

Analyzing economic performance and value added distribution in the Luong bamboo value chain: A case study of Thanh Hoa province, Vietnam

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ABSTRACT

With 1.5 million ha of bamboo forest, Vietnam ranks 4th among the world's largest bamboo producers. The bamboo sector has significant development potential in the context of national and international impacts to build a bio-economy and increase the use of biogenic renewable resources. The bamboo industry in Vietnam is considered to have great development potential, with a potential production value of USD 1 billion. However, a number of factors currently significantly limit this potential. For example, the bamboo resource is overexploited and mismanaged; the level of horizontal and vertical cooperation among actors in the Luong bamboo value chain is weak; the utilisation rate of material bamboo is low; high-value bamboo products have not been developed; and benefit sharing among chain actors is unequal. As chopsticks and votive paper are the most common semi-industrial products in Vietnam, this paper analyses the characteristics of chain actors and compares the financial and economic performance of different actors in the chopstick and votive paper value chain (VC) in Thanh Hoa Province. Data were collected through interviews with eight key informants, 12 bamboo producers, five traders, one votive paper company, one chopstick company and six focus group discussions. The results show that the utilisation rate of raw material in the chopstick VC is low at less than 20 %. The net profit per ton of finished product for the processing company is much higher than the net profit for the farmers and traders. The total value added is USD 182.5/ton in the chopstick VC and USD 244/ton in the votive paper VC. The value added by farmers and traders is very low (less than 10 % of the total value added). Possible options for promoting cooperation between chain actors and improving the performance of chain actors are discussed.

1. Introduction

Bamboo is recognised as the fastest growing terrestrial plant on Earth, reaching a maximum height of 40 metres and a diameter of 30 cm within the first four to six months of the growing season (Benton, 2015; Chaowana, 2013; Koren, 2010; Lobovikov et al., 2007; Rao et al., 1998; Zhang et al., 2007). The total global area of bamboo in 2010 was around 31.5 million hectares, accounting for almost 4 % of the total global forest area (Phimmachanh et al., 2015). Asia has around 65 % of the world's total bamboo area, with 28 % in the Americas and only 7 % in Africa (Lobovikov et al., 2007; Liese and Köhl, 2015). Vietnam ranks fourth with approximately 1.5 million hectares, of which 71,000 hectares are covered by planted bamboo (Phimmachanh et al., 2015; WWF, 2015a).

Current studies show that bamboo plays an important role in the ecology and environment, and is one of the most valuable and important

non-timber forest products (NTFPs) (Ben-Zhi et al., 2005; Bystrakova et al., 2003; d'Oliveira et al., 2013; Embaye, 2004; Foppes and Ketphanh, 1997; Ram et al., 2010; Song et al., 2011; Tripathi and Khawlhing, 2010; Yiping et al., 2010). Globally, 2.5 billion people depend on bamboo for their livelihoods and survival (Hogarth and Belcher, 2013; Lobovikov et al., 2007; Lou et al., 2010; Phimmachanh et al., 2015; Singh, 2008). In particular, the bamboo handicraft industry provides nearly 120 million working days per year in India (Adkoli, 1995; Din, 2014). Similarly, the bamboo rattan industry in Vietnam provides approximately 3.4 million jobs with an export value of USD 348 million in 2018 (MARD, 2019; MOIT, 2019).

Bamboo can be used for a variety of purposes, such as a simple construction material for housing, fencing, and also for agricultural purposes. In recent years, thanks to the development of technology and science, bamboo has been used in various high-value industries, such as

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bamboo activated charcoal, furniture, flooring, laminated bamboo products, paper, and chopsticks (Borowski et al., 2022; Gan et al., 2022; Kumar and Mandal, 2022; van Dam et al., 2018). However, the existing utilisation of the bamboo sector remains underdeveloped, resulting in low value-added products (Li et al., 2016; Lin et al., 2019). For example, Vietnam's bamboo industry has not invested in the production of high value-added products, and 68 % of bamboo is used for low value-added purposes such as construction, the manufacture of disposable chopsticks, and paper production (Marsh and Demestre, 2008a).

