International Tropical Timber Organization

de la part du Peuple japonais

PD 700/13 Rev.1 (I) : DEVELOPMENT OF INTRA-AFRICAN TRADE AND FURTHER PROCESSING IN TROPICAL TIMBER AND TIMBER PRODUCTS – PHASE I [STAGE 1]

"Technical training on improved practices in timber enterprises and 250 workers and st

(Activity A6.2)

de la part du
Peuple japonais

ITTO Project PD 700/13 Rev. 2 (I)
Development of Intra-African Trade and Further Processing in Tropical Timber and Timber Products-Phase 1 [Stage 1]

Report on the Implementation of Activity 6.2 of ITTO Project PD 700/13 Rev. 2 (I)
"Technical training on improved practices in timber processing for at least 10 enterprises and 250 workers and staff"

Executed by: Mr. Sukiman (Sae Yung Kim)

Yokohama, May 2016

Acknowledgements

I wish to express my sincere and heart-felt appreciation to the Executive Director of the International Tropical Timber Organization (ITTO) for granting me the opportunity to take part in the implementation of Activity 6.2 "Technical training in minimum 10 enterprises on improved practices in timber processing for at least 250 workers and staff" of ITTO Project PD 700/13 Rev. 2 (I) Phase 1 Stage 1 "Development of Intra-African Trade and Further Processing in Tropical Timber and Timber Products", which is being implemented by the Ministry of Water and Forests of the Government of Cote d'Ivoire. Implementing the activity was truly challenging, given the heavy tasks that had to be accomplished in a satisfactory manner in order to deliver the expected outputs predefined by the project.

I also wish to convey my wholehearted thanks to Dr. Tetra Yanuariadi, the ITTO Forest Industry Projects Manager, for his untiring assistance in making the necessary arrangements with concerned authorities of Cote d'Ivoire that facilitate the smooth execution of the in-house training; to Mr. Marcellin Nziengui, the Project Coordinator of PD 700/13 Rev. 2 (I) and staff for making the excellent logistical and administrative arrangements that made execution of the training progressing as planned, and; to the owners, executives, and employees of the respective host wood factories for their cooperation and enthusiasm in learning different techniques for improving efficiency of wood utilization.

Indeed, the in-house training format have been successfully implemented in nine ITTO member countries in the three regions where I was also heavily involved; the role of in-house training in improving performance of the wood industries is highly appreciated by those countries. I have no doubt that implementation of in-house training in Cote d'Ivoire will bring about increased efficiency of processing and improved quality of wood products nationwide provided that the participating wood industries are willing to keep practicing the appropriate wood processing techniques they have learned from the project.

With best regards,

Sukiman (Kim Sae Yung)
The Consultant

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1. Introduction

1.1. The activity defined

The activity that has been implemented and reported herewith is one of the activities pertaining to Output 6 of ITTO Project PD 700/13 Rev. 2 (I) Phase I Stage I entitled "Technical training in minimum 10 enterprises on improved practices in timber processing for at least 250 workers and staff". The activity was implemented in Cote d' Ivoire in two batches: the first batch on 11-18 December 2015 and the second batch on 18-22 February 2016 involving 14 timber industries in total and over 250 workers and staff of the host industries.

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

To implement Activity 6.2, an international consultant having accumulated practical knowledge and skills as well as experience in working with tropical wood processing over thirty years in Indonesia and other tropical countries, Mr. Sukiman or Mr. Sae Yung Kim, has been hired by the project. The terms of reference of the consultant are presented in Annex 1. The specific tasks of the consultant include:

- To support the organization and implementation of in-house training
- To undertake in-house training at no less than 10 wood industries in Cote d'Ivoire involving at least 250 workers and staff of the industries; and
- To prepare an in-house training report for submission to ITTO.

1.2. The expected outputs

The expected outputs of the activity include:

- At least, 250 workers and staff of at least 10 wood industries trained on improved practices in wood processing.
- Awareness and understanding of forest industry owners/managers as well as government training and research institutions increased on the importance of improving efficiency of forest industries;
- Improved knowledge, skills and mentality of forest industry operators, and;
- Validated approach and methodology of in-house training applicability to be further disseminated and implemented in different places.

2. Implementation methodology and approach

2.1. In-house training defined

In-house training is a format of capacity building endeavor wherein knowledge and skills of employees are improved through direct involvement in the detection of technical as well as operational and managerial problems, and in troubleshooting with the assistance of a highly competent professional on wood processing. As evident by the term “in-house training”, the training is specifically devoted to detecting and solving problems facing a particular wood industry. Obviously, it is a problem solving oriented training, tailored to specific needs of a particular wood industry.

2.2. Selection of wood industries

In light of availability of resources for implementation of the activity, especially level of funding of the project, it was necessary to limit the number of wood industries participating in the training. Selection of wood industry participants was fully accomplished by the Ministry of Water and Forest of Cote d’ Ivoire.

In the first batch of training conducted on 11-18 December 2015, 8 industries were included while, in the second batch implemented on 18-22 February 2016, 6 industries were selected giving a total of 14 wood industries as the training participants as shown in Table 1.

Table 1: List of the wood industries hosting the in-house training in Cote d’Ivoire

No.	Name	Location	Product line	Remarks
1.	Tranchivoire	Abidjan_Koumassi	Sawing and veneer	
2.	ITS	Abidjan_Yopougon	Sawing	
3.	Carpenters group of Yopougon	Abidjan_Yopougon	Furniture makers	
4.	ALPICI	Abidjan_Yopougon	Veneer and plywood	
5.	INPROBOIS	Adzope	Veneer, plywood and sawing	Revisited
6.	ESSIM Group	Abidjan_Koumassi	Furniture makers	Revisited
7.	KAMAAD	Abidjan-Koumassi	Sawing	
8.	SIDINE	Abidjan_Koumassi	Sawing	Revisited
9.	SMCI	San Pedro	Sawing, laminated panels and veneer	
10.	BSA	San Pedro	Sawing	
11.	Brou Menuiserie	San Pedro	Furniture makers	
12.	ITB	San Pedro	Sawing and coffins producer	
13.	SIBD (SOFIBEX)	San Pedro	Sawing	
14.	FIP	Adzope	Sawing, laminated panels, flooring	

The advantages of in-house training mode over the conventional training, i.e., a lengthy class room lecturing plus short field visit and a brief demonstration, include:

- Class lecturing, while undertaken, is used to brief the participants in the objectives and scope of the training thus consumes only a meager time resource;

- Accommodates a large number of participants, ranging from owners to executives, managers, supervisors, operators and employees in general at affordable cost as the training is conducted only on mill site, inside the industry building;
- Identification of technical as well as managerial problems and discussion on causes, consequences of the problems as well as the recipes of problem solving action can be accomplished right on site in an open and transparent manner without having to worry about business confidentiality.
- As technical and managerial problems are company specific in nature, work programme of any in-training session can be easily tailored to the needs of participating industry; and
- The expert and training participants can work together on the spot in identifying weaknesses and irregularities of wood processing operations including causes of the problems and their consequences and in demonstrating needed actions to repair the weaknesses and irregularities identified.

