



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

REPORT

CLEANER PRODUCTION AND DESIGN FOR SUSTAINABILITY ASSESSMENT IN HANDMADE PAPER VALUE CHAIN



Vietnam Cleaner Production Centre

4th floor, Building C10

University of Technology, Hanoi

Dai Co Viet street, Hanoi, Vietnam

Tel: (84.4) 3 8 684 849

Tel/Fax: (84.4) 3 8 681 618

Email: vncpc@vncpc.org

Web: <http://www.vncpc.org>

Hanoi, June 2011

CONTENTS

| | |
|---|----|
| CONTENTS | 2 |
| I. INTRODUCTION | 3 |
| II. ASSESSMENT METHOD..... | 4 |
| II.1 Value chain assessment | 4 |
| II.2 Quick assessment at enterprises | 4 |
| II.3. Cleaner Production (CP) and Design for Sustainability (D4S) methodology | 4 |
| III. OVERVIEW OF HANDMADE PAPER..... | 6 |
| IV. HANDMADE PAPER VALUE CHAIN EVALUATION..... | 9 |
| IV.1 The value chain | 9 |
| IV.2 Clean production evaluation of the value chain..... | 9 |
| IV.2.1 <i>Do cultivation and harvesting</i> | 9 |
| IV.2.2 <i>Raw material preparation</i> | 11 |
| IV.2.3 <i>Paper hand making</i> | 12 |
| IV.2.4 <i>Technology and equipments needs</i> | 15 |
| V. DESIGN FOR SUSTAINABLE FOR THE HANDMADE PAPER VALUE CHAIN | 16 |
| V.1 Current situation and issues..... | 16 |
| V.2 Analysis and suggestion | 16 |
| V.3 Samples in Vietnam..... | 18 |
| V.4 The development trend in Vietnam and on the world | 18 |
| REFERENCE..... | 19 |

I. INTRODUCTION

Recently, Vietnamese economy has been developed significantly with the rate of 6-7% GDP per annum. The country has become officially average income economy from 2010. The development progress helps the export value increasing at 20% per year, also creating 1.7 mil of career and decreasing the poverty to 14%. However, during the process, the gap of income between the people in city and countryside, especially the minority people areas and mountainous districts, has been wider and wider.

The export handicraft products from Vietnam has been interested by international consumer and considered as an emerging market. From the traditional production method, the almost of the production progress has been done at the family level. In the meantime, the Small and Medium Enterprise (SME) is acting as the raw material supplier, product finishing, packaging and exporting agent. The export value would be approximately 1.5 billion U.S dollars per annum.

The most important issue in the industry is very high raw material consumption during the progress which may lead to out of the resource in the country and increase material importing. In addition, the involving component such as SME and worker did not care about the raw material storage which causes the loss of raw material rate at 10-30%. Moreover, the cost from other factors such as energy, dyeing material, sewage in Vietnam is much higher than the other production country. In addition, in the past, the industry has advantage of the low labour cost in Vietnam. In present, the labour cost has risen day by day would lead to increase price of the product. All of those issues could decrease the competitive capability of the local product in comparison with the other.

Therefore, cleaner production evaluating and sustainable product design for bamboo and rattan, sericulture, lacquer, seagrass and handicraft paper production is required to figure out the weakness point in the value chain. In the second phase, the solution for the issues should be recommended such as technical optimizing, waste recycling and effective raw material using in order to decrease the output value of products, environmental effect and help for sustainable development. In addition, the project would help the SME to design more creative product which is friendly to environment and also attractive.

The evaluating process has been taken place in all stages such as pre-harvest, post-harvest, material collecting, transportation, pre-process, processing, finishing and packaging from family scale to organization scale in Nghe An, Thanh Hoa, HoaBinh and PhuTho during the investigation of the project: “Green Production and Trade to increase Income and Employment Opportunities for the Rural Poor”.

II. ASSESSMENT METHOD

II.1 Value chain assessment

Value chain is identified from cultivation, harvest, collection, transportation to pre-process, process, finishing and packaging. Each unit of value chain can be executed in one enterprise, or each enterprise, household is in charge of one unit in value chain.

