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GREEN PRODUCTION AND TRADE
MDGIF
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JOINT PROGRAMME ON GREEN PRODUCTION AND TRADE
TO INCREASE INCOME AND EMPLOYMENT OPPORTUNITIES FOR THE RURAL POOR

INTERIM REPORT

**CLEANER PRODUCTION AND DESIGN FOR SUSTAINABILITY ASSESSMENT FOR
FIVE VALUE CHAIN IN PROJECT AREA**



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ANNEX 28

I. Lacquer ware.

1.1 Project area description.

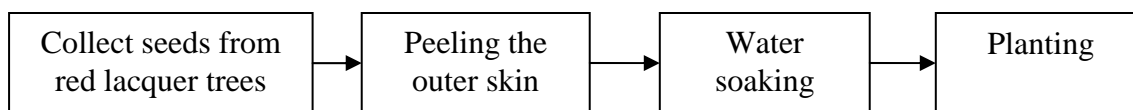
Lacquer ware production has long history in Phu Tho province. During the year 40s, the lacquer plantation areas are increasing from 3,424 ha (1939) to 4.400 ha (1943). Since 1945 to the end of the year 70s, the area is decreasing about 50%, while the plantation area is uses for cassava plantation. While the Eastern market was accepted during 1981 – 1985, it helps to increase the plantation area of lacquer tree in Tam Nong district up to 900 ha, which is 2 times higher compare to the current area. However, from the end of 80s to middle of 90s, the Vietnamese lacquer product was loss market in the Eastern countries then the raw lacquer sap after that is exported mainly to China. Due to the variation of Chinese market causing the plantation in Phu Tho province is unstable and it will effect to the livelihood of local people.

The research is focusing mainly on the Di Nau and Tho Van communes Tam Nong district. In the year 2009, total plantation area in Tam Nong is 494 ha, in which 320 ha is mature lacquer trees for harvesting. Di Nau and Tho Van communes are account for nearly 50% of plantation are in Tam Nong district.

1.2 Cleaner production for lacquer ware value chain

1. Germination.

Germination process of lacquer tree:



Seeds for germination are selected from the old lacquer tree which has high yield and quality. Then it was peeled the outer skin and soaked with water. The soaking time is about 1 – 2 days. Soaked seeds after that was planted to replace the over age trees which has low productivity.

Problems: The processing of germination is done base on the local experiences. However, the seeds after soaking will go to plantation and the quality of trees is uncontrolled. The evidence is that in the plantation area is also present the white lacquer trees which have low productivity and low quality.



Pic 1. Seeds for germination

Recommendation: Project or local authority should support the commune on:

- Germination technology
- Support seeds or young trees which high productivity and quality
- Plantation and cultivation techniques

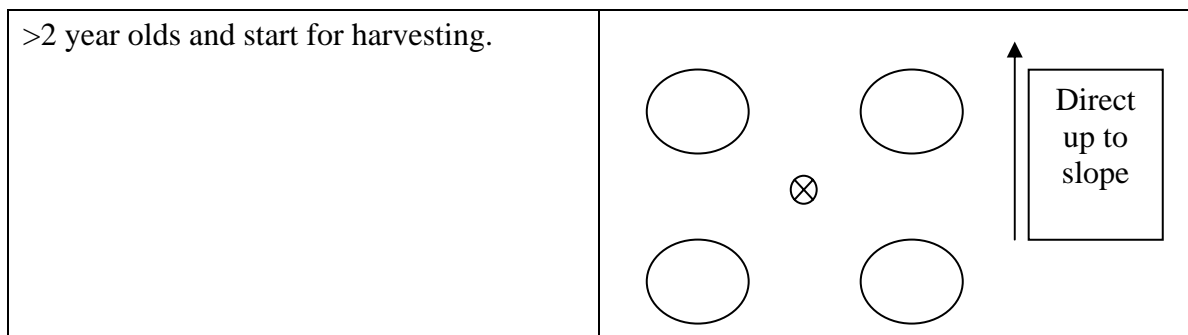
2. Fertilize:

Follow the local experience lacquer trees are fertilized 1-2 times per year.