2.3. Conceptual framework

- 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 in order to generate higher profits thus enhance business survival as shown in Figure 1 (Hill & Jones, 1998). The training reported herewith concerns only with efficiency of wood processing and quality of manufactured wood products.

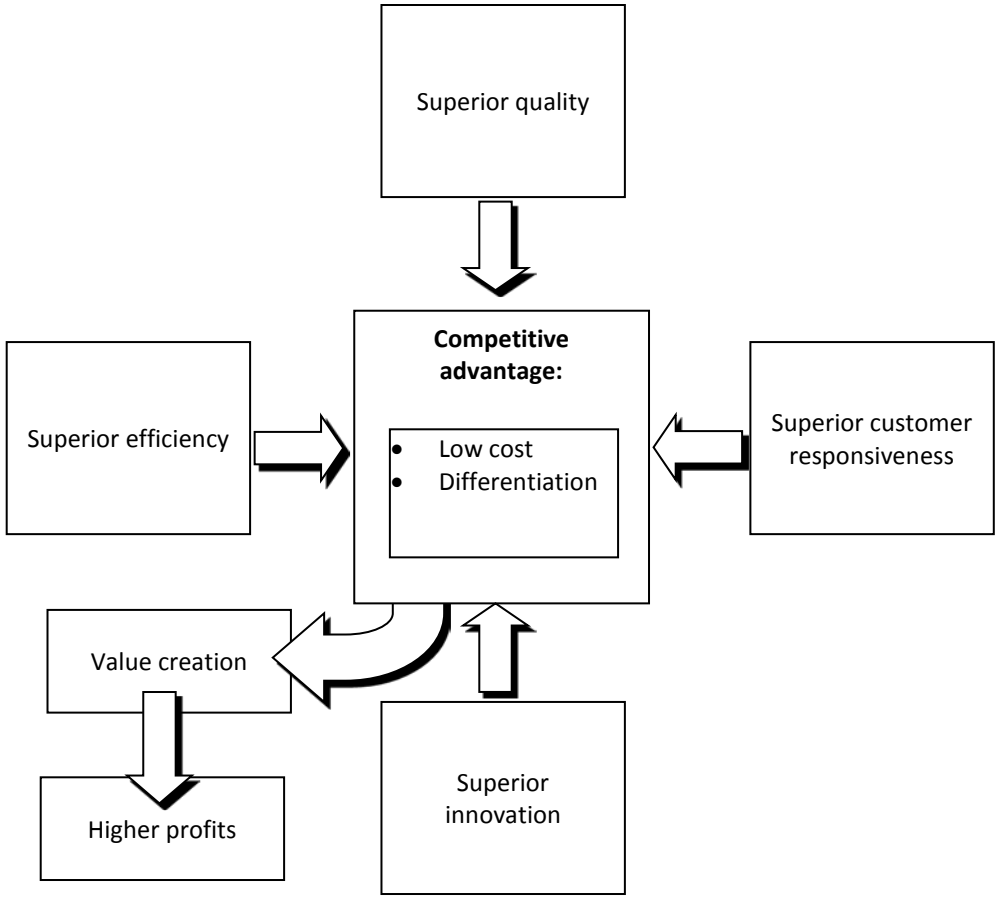


Figure 1. Building blocks of competitive advantage (adapted from Hill & Jones, 1998)

- Efficiency
  A company is a device for transforming inputs into outputs. Inputs are basic factors of production such as labor, land, capital, management and technical knowhow. Outputs are the good and services that a company produces. 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.

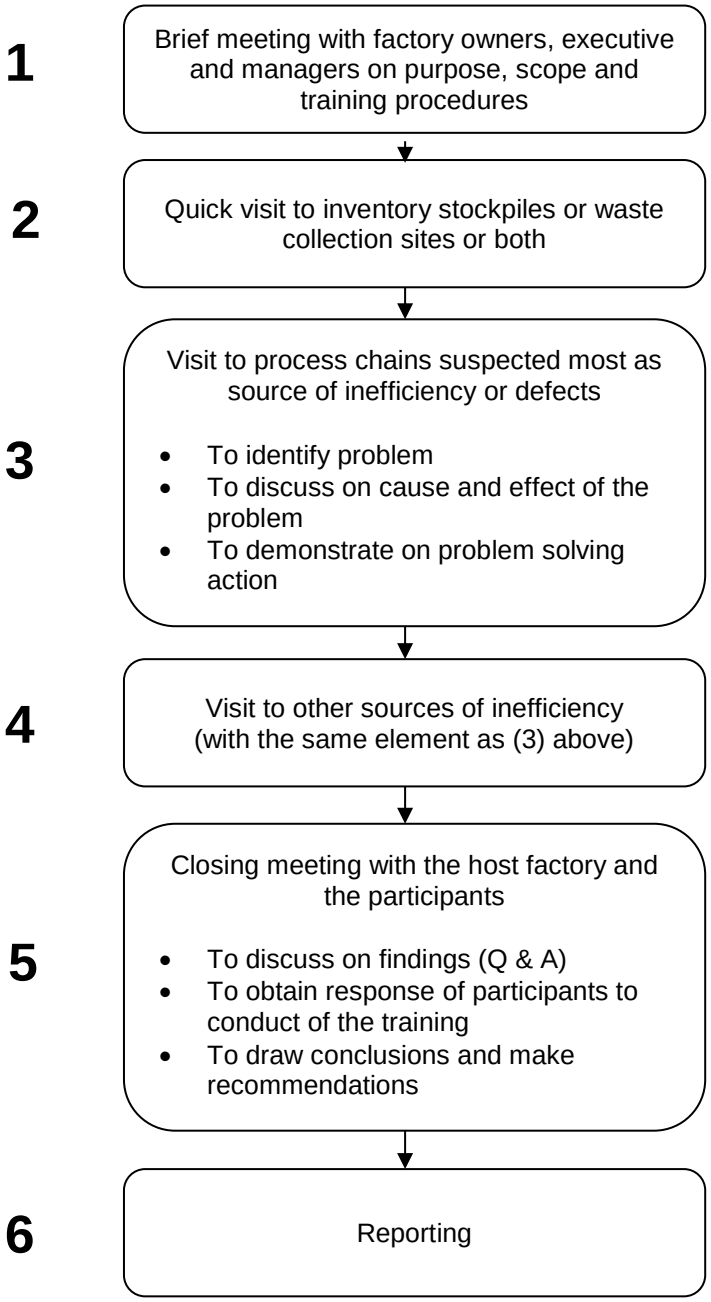
- Quality
  Quality products are goods and services that are reliable in the sense that they do the job they were designed for and do it well. The impact of high product quality on competitive advantage is twofold. First, providing high quality products increases the value of those products in the eyes 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.

2.4. Approach

There were 14 wood industries that hosted the in-house/in-factory training in Cote d'Ivoire. The training was divided into two batches: 8 industries on 11-18 December 2015 and 6 industries on 18-22 February 2016. The approach pursued in the implementation of in-house training at every wood industry is summarized in Figure 2, which basically consists of six steps, as presented below.