Data collection

- Before doing surveys, all data and information on current status of the chain in the project areas are collected via papers, documents to identify existing problems.
- At-site data are collected from households and enterprises through the samples which are designed for project.

Interview

Questions are developed to ask about existing problems at commune, district and province level in 4 targeted provinces of the project.

II.2 Quick assessment at enterprises

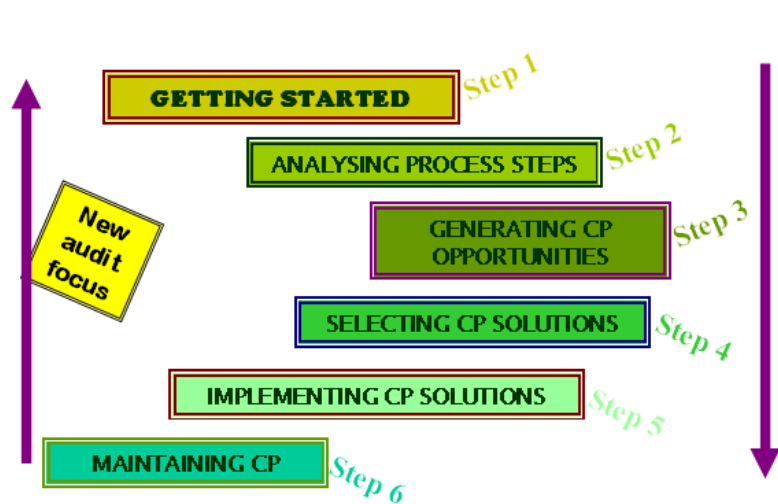
Vietnam Cleaner Production Centre will work directly with enterprises to evaluate the current production status and provide consultancy on resource and energy efficiency, product quality improvement, design innovation... The project assesses 27 enterprises in 4 targeted provinces, and 23 other enterprises in other areas (Hanoi, Ha Nam...) which are in the last link of value chain.

- The assessment includes following steps:
- Collecting database
- Identifying unsuitable factors during production
- Proposing improvement opportunities
- Proposing necessary technology and equipment to improve capacity and product quality.

II.3. Cleaner Production (CP) and Design for Sustainability (D4S) methodology

CP and D4S .the continuous application of an integrated preventive environmental strategy applied to processes, products, and services in order to increase efficiency and reduce risks to humans and the environment.

Targets of cleaner production is to increase profits and prestige of enterprises, reduce pollution as well as bad affect on human and community's health. Experiences show that CP is suitable for all company's size from big size to household scale. CP and D4S methodology consists of 6 following steps:



Cleaner production options can be:

- Avoiding leakage, spillage during transportation and production called good housekeeping options;
- Ensuring optimum production conditions relating product quality, productivity, resource consumption and emission;
- Avoiding using toxic materials by using other materials;
- Upgrading equipment to improve production;
- Installing efficient equipment; and
- Redesigning products to reduce resource consumption.

Some basic D4S techniques:

- o Selecting the materials of little impact
- o Reducing material consumption
- o Optimizing production technology
- o Optimizing distribution system
- o Reducing impacts during usage
- o Optimizing initial steps in life cycle
- o Optimizing product discharge step

III. OVERVIEW OF HANDMADE PAPER

The paper maker has been found in Vietnam from the 3th AD century for many purposes such as stationary, book and drawing. In the north western of Vietnam, it is also being used in the local festival or worship occasion. From the result of interview in the region, the paper hand maker has potential for future development due to the vast demand. In the area, most of the product come from Son La(Bac Yen and Song Ma – the Hmong community), Dien Bien (East Dien Bien – Hmong community), Lai Chau (Tam Duong – Dao community) and HoaBinh (Luong Son – Muong community). They use the available material in those areas for the maker. The traditional material for Muong people is Duong and Do (*Moruspapyrifera* L) plant; Hmong producers use Bamboo while Dao community use rice straw as raw material.

Except the handmade paper producer at Hop Hoa commune, Luong Son, HoaBinh Province which is quite successful, the other is too small and has lot of issues. The purpose of those handmade papers is used for worship occasion such as votive gilt papers... Therefore, the trading is just limited in the community and there is no more development. As rising of the niche market demand, handmade paper has a very good reason to be developed in the areas. It could bring more income to the community from the cheap raw material and the spare time of the farmer after the agricultural season.

