establish a composite index of performance prior to implementing a training taking the various elements of wood processing into account to allow comparison of performance over time

The achievement of the in-house training and the response made by the participants clearly point to the fact that in-house training mode is applicable to increasing processing efficiency and improving product quality in ITTO tropical timber producing countries. This is similar to the achievement of the in-house training previously implemented in Papua New Guinea, Malaysia, Myanmar, and Guyana. To increase effectiveness of such in-house training, it is strongly recommended for ITTO to develop technical manuals for different process chains indicating the correct procedures and techniques to apply. Availability of such manuals, in no doubt, will facilitate better and faster understanding on how to perform appropriate processing operations.

Individual mills should strive, as own initiative, to organize future in-house training using their own resources without having to rely to much on external assistance. For reason of short-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 level of performance by carefully looking at occurring weaknesses and irregularities of processing operations
- Conduct a series of in-house training with the assistance of experienced professionals in appropriate time intervals and consistently practice the advices given by the expert(s) during the preceding training sessions
- The cost of experts involved in the in-house training is to be borne by the mill as a component of operational cost.

Information on economic gain resulting from an in-house training is certainly most attractive to mill-owners. For example, mill owner is interested in knowing the effect of a one percentage increase in overall wood recovery on magnitude of monetary gain. By knowing the economic gain resulting from increased efficiency, the owner must be eager to pursue increased efficiency through implementation of training on efficient processing. Hence, it is strongly advisable to use economic gain as one of the impact indicators of in-house training. In this way, the mill-owner will appreciate an in-house training as a means to increase sales, not merely as a costly routine endeavor; that training on wood processing is a vehicle to build up competitive advantage instead of a mere cost center.

6. Conclusions and recommendations

The implementation of in-house training on wood processing and product quality at twenty-four wood industries in Cameroon, Ghana, Guatemala, and Mexico has led the Consultant to draw the conclusions and make the recommendations as outlined below.

6.1 Conclusions

i. The wood industries hosting the in-house training are experiencing inefficient operations at varying degree at different value chains.

ii. The main sources of inefficiency observed are improper practice of processing techniques and inadequate conduct of quality control at different value chains which include log handling at logyards, band sawing, saw doctoring, slicing, gluing, kiln-drying, cross cutting, finger jointing, laminating, sanding, packaging, quality control, waste utilization and mill management.

iii. Through participatory field observation and discussion as well as demonstration of troubleshooting actions, the training participants at individual mills have gained better awareness and understanding on the critical role the processing efficiency and quality control play in building up competitive advantage and in surviving market competition.

iv. In addition, the participants have also improved their knowledge and skills on proper wood processing techniques and on quality control procedures and techniques.

v. The exact gain in knowledge and skills by the participants is not known in the absence of measurable indicators for gauging impact of the training.

vi. The in-house training mode is proved applicable to increase efficiency of processing and improve quality of processed products as evidenced by the facts that it has realized its predefined outputs without major impediments and it is favored by the participants as well as the national forestry institutions.

vii. The owners, executives, managers, operators and employees of the wood industries hosting the training strongly expect that similar in-house training is continuously implemented in the future taking the lessons-learned into account in order to improve achievements.

6.2 Recommendations

i. To allow measuring of in-house training impact on technical and managerial skills, it is strongly advisable to develop a practical monitoring tool to gauge the changes produced by the training.

ii. The monitoring tool should clearly identify the main elements of processing and quality control to be considered and define measurable indicators of the respective elements.

iii. To increase effectiveness of future in-house training, there is a need to improve existing modalities of the training which include:

- Extension of time duration of 3 or 4 days per mill
- Encouragement of owners and executive to take part in
- Time interval between training sessions is no longer than one year
- Application of a robust monitoring system to accurately document occurring change in competence over time

iv. To promote attractiveness of in-house training to mill owners and mills, information on economic gain resulting from an in-house training program, e.g. monetary effect of increased wood recovery, needs to be made available by ITTO experts and widely disseminated.

v. To facilitate proper and deep understanding on techniques for wood processing and quality control, ITTO should considers developing practical, technical manuals for wood process chains commonly practiced in member countries which are complementary to in-house training activities.

vi. Mill owners and executives wish to survive competition in world market for timber products should consistently enhance competence of their employees in wood processing and quality control through conduct of continued in-house training at their own initiative, without relying heavily on external resources because such an endeavor is a means to increase economic gain in the long-run.

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