- **Step 1 : Brief opening meeting**
  On the meeting, objectives, expected direct outcomes and training inputs as well as procedures are discussed before the trainer and the host company.
- **Step 2 : Visit to inventory of wood products and wood waste piles**
  Visit to inventory piles provides good picture of product quality and performance in wood processing; volume and dimension of wastes provide hints and impression on on-going level of processing efficiency.
- **Step 3 : Visit to value chains**
  At this step, technical problem at particular value chain process is identified, its cause-effect discussed and problem solving actions demonstrated on the spot.
- **Step 4 : Visit to other value chains**
  As time permits, visit also are made to other less problematic value chain and undertake the same tasks as in Step 3.

Figure 2: The steps followed in conducting in-house training at individual factories



- **Step 5 : Closing meeting**
  At this gathering, a general discussion on conduct of the training is held to clarify any remaining puzzles. Participants are also granted opportunity to comment on the training as regards duration, approach, etc. The trainer makes clear the link between efficiency and product quality with competitive advantage, level of profit and business survival.
- **Step 6 : Reporting**
  In reporting, process of training, its findings and outcomes will be fully recorded as the basis for making recommendations for future actions.

3. Forest resources and industries of Cote d'Ivoire

This section provides brief information on forest resources of Cote d'Ivoire covering bio-physical and socio-economic aspects. The information presented here is taken solely from ITTO Technical Series No. 38 "Status of Tropical Forest Management 2011" prepared by Blaser, et.al. (2011) unless specific mention is made on other source(s).

3.1. Extent of forest land and forest types

- The total land area of the country is 32.3 million ha of which estimated forest cover was 10.4 million ha or 32% of the land area.
- The tropical moist forest belt extends inland from the coast for more than 250 km, beyond which there is extensive savanna.
- With the exception of small areas of remaining primary forests, e.g., in the Tai reserve and the western mountains, forests are heavily degraded.
- Two main forest types can be distinguished in the south: wet evergreen and semi-deciduous. The former type is poorly stocked in commercial timber although it contains such species as *Vapaca spp., Guarea cedrata (besse), Tieghemella heckelii (makore), Tarrietia utilis (niangon) and Triplochiton scleroxylon (samba).*
- The semi-deciduous forests, occurring in the central and northern parts of the zone forestiere was once rich in valuable timber species including samba, bete (*Mansonia altissima),* kotibe (*Nessogordonia papaverifera)* and acajou (*Khaya ivorensis*).
- Outside a small number of effectively protected areas, most forests of both types are heavily degraded or are at an early stage of secondary growth.
- In the domaine soudanais there are some dry forests and gallery forest containing species such as *Daniella oliveri, Isoberlinia doka,* and *Afelia africana*.
- There are about 10,000 ha of mangrove forests characterized by *Rhizophora racemosa* and *Avicennia germinans* (Spalding, et.al., 2010 in ITTO, 2011).

3.2. Permanent Forest Estate (PFE)

- The PFE officially comprises the 231 classified forests zoned for production and protection which cover an area of 4.2 million hectares of which only 1.95 million ha are still forested; there are nearly 2.1 million ha of forest in protected areas.
- Outside the PFE, in the rural forest domain, there were 385 forest harvesting areas in 2008; the entire timber production of the country comes from these areas.

3.3. SFM policy framework

There are two main categories of natural-forest ownership:

- Public or state-owned forests, which are divided into two kinds of land use:
  - The permanent forest domain which includes the reserved forest area and protected areas; and
  - The domaine forestier rural which includes PEFs or forest harvesting areas, and forests reserved for agricultural purposes.
- Community forests, which are based on traditional customary rights recognized in all forest areas in the country. There are 6,705 registered sacred forests covering a total area of 36,435 ha which are under the full jurisdiction of local communities. Many more forests may have cultural or spiritual value but are not registered.

An estimated 200,000 ha of the production PFE is under SFM, no forest is certified, and an estimated 840,000 ha of protection PFE is under SFM.

3.4. Forest for production

- Two forest management systems are employed: in the permanent forest domain, forest management is carried out by SODEFOR while the domaine forestier rural, it is carried out by private concession holders. In the past, timber was harvested mainly in reserved forest areas but excessive extraction over the past 35 years has led to their depletion. Today, nearly 90 % of timber is extracted from the domaine forestier rural.
- Until 2002, forest harvesting in the domain forestier rural was based on a license system called PTE which allocated areas of up to 2,500 ha to a large number of concessionaires. With a policy revision in 2004, the PTE system was abolished and replaced by a system based on PEFs. By law, a PEF is at least 25,000 ha in size and is allocated for 15-20 years; it can be renewed if management by the concession holder is satisfactory.
- As of 2007, 373 PEFs had been attributed to 112 concessions, covering a total area of about 1.4 million ha of productive forest. In the past ten years, the average timber harvest was 1.6 million m^3 per year.
- Despite the scarce forest resources, some large international timber companies of French, Italian and Lebanese origin are still operating in Cote d'Ivoire. Due to the earlier log export ban and the growing scarcity of the resource, these companies have invested in downstream wood processing. The French company, Inprobois, for example, holds 7 PEFs totaling 366,000 ha and manages forets classees of 22,000 ha in partnership with SODECOR. Almost all the company's production, which specializes in plywood and veneer, is for export. Other foreign companies also possess several PEFs that add up to the large areas. For examples, SNG has licenses to 480,000 ha, CIB has licenses to 628,000 ha and SIFCI has licenses to 505,000 ha.

3.5. Timber production and trade

- The forest industry is composed of several hundred small processing units with only 18 enterprises with a processing capacity of more than 10,000 m^3 per year and 70% of the industry is foreign-owned.
- Total roundwood production per year in the period 2004-2008 was estimated at 21.5 million m^3, of which nearly 20 million m^3 was for fuelwood and charcoal.
- Industrial log production fell from 5.3 million m^3 in 1977 to 3.3 million m^3 in 1985, 1.9 million m^3 in 2003 and 1.5 million m^3 in 2009. Total sawnwood production was about 471,000 m^3 in 2009, veneer production was 396,000 m^3 and plywood production was 81,000 m^3.
- In 2009, an estimated 125,000 m^3 of logs were exported, as were 252,000 m^3 of sawnwood, 103,000 m^3 of veneer and 11,000 m^3 of plywood. Exports went mainly to Europe (80%), USA, Japan and neighboring countries. Since 1994, there has been a ban on the export of logs of several high-value timber species obtained from natural forests.
- MINEEF taxes commercial collectors for the harvest of 44 NTFPs. Many more NTFPs are traded locally and used for subsistence. Among the most important are bamboo, rattan, and raphin palm for basketry, furniture and housing, the leaves and fruits of *Thaumatococcus danielli* are for medical purposes and as a sweetener.

3.6. Socio-economic aspects

- Until about 1985, timber was Cote d'Ivoire's third most important export by value but has since declined as the forests have been logged and depleted of commercially valuable trees. In 2006, the economic contribution of the formal forest sector was estimated at

1.9% of GDP. The total annual value of wood production, timber and fuelwood, is estimated at US$ 323 million.

