

CURRENT STATUS AND MEASURES TO PROMOTE SUSTAINABLE MANAGEMENT OF HOUSEHOLD PLANTATION IN QUANG TRI PROVINCE

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SUMMARY

Quang Tri is a province with a large area of plantation, in which household's plantations account for 49% (54,929 ha) of the province's plantation area. Up to now, in the province, there is a SFM group of households with an area of 2,853.91 hectares of plantation with FSC certification. The species planted by households are mainly *Acacia hybrid* and *Acacia mangium*, the technical measures are different between households participating in the SFM group model and non-participating in the model, especially in terms of tree density, thinning activity as well as timber production purposes

Keywords: Plantation, households, sustainable forest management, Quang Tri province

Households participating in SFM group model do not applied burn post harvested residue for land preparation, plant at a lower density, have a longer business cycle (7 - 10 years) and thin out 2 - 3 times to improve sawlog volume. On the other hand, households that do not participate in SFM group usually apply burn post harvested residue, plant with high density, have a short business cycle (4 - 5 years) and do not apply thinning. There is a strong linkage between households in group to support each other on planting and plantation management according to FSC requirement and there is also a cooperation between households in group and wood processing companies through the Forest Owners Association in consumption of timber from household's plantation. The plantation of SFM group model has higher economic effect than that of plantation from households not participated in SFM group model. To promote the development of household's plantation, it is necessary to implement synchronously solutions from awareness raising, capacity building and develop policies to support the operation and maintenance of SFM group, applying advanced techniques to improve productivity of plantation.

Thực trạng và các giải pháp thúc đẩy quản lý rừng trồng bền vững quy mô hộ gia đình ở tỉnh Quảng Trị

Từ khóa: Rừng trồng, hộ gia đình, quản lý rừng bền vững, tỉnh Quảng Trị.

Quảng Trị là tỉnh có diện tích rừng trồng lớn và phong trào trồng rừng rất phát triển, trong đó rừng trồng HGĐ chiếm tới 49% (54.929 ha) diện tích rừng trồng của tỉnh. Tính đến nay trên địa bàn tỉnh có 1 nhóm HGĐ với diện tích 3.147,06 ha rừng được cấp CCR. Loài cây trồng rừng của HGĐ chủ yếu là Keo lai và Keo tai tượng, các biện pháp kỹ thuật trồng và nuôi dưỡng rừng có sự khác biệt giữa các HGĐ tham gia mô hình CCR QLRBV theo nhóm hộ và các HGĐ không tham gia, đặc biệt là về mật độ trồng rừng và tỉa thưa cũng như mục đích kinh doanh. Các HGĐ tham gia mô

hình CCR theo nhóm hộ xử lý thực bì không đốt, trồng với mật độ thưa hơn, chu kỳ kinh doanh dài hơn (7 - 10 năm) và tiến hành tía thưa 2 - 3 lần để lấy gỗ lớn, trong khi các HGĐ không tham gia thì đốt thực bì, trồng rừng mật độ dày, chu kỳ kinh doanh ngắn (4 - 5 năm) và không tía thưa để lấy gỗ nhỏ. Trong mô hình CCR theo nhóm hộ đã có sự liên kết khá chặt chẽ giữa các HGĐ với nhau để thực hiện trồng rừng theo các tiêu chuẩn QLRBV của FSC và liên kết giữa nhóm HGĐ trồng rừng với các cơ sở chế biến gỗ thông qua Hội/chi hội chủ rừng trong việc tiêu thụ sản phẩm rừng trồng. Mô hình CCR theo nhóm HGĐ có hiệu quả kinh tế rừng trồng cao hơn so với rừng trồng của các HGĐ không tham gia CCR. Đề thúc đẩy rừng trồng HGĐ tiếp tục phát triển cần phải thực hiện đồng bộ các giải pháp từ nâng cao nhận thức, năng lực thực hiện và QLRBV cho đến các chính sách hỗ trợ vận hành và duy trì CCR theo nhóm HGĐ, ứng dụng KHCN trong trồng rừng,...

I. INTRODUCTION

The roles of plantation in providing wood and forest products are become more and more important in recent time, especially under the implementation of Decision No 2242/QĐ-TTg dated on 11 December 2014 of the Prime Minister about natural forest logging band. According to MARD (2019), there is about 4,316,788 ha of plantation, which share about 29.5% total forest areas of the country. Households are managing 1,594,028 ha of plantation, which contributes to 36.9% of total national plantation (Decision No 1243/BNN-TCLN dated on 15/4/2020 of MARD). Plantation brings important income for about 1.5 million households living in mountainous areas. Moreover, wood harvested from household plantation is significantly contributed to total wood harvested of the country every year.

Quang Tri is one of provinces where household's plantation is well developed. According to MARD (2019), there are about 96,484.5 ha of plantation in the province, including 45,902.1 ha managed by households, which shared for 47.6%. Most of plantation is productive forest and have significantly contributed to local economic and social development. This province is also the leading on promoting sustainable forest management

(SFM) and forest certification (FM) for both forest companies and households. Nevertheless, households are the object that easily affected by changes of market, social and environmental factors but have not been paid attention to and taken care. Plantations of households are facing many challenges such as small scale, difficult to access market and seed source of high quality, especially in remote areas; lack of knowledge and skill on sustainable forest management, etc. These challenges effect on sustainable development and long-term benefit of households. This article presents research results on current status of plantation development of household in Quang Tri province, thence to recommend measures of sustainable plantation management.