The upgrading of bamboo value chains in Vietnam faces several challenges, including weak coordination among chain actors and insufficient sharing of resources and information among actors (Hiep, 2021a; Ly et al., 2012; Oxfam Hong Kong, 2006). Bamboo resources in Vietnam face problems of overexploitation and mismanagement (Benedikter et al., 2022; Nguyen and Eiligmann, 2010; Tran, 2010), as awareness among bamboo farmers about sustainable bamboo cultivation and harvesting remains limited. In addition, due to rapid urbanisation in Vietnam, industries such as textiles, leather footwear and electronics have attracted workers from rural areas with enticing salaries, favourable working conditions and job security. As a result, small bamboo enterprises are struggling to retain their existing workforce and recruit new employees. This labour shortage poses significant challenges for these enterprises, particularly in meeting tight deadlines to fulfil orders.

Several previous studies have analysed the characteristics, structure and governance of the luong bamboo value chain in Thanh Hoa (Nguyen and Eiligmann, 2010; Oxfam Hong Kong, 2006; Tuong Trang and Eiligmann, 2010a; WWF, 2015b). However, studies that focus on the economic performance and distribution of value added among chain actors remain limited. Therefore, this paper explores the challenges of chain actors' production and business activities, compares their economic performances, and analyses the value-added allocation in the Luong bamboo value chain in Thanh Hoa Province.

2. Methodology

2.1. Selected study site

The fieldwork for this study was conducted in Thanh Hoa Province, located in north-central Vietnam. Thanh Hoa province has the largest bamboo area in Vietnam, covering a whopping 180,786 hectares, accounting for over 55 % of the total bamboo area in the country (DARD, 2023; Nguyen and Martin, 2015). Approximately 1.6 million tons of bamboo raw material are supplied to the market annually, with a total value of US\$24.3 million, accounting for 28 % of the forestry sector's production value (DARD, 2023). Given the availability of bamboo raw material, there were 57 bamboo-based processing enterprises in Thanh Hoa Province in 2023, with chopsticks and votive paper being the main products (DARD, 2023) Fig. 1.

In Thanh Hoa Province, *Dendrocalamus babatus* is commonly called 'Luong', *Schizostachyum sp* is locally known as 'Nua' and *Indosasa sp* is called 'Vau'. However, Nua and Vau are mainly found in natural forests and are harvested for handicrafts, while Luong bamboo is popularly cultivated for the production of chopsticks and votive paper. Therefore, in this study, Luong bamboo was selected to analyse the value chains of votive paper¹ and chopsticks. Luong bamboo can be harvested every year with a short rotation of 1–3 years. Luong bamboo is a giant bamboo

species with a diameter of 6–12 cm, an average length of 15–20 metres, a wall thickness of 0.5–1.5 cm and an average weight of 20–50 kgs per culm.

2.2. Data collection

Key secondary resources used in this research include bamboo source, supportive policies of local government and international organisation to chain actors, technology, innovation and socio-economic contexts. Many sources were used, such as reports from the Department of Agriculture and Rural Development, Forest Protection Division, Department of Foreign Affairs, companies, and bamboo projects funded by the International Bamboo and Rattan Organization (INBAR), the United States Agency for International Development (USAID), and the French non-governmental organization (GRET).

This paper used methods such as in-depth interviews, group discussions and direct observation to collect data to analyse the current state of bamboo value chains, the cooperation between actors within the value chain and the distribution of value added among chain actors. The primary data collection was carried out in three phases. The first phase, preliminary exploration, was conducted from August to October 2015, mainly to assess the feasibility of the study. The main objective was to gain a basic understanding of bamboo plantation, harvesting, bamboo production, bamboo value chain and market access. The second phase, empirical data collection, was conducted from March to July 2017. The main purpose was to collect empirical information from different stakeholders involved in bamboo VCs. The third phase was conducted in February 2023 to validate the data collected in the first and second phases. Due to the COVID-19 pandemic, input costs for production, such as raw material costs, labour costs and transport costs, as well as selling prices, had changed compared to the data collected in the first and second phases.