- Forests are important for sustaining the livelihoods of many people. Edible and medicinal plants are collected in great quantities. Bush meat remains a major source of protein in rural areas; despite the very restrictive hunting regulations, meat harvest volume is estimated at more than 120 tons per year. The consumption of fuelwood and charcoal is estimated at more than 20 million m^3 per year.

3.7. Summary

- Deforestation and forest degradation are major problems in Cote d'Ivoire and most national forest is considered degraded or secondary. The country's 231 state-owned forets classees have been over-harvested and have become depleted of timber. Natural forests in the domaine forestier rural and planted forests are providing an increasing part of the timber supply.
- The level of enforcement of existing laws and decrees appear to be low in much of the PFE. Forest management plans are under preparation or have been prepared for the forets clssees, but few have been prepared for the domaine forestier rural.
- While the recorded area of well-managed protection forest has increased, this is most likely due to improved information rather than a general improvement in forest management. Systematic improvements in forest management have been hindered in recent years by socio-political crises and a lack of political will. Illegal logging is thought to be widespread.

4. Main results of the in-house training

4.1. Logs handling at logyards

i. Common weaknesses observed at some mills are:
- ✓ Cracked logs left unattended causing even heavier cracks and lower sawing recovery
- ✓ No coating of log ends to prevent cracking of logs



(1) (2) (3)

ii. Demonstrated techniques for preventing logs cracking include:
- ✓ Application of plastic S-hooks
- ✓ Coating of log ends with wax or other material to prevent cracking
- ✓ Marking of cracked logs with specific color that requires specific sawing techniques due to specific shape of cracks in order to minimize waste



(4) (5) (6)

Photos (by Kim): Cracked logs (1, 2, 3); use of plastic S-hooks to avoid crack propagation (4); use of blue color to identify logs requiring specific sawing techniques (5); and log end coated with wax to prevent cracking from occurring (6).

4.2. Plymilling

i. Use of old fashioned rotary machines causing excessively big volume of waste with core diameter over 20 cm. This problem can be avoided using spindle-less rotary to reduce core size down to 5 cm in diameter.

(7)

(8)

Photos (by Kim): old fashioned rotary peeling (7) and spindle-less rotary peeling (8)

ii. Large end peeling waste due to improper trimming, too large length allowance of logs which can be easily avoided if logs are cut to length at minimum allowance.

(9)

(10)

(11)

(12)

Photos (by Kim): large end peeling waste (9) and nearly no end peeling waste (10), 20 cm width of end cut veneer (11) and 2 cm width of end cut veneer (12)

iii. Veneer breaks due to unuse of end tape which can be avoided simply by applying end tape.

(13)

(14)

Photos (by Kim): end tape not used (13), use of end tape avoids veneer tearing (14)

iv. Veneer damage due to untied veneer rolls which can be avoided by properly tying veneer rolls.

(15)

(16)

Photos (by Kim): untied veneer rolls (15) and tied veneer rolls (16) to avoid veneer breaks

v. Veneer are glued at too high of temperature causing poor quality of gluing; before gluing, veneers coming out from conveyor need conditioning which can be accomplished inexpensively using air fans.

(17) (18)

Photos (by Kim):poor quality of gluing due to too high temperature (17) and improved gluing quality by conditioning of veneer coming out from continuous dryer (18)

vi. Gum taping performed inefficiently as the tape is placed at distance from the worker which can be easily avoided by self carrying the tape.

(19) (20)

Photos (by Kim): inefficient gum tape application (19) and efficient gum tapping (20)

vii. Improper packing of veneer causing quality downgrading due to fungi and blue stain; this problem can be easily avoided by proper packing, i.e. use of plastic wrap, piling with limited bundle size and use of tape in bundling.


(21) (22)

Photos (by Kim): improper storage and packing of veneer (21) and proper storing of veneer (22)

viii. Veneer defect repairing without heating causing veneer have to re-enter hot press whilst heating can be easily done using steel iron that repaired veneer no need to undergo hot press again.


(23) (24)

Photos (by Kim):veneer repairing without heating (23) and with steel ironing (24)

4.3. Sawmilling

i. Occurrence of saw blade marks caused by uneven height of saw teeth. Such works will result in downgraded timber quality thus lower selling price; or the products made of it will be of lower quality thus lower selling price. The marks can be prevented from occurring by ensuring that saw teeth are of the same height. To this end, it is required to use a specific measuring device.

(25) (26)

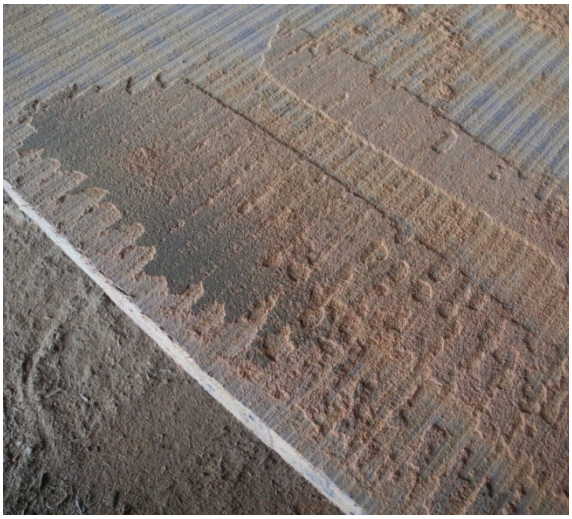
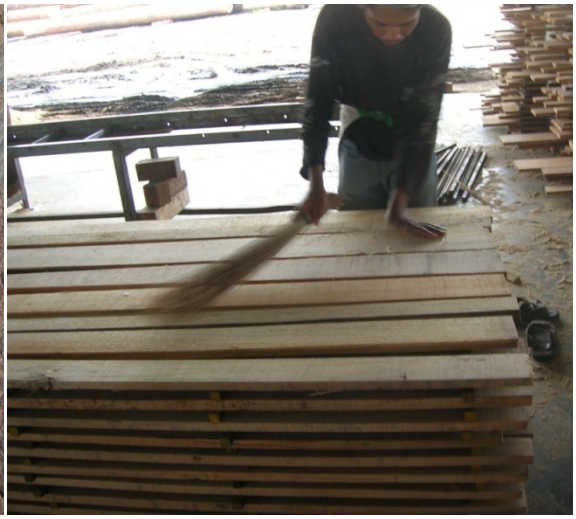
Photos (by Kim):saw blade marks (25) and saw teeth height measuring device (26)

ii. Use of conventional sawing technique at the risk of lack sawing precision and larger wood waste. Lack of precision in sawing may bring about rejected sawn products due to unmet specific physical dimension thus become wasted. Sawing precision can be significantly improved by employing a laser guided sawing wherein direction and speed of sawing is guided by laser beam.

(27) (28)

Photos (by Kim):conventional sawing technique (27) and laser-guided sawing (28)

iii. Sawn timber is heavily covered by saw dust which may result in quality downgrading due to fungi and blue stain. This dusty timber may be caused by poor space maintenance or malfunctioning of dust suction or blower. For whatever reason it might be, sawn timber must be kept free of dust cover at all time using simple technique like hard broom sweeping.