II. RESEARCH OBJECT, LOCATION AND METHOD

2.1. Research object: are plantation of households, of which there are households having FSC certificate and None-FSC certificate households.

2.2. Research location: Quang Tri province.

2.3. Research methods

+ Collected secondary data about plantation areas at Quang Tri province level and district level from forestry data introduced yearly.

+ Assess and evaluate technical measure applied for plantation: two steps:

i) Step 1: Meeting with local forest management agency at province, district and commune level to discuss and collect general information about silviculture and forest management technical applied by local households.

ii) Step 2: Field survey: At sampling selected commune, selected households participated and households not participated in FM certification group model. Interview selected household with semi-structure interview form, the main information is following:

- General information of household: Name, age, education, ethnic minority,...

- Information about plantation of household: Areas, location, species, ages, land use tenure right, year of started planting,...

- Technical measure applied: seedling sources, land preparation, species, planting density, fertilizer, weed management, tending, pruning and thinning;

- Evaluating plantation business rotation: based on household interview and technical evaluation above.

- Difficulties and problems in the development of plantation as well as time participated in forest certification groups will be investigated.

+ Research on linkages and household's wood consumption channels in Quang Tri province:

This content will be implemented corresponding with the above investigation at the selected research communes. The study also has a meeting to discuss with Association of Quang Tri Smallholder Forest Certification Groups and its sub-group to understand about the process group formation, horizontal and vertical linkages of households on forest management and wood selling. Moreover, this research also conducted an interview with wood processing companies about

consumption of plantation timber of households.

- Evaluating economic effect of household plantation

four following economic indicators were used:

a) *NPV - Net Present Value*

$$NPV = \sum_{t=0}^n \frac{Bt - Ct}{(1+i)^t}$$

Where: NPV: *net present value*

Bt: benefits in t year (t = 1,2,3... n)

Ct: cost in t year (t = 1,2,3...n)

i: discount rate; in this research the discount rate is assume at 7% per year

t: year = 1,2,3...n

b) *BCR - Benefits to Cost ratio*

$$BCR = \frac{\sum_{t=0}^n \frac{Bt}{(1+i)^t}}{\sum_{t=0}^n \frac{Ct}{(1+i)^t}}$$

Where: Bt: Benefits in each year

Ct: Cost in each year

i: discount rate;

t: year = 1,2,3...n

c) *IRR - Internal Rate of Return*

$$IRR = i1 + (i2 - i1) \times \frac{NPV1}{NPV1 - NPV2}$$

Where:

i1: Lower discount rate chosen (which lead to NPV1 > 0)

i2: Higher discount rate chosen (which lead to NPV2 < 0)

d) *Annual equivalent value (AEV) (Godsey, 2008): Used to compare economic efficiency between plantation with different business rotation:*

$$AEV = \frac{NPV}{\sum_{t=1}^n \frac{1}{(1+r)^t}}$$

* Proposing solutions for household's plantation development and sustainable management in Quang Tri province

- Strengths, Weaknesses, Opportunities, and Threats analysis (SWOT) for household in

term of participating on sustainable forest management group.

- Proposing solution to develop and sustainable management household plantation in Quang Tri province.

III. RESULTS AND DISCUSSION

3.1. Assessment of current status of household plantation development in Quang Tri province

3.1.1. Area of household's plantation in Quang Tri province

Table 1. Plantation area of households in Quang Tri province for a period 2002 - 2019

Unit: ha

Year	Total area of plantation of province	Plantation area managed by households		Plantation area managed by other forest owners	
		ha	%	ha	%
2002	62,815	24,240	38.6	38,575	61.4
2005	77,611	16,274	21.0	61,337	79.0
2010	88,364	19,907	22.5	68,457	77.5
2015	100,741	35,789	35.5	64,952	64.5
2019	112,127	54,929	49.0	57,198	51.0

(Source: Statistical data of MARD from year 2002 to year 2019)

The data from Table 1 shows that plantations managed by households in Quang Tri province always account for a large proportion of the total planted forest area of the province and tend to increase sharply in recent time, ranging from 21.0 % (24,240 ha) in 2005 to 49.0% (54,929 ha) in 2019, tended to decrease continuously over the years. This number is only 51.0%. Other plantation forest owners such as Forest Management Boards (Special used Forest Management Boards, Protection

Forest Management Boards), economic organizations (mainly forestry companies), Commune People's Committees, local communities and army units, the proportion of plantation managed by these groups tended to decrease continuously over the years, this number was about 51.0% in 2019.

* *SFM certified areas*

The data of SFM certified areas is presented at Table 2.

Table 2. Area of FSC-certified plantation in Quang Tri province in 2020

TT	Forest owners	Area	First time certification	Type of certification
1	Ben Hai forest company	8.664,10	2011	FSC FM/CoC
2	Duong 9 forest company	4.332,0	2015	FSC FM/CoC
3	Trieu Hai forest company	4.532,01	2015	FSC FM/CoC
4	Association of Quang Tri Smallholder Forest Certification Groups	2.853,91	2010	FSC FM/CoC
	Total	20.382,02		

(Source: <https://info.fsc.org/> September/2020)

In Vietnam, up to September 2020, there have been 2 types of forest management certificates issued to forest owners: FSC certificates and Vietnam Forest Certification Scheme (VFCS) which recognized by PEFC. Quang Tri is one of the first provinces in the country to be granted FM certification for both organization and household group. Up to now, in the

province, there are 20.382,02 ha of forest certified by FSC, including 3 state-owned forestry companies and 1 household group. The group namely Association of Quang Tri Smallholder Forest Certification Groups which has 2.853,91 hectares of certified plantation. Currently, there is none VFSC certificate issued to forest owners in Quang Tri province.