The history of the handmade paper in Vietnam is more than 500 years. The most famous handmade paper in the region is produced from Do (*RhamnoneuronbalansaeGilg*) plant. The body of the plant has been cut; dipped in water and skin removal. The skin after removal would be cleaned and grinded to powder. The powder then has been mixed with the fermented hibiscus root solution to form the paper paste. The paste will be spread on the bamboo screen to establish paper form. The screen will be stacked together and dried under sunlight or in drying cabinets.

The plant is cultivated from the 21⁰06 to 22⁰09 latitude degree at the height of 50-400m. Do spread on all the low mountain areas from the North east to the centre of the Northern Vietnam due to the suitable environment – high rain level (1,600- 3,800mm); high humidity (82-86%) and long sunlight period (1,520-1,620hours/year). The plant can grow on most of soils type from ferrite to mud with the low pH range. Moreover, the plant can live together with other in different condition such as: *Livistona*, *Ormosia*, *Engelhardia*, *Canarium* forests. The plant could grow from the seed or from the new branch of the mother tree. The second option of seeding can warrantee the healthy tree. From the negative impact, nowadays, most of the new tree has been cultivated from the mother tree branch.

The flowering occurs from October to December and fruit ripening happens in very short time at the end of March and begin of April. Therefore, at the period, the tree should be assessed more frequently to harvest at right timing.

The Do skin contains 40-50% of cellulose (depending on the age of the tree). The Do thread can be 6-7m long and 10mm wide. The thread is strong and durable.

The Do grinded powder contains 92-93% cellulose, low contain of copper at 1.13%. The best Do powder for paper making should contain not leaser than 90% of cellulose and 1.5% copper.

Therefore, Do skin is very suitable for high quality paper making (could last over 500 years). In traditional culture, the Do paper used to draw painting, book... Especially, all of the Reward certificates from the Royal Dynasty from the 15th century just used the Do paper for the long last storage purpose. Recently, lots of the certificate still kept at pagodas, villages and national storage agents.

In addition, the leaf, flower and root of the plant have been used as medical by the minority community. The body of the tree could be used to make paper powder or for heating purpose. Recently, lot of paper making organization in BacNinh and BacGiang provinces still use the traditional method to manufacture the Do paper.

The Do paper demand is rising due to the good characteristics. Moreover, the type of paper is more diversity for the various purposes. With lot of assessment, the result showed that Do powder is very good for produce the high quality paper.

Do paper – characteristics and application

The paper has been made from the Do skin powder. The powder has been done by a complex processing method.

The main difference between the modern technique and the traditional one is that the old one uses the tree skin instead of body like the modern method. The Do skin has been dipped, filtered, boiled and pounded to collect the powder with tiny thread remaining. Due to the soft and strong thread, the Do paper has very good ability and long lasting life.

From previous research, the expert has found the most difference point between the Do material and other paper material. That is Do ingredient is sulfite cellulose with no alkaline characteristic while the other paper material contain the sulfate cellulose with alkaline nature. Therefore, the organization in the South had failed to use the Do powder in modern method.

- In the past, the Do paper has been used very widely due to the long last life and borer and mold resistance ability. Even now, we still have lots of document from the very long time ago at the very good condition.
- Do paper is the most popular material in traditional painting such as Dong Ho painting, Hang Trong painting and Kim Hoang painting.
- In the copper casting and statue making, the craftsman has used lot of Do paper to form the body of it due to the strong and durable ability. For example, the Buddha statue in NguXa pagoda, the craftsman there used about 70 tons of Do paper, soil and rice straw to form the internal and external mold. The product is rated at 11.3 tons.
- The durable ability of the paper has been tested and used in golden powder maker in KieuKy – Hanoi. The craftsman uses the Do paper to wrap piece of gold and then pounds it to form the super fine gold powder but the paper still in good condition.
- In the 1969, Do paper had also used an ingredient to form the loudspeaker membrane. The good result has been published by the expert from Czech and Hungary.
- The Do paper has been exported to France and several countries. The painter at there is very interested in the material to draw the large painting.
- Nowadays, lots of museum know about the humidity absorbility of the Do paper and use them to place underneath the painting for protective purpose.
- In Vietnam, the Do paper has been used in various purposes such as votive paper, traditional toys. For the worship purpose, the votive paper burning very fast and complete that makes sense for the believer.