Key informants are familiar with issues such as plantation, harvesting, bamboo policy, bamboo processing, innovation, market access and bamboo technology. Eight key informants were therefore interviewed, including village chiefs (two), forest rangers (two), bamboo association members (two) and agricultural extension officers (two). Snowball sampling was used to identify actors within the value chain, such as two entrepreneurs, four managers and six employees, five traders, 12 bamboo growers involved in bamboo VCs with excellent communication facilities and willingness to provide comprehensive information were selected for further in-depth interviews. Each interview lasted between 30 and 90 min. Bamboo growers, traders and processors were purposively selected based on consultations with the Department of Agriculture and Rural Development and community leaders using criteria such as bamboo area, work experience, business size, employees and business performance. Finally, growers with more than three hectares of bamboo area and at least 10 years of experience were selected, traders with at least five years of experience who regularly deal with both bamboo growers and enterprises were selected, and two selected enterprises were established 15 and 12 years ago and have good experience in bamboo processing. Furthermore, two common products produced from bamboo plantations in Thanh Hoa Province are votive paper and chopsticks. Production waste from chopstick factories is bought as raw material by votive paper companies. Therefore, it is necessary to include both votive paper and chopsticks in the analysis of the whole value chain of bamboo cultivation in Thanh Hoa province.

Group discussions (GDs) were conducted to validate the data collected through interviews. Two group discussions were held with bamboo luong growers, two group discussions with bamboo collectors, one group discussion with processing enterprises, and one group discussion with all actors in the two value chains and representatives of local authorities at commune and district level. Group discussions (GDs) were conducted to validate the data collected through interviews. Two group discussions were held with bamboo luong growers, two group discussions with bamboo collectors, one group discussion with

¹ In some East Asian countries (e.g. Vietnam, China, Taiwan), votive paper, also known as spirit money," is used for various traditional religious and cultural practices, particularly ancestor worship. Votive paper is usually in the form of paper resembling money or other valuable items, such as houses, cars, or electronic devices. People burn these paper offerings during ceremonies or special occasions, believing that the smoke carries the essence of the items to the spirit world