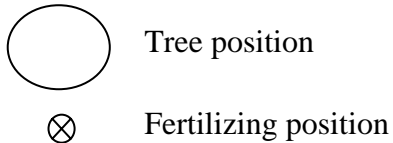
Type of fertilizer: composting.

The fertilizing process since new plantation is implemented as follow:

New trees	
1 year old trees	
2 year olds trees	



Note:



Problems:

Fertilizing is almost base on the traditional experiences from over long generation, but it may also discovered by the local. It is never researched on the necessary nutrient of tree for cultivation.

Recommendation:

- Research on the effect of nutrient to the tree development aiming at timely fertilizing for getting higher productivity and quality of sap.
- Research on the oil condition of the area for knowing which component of nutrient need to be added.
- Research on which fertilizer is suitable for each period of tree development.

3. Harvesting:

Harvesting is started when the tree over 2 year olds, normally a half shell of mussel is used to collect the lacquer sap leaking from the tree.

Harvesting mode:

- Use a knife to nick on the tree skin with V shape, then plug the shell mussel in to the tree skin under V shape to collect the lacquer sap.
 - Red lacquer tree: Lacquer sap pours slowly out and changing to yellow-red color after that.
 - White lacquer tree: Lacquer sap pours out very quickly.



Pic 2. Nicking the tree skin



Pic 3. Use shell mussel to collect sap



Pic 4. Lacquer sap of white lacquer tree



Pic 5. Lacquer sap of red lacquer tree



Pic 6. Collect sap from shell to plastic box



Pic 7. Store lacquer sap in bigger box



Pic 8. Lacquer box protected by plastic membrane to anti oxydize



Pic 9. Measure lacquer portion by simple method



Pic 10. Lacquer before burning



Pic 11. Lacquer after burning

At each position of nicking, lacquer sap pours out continuously in duration of 3 hours then dried and closed the capillary.

After nicking three hours when the harvester knows that the lacquer sap finish running then they will came back for collecting. The tool for collecting is a wood spoon (enough soft) to scrape lacquer sap from shell to the plastic box. When the box is full they will collect all to the bigger box with lid or plastic cover to protect lacquer sap out of oxygen to avoid the oxidation and solidity.

Each tree can be extracted lacquer every 3 days. At the beginning, the extract position is above the root about 10 cm then moving up to the top until the tree is no longer giving lacquer sap.

Harvesting seasons:

- From September to March (dry season): harvesting starts at 5 am in the morning and the quantity and quality of lacquer sap is the best among the year.

- From April to August (rainy season): harvesting starts at 3 am in the morning and the productivity is only 50% compare to the dry season.

Because the lacquer sap will be rotten if water contains in the lacquer thus the harvesting will be stopped when raining or raining is forecasted.

Problems:

- Because the cultivation of lacquer tree is unplanned then the local people harvest based on their experiences and then they may harvest the not enough age tree.
- The storage of lacquer sap after harvesting is very simple and causes a damage or decrease in the quality of lacquer.

Recommendation:

- Master plan for lacquer tree plantation helps to better manage, cultivate and harvest. During the short period, farmers could mark the trees aiming at recognizing the age of the tree for harvesting.
- Lacquer storage box should be taking into considering for better product.
- Recommend the farmer harvesting in the suitable season.

4. Preservation

Lacquer sap was collected from households, small collector level to the main collector for exporting. Before exporting, the quality of lacquers sap is tested and qualified ones will be stored in the sack with plastic bag layer inside. Testing approach is using the simple scale to weigh 100 g of lacquer sap then heat until the lacquer is boiling with white bubbles then finish firing. Scale the volume again, based on the weight before and after the test we can get the portion of lacquer in the sap.

Problems:

- Equipment using for test is very simple and takes long time. Within this reason some times the collector bought the low quality of lacquer with high water content and impurity.
- The local people using scale for testing without protection equipment causing the respiratory disease.
- The sack with plastic bag inside may easy tear off if not careful in transportation.
- Store lacquer without follow the principle of FIFO (first in first out).