The paper making villages in Vietnam

- The Nghia Do paper – the special one made from high quality Do paper and yellow colour from luscious. The front has dragon and cloud sign or drawing. The back has drawing of four noble animals and a poem. The colour ink made from gold, silver...
- Yen Thai paper village
- PhongKhe paper village

- AnCoc paper village.

The paper making at Suoi Co – Luong Son – HoaBinh

In order to recover the old traditional paper making career and improve the farmer life at the region, the Vietnam Handicraft Research and Promotion Center(HRPC), CSEED and the local authority has chosen Suoi Co commune to promote the career. The Muong community here has no knowledge about the job. Their income is from cultivation and the poor family is rated at 23%.

Due to the Duong plant grown wild and popular in the area, the paper making can be easily to establish. The farmer can harvest the one year old branch for manufacturing and after 1 year the new branch could be harvested again. Therefore, nowadays, the cultivation has been invested for stable material supply.

The expert from the center and also Japan has trained the farmer from the very first stage such as cultivation technique and branch collective method until the finishing stage.

The only technique has been reserved from the traditional method is pounding to maintain the cellulose threads.

The dyeing material has been made from natural source such as flower, leaf and etc... available there:

- Orange color from Hoang Dang fruit
- Yellow from luscious and turmeric
- Green from indigo
- Purple from the Cam Nam leaf
- Pink from Cam Hong leaf

The pink color is the most difficult producing. The leaf has to be harvested very early at morning. After that, the leaf should be processed immediately in day, otherwise the color is gone. In the region, the leaf has also used to coloring the sticky rice in occasions.

IV. HANDMADE PAPER VALUE CHAIN EVALUATION

IV.1 The value chain

The Duong plant grown wild and popular in the area, the paper making can be easily to establish. The farmer can harvest the one year old branch for manufacturing and after 1 year the new branch could be harvested again. The skin will be removed and boiled and pounded to form the powder. The powder then has been filtered and pressed to remove water content. The wet paper would be dried up and cut to form the product.



Pic 1. Value chain of handmade paper.

IV.2 Clean production evaluation of the value chain

IV.2.1 Do cultivation and harvesting

The most value part of the Do is its skin. It's the main ingredient for paper making. The skin contains cellulose thread which can be measured as medium length of 6-7mm and wide of 10 μ m and the cellulose percentage of 92-93%. That means the material is very suitable for high quality paper making. In the paper making village such as Buoi, ThuyKhue (Hanoi); ChauKhe, That Khe (BacNinh), the quantity of Do skin consumption would be thousand tons per year.

In addition, the tree has been used to form the natural fence for the house in several areas.

Appearance characteristic

Wood bush tree with height of 3-4m, sometimes could reach to 10m. The diameter of the root should be 3 - 4cm - the old one could be 20-30cm. The brown skin is smooth with few scars on it; thickness would be 3-3.5mm. The single leaf is oval with the round tip, the front is dark green and the back has small furs. Its length would be 8-10cm, width of 3.5-5.5cm. The flower is oval shape comes out at the tip of the branch in group of 3-4 flowers, inside is the 8 stamens in two rows. The fruit also is oval shape length of 1-1.2cm, diameter of 3-4mm and the fur covering all the skin. Each fruit contain a seed of 0.5-0.8mm, diameter of 1-1.5mm. The color is green at young stage and turn to black at mature the skin is water resistant. 1 kg of fruit contains 17,000-18,000 seeds. The harvest time is March and April.

Bio-chemistry characteristic

The plant is spreading at the South of China and North of Vietnam. In Vietnam, Do grow natural and cultivates in the mountainous area in the North such as Thai Nguyen, Tuyen Quang, Yen Bai, PhuTho and Ha Tay.

