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Changes in the Vietnamese Timber Processing Industry: A Case of Quang Tri Province, North Central Region

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Abstract: Vietnam's forestry policies have expanded the area of planted forests in order to meet the supply of raw materials for the timber processing industry. However, the diversity and volume of demand in the industry have also increased, and a shortage of raw materials can be assumed. For clarifying the correspondence of stakeholders, we explore changes in the resource supply behavior of forestry companies and procurement strategies of companies that manufacture lumber for glued laminated timber, medium density fiberboard (MDF) and wood pellets. Next, we discuss issues and future developments surrounding the supply and demand for timber from planted forests. According to a survey of Quang Tri Province, both industrial and on-farm tree planting play an important role in Vietnam's wood industry. The origin of the supply has been categorized according to its purpose (products). On the other hand, with the declining supply of imported timber and natural forest timber, inquiries from sawmills and glued laminated timber factories for timber from planted forests have increased, and wood pellet manufacturers are facing competition for raw material procurement with MDF manufacturers, and the supply of timber from planted forests is becoming scarce. The key to the solution lies in improving the low productivity of current on-farm tree planting. To this end, forming farmer groups upon the acquisition of forest certification will help achieve economies of scale and bargaining power.

Keywords: forestry company; glued laminated timber; medium density fiberboard (MDF); wood pellets; forest certification



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1. Introduction

The global forest area has continued to shrink, but the loss of forest cover is slowing. The reason for this lies in the expansion of tree plantations, which offsets part of the forest cover loss. Particularly, among the top 10 countries with increasing forest areas, China has been leading overwhelmingly in terms of the expansion of tree plantations. Even in tropical regions, India, Chile, and Vietnam have achieved a remarkable annual expansion of the area of tree plantations by 266 thousand ha, 149 thousand ha, and 126 thousand ha, respectively [1]. Moreover, forest cover loss has been halted through tree planting and forest conservation activities.

Vietnam is the only country in Southeast Asia that ranks in the top ten countries with increasing forest areas. It can be argued that Vietnam's strategy for forest resource management is the most comprehensive from the viewpoint of policy implementation. The Vietnamese government implemented a forest resource management policy encompassing four aspects: forest plantation for the rehabilitation of forests (natural forest) and the

expansion of forest resources (plantation forest) from 1992, an export ban on timber for resource nationalism and sustained forest resources from 1992, gradual and areal extension of logging bans in natural forests for conservation from 1992, 1997, and 2014, and a partial timber import ban for legality from 2014 [2,3]. In terms of Vietnam's policies regarding planted forest resources, comprehensive efforts have been made from the establishment of planted forests to the development of wood processing industry. The area of planted forests has been expanding along with an increase in timber demand [3].

Vietnam's forest area had decreased by more than 5 million ha by 1990 due to the Vietnam War, conversion to farmland, and increased demand for timber [4,5]. To rectify this, plantation policies were introduced to restore barren lands to forested areas. Furthermore, Program 327 introduced in 1992 and the Five Million Hectare Reforestation Program (5MHRP) introduced in 1997 stimulated tree planting through government funding [5,6]. In addition, forestland was allocated and leased under the 1994 Decree on "Allocation of forestland to organizations, households, and individuals" and the 1999 Forest Land Allocation (FLA) program on "Allocation and lease of forestland to organizations, households, and individuals for long-term and stable use for forestry purposes". Consequently, on-farm tree planting has increased [5]. The area of planted forests managed by companies fluctuated between approximately 600 thousand ha and 800 thousand ha, but the area managed by households and communities continued to expand from 730 thousand ha in 2002 to 1.7 million ha in 2019 [7].

Remarkable developments have been observed in the wood processing industry in Vietnam. In addition to planted and natural forests where raw materials for the wood processing industry were obtained, timber was imported from countries such as Laos and Cambodia. Each source is greatly influenced by the policies. Since the introduction of plantation policies in the 1990s, the area of planted forests has been expanding. On the other hand, a ban on logging in natural forests was introduced in 2014. The supply of timber from natural forests was systematically halted, except for that from auctions of seized timber from illegal logging or from the excess originating from road construction [2] (Figure 1). Furthermore, imported timber accounts for two-thirds of the raw materials used in the wood processing industry [8–10]. However, a ban on timber imports from Laos and Cambodia was introduced in 2014, leading to a decline in timber supply. Therefore, the current sources of raw materials mainly consist of timber imports from countries other than Laos and Cambodia, including the supply from domestic planted forests. Timber imports from African countries have increased in recent years, but issues such as delayed delivery have been highlighted [2]. Consequently, expectations for planted forests as a source of timber have risen higher than ever before. Furthermore, the acquisition of forest certification for planted forests in Vietnam is growing in terms of area and number. The concern for illegality is lower than that of timber from natural forests and imported timber, which is also a factor contributing to the growth in demand for planted forests [11]. As a result, inquiries about timber from planted forests have been increasing in recent years for the production of medium density fiberboard (MDF) and wood pellets, in addition to their conventional use for producing paper, lumber, and glued laminated timber (Figure 1). The increased demand for wood pellets is due to their growing use as fuel in large-scale wood biomass power plants that were established under Japan's feed-in-tariff system. Moreover, Vietnam's recent economic growth has brought about an increase in consumption among middle- and low-income earners, leading to an increased demand for furniture manufacturing that uses timber from planted forests [2].