3.1.2. Assessment of forest planting techniques and plantation management

Table 3. Forest planting techniques applied by households in Quang Tri province

Content	Households having FSC certification	None-FSC Households
Species	<ul style="list-style-type: none"> - Acacia hybrid propagated by cuttings: BV10 clone, BV16 clone, BV32 clone - Acacia hybrid propagated by tissue culture: rarely and in trial scale. - <i>Acacia mangium</i>. - Native species: <i>Homalium hainanense</i>, <i>Chukrasia tabularis</i>, <i>Hopea odorata</i> according to FSC standard requirement. 	Mostly <i>Acacia hybrid</i> propagation by cutting and <i>Acacia mangium</i>
Seedling sources	Buying from seed agents in districts, from other districts and even from other provinces. Household know the origin of seeds and the sellers can provide seedling certificates evidence.	<ul style="list-style-type: none"> - Buying from seedling traders in village and commune (seedling traders buys seedling from seed agents, nursery and sell to farmer to get benefits). Household do not know about chain of seedling custody and seedling origin; - Collecting seedlings regenerated naturally in the forest for planting.
Post harvested residue and pre-planting vegetation cover treatment management	- Whole area, most of HH do not apply burning residue.	Whole area, 35% of household not applied burning; 66% of household applied burning;
Land preparation	- Used excavator to make planting hole; hole's size: 25x50x40 cm, 40x40x40 cm, and in some place, the size is 70x70x70 cm.	Used excavator to make planting hole; hole's size: 25x50x40 cm, 40x40x40 cm; or used excavator to completely prepare land.
Planting method	<ul style="list-style-type: none"> - Monoculture <i>Acacia hybrid</i>; Monoculture <i>Acacia mangium</i>; - Mix <i>Acacia hybrid</i> with native species; the native species was planted in row or group at place closed to stream and river according to FSC requirement. 	<ul style="list-style-type: none"> - Monoculture <i>Acacia hybrid</i>; - Monoculture <i>Acacia mangium</i>
Planting density	Planting density from average to high: 1,660 - 3,000 tree/ha; the density is changing according to behavior of household and thinning activity.	Planting density from high to very high: 2,000 - 4,000 tree/ha; the density is changing according to behavior of household and business rotation;

Content	Households having FSC certification	None-FSC Households
Pre-planting fertilizer application	- Pre-planting fertilizer application with different types fertilizer and different dose: 50 g NPK (16:16:8)/tree, or 200 g NPK (5:12:3)/tree or used other types of fertilizer with different trademark such as "Phân đầu trâu", "Việt Nhật", "Bông lúa", "Nung Chảy" (Thuong Nghia village, Cam Nghia commune)	Pre-planting fertilizer application with different types fertilizer and different dose 100 - 200 g NPK/tree.
Tending and after-planting fertilizer application	- Weed clearing in year 2 and year 3 after planting; - Fertilized application additional dose: 100 g NPK (16:16:8)/tree after planting 4 months and 100 g NPK (5:12:3)/tree after one year. - The disease has not been detected on a large scale; local farmers do not have skills and knowledge about pest and diseases control.	- Weed clearing in year 2 and year 3 after planting; - Fertilized application additional or not. - The disease has not been detected on a large scale; local farmers do not have skills and knowledge about pest and diseases control.
Pruning	- Some households do not apply pruning. - Some household apply pruning at year 2 and year 3 together with tending (Giang Xuan Hai sub-group, Trung Son commune, Gio Linh district)	No pruning
Thinning	- Most of Households applied thinning - Number times of thinning: 2 - 3 times;	No thinning
Planting season	- September - October; rarely January - February.	- September - October; rarely January - February.

The information from above table shows that there are differences in planting techniques between Households participated in the SFM model and those not participated. Some key points can be summarized as follows:

- Species and seedling sources: The Households participated in the SFM group have more diverse plant species. The main species for economic purpose are *Acacia hybrid*, *Acacia mangium* and others native tree species have been planted to meet FSC requirement such as *Homalium hainanense*, *Chukrasia tabularis*, *Hopea odorata*, etc. These species can be used to plant in line around forest plot of HH or plant along banks of stream, lake and river. The quality of seedling source is also better controlled. Moreover, some households planted seedlings produced by tissue culture. The Households were also guided by the sub-group in the villages (under SFM group) in reviewing and obtaining certificates of seed origin.

On the other hand, Households not participated in the SFM group only plant *Acacia* species and varieties created from cuttings. Most of the Households that buy seedlings from traders in villages and communes without any information about seedling origin or certificate. The price of this type of seedling is usually cheap, only about 700 - 800 VND/seedling (ship to field for planting) and often has no evidence of origin. Some households still go into the forest to pick up naturally regenerated *Acacia* trees and plant them, which caused to poor quality of plantation.

In all surveyed sub-groups, none of them has seedling nurseries to provide high quality seedlings for their HH members. There is only one sub-group in Quat Xa village, Cam Nghia commune started to receive investment in nursery but has not been put into operation. This issue is needed to be paid attention to support Households to access high quality seedling sources.