The tree grows well in the condition of average temp of 22-23⁰C; rain level more than 1,500mm and humidity of 82-86%. The suitable soil would be the thick and high clay content without high water content. It can be cultivated with other trees. The reproductive rate is high.

Cultivation technique

Cultivation condition:

- Latitude: mountainous area below 500m from sea level.
- Weather: average temp of 22-23⁰C;
- Soil: thickness of 40-50cm; good drainage ability
- Vegetation: new and rejuvenate forest.

Seeding:

Report on Cleaner Production and Design for Sustainability in handmade paper value chain

- Choose the mother tree from 5 year old or two new branch 2 year old; good growing , large leaf white flower and no disease
- Harvest in March and April, collect the black fruit and immediately seeding.
- Do not store more than 7 days.

New tree:

- On the good preparation orchard, rate bed with width of 1-1.2m, height of 15-20cm, the distance between two beds should be 35-40cm. fertilizing 3-4kg composing for 1m² of bed areas.
- Dipping the fruit in water in 4 hours, take it out and seed with distance of 10cm. cover the seed by soil of 2-3cm thick.
- Using the sterile rice straw to cover the bed and watering enough in 2-3 weeks until the branch comes out
- Using the bamboo shed to decrease the sunlight about 50-75% and continuous watering
- When the tree is 2 months old, trim the high density area to reach to 100-200 tree/m². The distance between trees should be 10x10cm or 10x15cm.
- Bring the young tree to separated soil cup. The outside covered by nylon height of 12cm and width of 9 cm. the soil would be 89% of soil, 10% composing and 1% of superphosphate fertilizer
- The soil cup could be placed on the prepared bed or other place but need the shed to lowing the sunlight.

Young tree:

- Watering to maintain the high humidity. Frequently, weed removal in 2-3 week interval
- For the less development tree, fertilizing with sulfate Kali and Nitro sulfate 0.2% with quantity of 1.5-2 litter per m². After that, wash the leaf by water.
- Stop the care and shed using before cultivating 1-2 months

| Young tree standard | Young tree and the cutting tree without soil cup | Young tree with soil cup |
|----------------------------|---|---------------------------------|
| Age (month) | 10 - 12 | 6 - 8 |
| Root diameter (cm) | 0,5 – 1,0 | 0,3 – 0,5 |
| Height (cm) | 40 - 50 | 40 – 45 |
| Strength | Good growing, no disease | |

Cultivation:

- Cultivate under the natural wood forest with the coverage of 0.5-0.6 or group
- The suitable time is spring and autumn
- Weed removal by bank or hole of 80cm
- The cultivating hole dimension of 30x30x30 cm
- The density of the orchard:
 - ✓ 5000 trees/ha with distance of 2x1m
 - ✓ 6000 trees/ha with 1.5x1m distance, cultivating by bank , 3-5 row/bank

Report on Cleaner Production and Design for Sustainability in handmade paper value chain

- Weed removal around the cultivation hole with the diameter of 0.8-1m once or twice per year.

Harvesting:

- From the year three, the plant is ready for harvest. Harvesting should be done with the interval of 2-3 year. The cycle life of the tree would be 3-4 harvest time.
- For the first harvest, the optimum productivity would be 8000kg of fresh skin which is equal to 2285 kg of dried skin or 9600 kg of tree/ha. The next harvest should be around 5472 kg of fresh skin or 1536 kg of dried skin or 10,000kg of fresh wood/ha.



Pic 2. Duong cultivation in the orchard.

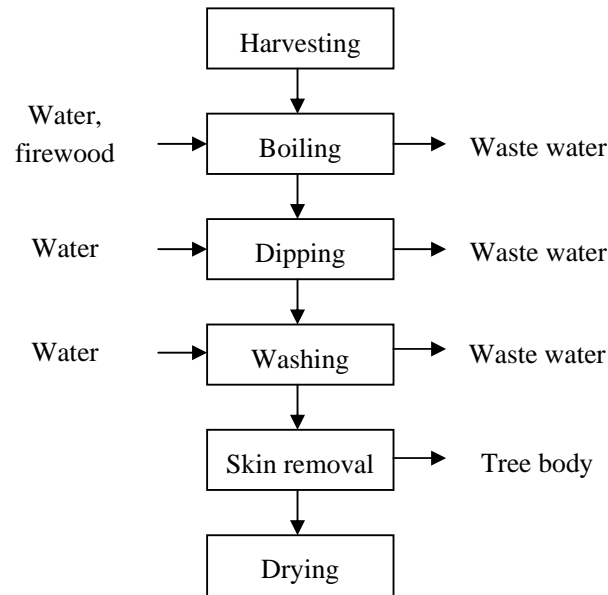
- Cutting should be done with right method: clear, smooth and inclined. Do harvest at the end of raining season to avoid root rot and easier to do skin removal.
- When the new branch reaches to 5-10cm, trim the weak or small branch and keep only 2-3 strongest branches. In addition, fertilizing 100-200grs of organic fertilizer each tree.