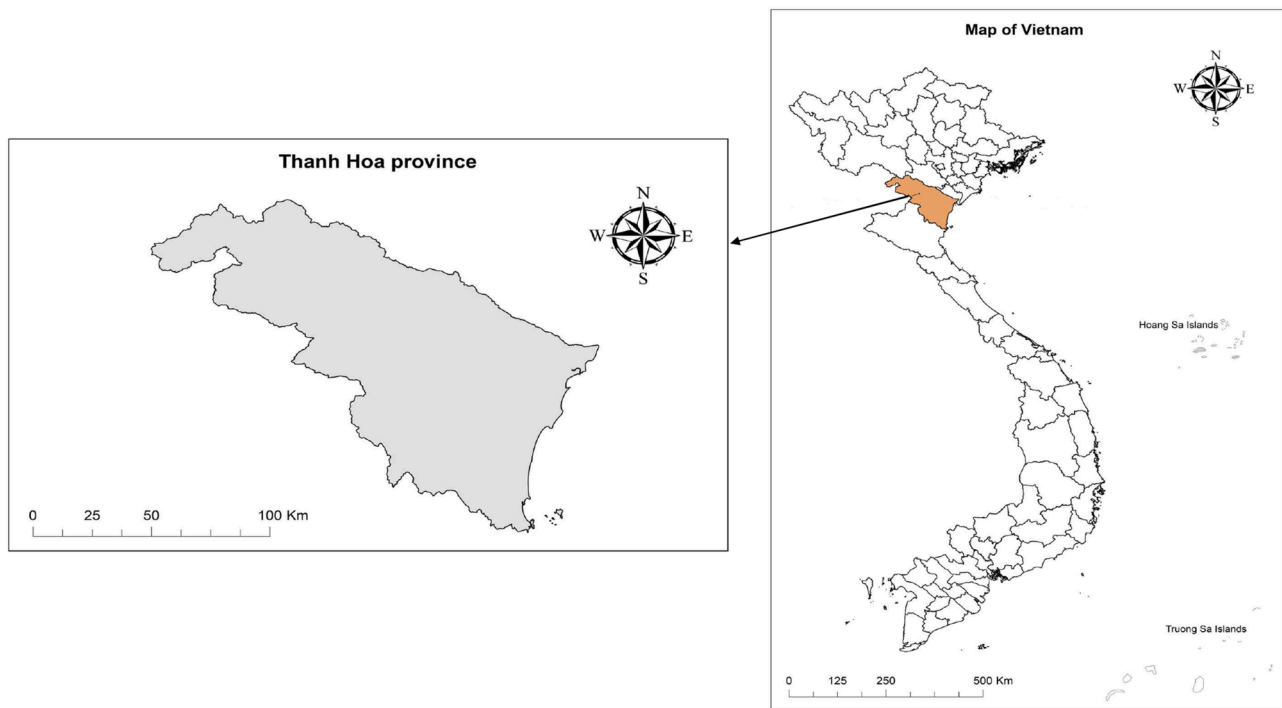


Fig. 1. Location of the study area: Thanh Hoa province.

processing enterprises, and one group discussion with all actors in the two value chains and representatives of local authorities at commune and district level.

Topics discussed included cooperation among chain actors, bamboo management, the bamboo market, livelihoods, and constraints and potential interventions. Each FG was conducted with four to eight participants, depending on the topic and value chain. The discussion lasted approximately 2.5 h, with the chosen protocol being transcribed for further analysis. Direct observation was used in both the first and second fieldwork. This method was also used to cross-check the data collected from the interviews in order to increase the validity of the data (Yin, 2013).

2.3. Data analysis

At the level of primary production and local trade, costs and incomes were calculated based on data provided by the bamboo farmers and traders, including costs of cultivation, harvesting, transport and returns from bamboo sales. According to interviews with bamboo farmers, they inherited their bamboo gardens from the previous generation who had been growing bamboo since the 1970s. Therefore, plantation costs were not included in this research. For the processing companies, information on their inputs, outputs and cost-benefit structure was documented.

In general, economic performance displays the way in which a firm functions to achieve its intended operational objectives. Specifically, it is represented by the benefits of a firm derived from its performance (Baines et al., 2024; Succurro, 2016). Estimation of financial profitability employed the average reported quantities, prices, costs, profits for each actor in the bamboo VCs. Economic evaluation, additionally, utilized a number of indicators, such as added value, return on labor, labor standard. VC analysis revolves around how value is generated and distributed between the different transformation stages of products or services

Value added represents the wealth contribution of a particular sector to the development of the economy. According to Tallec and Bockel (2005) and Vedeld et al. (2004), value added can be estimated as the sum of net profit, labour costs and taxes (and levies).

$$VA_i = \text{Net profit} + \text{Labour costs} + \text{Taxes}$$

Where VA_i : value added at i^{th} stage. The value added for the whole VC is calculated by summing the value added at each stage of the VC (La et al., 2021). In this study, value added is calculated in tons of final product to facilitate the comparison of value added between different bamboo VCs.

3. Findings

3.1. Overview of analyzed bamboo value chains

This study focuses on two value chains: chopsticks and votive paper. These are two value chains that consume approximately 67 % of bamboo plantation production in Thanh Hoa Province. The remaining Luong bamboo production is used for primary construction and agricultural purposes with low value added.