Recommendation:

- Using the analyzing equipment which gives quick result, more accuracy and safe.

- The storage room should be redesigned to avoid the moisture.



Pic 12. Store in the house before exporting



Pic 13. Lacquer stores in plastic bag

5. Processing

Up to now, almost lacquer ware is exported to China for processing then Vietnam is imported the final product for painting. Some of artisans are still using raw Vietnamese lacquer ware for painting in small scale with some reason.

Problems:

- Drying time is very long (3 days)
- Poor shining
- High ability of allergy
- Low ability of mixing pigment

Recommendation:

- Analyze the chemical components of current lacquer sap and imported lacquer for comparison
- Research on the processing technology to produce lacquer from raw material to final product

- Install the pilot system for testing

6. Application

Currently, due to the high cost of imported lacquer ware from outside countries then most of SMEs are using cashew nut paint instead of lacquer.

In case of order using lacquer ware, the company will apply the raw lacquer sap to create the background and use imported lacquer for painting. Due to the long dry of lacquer sap (3 day) then the processing time for painting is long.



Pic 14. Coat cashew nut based paint to bamboo bowl



Pic 15. Polish surface of bowl with water



Pic 16. Wastewater will discharge directly to



Pic 17. Drying by natural ventilation or under sun light



the pond without treatment

Pic 18. Drawing using cashew nut paint

II. Sericulture

II.1 Project area description

The investigation to gather information for project at Hong Do, Thieu Do commune, Thieu Hoa district where sericulture is one of the biggest in the country. Thieu Do commune has 40% of population working with mulberry plantation and sericulture and the average income is about 9.000.000 VND/year. Aiming at getting valuable information for the cleaner production assessment at sericulture value chain, the investigation also take place at Hoa Binh provinces with two selected enterprises as Tu Dinh Company in Vu Ban, Lac Son district and Phu Ngan Cooperative in Man Duc, Tan Lac district where they are specializing in weaving and product finishing.

II.2 Cleaner Production for sericulture value chain

1. Silkworm

Currently, they are using Vietnamese yellow silkworm species but it is just suitable for the duration from April to July, from August to October it is suitable for white silkworm species from China (the best condition for silkworm eating is temperature in the range of 25 -30°C). Silkworm is breeding in bamboo large flat basket in the 300 households in the targeted village .

Problems:

The Chinese silkworm species has been imported to Vietnam with small volume and show unstable quality because it is not be treated germ during the hibernation time. Especially in the summer season, the portion of death cocoon was about 50% compare to another season.

Recommendation:

- Invest the imported silkworm preservation system to avoid the death.
- Construct the silkworm breeding system which separated with residence to increase the silk quality and reduce the death due to the poison from pesticides, brick kiln, and mosquito pesticides.
- Silkworm breeding system should be equipped air conditioning to adjust the temperature depends on season to reduce the death rate.
- Salvage the big volume of silkworm feces for using in rice paddy field instead of using fertilizer.



Pic 19. Silkworm

2. Mulberry

The mulberry variety which is given by local authority (Department of Agriculture and Rural Development of Thanh Hoa province) is unsuitable and giving low yield. The commune also tested with Chinese variety (seed) but it is also given low yield in the raining time. There are some household using mulberry variety (H12) from Institute of Sericulture of Vietnam is giving high yield but it is costly due to the difficulty in transportation and preservation.

Problems:

- Mulberry variety H12 is suitable but the transportation is high cost even higher than mulberry trees.
- Insect attack (borer) is a problem in this area.
- Mulberry quality is also effected by soil condition as well as people often alternate to cultivate another crop causing low productivity. The local commune also has a plan on the mulberry area, soil rehabilitation, using alluvia land for cultivation.



Pic 20. Mulberry field

Recommendation:

- Using the suitable land for mulberry, not cultivate other trees in the mulberry land.
- Select one household for buying mulberry variety and distribution to other households. Beside of that the local authority should help famers on selecting variety as well as preservation.
- Training on mulberry plantation, cultivation, harvesting, and using pesticides.