IV.2.2 Raw material preparation

The skin of Do tree which contains high cellulose thread is the raw material for paper making. The branch and body of tree after harvest would be boiled to remove the skin. One part of the collected skin has been used for powder making; the other comes to storage for next process time.



Pic 3. Skin removal by boiling



Pic 4. Raw material preparation

The harvested branch or tree has been boiled in tanks for 4 hours. The boiling solution is combination of water and $\text{Ca}(\text{OH})_2$ with ratio of 20:1 to make skin softer and easier to remove. The periodically boiling by tank is wasting energy and environment pollution due to:

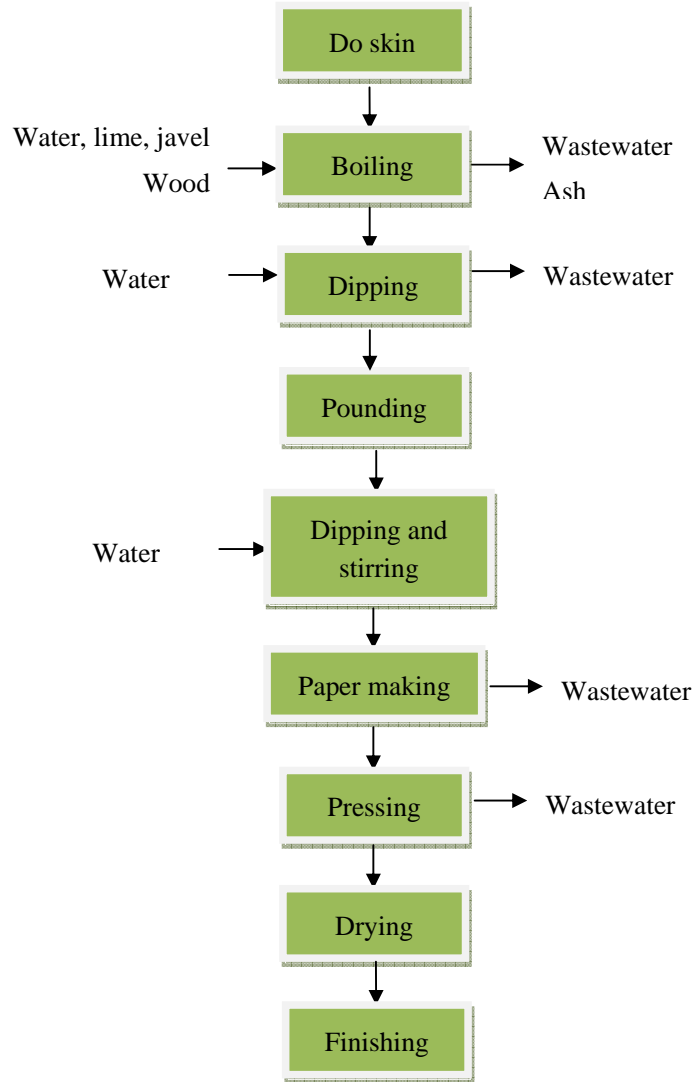
- After each boiling, the solution has to discard and waste the solution
- The tank is simple without insulation which cost more energy. The solution content calcium hydrate could damage the tank
- The material should be washed before boiling for easier filtration.