After harvesting from gardens, Luong bamboo was sold to local village traders at an average price of USD 30.8 per ton (Fig. 2.). The traders classify the quality of Luong bamboo according to the production requirements of each enterprise, and then transport the classified bamboo canes to the factories based on each order. For example, the production of chopsticks requires Luong bamboo with a diameter of more than 10 cm, a length of 9 metres and a minimum age of 1.5 years, with a price of 44.1 USD/ton of fresh culms at the factory gate. Luong bamboo culms that do not meet the requirements for chopstick production are sold to votive paper companies at US\$39.6 per ton of fresh culms. Although the utilisation rate of bamboo culms in chopstick production is low, reaching only 20 % due to outdated machinery, 80 % of the waste from chopstick production is sold as raw material to votive paper companies at a price of US\$ 42/ton of fresh waste. Most of the votive paper is exported to Taiwan with a factory gate price of USD 396.5/ton. Meanwhile, dried chopsticks are mostly consumed domestically, with a factory gate price of US\$ 576.5/ton (Fig. 2.).

A number of institutions such as the Provincial People's Committees, the Ministry of Agriculture and Rural Development, USAID and GRET have provided technical and financial assistance to promote high-value

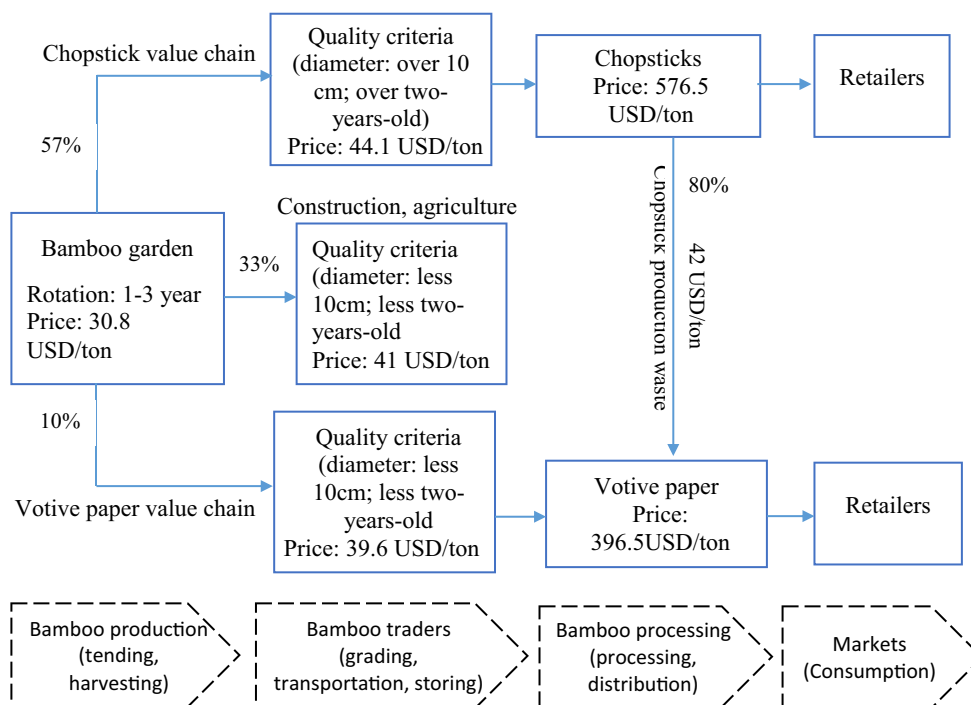


Fig. 2. Luong bamboo value chain in Thanh Hoa province. Source: Fieldwork (2015–2023).

bamboo plantations, improve harvesting techniques and link bamboo growers to enterprises.

3.2. Bamboo producer performance

According to interviews with bamboo farmers, they usually own between one and five hectares of plantation, inherited from their ancestors who have been cultivating bamboo since the 1970s. To encourage households to expand their luong bamboo plantations and maintain their existing luong bamboo plantations, Thanh Hoa Province exempts these households from forest land taxes. Accounting for about 55 % of total household income, luong bamboo plantations played a crucial role in the livelihoods of bamboo farmers in the study area.