It is not difficult to predict that a shortage of raw materials will occur in response to such a significant increase in demand. Responses to the shortage of raw materials were observed by changing the tree species, such as the old growth of Douglas fir (*Pseudotsuga menziesii* (Mirb.) Franco) to southern yellow pine (*Pinus echinate* Mill., *Pinus palustris* Mill., *Pinus taeda* L., and *Pinus elliottii* Engelm.) in the United States [12] and from meranti (*Shorea* spp.) to falcata (*Paraserianthes falcataria* (L.) Nielsen) [13]. In addition, since the 1990s, a shift from natural forest timber to plantation forest timber has been seen as a global trend.

The movement toward sustainable forest management, the expansion of industrial tree planting, and the promotion of the timber industry in timber exporting countries were behind this trend [14]. However, in Vietnam, significant changes in tree species have already been observed in acacia, eucalyptus, and rubber. In the case of shortage of raw materials, is it possible for such changes in tree species among these? Or will it follow the same path as Thailand where a natural forest logging ban was issued in 1989 due to significant deforestation, and since then, the use of domestic plantation timber has been focused on to overcome an import-dependent constitution [15–17]? That is, the area of fast-growing plantation forests increased, and based on this, the export of wood chips and pulp, particle boards, and fiber boards was promoted. Thailand and Vietnam have something in common with the diversity of products and the existence of a large export market such as Asia and Europe. On the one hand, Thailand has adopted a strategy based on contract plantation with local people in private lands in order to avoid conflict with local people. As a result, Thailand could not compete with the productivity of Brazil and Indonesia, which mainly consisted of large-scale industrial plantation, and there was a limit of expanding the scale and strengthening international competitiveness [18]. This may be a barrier in the future in Vietnam, where the proportion of plantation forest area managed by local people is large. What kind of path will Vietnam take in the situation of a raw material shortage and multiple possible scenarios to deal with it? It is necessary to understand and analyze the behaviors of the country, regions, companies, and farmers.

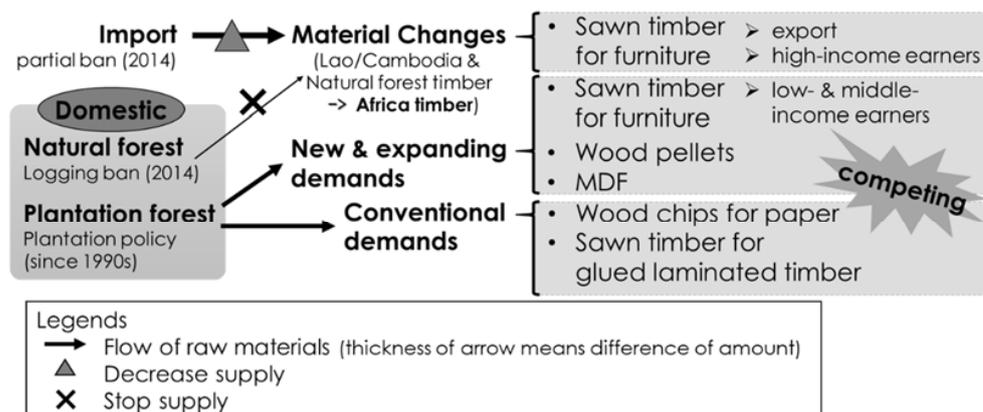


Figure 1. Changes in raw material origin and types of demand for plantation forest timber. Source: [2,11].

Concerning sawn timber for furniture export and for furniture for high-income earners, Iwanaga et al. [2] found that material changes pertaining to African timber are occurring because of the prohibition against obtaining timber from domestic natural forests and importing from Laos and Cambodia. We explore changes in the resource supply behavior of forestry companies and resource procurement strategies of companies that manufacture lumber for glued laminated timber, which has been in conventional demand. Such demand comes amid the decreased supply of timber due to a ban on timber importation from Laos and Cambodia, and in response to increased production of new products such as MDF and wood pellets in addition to increased furniture production. Furthermore, we explore the trends in raw material consumption and manufacturing pertaining to MDF and wood pellets. Moreover, we explore the trend of using certified timber in the wood industry, which has a growing demand in Vietnam and is closely related to planted forest operations. In addition, we discuss issues and future developments surrounding the supply and demand for timber from planted forests.