3. Reeling

In the commune there are about 30 households involving in reeling. The dead larvae after releasing all the silk was chilled and sell to some provinces or China. In fact, 130 kg of cocoon can gives 20 kg of silk/day.

Problems:

- Using the manual reeling system leads to ow productivity, and low quality (low polish) as well
- Silk is not completely reeled with the current system but China company often buys the waste cocoon and continues reeling after degumming.
- Big volume of wastewater is discharged directly to the sewage system without any treatment.

Recommendation:

- Invest the new reeling machines with 18-20 fulcra which will help to increase the productivity 2 times with high quality product.
- Build the chiller system for dead larvae preservation to avoid the waste larvae.
- Build the biogas system for treatment of high BOD, COD wastewater to recover the gas for domestic uses.

4. Degumming, twisting, weaving

Problems:

In the investigation area, almost households are using the very out-dated machine with low productivity which causes high cost and low attractive to the market. Most of the process of degumming and dyeing is made by traditional experiences.

Using chemical as: NaOH, H₂O₂, SiO₂ for degumming with hot water

Recommendation:

- Invest the new twisting and weaving machine with high productivity, high quality and low reject rate.
- Research on the mechanism of using chemical for degumming to optimize the system
- Build the wastewater treatment system before discharging

5. Dyeing

The dyeing process is investigated at the companies in Hoa Binh province. This area mainly use two natural colors as indigo and black, and other colors are get by dyeing with chemical dyestuff.

Problems:

- Dyeing with natural color will increase the cost.
- Dyeing process is only based on traditional experiences
- Low quality of natural dyeing: fast fading, weak fixation, color differs from batch to batch
- Wastewater from chemical dyestuff dyeing contains heavy metals

Recommendation:

- Research on using available materials in local area for making natural dyestuff.
- Research on natural dyeing process with parameters, mechanism which can be applied to the local people after that.
- Build the pilot system for natural dyeing



Pic 21. Bamboo large flat basket using for silkworm breeding



Pic 22. Twisting by traditional system



Pic 23. Weaving frame



Pic 24. Dead larvae covered by outer layer after reeling



Pic 25. Byproduct silk which is export to China for recycling





Pic 26. Auxiliary and equipment using in sericultural sector

III. Handmade paper

III.1 Project area description

Handmade paper is made from “do” tree at Suoi Ngan, Hop Hoa commune, Luong Son district, Hoa Binh province. Hiep Hoa is one of the poorest communes of Luong Son district. People living in this area are mainly Muong ethnic groups and most of the production process is done by women.

III.2 Cleaner Production for handmade paper value chain

1. “Do” tree cutting

Branches with about 2-4 cm in diameter and 60-90 cm in length of 1 year old tree are cut down. then tighten together in bundles of 20 cm and carry back to the household for production. The harvesting season can be all the time in year, but the best time is March because the weather with high humidity helps to cut the trees easily. After harvested, it was boiled about a week to peel the outer layer.

Problems:

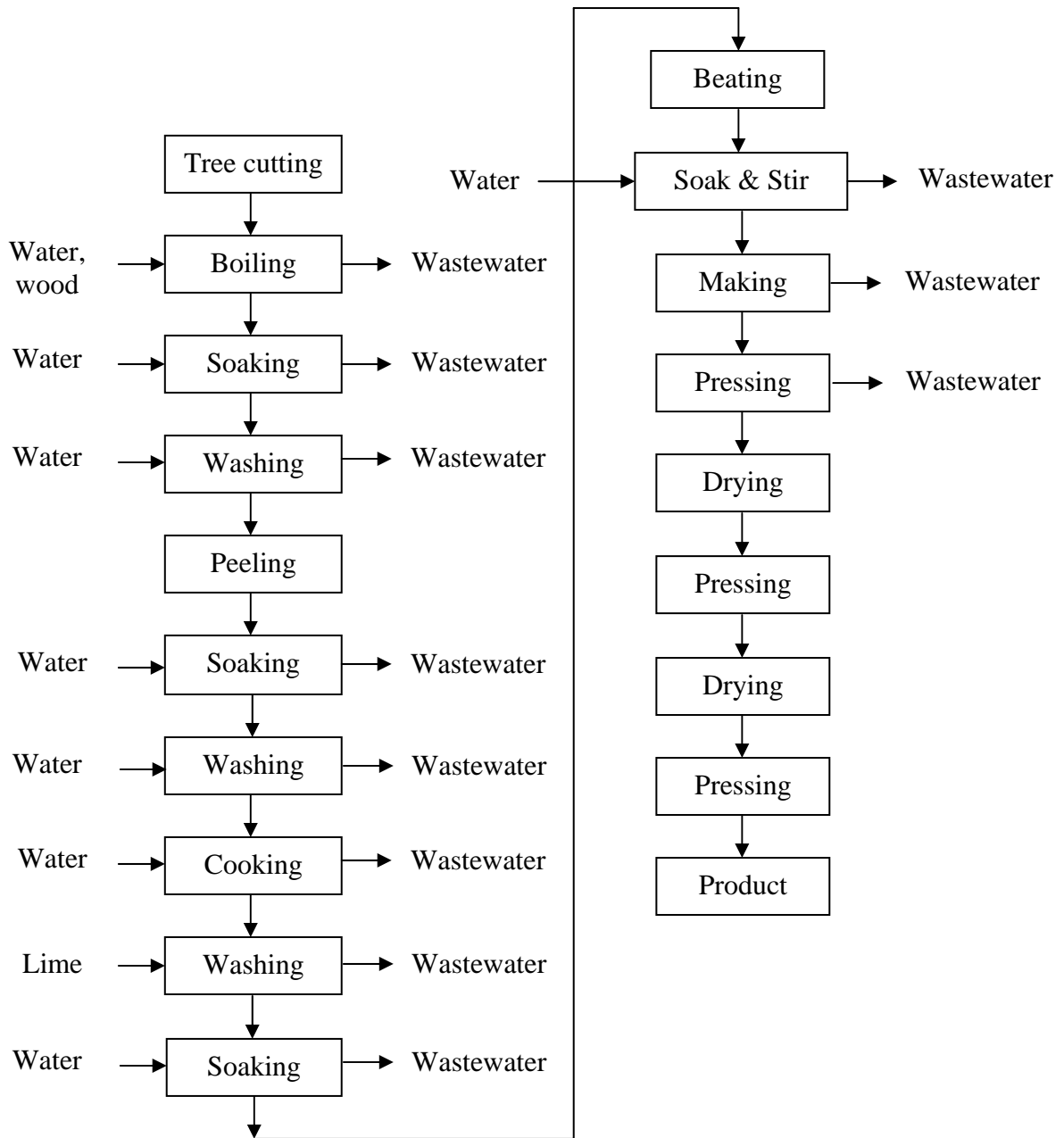
- Cut the unqualified trees
- “do” tree becoming exhausted because of overexploitation
- Cutting process not carefully causing a damage for the tree roots

Recommendation:

- The harvester should be trained on sustainable harvesting and cultivation
- The germination and cultivation is also needed to transfer to the local people
- Harvesting tool as: hat, gloves and boots are recommended.

- Arrange an area for cultivating “duong” and “do” tree.

2. Handmade paper production



2.1 Boiling

Tree after cutting was boiled in the barrel (which is recycled from oil barrel) with water using wood for burning in 4 hours. After boiling, tree was soaked in the water to peel the outer layer which is used for paper making.



Pic 27. Use barrel for boiling the trees.

2.2 Peeling & Drying

After soaking outer skin is separated from the inner layer, dried under the sun and stored in the house for further production. Whenever the production required, the dried outer skin is taken for cooking.



Pic 28. Outer skin of tree is dried and stored in the house

2.3 Cooking & Beating

The same barrel is used for cooking the outer layer with mixture of water, chlorine, and lime aiming at white bleaching in duration of 4 hours. Material then is washed with lime and soaked in water then moves to the beating step. The material is put into a steady wooden board and beaten with wooden cane during 1 hour. This manual process makes the paper fiber strong and nice.