(29) (30)

Photos (by Kim):sawn timber nearly fully covered with saw dust (29) and sawn timber free of dust (30)

4.4. Wood drying

i. Improper stacking of sawn timber caused primarily by poor understanding on wood drying process, poor supervision and lack of professionalism. The uneven vertical distance between timbers will cause some timbers get dry faster than the others; the uneven horizontal distance of sticks may result in timber bowing or bending. Therefore, it is necessary to do proper stacking of sawn timbers to ensure an even and high quality of dried timbers.


(31) (32)

Photos (by Kim):improper stacking (31) and proper stacking of sawn timber (32)

ii. Another weakness in timber stacking is that timbers are placed so close to each other that air flow is nearly fully blocked and drying time may be extended considerably.


(33) (34)

Photos (by Kim): wood drying without air flow (33) and proper stacking (34)

4.5. Further processing

i. Inefficient use of solid wood

Some mills unnecessarily used solid wood as material for making arc, curved products such as those for door part or furniture parts. This fact is due primarily to lack of understanding on the basic notion of “efficiency” and its role as a building block of competitive advantage. The immediate consequence of this practice is wasting of valuable resource, decreased overall recovery rate and increased overall production cost. This inefficiency problem can be easily avoided by using laminated veneer, especially damaged sheets, in the making of arc products.


(35) (36)

Photos (by Kim): use of solid wood (35) and veneer (36) in arc products making

ii. Inadequate air suction system

Some mills are employing computerized sawing system in the making of assembly parts, e.g. in moulding, planing, sanding, etc. But, the system lacks of dust suction pipes/hoses causing the room dirty, covered by dust and damaging to human health. This problem is, perhaps, a matter of ignorance since installment of dust suction

facility is inexpensive compared to the investment made in the computerized system. Therefore, installment of adequate air suction is truly needed.

(37)

(38)

Photos (by Kim):improper installment of air suction facilities makes working hall and products dusty (37) and proper installment of suction facilities can avoid the problem (38)

iii. Burn marks

Burn marks on sawn timber are not uncommon, which, certainly, downgrade quality. Such marks are caused by inappropriate setting of moulder roller pressure. To avoid such a problem, pressure of moulder rollers have to be set at the same level with the aid of a pressure gauge.

(39)

(40)

Photos (by Kim): burn marks in moulding pressure (39) due to weak control of roller pressure (40)

iv. Defective planed timber

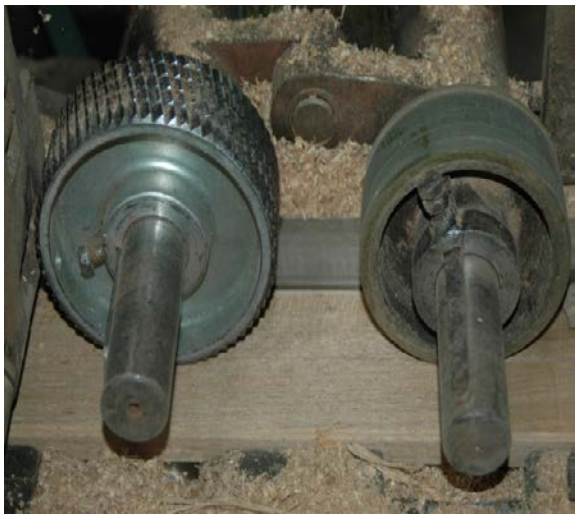
Occurrence of holes on planed timber is not uncommon which may be due to natural or artificial causes. If left unrepaired, such defect will surely reduce timber quality which can be overcome by filling quality putty in the holes.


(41) (42)

Photos (by Kim):holes on planed timber (41) have to be repaired by filling putty in the holes (42)

v. Roller marks

Roller marks is caused by improper setting of steel roller pressure in moulding process. Such marks will surely downgrade product quality and can be easily avoided by setting roller pressure on the right level using a pressure gauge.

(43) (44)

Photos (by Kim):roller marks on products (43) due to improper setting of steel roller pressure (44)

vi. Inefficient multi-ripping

Multi-ripping process is still in use by some mills; the process unavoidably results in large volume of waste due to use of several saw blades of certain thickness. In addition, yielded sawn timber is prone to bowing or twisting which is difficult to repair. Use of slicing technique is more efficient especially for fancy plywood, flooring, or layer flooring.

(45) (46)

Photos (by Kim):sawn timber from multi-ripping process (45) and sliced parts from slicing process (46)

vii. Improper jointing

Jointed boards may get loose after sometime due to use of inappropriate jointing material such as steel nails or unsuitable dowels. Loosen joint is certainly not desired. It is better to use groomed dowels in jointing board pieces noting that the species and dryness of the dowels should be the same as the boards to be jointed.

(47) (48)

Photos (by Kim): loosen joint of panels (47) and dowels used for jointing (48)

viii. Inefficient sanding

Hand sanding is a common practice in some mills. When using electric sanding tool, use of energy is quite significant. It is better to use a light, air sander in order to minimize energy cost, with comparable quality of sanded materials.


(49) (50)

Photos (by Kim):use of electric hand moulding tool (49) and air hand sanding for energy saving (50) with comparable quality of sanding

ix. Inefficient sanding of curved materials

Sanding of curved materials may be accomplished manually and it can be carried out either by directly holding sand paper on hand or by placing sand paper around a piece of solid material. The latter option is more efficient than the former one as it allows flexible movement of sand paper and sanding surface is larger which will increase productivity and reduce consumption of sand paper.


(51) (52)

Photos (by Kim):hand sanding of curved materials (51) is less efficient than hand sanding with the aid of a simple tool (52)

4.6. Wood waste utilization

i. Wasted log ends

Log ends are found neglected at some mills. This is a source of inefficiency due to ignorance or lack of idea on waste utilization. Log ends can be finger jointed and then peeled to produce veneer or sawn to produce lumber. In this way, overall wood recovery would be increased and production cost decreased.


(53) (54)

Photos (by Kim):big diameter log ends left unused (53) and finger jointed log ends (54)

ii. Wasted damaged veneer

Damaged veneer can be used in making different valuable materials with only simple technique.

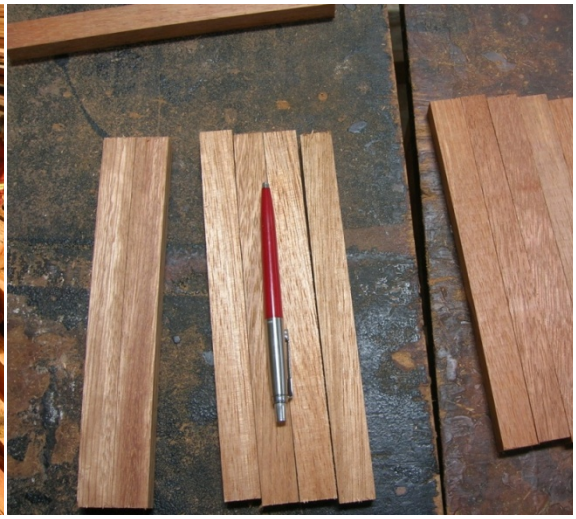


(55) (56) (57)

Photos (by Kim):damaged veneer left unused (55) while the veneer can be sorted (56) then used for packaging (57)

iii. Inefficient sawing

Inefficient breakdown and phony sawings result in large volume of waste which is a big loss to the company if the waste is left unused. The waste can be sorted and grouped, then utilized for making valuable materials.