2. Materials and Methods

2.1. Study Site

The area of planted forests in Vietnam is expanding in all regions except for the Mekong River Delta (Figure 2) [19]. Remarkable expansion has been observed in the

Northern midlands and mountainous regions (where the area of planted forests expanded by 502 thousand ha from 2008 to 2019) and the North Central and Central Coastal regions (where the area of planted forests increased by 755 thousand ha) (Figure 2). In 2019, the area of planted forests in the Northern midlands and mountainous regions amounted to 1.5 million ha (34% of the total area of planted forests in Vietnam) and amounted to 1.8 million ha (41% of the total) in North Central Coast and Central Coastal regions (Figure 2).

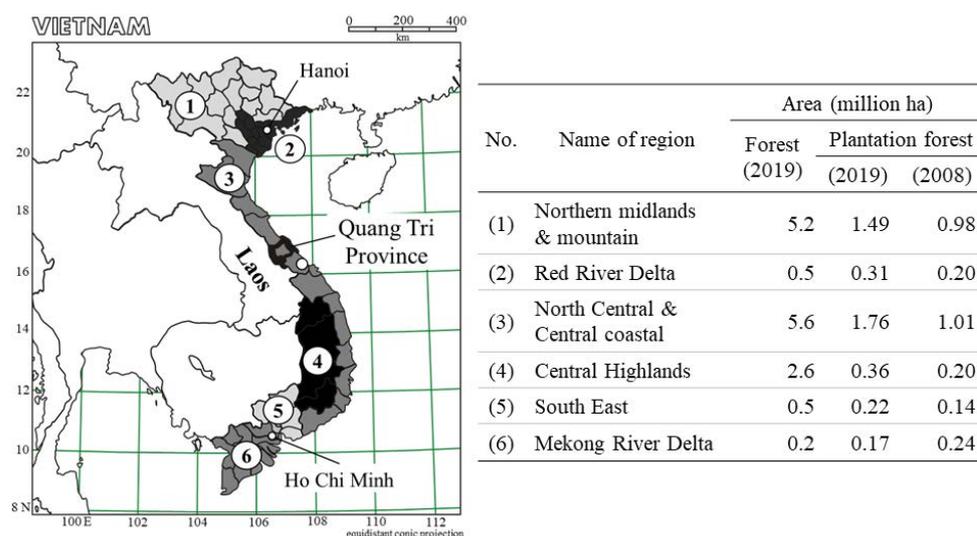


Figure 2. Location of Quang Tri Province and the names and characteristics of regions. Source: [19].

Of the North Central Coast and Central Coastal regions, the North Central Coast region, bordering on Laos where timber importation is banned, has accumulated many wood processing companies, expanding the area of industrial and on-farm tree plantation (Figure 2). Therefore, the North Central Coast region was suitable for understanding timber distribution and material changes due to the concentration of timber processing companies, for identifying the effect of expanding timber demands on plantation forests from having the largest area and largest expanding area of planted forest, and identifying the effect of the partial timber import ban due to neighboring Laos.

In particular, to identify the use of certified timber, which is closely related to an ecologically considerate use of timber, Quang Tri Province was selected as the study site (Figure 2). Quang Tri Province, where the movement for attaining certification occurred earlier than in other areas [11], has a population of 630,600 and a population density of 136 per km² [19]. The total area of this province is 462,170 ha. As of 2019, there were 140,800 ha of natural forest and 112,100 ha of planted forest, with a forest coverage rate of 54.7% [19].

2.2. Research Methods

First, information about plantation forest and plantation forest timber and its distribution was obtained from the Department of Agriculture and Rural Development (DARD) of Quang Tri Province. In addition, the DARD of Quang Tri Province provided us all manufacturers' information in the province including location (district/district-level town/provincial city and ward/rural commune/commune-level town). Next, to collect information from the supply side of timber originating from planted forests, we interviewed all three companies (forestry companies) in Quang Tri Province, which carried out tree planting and logging, about the impact of each policy on the scale of their operations, their plantation areas, their customers, and the process of obtaining forest certification. From the demand side, we interviewed all 15 manufacturers of lumber for glued laminated timber in Quang Tri Province, for which there is conventional demand; an MDF manufacturer, which is the only company for this in this province; and a manufacturer of wood pellets,

which is also the only company in this province for wood pellets—a new industry demand. We asked about changes that occurred with regard to raw materials, production output, customers, and utilization of certified timber. These surveys were conducted in February, October, and November 2019.

First, to clarify the trends within the plantation forest in Vietnam and Quang Tri Province, national and provincial statistical data were collected, and the relevance between these data and the information from the interviews with the DARD of Quang Tri Province were examined. Second, to clarify the changes in resource supply behavior and resource procurement strategies, the respective results of interviews with forestry companies and companies that manufacture lumber for glued laminated timber, MDF, and wood pellets were analyzed qualitatively.