IV.2.3 Paper hand making

The after boiled Do skin is dipping in the water tank for the softer process occurred. For whitening the paper, Javen solution could be added in the tank. After that, the skin is pounding to form the powder with tiny cellulose threads. The process has to be done by manual for better control. In fact, the finished product cannot reach to the fine as requirement due to the different size of threads. However, it could be an advantage as it creates the linkage, strong and durability of the paper.



Pic 5. Pounding tool (left) powder solution tank (right)



Pic 6. Processing chain

Table 1.material and energy consumption for each ton of paper

| No | Input | Common rate (2010) |
|----|---------------------------------|--------------------|
| 1. | Do skin (ton) | 1.2 |
| 2. | Ca(OH) ₂ (kg) | 5-10 |
| 3. | Bleaching agent - javen (kg) | 15-50 |
| 4. | Water (m ³) | 75-150 |
| 5. | Firewood (kg) | 0.08 |

The powder after pounding is diluted in water and stored in tanks. Therefore, to avoid the rot of the paste, it should be processed as soon as possible. On the bamboo frame, there is a membrane made from bamboo for water draining but keep the paper powder to form the paper. The craftsman will dip the frame into the tank and gently stir it for the solution cover all the membrane and then take it out. The water will be drained out in few seconds and the powder forms the paper.

The membrane is then removed and stacked together and put in to the pressing machine to remove the remaining water. The waste water is not recycling.



Pic 7. Pressing machine (left) and the cutting tools (right)

The membrane is then dried under the sunlight. In the rain season, it should be more difficult as the drying stage occurs indoors for a longer time and high humidity. The finishing stage is cutting and the waste can be recycled such as raw material.

The current processing line is low productivity and quality. Moreover, the design is not as nice as expected and diverse. That leads the business to get lots of issues.

In order to improve the productivity and quality of the product, those issues should be done:

1. Material:
 - The harvesting tree should be mature enough to ensure the high cellulose content.
 - Wash the skin before boiling to remove the impurities to increase the quality of paper
2. Boiling:
 - The raw material should be collected enough for boiling to save the energy and boiling solution.
 - The tank should have the cap to reduce the dust coming in and the evaporation rate.
 - The tank material should be changed to inox to prevent the corrosion.
3. Dipping, pounding and stirring
 - The water used in dipping should be high quality to avoid the contamination such as soil or sand
 - Upgrade the manual pounding to automatic pounding machine to improve the productivity.
4. Drying
 - Due to the process depends on the weather and could be easily impacted from it, the solar energy absorbing panel should be used to improve the capacity and quality of the process.

IV.2.4 Technology and equipments needs

From the results of the investigation, the automation in the processing line and natural dyeing material application is most wanted aspects.

The technique is needed to study:

- Natural dyeing material and method for safer and diverse products

The equipment needed:

- Pounding machine
- Pressurizing machine for water removal
- Solar drying chamber.

V. DESIGN FOR SUSTAINABLE FOR THE HANDMADE PAPER VALUE CHAIN

V.1 Current situation and issues

In the five investigated industry, this one is the most difficult business in HoaBinh province. There are only 15 members in the cooperative; the capital is just 22 million VND in 2010. However, the product is amazing and shows the talent of the cooperative member. Even though, the output is just used as wrapping material for other products. The consumer is just known person or organization, there is no marketing at all. Therefore, the production is inhibited at low level and there is no way to upgrade the equipment.



The other condition of production at Suoi Co is very simple: there is just some small room with the drying yield is the orchard of the chairwoman of the cooperative. The tank is reused from the oil tank and the fuel is firewood, the paper drying canvas is bought from BacGiang. All of the equipment is simple and outdated.



The other issue is shortage of raw material and dyeing material

V.2 Analysis and suggestion

The weakest point in the organization which involved in the program is product design, marketing.

Most of the organization develops the product without ineffective methodology or research. Hence, the new product is just simple satisfying a demand from the customer at that time. There are three different ways to do that:

- Copy the design from a rival and sell to the same market.
- Produce the product from an original sample from buyer
- Develop a new product from their point of view about the demand and sell to the market.