Pic 29. Beating tool

2.4 Paper making

The beaten materials are put into a tank with water and stirred very carefully. The tank should be kept clean, avoid impurities which can directly affect on the quality and appearance of paper. A deckle and mould are needed, both are made by “Thi” or pine wood with a bamboo screen inside. Hold them both together and submerge both under the water with the pulp in it to capture the pulp on the screen. Withdraw the mould and deckle slowly and evenly allowing the water to drain back in to the tank. During this process, many decorative items can be added such as dried flowers, colorful thread, souvenir items so that they can stick between two layers of paper. The paper is put together one layer after another and has to wait 24 hours before pressing.



Pic 30. Pulp tank (left) and deckle and mould for making (right)

2.5 Pressing, drying, splitting

Use a pressing tool to eliminate the water content, in order to avoid the cracking, this process should be carried out slowly. After pressing, pile of paper sheets is left about 1-2 days, then be pressed again in 1-2 days to make the sheet even. Sheet of paper is get by separating from the pile. Producers usually put a small piece of tape between two sheets to make the separating

easier. Paper can be dried naturally in summer time or in the drying chamber in winter time. The paper is put on the smooth surface, until it becomes totally dry.



Pic 31. Pressing tool

Problems:

- Mode of production is very small scale and low productivity
- Uncontrolled impurities in the pulp and paper
- Barrel (cooker) is corroded very quickly due to using chlorine
- Wastewater is untreated
- Simple design
- Paper quality is depend very much on the weather

Recommendation:

- Research more detail on the handmade paper making especially for the raw material as “do” and “duong” trees.
- Research on application of chemical to increase the quality of paper
- Support the pilot system with more efficiency and productivity in paper making
- Train local people on paper making principle and the role of chemical, process control for better product.
- Support new design for the groups.

IV. Seagrass

IV.1 Project area description

Nga Son is the district of Thanh Hoa province has sea grass area of 1,570 ha (2009). Total processed sea grass product in the district is about 30,400 ton. In which, 19,000 ton is planted in

district and other 11,200 ton is bought from other provinces. Total value from sea grass production is about 165.46 billions in 2009.

Sea grass in planted mainly at 6 communes (Nga Thanh, Nga Thuy, Nga Tan, Nga Tien, Nga Lien, Nga Thai) accounted for 77% of production land. In 2009, 15,662 ton sea grass is produced in these communes account for 82% of gross domestic of district. The output of these 6 communes are near to the average output of country is 8.8 ton/ha in 2009 (Nga Thanh: 9 ton/ha; Nga Lien: 8.5 ton/ha; Nga Thuy: 8.3 ton/ha; Nga Thai: 7.8 ton/ha).

IV.2 Cleaner Production for sea grass value chain

1. Sea grass plantation:

Till the land: Dig 50 cm deep in the land field and turning the soil or bring the new soil from another area to make-up the loss.

Variety selection: Round root, round pick, no white species.

Fertilizing:

- Fertilizing is starting 1 month after planting with 5 kg/500 m².
- When the grass tall from 1.45 m and it was fertilized 15day/1 time, 15-20 kg fertilizer per time.

Harvesting:

- Cut the root.
- Sorting by length.
- Dry under sunlight 3 days (6 – 8 h/day).

The next harvesting is 6 months after . It can harvest up to 5-7 years if they are aluminous and salt water field (1 season/year) or 3-4 years if they are fresh water field (2 season/year).



Pic 32. Sea grass feild

Problems:

- No efficiency in soil rehabilitation.
- Fertilizing based on the traditional experiences

Recommendation:

- Research on the soil rehabilitation method
- Training for the local people in variety selection and fertilizing

2. Production

Sea grass after drying is used for weaving match, weaving handicraft products



Pic 33. Match weaving machine



Pic 34. Low efficiency of preservation room



Pic 35. Sea grass handicraft product

Problems:

- Getting mould easily in preservation.
- Low productivity of weaving product
- Dye with chemical dyestuff and discharge untreated wastewater to sewage

Recommendation:

- Apply the solar heat in drying room for drying and preservation
- Redesign the drying and preservation room
- Support new match weaving machines for improve the productivity and quality
- Research on applying natural dyeing in sea grass.