3. Results

3.1. Changes in the Area of Planted Forests in Vietnam

In 2019, the area of planted forests in Vietnam amounted to 4.3 million ha, of which 82% (3.5 million ha) consisted of production forests, 16% of protected forest and 2% of special use forest (Figure 3, left). Following the ban on logging in natural forests, the activities undertaken in natural forests were mainly oriented toward conservation. Consequently, the role of planted forests in timber harvesting has increased. Therefore, the proportion of production forests in the total area of planted forests grew annually from 59% in 2002. Furthermore, all convertible forests, which had an area of 0.6 million ha in 2016, were converted into production forests in 2019. The breakdown of planted forest areas by ownership shows that 16% is owned by companies, 39% belong to households and communities, and the remaining 45% belong to other entities (Figure 3, right). The area of planted forests managed by companies changed from 580 thousand ha to 800 thousand ha. No major expansions or reductions were observed. The area of planted forests managed by households and communities continued to increase from 730 thousand ha in 2002 to 1.8 million ha in 2014, remaining high between 1.6 and 1.8 million ha since then. As previously mentioned, this expansion can be attributed to the increase in on-farm tree planting as a result of allocation and lease of forestland to households under the FLA program. Furthermore, the area of planted forests owned by “others” (Forest Management Board, People’s Committee, etc.) has also seen a major expansion since 2015. This expansion is also closely related to the FLA program. This is because under the program, forestland is not directly allocated to households. Rather, it provisionally remains under the management of the People’s Committee before allocation [20]. The larger the area of land that is to be allocated, naturally, the larger the management that is provisionally placed under the control of the People’s Committee. Therefore, the area of planted forests managed by the People’s Committee and its share of the total area has expanded from approximately 170 thousand ha (9%) in 2002 to 1.3 million ha (30%) in 2019. As of 2019, the area of planted forests managed by households and communities rose once again. With the growing demand for timber from planted forests, it can be expected that further allocation of forestland has been prepared. Furthermore, owing to on-farm tree planting by households and communities under the FLA program, production forests can be expected to continue expanding (Figure 3).

3.2. Policy Impact on Quang Tri Province

Both natural and planted forests in Quang Tri Province have continued to regenerate and expand. In particular, statistics on the area of new tree plantations established from 2016 to 2019 are missing, but the total plantation area exists; consequently, it increased by 28.5 thousand ha during the 11 years from 2008 to 2019 [19] (Figure 4). The ban on logging in natural forests was imposed in Quang Tri Province in 1997, prior to its nationwide enforcement in 2014. Factors that contributed to the year-over-year expansion of the area of planted forests by 8% and 18% from 2014 to 2016 included the ban on timber imports

from Laos, which was a major factor, and the trend toward increasing the supply of timber from planted forests as an attempt to substitute the supply of imported timber.

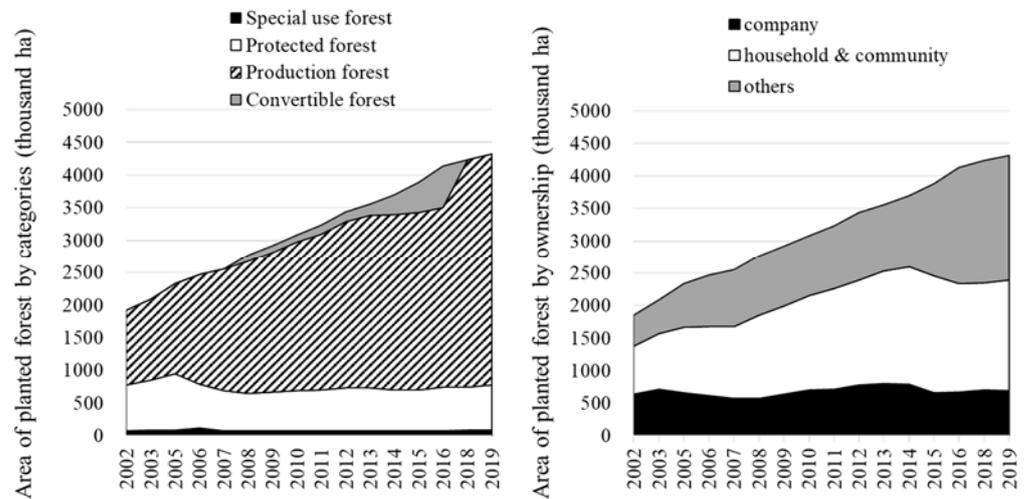


Figure 3. Transition of planted forest area by categories and ownerships. Source: [7].

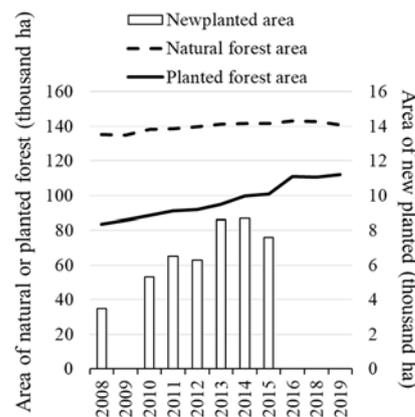


Figure 4. Transition of natural and planted forest area in Quang Tri Province. Note: The statistics on the area of new tree plantations established from 2016 to 2019 are missing. Source: [19].