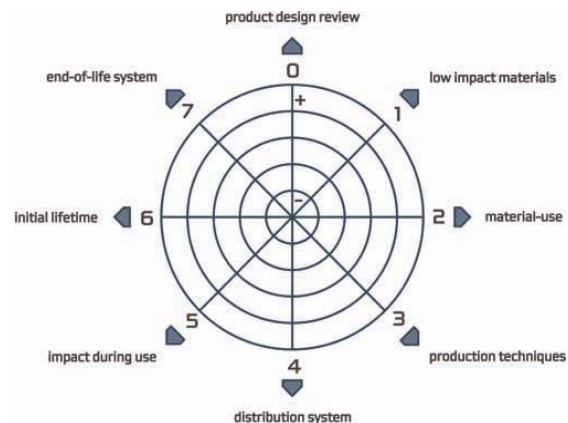


Therefore, the producing is in-active and has no foundation for further development which can lead the organization to nowhere.

In order to solve the issue, the organization should be more active and smart in product design and marketing with the new strategy, methodology. The company also should have the short and long terms plan and focus on the suitable niche market for it. In addition, the enterprise should establish a Department for design for sustainable with the good training staff.

There are also some organization who aware the sustainable development but lack of finance and technology. They acknowledge the concept but do not know how and where to start. The question is what aspect the program can help the enterprise to solve the issue?

From the current experience, the program should



help the potential organization in the efficiency energy and material consumption and reduce the waste to environment. Development of the bio-gas in waste treatment and the solar energy should be investigated. In addition, the new material treatment should be used instead of traditional method to save the environment.

With the correctly and effectively application of Design for sustainable (D4S) in the new product design and marketing, the received profit would be much higher than current situation. However, the process would face several difficult issues such as:

If the organization develops the complex product with multi-material or parts from different suppliers, the poor co-operation could harm the procedure timing and cost due to the supplier behavior and planning.

If the organization trying to do it all, the productivity would not be high and the efficiency is also not good. In the case, it could not achieve its strength and reduce the weakness. Considering in whole industries could lead to self-competition. In order to get the best achievement, the company should discuss together to form the best networking in both marketing and support. The agreement would help the organization improves the quality and price of product though the group manufacturing and marketing. For the highest performance, the enterprise should establish a union which could do marketing research, trademark formation, support partner in technology and competitive capability and guide the organization to the sustainable development.

For the researched organization, even the assessment time was short and the scale is small, there are some recommendations:

- Investing on the new technology from the developed organization or region. Optimized application the new method or technique could help the company to improve the quality of product and also its competitive
- Applying the solar or biomass energy in drying and heating instead of the fossil fuel to reduce the cost and environmental impact.
- Optimizing the housekeeping method and recycling the wasted energy in each stage of the process.
- Applying the modern technology in cultivation to get the higher yield.
- Establishing the union in the industry for the better co-operation between companies.

V.3 Samples in Vietnam



The handmade paper with the diversity in colour and patterns is the new trend in interior, fashion, other art designs.

V.4 The development trend in Vietnam and on the world

The sustainable consumption and production has been promoted in Vietnam and on the world, especially in the city. The young people now has been more and more interested in the green product and avoided the environmental harm ones.

Recently, due to the visible impact from lot of factors to environment and human, the human and community health become the most concerned issue. Therefore, the green and harmless product would be more popular along with the economic development. In the case, the industry should build up its production capacity and introduce the sustainable product as soon as possible to get the advantage of early start.

Besides, the national government has supported in both research and finance to the organization to catch up with the trend. That has been showed in the latest regulations and financial planning of the government in Agriculture, Aquaculture and Environmental Programs such as: the emission control, hazardous chemical prohibition, reduce pesticide and fungicide regulations. Meanwhile, the supporting scheme has been developing by the national authority to meet the worldwide demand and WTO. It is the most important development due to the deadline of WTO commitment will be arrived soon. If it's not well prepared, the overseas manufacturer could defeat ours very shortly.

On the world, the concept of sustainable development has been found long time ago and lot of green product has been introduced, especially in the developed country. Lots of regulation on green product, sustainable development and production has been applied in those countries. Therefore, in order to gain the access to those rich markets, the Vietnamese product must fulfill all the requirement and regulation. That why the organization has to do it as soon as possible.

REFERENCE

[1] Environment science and technology research Institute: Current situation of handmade paper production in Vietnam