V. Bamboo

IV.1 Project area description

Thanh Hoa is one the provinces with the largest volume of bamboo in Viet Nam. In Thanh Hoa, there are some hundreds of farmers specializing in harvesting Lung bamboo (*Bambusa longisima* sp. Nov) in Quan Son, Ba Thuoc and Quan Hoa districts) to supply to export-oriented handicraft producers (Like Quoc Dai Company). In the two targeted communes of Tan Tho and Thang Binh, rattan and Lung raw materials are not available for either cultivation or harvesting. Therefore, Lung bamboo is mainly provided by traders from other districts like Quan Son, Ba Thuoc and Quan Hoa. The major raw material to be found in Nghe An is Lung Bamboo (*Bambusa longisima* sp. Nov), concentrating in Quy Chau and Que Phong districts; thus there are hundreds of farmers in Chau Thang commune who earn their living by regularly harvesting the material in the natural forest. The Chau Thang commune has become a very important source of raw Lung Bamboo for many handicraft communes in Nghe An province and also former Ha Tay province. The harvesting is mainly done manually, in a simple way, following the requirements of processors. For example, farmers usually do the pre-processing of Lung Bamboo in the forest, by cutting it into short sections, peeling the outside cover, splitting and drying in the sunlight. When fully dried, the bamboo is transported to the villages. The harvesting method for bamboo varies depending on the final products, i.e. on whether chopsticks, building poles etc. are made.

IV.2 Cleaner Production for bamboo (lung) value chain

1. Harvesting

Local people often go into the forest for cutting Lung bamboo; the highest volume of harvesting can reach from 3 to 5 tones per day. After being cut down, Lung is cut by appropriated portion and nodes are removed, and then the cane are splitted into 3 or 4 slats, tight in bunches for convenient of carry.

Standard for harvesting:

- The outer layer is blue (in case of deep blue color, the cane is young, the cane is old in yellow)
- Height from 6 – 8m.
- Diameter over 60 cm
- Length of each section over 60 cm

- Age from 1.5 to 3 year (if the cane is old, the flexible is not qualify for weaving).

Problems:

- Exploited unqualified bamboo
- Bamboo quality is decreasing due to the overexploitation and degeneration.

Recommendation:

- Plan the bamboo area and giving the land property to the local people
- Train harvester on sustainable harvesting and cultivation

2. Transportation

From the forests:

- On water way: boat is used to carry but the time of Lung submerging on water is should be no longer than 3 days.
- By land: it can be by pulling or carrying by car, the second option is better due to good protection of materials.

From the collector to company:

- Transport preprocessed raw material to company by vehicles from 150 – 200 km.

Recommendation:

- Currently only 10-30% of material is used at company and 70% is wasted. Therefore, the company should build the workshop near the harvesting area for drying and splitting before transporting to company

3. Preprocessing at household

Raw materials are collected by local traders and then the skin of bamboo is removed with the declination of blade is about 3 – 5°, and scraping direction is from the top to the bottom of the bar. After being scraped, bamboo slats are put on shelf 20 – 30cm from the ground and exposed under sun for 3 daylight and in the dew for 3 nights, it is traditional approach to protected bamboo from fungi and insect.