(58) (59)

Photos (by Kim):sawing waste left unused (58) or used in making valuable products (59)

iv. Unused veneer

Large volume of damaged veneer is left unattended by some mills and is one of sources of inefficiency. In fact, depending on size, veneer can be plaited and use for packaging material.


(60) (61)

Photos (by Kim):unattended damaged veneer (60) and plaited veneer (61) for packaging material

v. Cross-cutting waste

Cross-cutting may result in large volume of waste if performed inadequately by inexperienced operators and workers. If the yielded waste is left unattended, it is a big loss to the company. Waste can be laminated and then used in the production of valuable products, e.g. arc door frame.


(62) (63)

Photos (by Kim):unattended cross-cutting wastes (62) and laminated wood waste (63) is used in door frame making

vi. Inefficient use of saw dust

Some mills do not efficiently use saw dust by burning it for boiler. In fact, saw dust can be used in pellet making with simple technology thus, generate some revenue for the company.


(64) (65)

Photos (by Kim):unused saw dust (64) and use of saw dust for pallet (65)

vii. Damaged veneer not utilized

Some mills do not adequately utilize damaged veneers that occur for different reasons. The immediate consequence of such decision is financial loss and reduced revenue. In fact, damaged veneers of different size can be assembled, laminated and use as a core in plywood making.


(66) (67)

Photos (by Kim):damaged veneers left wasted (66) and utilized for core of plywood (67)

viii. Sawing waste not utilized

Some mills do not pay due attention to utilization of sawing waste which is a revenue loss to the company. Using simple technique, such waste can be transformed to become solid laminated block and utilized as raw material in making different wood products.


(68) (69)

Photos (by Kim):wood waste of sawing neglected (68) whilst can be transformed to solid laminated block (69)

ix. Poor piling of cores

Some mills do not properly pile cores causing the cores damaged due to humid air, fungi or pests. Cores are valuable material that can be easily transformed to pallet for packaging or sawn to produce bare core that reduce financial loss.

(70)

(71)

Photos (by Kim):reckless piling of cores (70) and proper piling of cores before further processing for pallet, bare core or other wood products (71)

4.7. Saw-doctoring

i. Sawmarks

Sawmarks are common defects found with many mills which are caused by uneven height and width of saw teeth. Such defect certainly is downgrading quality of sawnwood and is a form of financial loss. To avoid such defect, saw teeth must be ensured of the same height and width with the aid of a special measuring instrument.

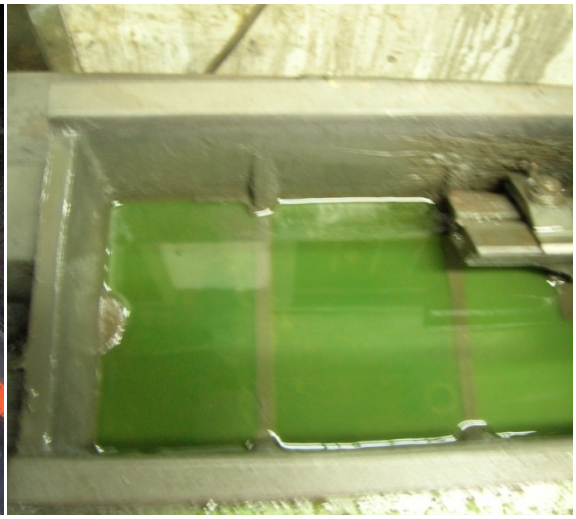
(72)

(73)

Photos (by Kim):sawn marks occur due to inadequate maintenance of saw teeth (72) and control of teeth height with the aid of a measuring gauge (73)

ii. Improper knife grinding

At some mills grinding of knives are accomplished without applying a coolant causing excessive burn, occurrence of fissure on the knives or cracks due to overheating. Using such knives will certainly create defects on yielded products thus, must be prevented from happening.

(74) (75)

Photos (by Kim):knife grinding without coolant (74) and with suitable coolant (75)

iii. Improper maintenance of saw blades

At some mills band saw blades are placed directly on the floor causing blades dirty, easily get rusty and time consuming in mobilization. Bandsaw blades are best cleaned and rolled before storing and stored in hanging position.


(76) (77)

Photos (by Kim):improper (76) and proper storage of bandsaw blades (77)

iv. Improper storage of circular saws

Some mills commit improper storage of circular saws by placing the saws randomly in a flat position causing the blade may get twisted or damaged which will require significant repairing before use. It is best to store circular saws in a clean condition and placed vertically on special rack that individual saws do not attach to each other.


(78) (79)

Photos (by Kim):improper placing (78) and proper storage of circular saws (79)

v. Improper side sharpening

At some mills, side sharpening is not properly performed as surface of the sharpener is not fully flat causing difficulty in tensioning the blade.


(80) (81)

Photos (by Kim):use of defective grinding stone in sharpening (80) causing difficulty in tensioning (81)

vi. Improper teeth sharpening

At some mills sharpening of circular saw teeth is not accomplished with the aid of micro gauge to measure teeth height.

(82)

(83)

Photos (by Kim):sharpening without use of micro gauge (82) and a typical micro gauge (83)

4.8. Packaging

i. Improper packaging of veneers

Some mills commit improper packaging of veneers by tying veneers with wrapping band at the wrong position causing damage and waste of materials.

(84)

(85)

Photos (by Kim):incorrect tying of veneers, directly on veneers (84), and the correct position of tying band (85)

ii. Inefficient positioning of steel band

Improper positioning of steel band also takes place at some mills and reduce productivity of workers as more time is consumed to go back and forth from the place where the band is kept to the place of materials. This inefficient conduct of work can be easily avoided by placing steel band on a trolley that can be easily moved nearing the products to be worked on.

(86)

(87)

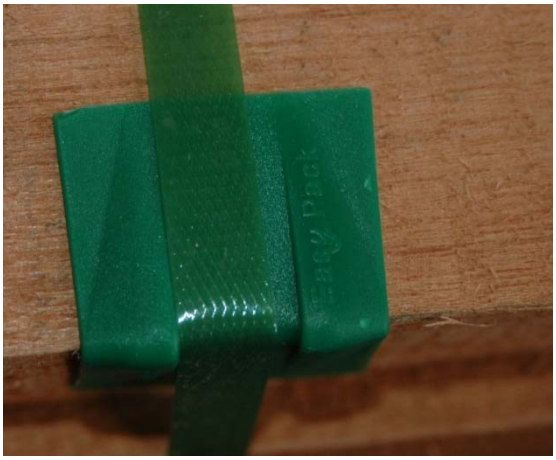
Photos (by Kim):placing steel band at a fixed point (86) or on a trolley (87) to measure productivity

iii. Unappealing wrapping of products

Some mills pay undue attention to packaging by using flimsy, cheap materials like cardboard or carton and misplacing binding straps causing damage to the packed products. In addition, this manner of packaging demonstrates poor taste and is contra-productive to business promotion effort.