Bamboo was harvested early, before the normal two-year rotation. This may have been due to the attractive financial returns associated with the high demand for material in the production of chopsticks and votive paper. Most of the gardens were located in mountainous areas with hilly terrain, and there had been no investment in logging roads, so there were many difficulties in transporting the bamboo canes to the buying points. In addition, most of the working-age population migrates to industrial areas and cities for work due to attractive income opportunities, leaving many households with a shortage of labour for bamboo harvesting. Therefore, most bamboo growers hired a local harvesting team to harvest the bamboo under a fixed contract. For example, the garden owners received 50 % of the bamboo sales, while the rest was given to the hired harvesting team.

With an average bamboo price of USD 30.8/ton, harvesting costs were estimated at USD 15.4/ton, representing the highest proportion of farmers’ total costs. Farmers reported spending approximately 36 days per hectare per year on bamboo cultivation. Considering the average daily wage in the upland areas of USD 6.5 and an annual bamboo harvest of 16.5 tons per hectare, the labour cost was approximately USD 14.4/ton. The net benefit to the bamboo producers was USD 0.7/ton, with a generated value added of USD 15.2/ton. On a per-hectare basis, households earned an income of USD 508.8 per hectare per year, with a value added of USD 250 per hectare per year (Table 1).

Table 1

Annual costs and benefit of bamboo growers in the bamboo VCs, based on 1 ha of bamboo plantation following normal forest scheme, Thanh Hoa Province, north-central Vietnam.

No	Description	USD/ton	USD/ha
1	Average garden gate price	30.8	508.8
2	Seedlings	0	0
3	Equipment (machetes, clothes, farming boots)	0.3	4.4
4	Fertilizer	0	0
5	Harvesting service cost	15.4	254.4
6	Labor cost (tending and protection)	14.4	237.9
7	Land tax and duties	0	0
8	Total cost ((2)+(3)+(4)+(5)+(6))	29.8	492.3
9	Net profit ((1)-(8))	0.7	12.1
10	Value added ((6)+(7)+(9))	15.2	250

Note: Some figures could vary due to rounding error.

3.3. Bamboo trader performance

There are only one or two bamboo traders in each village, and each trader buys an average of about 728 tons of Luong bamboo per year. Due to their small size and limited capital, the traders do not invest in trucks to transport bamboo. Instead, they developed close relationships with at least one household that provided transport services. In addition, the traders do not have permanent employees, but have strong links with local loading teams. Transactions between companies and traders are conducted through verbal negotiations on purchase prices, bamboo volumes and delivery times.

At USD 30.8/ton, the price paid to bamboo growers accounted for 78 % of the traders’ total costs, followed by labour costs (loading and unloading) at USD 4.4/ton. For a 10-ton truck, transport costs from the farm to the factory are calculated at USD 2.9 per ton, and USD 1 per ton from the bamboo garden to the farm. Preferring informal business with less responsibility to the government, the traders did not register their activities. With a factory gate price of USD 42.6/ton, the traders made a net profit of USD 2.9/ton, or about 40 % of the value added (Table 2).

Table 2

Costs and benefits of bamboo traders, based on sale of bamboo culms from 1 to 3 year rotation, Thanh Hoa Province, north-central Vietnam.

No	Description	USD/ton
1	Luong bamboo selling price	42.6
2	Purchase of Luong bamboo	30.8
3	Transportation service costs	3
-	Transportation from the bamboo garden to yard	1
-	Transportation from the yard to the factory ¹	2.9
4	Interest ²	0.4
5	Labor cost (loading and unloading)	4.4
6	Facilitation fees ³	0.07
7	Other costs (phone, electricity, water)	0.1
8	Depreciation	0.1
9	Taxes and local duties	0
10	Total cost ((2)+(3)+(4)+(5)+(6)+(7)+(8)+(9))	39.7
11	Net profit ((1)-(10))	2.9
12	Value added ((5)+(9)+(11))	7.3

Some figures could vary due to rounding error.