The interview with the DARD of Quang Tri Province revealed the following. Quang Tri Province was the first province where logging in natural forests was banned in 1997 (logging in the northern highlands and midlands, the southeast, and in the Mekong River and Red River Delta Provinces was prohibited) [21]. Therefore, it was largely unaffected by the ban on logging in natural forests imposed in 2014. On the other hand, the supply of high-quality timber declined as a result of the ban on timber imports from Laos and Cambodia introduced in 2014. Consequently, illegal logging in natural forests increased, and timber prices increased. Moreover, timber imports from Africa and the supply of large diameter timber from planted forests also increased (Table 1).

3.3. Trends among Companies Involved with Timber from Planted Forests in Quang Tri Province

3.3.1. Three Forestry Companies

Until the early 2000s, the surveyed forestry companies focused on the restoration of degraded natural forests, but from the latter half of the 2000s, they began to focus on planting forests. Currently, the three companies mainly carry out planting and harvesting acacia. In the first half of the 2010s, the logging areas of companies B and D expanded two to three times (Table 2). One of the reasons behind this was that the demand for timber

from planted forests grown since 2014, including the demand from MDF companies. The increase in the production per logging area is due to the extension of the cutting cycle to produce timber with a large diameter. All three companies obtained FSC forest certification in anticipation of export.

Table 1. Impact of each event and policy on the forests, forestry, and wood industry in Quang Tri Province.

Year	Event/Policy (No. of Legal Document)	Impact on Quang Tri Province
1990–	(Nationwide) The beginning of planted forest area expansion (ex. 327-CT in 1992)	Growth of timber harvest from planted forests
1992	(Nationwide) Ban on the export of timber and lumber from natural forests (Some categories and regions) Ban on logging in natural forests	Acceleration of the growth of timber harvest in planted forests
1997	(Some regions (including Quang Tri Province)) Ban on logging in natural forests	
	(Nationwide) Ban on logging in natural forests (2242/QD-TTg)	no impact
2014	(Nationwide) Ban of timber import from Laos and Cambodia (37/2014/TT-BCT)	<ul style="list-style-type: none"> • Supply of quality timber decreased. • Timber price increased. • Illegal logging in natural forests increased. • Timber import from Africa increased. • Supply of large-diameter timber from planted forests increased.

Source: [2,21], and Interview with DARD of Quang Tri Province in February 2019.

Table 2. Changes in acacia forest management, logging area, and production pertaining to the three forestry companies in Quang Tri Province.

		Company B	Company D	Company T
Year of Establishment (as a Management Body)		2007 (1961)	2007 (1974)	2006 (1976)
Area of production forests managed (ha)		4335	5200	4200
Felled area (ha/year)	previously	100–150 (–2010)	150 (–2012)	400–500 (–2011)
	currently	300–400	350	400–500
Output (ton/ha)	previously	70–100	80	30–40
	currently	120–150	130	90–100

The forestry companies used a planting density of 2 m × 3 m or 1600 trees per hectare. They extended the cutting cycle from 5–7 years before the acquisition of forest certification to 10 years (Table 3). They operate in accordance with the regulations of the forest certification system. The branches and leaves are left at the felling site to avoid the outflow of soil and nutrients. They also carried out site preparation, thinning, and fertilization. For comparison, as shown in Table 3, small-scale forest owners use almost the same planting density, but their yields are lower. Small-scale forest owners form farmer groups upon the acquisition of forest certification. Information on small-scale owners shows the state of affairs preceding the acquisition of forest certification. The farmer groups carry out the same operations as forestry companies, and their yield has become greater than that of forestry companies. However, while forestry companies annually use only about one-tenth of their total plantation areas for logging, those of the farmer groups and small-scale forest owners are not large enough for harvesting every year, if calculated per household. Therefore, the farmer groups and small-scale forest owners harvest approximately once every 8–10 years or every 5 years, respectively.

Table 3. Comparison of operation by type of timber supplier.

	Forestry Companies	Small-Scale Forest Owners	Farmers Groups
Planting density	1600/ha or 2 m × 3 m		
Rotation ages before certified	5–7 years	5 years	5 years
Rotation ages in present	10 years		8–10 years
Yield (m ³ per ha)	151	92	177
Biomass	Leaving branches and leaves at the felling site	Sold	Leaving branches and leaves at the felling site
Site preparation	Yes	Yes burning	Yes
Thinning	4–5 years	no	4–5 years
Fertilization	yes	partially	yes

Source: Field survey and [11].