(88)

(89)



(90)

(91)

Photos (by Kim): unappealing (88,89) and appealing packaging (90,91) by using strong and eye catching elements

iv. Wasting of damaged veneers

At some mills, damaged veneers are left unused causing financial loss to the company. Such a loss can be minimized by using damaged veneers as packaging material with only a simple technology.

(92)

(93)

Photos (by Kim): damaged veneers not utilized (92); veneers made of log end waste utilized in packaging (93)

v. Inefficient use of solid wood waste

Using solid wood waste for packaging must be done with care as it is commonly useful for making certain products thus reducing loss to the company. Pallet should always be made of waste either in solid form or not by first laminating waste pieces.

(94)

(95)

Photos (by Kim):use of defective solid wood (94) is not recommended and laminated solid wood waste (95) is suitable for packaging

4.9. Mill management

i. Careless supervisors

At some mills, different wastes can be found at different spots, e.g. room corner, floor, etc. which indicates poor attention to cleanliness of mill and to waste utilization. A thoughtful mill supervisor or manager should be willing to collect even a smallest piece of waste and put it on a waste collection box which demonstrates respect on healthy environment.

(96)

(97)

Photos (by Kim):damaged veneers placed in processing hall (96); a mill supervisor collects a piece of waste scattered on the floor (97)

ii. Improper positioning of hook

In log moving operation, some operators place hook on side position and damage the log which will require repairing of veneers indicating a weak supervision of operation. Such a cost can be avoided if supervisors tell operators to always place hooks at log tips.

(98)

(99)

Photos (by Kim):damage on log hole due to improper positioning of hook in log peeling operation (98); damaged veneers require repairing to restore quality (99)

iii. Improper end cutting of veneers

Some operators do not properly perform veneer end cutting that veneer ends are hairy or damaged, usually because the use of blunt knives. Such an operation is costly because the cut veneers may become a reject quality or have to undergo re-cutting process. Such a problem can be easily avoided by always using sharp knives.

(100)

(101)

Photos (by Kim):improper end cutting of veneers (100) and proper cutting (101)

iv. Cracked sawn timber left unattended

At some saw mills, sawn timbers are cracking due to inappropriate drying process. The cracks will certainly reduce quality and limit the choice for its use. This is particularly true if the cracks propagate further. A mill supervisor is responsible for avoiding or handling such problem.

(102)

(103)

Photos (by Kim): cracked sawn timber not attended (102) and preventing propagation of cracks using S-hook (103).

v. Defects on sawn timber not repaired

Holes may occur on sawn timber due to natural or biological causes. At some mills, such holes are not allowed causing quality discount and reduction in economic value. This form of loss can be minimized by carefully filling up the holes with appropriate putty.

(104)

(105)

Photos (by Kim):a pinhole on a sawnwood (104) and the hole fully removed using appropriate puttying technique (105)

vi. Improper sanding position

Sanding position affects quality and productivity of work. Hence, a proper position is truly desirable.

(106)

(107)

Photos (by Kim):sanding in a squatting position (106) is less efficient than sanding a wood material placed on a sanding table with worker comfortably standing on foot (107)

vii. Improper position of workers in gluing

Improper position in gluing affects productivity and quality of work and may consume larger amount of glue than necessary. It is best to perform gluing in a comfortable manner by standing on foot rather than sitting down on a piece of log.

(108) (109)

Photos (by Kim): improper, less productive position (108) and a more productive position (109) in performing gluing process.

viii. Improper inventory control

Some mills do not pay due attention to inventory management. Wood products are piled without label and different sortiments mixed up. This manner shows a lack of appreciation to the efforts spent on processing and creates problem in stock accounting.

(110) (111)

Photos (by Kim): inventory without labeling (110) and a neat inventory handling (111).

5. Discussions

5.1. Sources of inefficiency

The weaknesses in wood processing observed at 14 factories that hosted the in-house training as presented in the preceding section clearly indicate that the factories, in general, have not yet operated in an efficient manner; individual mills are operating at different levels of efficiency. Some mills were found weak in wood handling at logyards, some mills were weak in logs sawing, some mills were weak in wood drying, yet some other mills were weak in further processing, wood waste utilization or in packaging or in combination. In fact, none of the mills committed to only one inefficiency problem but to several ones. Also none of the mills was facing inefficiency problem with the entire value adding processes as listed in the previous section. It is, therefore, reasonable to conclude at this stage that none of the host factories has exhibited satisfactory level of processing efficiency.

The inefficient conduct of processing at different value chains have certainly resulted in larger volume of wood waste and defective products which, separately or combination, will make average cost of production to rise, reduce revenues and profits thus, weaken competitiveness. A one percentage reduction in overall wood recovery, for instance, *ceteris paribus*, may translate to a large magnitude of reduction in revenue, depending on the scale of operation.

In essence, the inefficient processing will raise unit cost of production and reduce competitiveness of the factory involved. Hence, it is imperative for the wood factories to remove sources of inefficiency by performing appropriate techniques of processing at the entire value-adding chains in accordance with the standard operating procedures applicable to any processing machines, equipment and facilities.

5.2. Sources of inferior product quality

By definition, a quality wood product is a product that can do the job it was designed for and does the job well. The intended design is realized when a set of predefined technical specifications are satisfied which may include physical dimension, strength, appearance, minimum defects and other attributes as agreed upon with buyers. Failing to meet the technical specifications in one or more process chains including sawing and re-sawing, sanding, gluing, painting, packaging, etc., as observed at individual mills hosting the in-house training, is the basic source of inferior product quality.

Knowing that quality is one of the building blocks of competitiveness, it is imperative for any factory to manufacture products that meet the technical specifications by adequately performing any value-adding processes because providing high quality products will increase the values of the products to buyers and the company can charge a higher price. In addition, yielding high quality will lower unit costs due to greater productivity of employees which translates to lower unit costs thus stronger competitiveness.