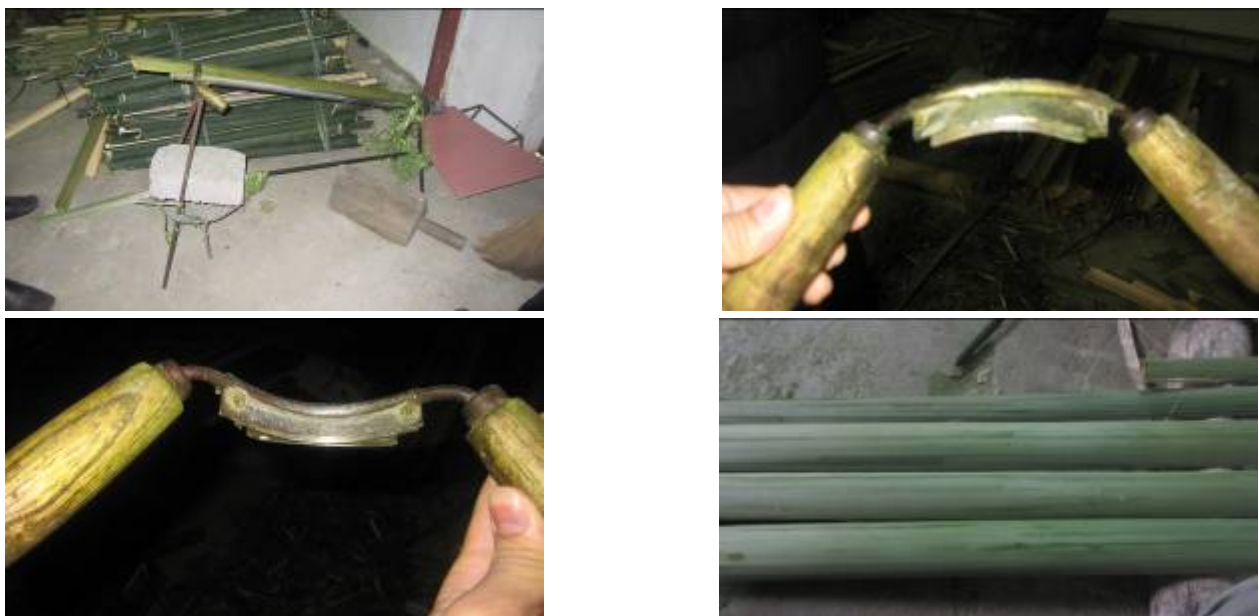
Pic 36. Peel the outer skin, weighting at household (two left) and transport to company (right)

Problems:

- Low productivity on peeling outer layer skin
- Drying depends much on the weather
- Uncontrolled the bamboo quality
- Bamboo is easy attacked by fungi, mould and insects

Recommendation:

- Apply the new design cutter as below for peeling skin
- Design the drying room for household level using in the raining season.
- Research the boiling technology for anti mould, fungi and insect.



Pic 37. New design knife for peeling outer layer

4. Processing

Bamboo after drying was splitted to take the thin layer for weaving. Normally this process of splitting is done by manual at the household level with low productivity. But in some company are using splitting machine with 20 times higher than manual and give the splitted bamboo laths to people for weaving.

Semi-product after weaving is collected at household to the company for repairing, quality checking and hardening with glue (PVA) and paint with varnish, paint if required.

Problems:

- Use only 10-20% of bamboo for weaving and 80-90% is wasted
- Low productivity of splitting
- Product design is not diversify

Recommendation:

- Use machine to recycle the waste to produce new products as: tooth pick, incense stick,...
- Apply new technology in compressing the saw dust bamboo to produce heat-pellet for burning



Manual splitting



Splitting machine

ANNEX

List of visited companies at 5 value chain in 4 provinces

Nghe An:

- Visit value chain of bamboo
- 3 Companies: Duc Phong, Dinh Trieu, Ngoc Canh

Phu Pho:

- Visit lacquer ware value chain
- 3 companies: Tam Son, Phu Tho lacquer cooperative, LV & Oriental Pearl

Thanh Hoa:

- Visit sea grass, sericulture value chain
- 10 companies: Son Phu, Ninh Huyen Thong, Hoang Long, Viet Anh, My Quang, Quoc Dai, Duy Hai, Thanh Duc, Tan Tho, Tran Van Duong

Hoa Binh:

- Visit handmade paper, sericulture value chain
- 4 companies: Sanda, Vong Ngan, Tu Dinh, Handmade paper group