3.3.2. Fifteen Manufacturers of Lumber Products

The 15 companies surveyed were all manufacturers of lumber for glued laminated timber. Ten of these companies manufactured only lumber, while the remaining five companies also manufactured glued laminated timber. Of these five, two companies also manufactured flooring products. Regarding the location of their mills, five companies cited being close to places where timber could be obtained, and eight companies cited being located in an industrial area. Apart from those that cited the appeal of being located in an industrial area, other manufacturers' mills were spread within the province. The years when the companies started operating ranged widely, from 2000 to 2018, and three of the companies started operating in 2014. It can be pointed out that having been substantially affected by the ban on timber importation from Laos (2014), these companies found a business opportunity in wood processing using timber from planted forests. These companies employed 77 people on average, ranging from a minimum of 12 to a maximum of 220 people.

The total and average consumption of acacia timber and rubber wood is increasing (Table 4), and prices are rising owing to the growing demand. On the other hand, the consumption of pine timber, the prices for which have risen sharply, has decreased as a whole, and a shift toward other species has occurred. However, even though the number of consumers and total consumption decreased, the average consumption slightly increased, which indicates that there are sawmills specializing in pine trees.

Table 4. Changes in the amount and price of timber consumed by sawmills in Quang Tri Province from establishment to 2019.

	Acacia		Rubber		Pine		Total		
	Established	2018	Established	2018	Established	2018	Established	2018	
Number of Sawmills	12	13	4	7	9	6	15	15	
Amount (ton)	Total Consumption	84,050	110,010	13,020	49,520	31,627	22,777	128,697	182,307
	Average Consumption	7641	9168	3255	7074	3514	3796	5148	7012
Price per ton (thousand VND)	897	1284	917	1117	684	1131	-	-	

Note: The amounts of “Established” year were the total of the first 12 months of 15 sawmills. The duration of test operation was not included, and we also checked for sudden changes within a few years from the beginning of the operation.

There are three types of timber suppliers: small-scale forest owners, farmer groups, and forestry companies. However, there have been major changes leading up to 2018.

A total of 44% of the acacia timber was supplied by small-scale forest owners, and 42% was supplied by forestry companies. By 2018, the proportion supplied by small-scale forest owners had decreased, amounting to 27%, whereas the proportion supplied by forestry companies increased, reaching 56% (Table 5). A similar trend was observed for rubber. It is surmised that due to the growing demand for raw materials at sawmills, which required a large supply, forestry companies shifted toward acacias and rubber plantations, which have shorter rotation ages. On the other hand, due to reductions in the supply of pine, which has a relatively long rotation age and is supplied by forestry companies, the proportion of pine supplied by small-scale forest owners increased.

Table 5. Changes in the amount and proportion of timber by supplier in Quang Tri Province.

Suppliers		Acacia		Rubber		Pine	
		Established	2018	Established	2018	Established	2018
Small-scale forest owner	thousand ton	37	30	6	13	13	12
	%	44	27	48	26	40	51
Farmers group	thousand ton	12	19	0	3	4	1
	%	14	17	0	5	13	6
Forestry company	thousand ton	35	61	7	34	15	10
	%	42	56	52	69	47	43

Note: The amounts of “Established” year were total of first 12 months of 15 sawmills. Duration of test operation was not included and also, we checked sudden change within a few years from the beginning of operation.

3.3.3. MDF Manufacturer

The company was established in 2005. One mill was added in 2016 to meet growing demand, and the output increased 2.5 times (210,000 to 220,000 m³ per year). The company’s current output reached its maximum production capacity. A total of 40% of their products are directly exported, and 48% are processed domestically before export. A total of 12% of their products are oriented toward domestic demand. Before starting the operation of the additional mill, India and the Middle East were the destinations for direct export. However, since 2016, the company has also been exporting to Korea and Japan. Before 2016, the amount of raw materials used by the company ranged from 80,000 to 90,000 tons per year. Since 2016, the company has used 250,000 tons of raw materials per year. It was thought that the combination of acacia and pine timber at a mixing ratio of 40 to 60 produced the highest quality MDF. However, a mixing ratio of 60 to 40 acacia timber and pine timber/rubber wood was actually used. Approximately 70–80% of these raw materials were supplied from on-farm plantations, while the remaining 20–30% was supplied from industrial plantations. Although there has been no shortage of raw materials overall, the current mixing ratio can be attributed to a low supply of pine timber. The ratio of supply origins has not changed since the company started operating. The price for unprocessed timber was 1 million VND per ton with bark and 1.2 million VND per ton without bark for all tree species. It was highlighted that most timber from on-farm plantations was harvested in the fifth year, while that from industrial plantations was harvested in the seventh or eighth year and was of better quality in comparison. As the number of customers requesting certified wood products has increased, the company plans to acquire CoC of FSC by the end of 2019.