5.3. Achievement of the in-house training

Achievement of the in-house training in Cote d'Ivoire that was participated by fourteen factories of different scales and product lines is assessed in light of predefined expected outputs, namely:

i. At least ten wood factories with at least 250 workers and staff have improved practices in timber processing;
ii. Awareness and understanding of forest industry owners/managers, government training and research institutions have been improved on the importance of increasing efficiency of forest industries;
iii. Knowledge, skills and mentality of forest industry operators have been improved; and
iv. Approaches and methodologies of in-house training have been validated for further dissemination and implementation in different places.

i. Participants of the in-house training

- The first batch of training conducted on 11-18 December 2015 was hosted by eight factories. At completion of the training, the Project Coordinator, on behalf of the forest industries, made a strong request for organizing a similar training; the request was positively responded by the ITTO representatives. Accordingly, the second batch of in-house training was organized and conducted on 18-22 February 2016 involving six factories as the hosts. In total, 14 factories have taken part in both trainings and served as the hosts.
- The record made by the Project Coordinator indicates that 147 workers and staffs of 8 forest industries were directly involved in the first in-house training in December 2015; 110 workers and staffs of 6 wood industries participated in the second batch of training in February 2016; and 30 employees participated in revisiting of three factories in February 2016. In total, therefore, 287 workers and staffs of 14 forest industries have been directly involved in the in-house training sessions, or an average of 20 trainees per factory.
- It should be noted that, based on available data with the project, the number of employees of forest industries in Cote d'Ivoire ranges from 60 to 100 workers and staff. It can be expected that the 20 employees that have been trained will pass or transfer the skills they have learned to their colleagues and friends in a formal or informal ways, e.g. during individual talks, during working in a team, etc. Assuming an average number of 80 workers and staffs per factory of which 20 people have been directly trained, the expected indirect impact of the in-house training may reach 840 people (14*60). In the mid-term, total number of trained workers and staffs in 14 factories, directly and indirectly trained, may reach 1,120 people. If more factories are involved in in-house training, its positive impacts in the long-run are quite significant in terms of competitiveness of the forest industries, forest resource conservation and government revenues.

ii. Awareness and understanding on the importance of efficiency

There is no doubt that 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 have generally been deepened as suggested by the following observations:

- The number of employees of different levels taking part in every training session was satisfactory, averaging 20 employees per factory depending on the scale of operation; in addition, owners and executives of some factories also were involved in the training, at least during the opening and concluding discussions.
- The enthusiasm demonstrated by the trainees at every single process chain is evident from the number of questions raised as regards the weaknesses identified; and;
- The expressed expectation of the participants for having similar training in the future yet with a longer time duration.

iii. Knowledge, skills and mentality

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 prerequisite to build up competitive advantage of any wood industry, yet mentality of the employees is a sufficient condition that must prevail in order to be successful. 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.

iv. Validation of applicability of in-house training skills

As regards applicability of the in-house training mode, there is no doubt that it has been validated. The training sessions have been running without any major difficulties and the participants generally expressed satisfaction with the training processes and results. The same experience also has materialized in the conduct of previous trainings in nine ITTO member countries involving hundreds of wood industries.

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 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.

5.4. The short-run progress observed

In the occasion of implementing the second batch of in-house training, three factories that had received training in the first batch were re-visited.

The main purpose of the revisits to the factories that had been previously trained in December was to discuss with the managers and workers on how they had implemented the recommendations made two months earlier during the training. Except SIDINE group, which was on the process of relocation of the factory due to a conflict with the owner of the land where they are located, the ESSIM group and INPROBOIS had started the implementation of most of the recommendations. The team of trainers was very happy and had appreciated how far they had taken into account most of the recommendations of the training. The trainees had also pointed out improvements they made in most of the areas where recommendations were made. They were on the way to implement all the recommendations and even were ready to move forward. They express their happiness to have been involved in the training and hope that they will get the opportunity to be trained in the future.

The trainers were also glad to see that the recommendations were implemented. Several new advices had been given to them in order to improve the quality of their final products and their recovery rate.

5.5. Future implementation of the 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 2-4 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

Expecting continued support of ITTO on the conduct of in-house training on wood processing is just right noting that ITTO's support is also constrained by availability of financial resource. Consequently, relying solely on ITTO's support is, perhaps, not advisable.

Individual mills should strive, as own initiative, to organize future in-house training using their own resources without having to rely too 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.

It may be worth repeating here that maximizing level of processing efficiency and minimizing defective wood products are the fundamental objectives of in-house training. To maximize processing efficiency and minimize occurrence of inferior product quality, 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 periodical organized and informal discussions
- To identify needed measures and actions to remove the weaknesses
- For the owners, to provide the necessary inputs and investment to implement the actions
- For the executive(s) to develop a mid-term training program on processing efficiency and quality control
- For mill managers and supervisors to intensively and continuously undertake control on processing on the entire value chains

Indeed, role of 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 to implement 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 operational weaknesses is prerequisite to moving forward on building up competitive advantage.

6. Recommendations

Following are a few recommendations for the development of wood industries in Cote d'Ivoire based on the experience in conducting in-house training on wood processing at fourteen factories:

i. Innovation

Innovation as the third building block of competitive advantage should be seriously promoted by the wood industries. This is particularly true in the utilization of wood wastes. Transforming waste to valuable products requires innovative, creative efforts on how to convert waste to money.

ii. Sawing technique

Sawn timber is to be used in further value-adding processes thus attributes of sawn timber, positive or negative, are carried over to subsequent processes. Therefore, sawing should, to the extent possible, be adequately performed in order to yield defect-free sawn timber. Use of laser guided sawing as well as properly maintained and installed band or circular saws is strongly recommended.

iii. Old-fashioned rotary peeling

Use of old-fashioned rotary in logs peeling generates large volume of waste; it is strongly recommended to invest in spindle less rotary in veneer making.

iv. Finger jointing

Finger jointing, aside from directly produces particular wood parts, is also a powerful process in waste utilization, especially the waste resulting from sawing operation.

v. Laminating

Skillful operators and workers in laminating process can transform damaged veneers or defective boards into valuable products.

vi. Saw doctoring

Many product defects are the result of using damaged or defective saws and knives. Training of professionals on saw doctoring should be given priority by most, if not all, of the wood industries.

vii. Improved mentality

Wood is a gift from God thus should be used efficiently. The argument by some employees saying "we have abundant of natural wood here" when they were admonished for wasting wood, is completely incorrect. Experience shows that a number of tropical countries that had been blessed with vast and rich natural forests are today facing difficulty at varying degrees to sufficiently feed their wood industries with natural woods. The message is an appeal to build up a mentality that consistently dislikes wood wasting but advocates efficient use of wood resource.

Selected references

Blaser, J.; Sarre, A.; Poore, D.; and Johnson, S., 2011. *Status of Tropical Forest Management 2011*. ITTO Technical Series 38, June 2011.

Hill, Charles W.L. & Jones, Gareth L. 1998. Strategic Management Theory: An Integrated Approach. Houghton Mifflin Company, USA.

Annex 1. Terms of Reference of the Consultant

Activity 6.2. Technical training in minimum 10 enterprises on improved practices in timber processing for at least 250 workers and staff

Expected outputs:

- 250 workers and staffs of 10 wood factories trained on efficient wood processing
- Awareness and understanding of forest industry managers/owners, government training and research institutions increased on the importance of improving efficiency in forest industries.
- Improved knowledge, skill and mentality of forest industry operators.
- Validated approach and methodology of in-house training applicable to be further disseminated and implemented in different places.

Tasks to be carried out:

- To support the organization and implementation of in-house training
- To undertake in-house training at no less than 10 wood industries in Cote d'Ivoire involving at least 250 workers and staff of the industries; and
- To prepare an in-house training report for submission to ITTO.

Inputs:

- Duration of the assignment is 8 weeks within the period of up to 9 months.
- USD 12,500 of honorarium excluding DSA and transport costs.