- Post harvest residue management and land preparation: There has been a marked improvement compared to many other localities, showing that most of Households participated in SFM group do not applied burning practice for post harvested residue - this is also a mandatory requirement of FSC. For Households who do not participate in CCR group of households, 65% of them apply burning residue, 35% of them have learned from SFM group that do not burn residue. This is one of the successes of the SFM group model in Quang Tri province. The awareness about SFM of local farmers is raised and the SFM practice has spreaded out. Throughout interviews, households said that although burning post-harvested residue will help them to make planting process become easier, it also leads to high density of weed in the 2nd, 3rd year, causing to more investment on weed clearing. Harvest residue and vegetation left on forest ground is also an obstacle which provides protection for seedlings in the early years from the impact of wind and storms.

In terms of soil preparation techniques, there is no difference between two groups. Most local people used excavators to make hole for planting. The use of an excavator can make a hole with large size to ensure space for

fertilizing as well as help to increase soil porosity. However, in some planting areas, the hole is too wide, causing to the tree easily fallen down and broken when storm coming. Some households participated in SFM group who have experience in this situation have made holes with a slightly smaller size to limit the falling down of tree.

- Planting density and thinning: This is the most difference between two groups. Most of the households participated in SFM group planted trees with a low density of 1.660 to 2.500 trees/ha, a few households planted at density of 3,000 trees/ha. Most of these households thinned their forests in two or three times with business cycle is about 7 - 10 years to get sawlog. The households that did not participate in SFM group planted forests with high density which ranges from 2,000 - 4,000 trees/ha. Households in this group have not applied thinning and have short business rotation at 4 - 5 years for wood chips production.

- Fertilization and taking care of plantation: In general, Households participated in SFM group pay more attention to fertilizing and taking better care in both dosage and frequency of fertilizing. Some Households applied pruning branches and trunks to improve wood quality and production.

3.1.3. Assessment on business rotation and products of household plantation

Table 4. Business rotation and products of household plantation

TT	Content	Households having FSC certification	None-FSC households
1	Business rotation	7 - 10 years	< 7 years, mainly 4 - 5 years
2	Business objective	Large timber	Small wood (wood chip, paper pulp)
3	Intermediate products (thinning)	Small wood (wood chip, paper pulp)	none (Due to no thinning)
4	Main products at final cutting	- Large timber: 70 - 75% - Small wood: 25 - 30%.	Small wood: 93 - 95% Large timber: 5 - 7%
5	Procedure of product consumption	Linkage with processing mills in the province	Free market
6	Selling price	15 - 20% higher than market price.	Market price

The information from Table 4 shows that there is a clearly difference in the business goals and the orientation of wood product between two groups. Most of Households participated in SFM have business from 7 to 10 years in order to get sawlog for selling to wood processing factories. Due to the long business cycle, the Households thin the forest from 2 to 3 times at the age from 2.5 to 6 years. The thinning products have small size and will be sold to wood chip factories to get additional income when waiting for income from sawlog harvested.

For Households participated in SFM group, if they have financial difficulties at early ages of the forest from 4 - 5 years, they might decide to thin out and extend the business cycle for more 2 - 3 years to get sawlog, they will get a support from wood processing company that linked with the SFM group. The company will provide a loan of 4 million VNDs/ha with an interest rate lower than that of commercial banks at the time of borrowing, which is 2% per year. The harvested wood product consists of 70 - 75% of sawlog and 25 - 30% of small wood. Since 2018, Scansia Pacific Company has signed a contract to commit for buying FSC certified sawlog (over 13 cm) with premium price is 15 - 20% higher than uncertified wood at the same time, depending on the wood quality and do not force prices when there are natural disasters, risks.

The households that did not participate in SFM group are mostly planting trees with short rotation from 4 to 6 years, high density for the purpose of obtaining timber selling for woodchip. They do not have contracts with wood factories, often sell standing trees to middleman at market prices.

3.2. Research on linkages and household's wood channels in Quang Tri province

3.2.1. Research on linkages for planting and selling household's wood

Survey results shows that only Households participated in the SFM group have a linkage

among households and bands with wood processing factory. Most of Households did not participate in the SFM group have no linkages between Households and with wood factory. Therefore, this paper only focuses on analyzing the linkages in the model of households participated in SFM group.

**** Setting process overview of SFM group in Quang Tri province***

This model firstly was setup and supported by WWF and the development process can be summarized in three following stages:

- Period from 2007 to 2010: Mobilizing participation of Households, the first group of Households was established in 2007 with a total area of 350 ha of planted forest which was contributed by 150 Households. Then the Households in group were trained to improve capacity for implementation and management of their plantation in compliance with principles, criteria and indicators according to FSC requirement. By year 2010, this group was audited and granted FSC FM certification with a scale of 316 hectares of plantation from 118 Households (Hoang Lien Son, Vu Duy Hung, 2017). At this stage, the group entity is the WWF.

- Period from 2011 to 2014: Completing group's organizational and management system. Association of Quang Tri smallholder Forest Certification Groups was established in 2014 and became group entity. The association has legal status, seal, bank account and is under the management of Department of Agriculture and Rural Development. The Association has developed operational regulations, financial regulations which were approved by Quang Tri People's Committee. The association has completed structure such as managing board, monitoring board, association office and number of sub-groups at commune and village levels. The sub-group was set up according to

cooperative group. The association plays a role on finding donors and cooperated with wood processing enterprises and wood business company to support 100% of the FSC audit cost for the period 2016 - 2020.