3.3.4. Wood Pellet Manufacturer

The company was established in 2014. Approximately 90% of the raw materials were sawdust, 30% of which was purchased from sawmills of the same company group. The remaining 10% (2300 tons per year) is acacia timber from on-farm plantations, which is purchased with bark for 1.4–1.5 million VND per ton. The pellets are CoC certified, and the timber is FSC certified, so the price is higher. Domestic pellet production has increased due

to the growing demand in the international market, especially in Japan and South Korea. However, due to increased timber prices from planted forests caused by competition in the procurement of timber with MDF manufacturers and others, the company has faced difficulties obtaining timber. Furthermore, as the pellet market is affected by oil prices, instability here has also been a barrier to production.

4. Discussion

As a result of the plantation and land policies introduced in the 1990s, the area of planted forests in Vietnam has expanded. The key figures behind the expansion are households and communities that manage forests and plantation sites (Figure 3). In terms of forest classification by purpose, production forests accounted for over 80% of the expansion. It is apparent that these forests are intended for timber harvesting. Following the ban on logging in natural forests imposed in 2014, planted forests became the cornerstone of timber harvesting in the nation. Furthermore, since 2015, after the ban on timber importation from Laos and Cambodia was introduced, the area intended for tree planting, which was provisionally managed by the People's Committee before being allocated to households under the FLA program, has significantly increased, which is not unrelated to these policies. Planted forests established by on-farm tree planting, which are expected to continue to increase in the future, are intended to compensate for declining timber supply as a result of the two policies.

A nationwide planted forest expansion can be observed, and in terms of region, a remarkable increase has taken place in Northern Midlands and Mountainous regions and North Central Coast and Central Coastal regions. In particular, North Central Coast and Central Coastal regions, which have a long coastline, serve as a wood processing base. Located in the North Central Coast region, which borders Laos, Quang Tri Province has a large area of planted forests. The province, which has also advanced in terms of forest certification, was particularly affected by the ban on timber imports from Laos. Therefore, the following changes occurred in the province: the supply of timber decreased, timber prices rose, timber imports from Africa increased, a shift occurred toward obtaining raw materials from planted forests, and the diameter of timber harvested from planted forests increased (Table 1).

According to our interviews with forestry companies, the harvest of timber from planted forests has increased for each of the companies since the first half of the 2010s. It can be indicated that the increase in the supply of timber from planted forests offset the impact of the ban on logging in natural forests and that of the ban on timber importation from some countries (Table 2). Furthermore, as the capacity of timber supply from planted forests increased, the number of companies that would use it as a raw material also increased in the 2000s. One category of companies is glued laminated timber manufacturers, whose timber consumption has increased. Meanwhile, timber prices have also risen (Table 4).

Looking at the timber suppliers of these companies, it became apparent that more companies than farmers have become suppliers of acacia timber and rubber (Table 5). Forestry companies started planting and harvesting only acacias or rubber more intensively than before. An increasing number of farmers have planted and harvested pine trees, aiming for a niche. On the other hand, farmer groups have had a growing presence as suppliers of acacia timber and rubber wood, similar to forestry companies. It can be pointed out that they are utilizing economies of scale alongside forestry companies.

The raw materials used by the manufacturer of MDF, which is a wood product with new demand, all came from planted forests. A total of 70% to 80% of the raw materials used by the MDF manufacturer was supplied by farmers. Furthermore, as the MDF manufacturer started operating an additional mill in 2016, its consumption of timber from planted forests increased 2.5 times. The output of the manufacturer of wood pellets, which is also a wood product with new demand, has been increasing year by year. The demand for timber by farmers has also increased accordingly. The MDF and wood pellet manufacturers consumed more timber from on-farm plantations than from industrial plantations.

According to statistics, the area of planted forests in Vietnam has been increasing, reaching 4.3 million ha in 2019, 38% of which was managed by households and communities, whereas forestry companies managed only 16% of the total area (Figure 3). However, as shown in Table 3, forestry companies' yield per unit of land area is 151 m³ per ha, while that for small-scale forest owners is 92 m³ per ha, which indicates that the productivity of industrial tree plantations is significantly higher. The calculation of annual growth indicates higher value in small-scale forest owners (forestry companies: 15.1 m³, small-scale forest owners: 18.4 m³), and it can be said the difference of yield per unit of land area is affected by rotation age (forestry companies: 10 years, small-scale forest owners: 5 years). However, what is important is the difference of management or owned forest area, namely forest companies manage a sufficiently large area for logging every year, on the one hand, small-scale forest owners own a small area that they are able to harvest only once every 5 years. Furthermore, it has been highlighted that there is a difference in the quality of timber at the MDF company. Unlike on industrial tree plantations where trees are well managed, trees are planted on vacant sites within the territory. Therefore, it can be pointed out that due to improper management and the influence of other crops, trees planted on farms suffer from withering and decay. In terms of lumber intended for furniture production, which was not included in this study, preference is given to large-diameter timber from industrial plantations that apply uniform spacing. Furthermore, if exports are anticipated, certification is also required, and the demand for timber from forestry companies accumulates. It can be said that there is significant demand for timber from forestry companies.