¹ Average distance from the bamboo garden to the yard is 5 km, the yard to the factory is 15 km.

² Average interest paid by traders to the bank is 8 % per year.

³ Fees paid to the police/range station for inspection.

3.4. Processing company performance

3.4.1. Company overview

According to the Thanh Hoa Provincial Department of Agriculture and Rural Development, there are currently 23 chopstick enterprises with annual revenues ranging from USD 50,000 to USD 600,000, and 6 votive paper enterprises with annual revenues ranging from USD 100,000 to USD 2.5 million. However, bamboo enterprises face difficulties in accessing capital, expanding their market and dealing with outdated machinery. In order to gain a competitive advantage over bamboo enterprises from other provinces in sourcing raw materials, both the chopstick and votive paper enterprises are located close to bamboo material sources, with distances ranging from 3 to 15 km, and have established strong social links with traders.

3.4.2. Chopstick production

At a 20 % utilisation rate, it took five tons of Luong bamboo to produce one ton of chopsticks. About four tons of production waste was generated, which could be sold at US\$136/ton.

The chopsticks are sold at the factory gate for 440.5 USD/ton. Therefore, the chopstick production generated a revenue of 576.5 USD/ton. The cost of materials was 220.3 USD, accounting for 40 % of the total cost, followed by depreciation (29.6 %) and labour (23.5 %), the net profit was 24.3 USD/ton of chopsticks and the value added was estimated at 160 USD/ton of chopsticks (Table 3).

3.4.3. Votive paper production

To produce one ton of votive paper, 1.9 tons of waste from chopstick production and 0.2 tons of fresh Luong bamboo culms were required at a cost of 77.1 USD and 9 USD respectively. Material costs accounted for the largest proportion of total costs at US\$86.2 (33.3 % of total costs), followed by labour costs at US\$49.2 (19 % of total costs), depreciation costs at US\$35.1 (13.6 % of total costs) and selling costs at US\$21.2 (8.2 % of total costs). The selling price per ton of votive paper at the factory gate was USD 395.6/ton. After deducting the total cost of production from the selling price, the net profit was 137.9 USD/ton (Table 3). The estimated value added per ton of votive paper was USD 221.5/ton. It can be seen that the highest proportion of value added is net profit (USD 137.9), followed by workers' wages (USD 49.2) and taxes and duties (USD 34.5) (Table 3).

Table 3

Costs, net profit, and value-added of bamboo companies, Thanh Hoa Province, north-central Vietnam.

No	Description	Chopstick VC USD/ton	Votive Paper VC USD/ton
1	Gross revenue	576.5	396.5
-	Revenue from chopstick	440.5	0
-	Revenue from bamboo production waste	136	0
-	Revenue from votive paper	0	396.5
2	Material costs	220.3	86.2
-	Bamboo raw material	220.3	9
-	Chopstick production waste	0	77.1
3	Costs for services	33	53.7
-	Payments to suppliers	10.5	15.6
-	Selling expenses	11	21.2
-	Administration cost	7.1	16.1
-	Interest	4.5	0.8
4	Depreciation	163.2	35.1
5	Labor cost	129.7	49.2
6	Taxes and duties	6.1	34.5
7	Total cost (2 + 3 + 4 + 5 + 6)	552.3	258.6
8	Net profit (1-7)	24.3	137.9
9	Added value (5 + 6 + 8)	160	221.5

Note: Some figures could vary due to rounding error.

3.5. Comparison on economic performance and value added of actors in bamboo VCs

Comparing the contributions of the different components to value added in the two chains, labour stands out in the chopstick value chain, accounting for 81 % of its total value added. In contrast, profit dominates in the votive paper value chain, accounting for 58 % of its total value added (Fig. 3.).