- Period from 2014 to present: Operating under the association structure. During this period, the number of members continued to increase rapidly. As of 2020, the certificated area is 2.853,91 ha with the participation of 490 families in 33 branches in 22 wards and communes in 7 districts, cities and towns (Vinh Linh, Gio Linh, Cam Lo, Trieu Phong, Hai Lang district, Dong Ha city and Quang Tri town). In this period, many sub-groups have been set up at commune and village levels to support Households to participate in SFM group.

* Horizontal linkages between Households in SFM group

Because the size of Households plantation is small and scattered, they need to associate into a group to form larger areas of plantation for economic effect of SFM model. The experience from practice in Vietnam and oversea shows that the larger the area certified for forest, the lower the cost.

When Households participated in SFM group, they must comply with FSC requirement about plantation management and group management. The sub-groups have role to guide and inspect household members to follow these requirements. Households have many opportunities when they join the group, such as:

- Be trained in techniques of planting and protecting plantation according to FSC sustainable forest management standards, especially requirement about seedling sources, thinning techniques, and taking care of plantation for sawlog production purpose.
- Improve capacity for plantation management and business;

- Information and support to access market for wood product;

- Get updated information about FSC wood market at national and international level;

- Have opportunity to learn best practice from other Households;

- Raise awareness about forest fire prevention and fighting; have group plan to support each other on forest fire prevention and fighting.

- Raise awareness about economic, environmental and social value of SFM model.

When Households join the SFM group, the management of forest in villages also changes from the separate management of each Household to a group management which helps to improve effectiveness of management activity and reduce time and cost for forest management. Households in a sub-group (normally in same village) have supported each other in terms of technology advice, plantation patrol and protection, as well as finance. With the linkages between Households, the high volume of sawlog has been produce and there is more convenience for them to contact with wood consumer than others Households.

Therefore, it can be seen that the linkages between Households into groups of SFM is necessary in the current context of Quang Tri province. In terms of form, it is like accumulating land to create a “large field” which lead more efficiently and sustainably. However, forestry sector has some special characteristics such as long business cycle, facing with risk from storm, forest fires, pest and diseases,... so that the linkages between Households also has specific characteristics and differences.

* *Vertical linkages between Households in SFM group and wood processing company*

Beside the horizontal linkage between Households, there is also the vertical linkage

along the plantation value chain. This is the cooperation between SFM group and wood processing company. These linkages help to ensure the sustainability of the SFM group’s model. In this cooperation, Scasia Pacific company made an agreement with SFM group to buy sawlog (which have diameter ≥ 13 cm) with FSC label with premium price is 15 - 20% higher than uncertified wood at the same time, depending on the wood quality and do not force prices when there are natural disasters, risks. This strong linkage is not only ensuring that Households can sell their wood with the best option, but also ensures that the wood processing company has enough raw materials with FSC label for their stably operation. During the cooperating process, the company also has many support activities for households facing financial difficulties such as providing a loan with low interest rates.

Other vertical linkage has been pointed out is the cooperation with seedling company to provide high quality seedling for group members. However, this activity has not been implemented, therefore in the future, it is necessary to pay attention to this issue.

To sum up, it can be seen that the horizontal linkages between Households in SFM group has created sustainability in plantation and wood production; vertical linkage creates a sustainable and stable in consumption of wood from household's plantation. Households participated in this SFM model also have ability to provide information and evidence for fastest wood traceability. This is also a mandatory requirement when Vietnam Timber Legality Assurance System (VNTLAS) is implemented and applied for both exported and domestic used of wood products.

3.2.2. Household's plantation wood consumption channels in Quang Tri province:

*** Consumption channels for wood from Households who do not participate in SFM group model**

Consumption channels for wood from Households who did not participate in SFM group model is describe in following diagram:

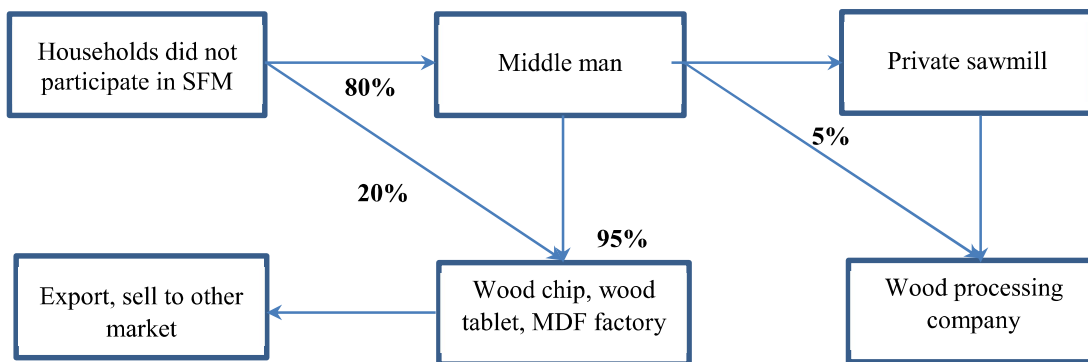


Figure 1. Consumption channels for wood from Households did not participate in SFM group

The reserch result shows that the wood from Households did not participate to SFM group uncluding:

- 80% of Households sell standing trees to middleman, then middleman hire worker to

harvest and classify to sawlog (Diameter ≥ 13 cm) and small size timber. There is about 5 - 7% wood volume is classified as sawlog which is sold to private sawmills or wood processing factories. At these factories, sawlog would be

sawn to pallets and sent to wood processing company in Ho Chi Minh City, Binh Duong, Binh Dinh, Dong Nai provinces,... There is about 93 - 95% of the remaining timber from Households plantation are small size timbers that middleman will sell to woodchip factories, tablets factories or MDF factories.