Thus, both industrial and on-farm tree planting plays an important role in the wood industry in Vietnam. The sources of supply have been categorized according to their purpose. On the other hand, amid declining supply from sources of raw materials (import and natural forests), inquiries from sawmills and glued laminated timber factories for timber from planted forests have increased. Wood pellet manufacturers reached the point of facing competition for raw material procurement with MDF manufacturers, and the supply of timber from planted forests is becoming scarce.

5. Conclusions

We explored changes in the supply behavior of forestry companies and changes in the resource procurement strategies employed by companies that manufacture lumber for glued laminated timber, which meets conventional demand. This has resulted in export expansion and the emergence of new demand such as MDF and wood pellets, in addition to a reduction in the sources of timber supply as a result of government policies. Moreover, we explored raw material procurement and production trends pertaining to MDF and wood pellets, which are wood products with new demand. Furthermore, we also investigated the situation regarding the acquisition of forest certification by the aforementioned stakeholders. Based on the above, we discuss the issues and future developments pertaining to the supply and demand for timber from planted forests.

The national goal is to export more wood products in the future. In particular, the government is considering adjusting tariffs to promote the export of furniture and other products with high added value, rather than products such as woodchips (Decision 5115/QĐ-BNN-TCLN in 2014). Furthermore, with regard to timber harvesting, it has also been recommended that the rotation age be extended from 4–5 years, which is extremely short, to 10 years. Subsidies aimed at this are being prepared (Decision 5115/QĐ-BNN-TCLN in 2014). As much as under the conditions that were not compromised by risk factors such as typhoon damage and/or disease, Blackburn et al. [22] stated that a higher percentage of 10 years rotation timber could be utilized for sawn timber rather than for 4 years rotation timber, and also calculated that income returns from 10 years rotation timber could be more attractive than the 4 years one. Considering these circumstances, the production of lumber for glued laminated timber, MDF, and furniture is expected to increase. These policy-driven developments may have a significant impact on pellet production.

On the other hand, much of the land that is to be allocated to farmers is still secured in the name of the Forest Management Board and the People's Committee (Figure 3). Due to the ban on logging in natural forests and the ban on timber importation from Laos and Cambodia, which was introduced in 2014, timber supply to wood pulp and pellet mills is not likely to be disrupted for some time to compensate for the amount of available timber from the land that will be allocated to farmers. Furthermore, superior quality industrial timber with at least 7–8 years of rotation age is oriented toward lumber manufacturing, while the timber from on-farm plantations is oriented toward woodchips, wood pellets, and MDF, which is likely to continue for some time. The key point in the future will be to find a way to improve the productivity of on-farm tree plantations and the quality of timber from these plantations. The difference in the yield per unit of land area between forestry companies (151 m³ per ha) and small-scale forest owners (92m³ per ha) indicates that there is room for up to approximately 60% growth (Table 3). If the supply of timber for woodchips, wood pellets, and MDF is increased as a result of the improvement, it will be possible to produce and export products with both high and low added value, leading to further export expansion. Annual growth per ha is higher in the forest of small-scale forest owners; however, as mentioned in the "Discussion" section, it should be considered that the available logging area is substantially different in each stakeholder. In addition, the simple approach that lengthens rotation age may not be smoothly accepted by small-scale forest owners, because time preference (time discounting) rate and risks of damage such as that by typhoons will be higher. Therefore, it can be said that increasing the yield per unit by lengthening the rotation age is difficult. The key lies in farmer groups because, as shown in Tables 3 and 5, farmer groups for forest certification are operating more like companies than individual farmers. That is, economies of scale have come into play. This also leads to the improvement of management and operation along with the regulations of the forest certification system, such as fertilization for yield increase, thinning for higher quality of timber, and spacing between trees to avoid withering and decay. Furthermore, by forming groups, farmers gain advantages such as bargaining power, which they do not have individually. Farmer groups are formed upon the acquisition of forest certification. Forest certification not only facilitates the attainment of main objectives such as sustainability and legality, but also promotes the revitalization of farmer forestry. Since the first acquisition of forest certification by a farmer group in 2011, the number of forest certifications obtained by farmer groups has increased, reaching 12 (25 thousand ha) in 2020 [23].

In this research, we conducted surveys and discussions centered on forestry companies. It could be concluded that plantation forests managed by forestry companies will not expand drastically, because the area is included in state forests and the total or maximum area of state forest has limitations. In addition, the yield per unit of land area in plantation forests managed by forestry companies is already high and will not increase remarkably. Therefore, the amount of timber production will transition to a stabilizing and sustaining stage. As stated in the latter half of the "Conclusion" section, the trend of farmer forestry is also important as a room for the growth of timber production in Vietnamese forestry. In future research, we would like to examine the productivity of small-scale forest owners and farmer groups and the power dynamics in their relationships with the companies.

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