- 20% of Households harvest plantation and then most of them sell timber to wood chips factories, tablet factory and MDF factories; others sell timber to middleman. The woodchip from factories then will be exported

or sold to others factories. There is about 30% of woodchip exported to Laos through Lao Bao International border gate, 30% is exported to China through Cua Viet port, 15% is exported through Chan May port and Tien Sa port in Da Nang city, 25% is used for processing tablet and MDF in Quang Tri province.

*** Consumption channels for wood from Households participated in SFM group model**

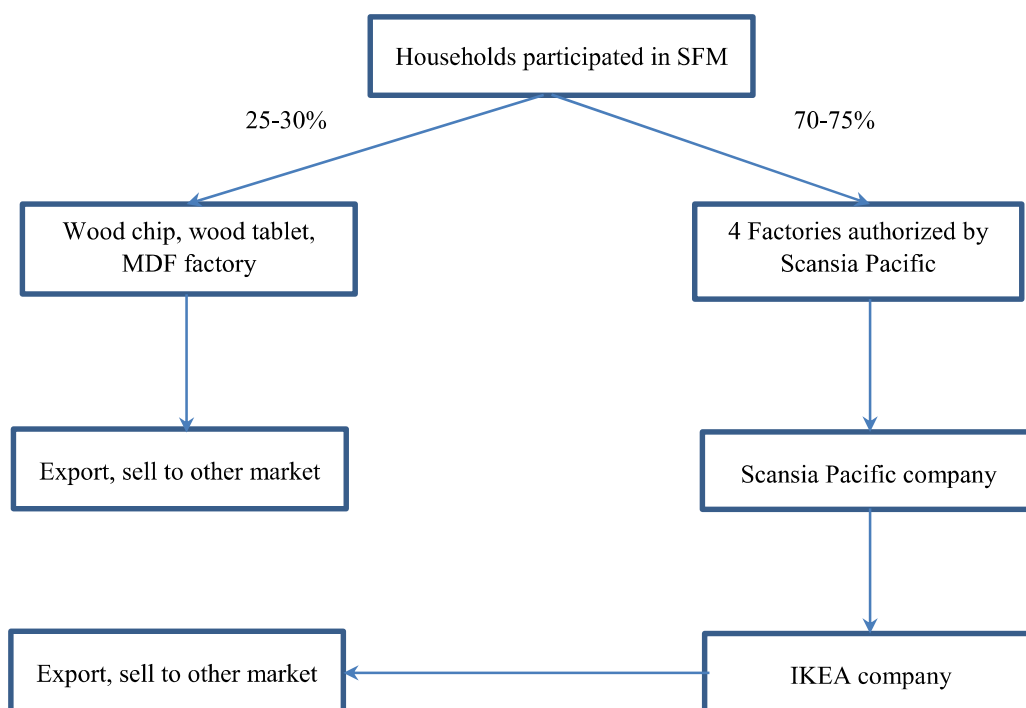


Figure 2. Consumption channels for wood from Households participated in SFM group

Information from above figure shows that:

- There is about 70 - 75% of the products are sawlog with FSC label have been sold directly to 4 processing factories which authorized by Scansia Pacific Company. These factories already signed contract to buy FSC label sawlog from Households with premium price is 15 - 20% higher than uncertified wood at the same time. Most of the Households participated in SFM harvest their plantation by

themselves or have support from sub-group to exploit their plantation. There are four factories in the raw materials supply chain authorized by Scansia Pacific Company to buy household's timber with FSC label are: i) Nguyen Phong Wood One Member Company Limited; ii) Manh Trieu One Member Company Limited; iii) Cam Lo Energy Tablet Factory; and iv) Thu Hang One Member Company Limited. Although there is

a commitment to buy with premium price higher than 15 - 20% compared to uncertified wood, in recent times the premium is only higher than about 10%. These four factories make sawn wood and pellet, then send to Scansia Pacific Company for processing into final products. Then the product is sold to IKEA Company for export to overseas.

- There is about 25 - 30% of small size wood is sold to factories for woodchip processing, producing pellets and MDF. The supply chain of raw materials for these types of wood is similar to the consumption channel of wood from households who did not participate in SFM group (described above). Small size wood is sold to chipping factories which are distributed in most districts of the province.

Therefore, selling small size wood has competitive advantage comparing to selling sawlog in term of distance of transportation. The selling price of small size wood in the past 5 years ranges from 850,000,000 - 1,100,000 VND per ton. There was a time when the price of small size wood grows up close to the price of sawlog with FSC label, caused to many households left the SFM group to sell their plantation early at that time.

3.2.3. Evaluating economic efficiency of household's plantation

The calculation about economic efficiency of household's plantation is presented in following table.

Table 5. Economic efficiency of household's plantation at some places in Quang Tri province

Unit: 1,000 VND/ha

No	Business model	Characteristic of model	Income	Cost	NPV	BCR	IRR (%)	AEV
1	Households participating in SFM Sub-group at Giang Xuan Hai village, Trung Son commune, Gio Linh district	Species: <i>Acacia hybrid</i> ; Density: 2,000 - 2,500 tree/ha; fertilize applied; rotation: 10 year; thinning applied 3 times;	171.500	25.371	128.696	4,0	26,6	18.323
2	Households not participating on SFM Sub-group at Giang Xuan Hai village, Trung Son commune, Gio Linh district	Species: <i>Acacia hybrid</i> ; Density: 2,000 - 2,500 tree/ha; fertilize applied; rotation: 5 year; not applied thinning;	83.545	20.453	57.227	3,2	44,9	13.957
3	Households participating in SFM Sub-group at Kinh Mon village, Trung Son commune, Gio Linh district	Species: <i>Acacia hybrid</i> ; Density: 2,000 - 3,000 tree/ha; fertilize applied; rotation: 10 year; not applied thinning	160.000	18.869	128.844	5,1	31,1	18.344
4	Households not participating in SFM Sub-group at Kinh Mon village, Trung Son commune, Gio Linh district	Species: <i>Acacia hybrid</i> ; Density: 2,000 - 3,000 tree/ha; fertilize applied; rotation: 5 year; not applied thinning	86.250	19.953	60.834	3,4	48,8	14.836

The data from Table 5 shows that there is a clear difference between the model of households participated in SFM group and not participated. In terms of economic efficiency, the NPV of the 10 - year SFM is about 129,799,847 VND, much higher than that of the non FSC 5 - year rotation model of VND 57,227,734. The entire plantation model (FSC and non FSC) are profitable. The BCR indicator of plantation in SFM group CCR model is 4.11, which is much higher than that of the non FSC model of 3.17. In order to compare the economic efficiency between plantation in SFM group and not in group, due to different business cycles, the annual equivalent value (AEV) indicator should be used. This value of SFM group model is 18,480,578 VND/year which is also much higher than 13,957,312 VND/year of the non FSC model. Thus, if wood with SFM certification can be sold at a price of 10 - 15% higher than the market price, the SFM group

model has significantly economic efficiency compared to the non-SFM group model.

For SFM group model, if only based on household's cost and income, the NPV is 129,799,847 VND and AEV is 18,480,578 VND/year. However, there is still an investment for certification, including the cost of group management, team building, auditing and certification, etc., which farmers have not invested but made by sponsors. This average number ranges from 63,551 to 152,523 VND/ha/year. If this cost is included, the NPV is decreased to 128,696,985 VND/ha and the AEV is decreased to 18,323,555 VND/year.

Similar to plantation in Giang Xuan Hai village, the plantation of Households in SFM sub-group in Kinh Mon village also have higher economic efficiency than non-SFM certification models. These assessments are based on actual data but do not take into account the risks of storm impacts on the plantation.

3.4. Proposing solutions for household's plantation development and sustainable management in Quang Tri province

3.4.1. Strengths, Weaknesses, Opportunities, and Threats analysis (SWOT) for household in term of participating in sustainable forest management group

The Strengths, Weaknesses, Opportunities, and Threats analysis (SWOT) is presented in following table.

Table 6. SWOT analysis for plantation and sustainable management of households' plantation in Quang Tri province

Strength	Weakness
Plantation in the province was developed strongly in the passing years.	The species for plantation are not diverse. Mostly are <i>Acacia</i> species; the use of native species is limited.
Households already have experiences and knowledge about planting techniques and plantation management.	Most plantation areas have business goals are for small size timber with low economic value.
Have SFM group with the participation of hundred households.	There are many new varieties and technological progress for high timber production is available, however it is slow to be applied and transfer for farmers.
The Association of Quang Tri Smallholder Forest Certification Groups has been established and has been operating stably in last 10 years.	Lack of high quality nurseries in province; Seedlings created from tissue culture have not much been used.

Strength	Weakness
Local authorities have pay attention to support plantation development and SFM certification model.	Seedling for plantation is not well managed.
There are some Households get high income from plantation.	Linkages on plantation management and selling timber from household's plantation are not strong enough, especially for Households who not participating on SFM group model.
Opportunity	Threat
Government introduce Vietnam Forestry Development Strategy in the 2021 - 30 period with a vision toward 2050 with many supports to plantation and SFM certification.	There is risk for plantation posted by storm every year, especially for long rotation plantation.
Many international agreements and cooperation have been signed, opening up opportunities of exporting wood and wood products to international markets such as VPA/FLEGT.	Many Households with poor economic condition and low capacity to invest on intensive plantation, sawlog plantation
The Vietnam Forest Certification scheme was setup and recognized by PEFC. This certification scheme will provide support and opportunity for Households to get SFM certification.	Awareness of Households about cooperation for better plantation management and about economic-environmental efficiency of SFM certification is poor.
There are many new varieties and advanced techniques for high timber production have been introduced in recent time, especially for native species.	Low capacity to access timber market and information; low capacity to use and apply technology on plantation management.
The government releases many policies which support the development of Households plantation and toward SFM certification.	Plantation of Households is small size and fragmented, cause to difficult for land accumulation and linkages on plantation management, harvesting and timber selling.

3.4.2. Proposing solution to develop and sustainable management household plantation in Quang Tri province.

Based on research findings, there are some solutions to develop and sustainable management household plantation in Quang Tri province as following:

- Continue to raise awareness of Households about the effective of linkages and participating SFM as well as develop plantation for purpose of providing sawlog.
- Currently, in Quang Tri province, many households are still planting with short rotation rather than long rotation with SFM certification due to economic pressure as well as potential to be damaged by natural disasters.

To solve this problem, it is necessary to have capital support policies for households so that they can keep their plantation for long business rotation and apply thinning technical to improve sawlog volume and timber quality. In addition, it is necessary to have solutions to promote the application of tissue varieties for plantation. The reason is the seedling root system of tree created by tissue culture grows stronger and deeper than the root system of the tree created by cuttings. This feature of tissue culture tree help plantation to strengthen its resistance to storms.

- It is necessary to have a plan and develop a system of high-quality industrial nurseries at districts level to provide high quality seedling household's plantation. Currently, there is a

Forest Science Center for North of Central region, which can provide techniques for tissue propagation, cuttings as well as providing high quality original seeds.

- Promoting linkages along the value chain from seedling stages to plantation and timber consumption. The link between plantation and timber consumption is now available and should be expanded. However, the link between seedling supply organization and Households for plantation has not been well implemented. Therefore, Association of Quang Tri Smallholder Forest Certification Groups and its sub-groups should pay attention to the issue. In this regard, promoting the signing of cooperation agreements to provide seedling with recognized seedling organization, ensuring the information about origin of seeds as well as traceability.

- Regarding techniques for planting and caring plantation, it is necessary to promote the application of technology progress such as probiotics, biological products, microbial organic fertilizers, and preparations for decomposing organic materials under the forest canopy, etc. to improve the productivity and quality of household's plantation timber.

- Currently, forest pests and diseases in Quang Tri have not occurred on a large scale, so it has not affected to local farmers. However, recent investigation and survey results by the Vietnam Academy of Forestry Science showed that wilting and death of trees disease has started to damage 5 - 15% of plantation in some places. Under the effect of climate change and the current large-scale monoculture plantation of Acacia species, there is high risk of pest and disease epidemics, therefore it is necessary to pay attention to the recommendations of the Ministry of Agriculture and Rural

Development about pest and diseases for acacia plantation as well as introduce to Households the technical measurement for pest and diseases control.

The Association of Quang Tri Smallholder Forest Certification Groups model initially proved effective in Quang Tri province, it has promoted the development of household's plantations in Quang Tri province in particular and production plantations in the province in general. The finance for the Association's activities is ideally come from the revenue from the membership fees and the distribution from Households when they selling timber with premium price. However, this finance source is quite limited and cannot cover the costs related to association's activity and auditing cost. Currently, funding for auditing cost is still depended on the support of NGOs and wood processing company. Therefore, it is necessary to have a long-term solution to ensure the financial sustainability of this model. In the short term, it is necessary to continue to encourage wood processing to support. In the long term, it is vital to take into account the funds collected from the carbon sequestration and storage services of the forest. This is one types of forest environmental service and will be pay in Vietnam for plantation the future.

- Sub-group of SFM have been developed in many villages, communes and districts, however the operation of sub-group still faces many difficulties. One of the main reasons is that commune-level authorities have not fully understood the roles and benefits of SFM and certification, so they have not enthusiastically supported it in somewhere. Therefore, it is necessary to pay attention to propaganda and raise awareness of local authority at commune level, including leaders of sub-groups.

IV. CONCLUSION

- Quang Tri is a province with a large plantation area and the plantation in here is well developed. Households play an important role in plantation development since they managing up to 49% (54,929 ha) of the province's plantation area. Up to now, in the province, there are 20.382,02 ha of forest certified by FSC, in which there is a group of households with an area of 2.853,91 ha.

- The main species for planting are *Acacia hybrid* and *Acacia mangium*. Technical measures for plantation and management are different between Households participating in the SFM group and Households do not participating in the model, especially in terms of density, thinning activity, rotation as well as timber production purposes. Households participating in SFM group model do not apply burn post harvested residue for land preparation, plant at a lower density, have a longer business cycle (7 - 10 years) and thin out 2 - 3 times to improve sawlog volume. In other hand, Households who do not participating in SFM group apply burn post harvested residue, plant with high density, have a short business cycle (4 - 5 years) and do not apply thinning.

- The SFM group model in Quang Tri province had technical and financial support from WWF in its formation and operation. In 2010, this SFM group was audited and issued certification for the first time with a scale of 316 hectares of plantation for 118 households. In 2014, the organizational structure of the group was officially changed to the Forest Owners Association. As of 2020, the certificated area was 2.853,91 ha with the participation of 490 households in 33 branches in 22 wards and communes in 7 districts, cities and towns.

- In SFM group model, there is a strong linkage between households (horizontal linkages) to plant and manage plantation according to FSC's sustainable forest management standards. There is also cooperation between Households in group and wood processing companies (vertical linkages) through the Forest Owners Association in the consumption of timber from household's plantation. These linkages ensure the sustainability and effectiveness of the SFM group model.

- There are also differences in the consumption channels for wood from Households who participate and who do not participate in SFM group model. For Households in group, the main product is sawlog with FSC label can be sold to 4 processing factories authorized by Scansia Pacific Company for preliminary processing, then transferred to Scansia Pacific Company for finished product processing then sold to IKEA Company for exportation. For households not participating in the SFM group, their timber product is small size wood and it mainly sold to the chipping factory for woodchip and Tablet processing. These products then be exported or sold to another place.

- The plantation of SFM group model has higher economic efficiency than that of plantation from households who not participating in SFM group model.

- To promote the development of household's plantation, it is necessary to implement synchronously solutions from awareness raising, capacity building and develop policies to support the operation and maintenance of SFM group, applying science and technology to improve productivity of plantation.

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Ngày nhận bài: 27/09/2021

Ngày phản biện đánh giá và sửa chữa: 05/10/2021

Ngày duyệt đăng: 07/10/2021