This can be attributed to the fact that votive paper companies invest in modern machinery to increase productivity, reduce labour costs and benefit from easy access to abundant sources of production waste from chopstick companies. In addition, the high demand for votive paper in the markets, especially in Taiwan, plays an important role. Conversely, chopstick production relies heavily on manual labour, making labour costs a significant component of value added for all actors in the chain.

Furthermore, the votive paper value chain has a total value added that exceeds that of the chopstick value chain by USD 61.5/ton, and the distribution of this value added among the actors in the chain varies considerably. Chopstick and votive paper companies capture the majority of this value, accounting for 87.7 % and 90.8 % of total value added respectively, while local traders benefit the least, accounting for less than 4 % of total value added (Table A1). The distribution of value added in the chopstick value chain is more balanced than in the votive paper value chain. This suggests that the roles of farmers and traders, as well as the vertical integration of downstream activities, are more important in the chopstick value chain than in the votive paper value chain.

4. Discussion

4.1. Increasing bamboo grower's economic performance

The results of this study show that Luong bamboo is cultivated in mountainous areas characterised by high slopes and that harvesting sites are located far from roads. The harvesting and extraction of bamboo from dense clusters is mainly done manually. Subsequently, most of the bamboo is manually transported by individuals to roadside collection points after harvesting (Hiep, 2021a; Tuong Trang and Eiliggmann, 2010b). As a result, bamboo harvesting costs are high (accounting for 50 % of bamboo sales), while harvesting productivity remains relatively low. According to the Thanh Hoa Provincial Department of Agriculture, an effective strategy to reduce harvesting costs is to invest in logging

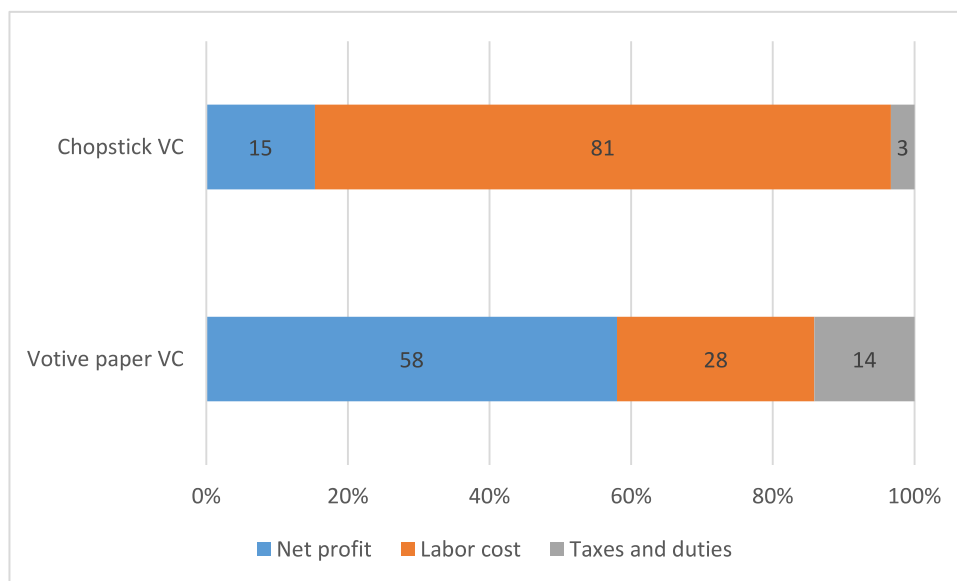


Fig. 3. Components in the added value added of the chopstick and the votive paper value chain.

roads to facilitate the use of tractors. In this regard, local governments and businesses play a key role in financing transport infrastructure, as bamboo farmers often lack the financial capacity and resources for such endeavours. The establishment of joint ventures between bamboo enterprises and farmers is useful, as enterprises can invest in bamboo plantations and support farmers in harvesting, and in return, farmers can enter into long-term sales contracts with bamboo enterprises (Zhaohua and Wei, 2018).

Bamboo farmers have the potential to increase both harvesting productivity and income by adopting chainsaws as an alternative to machetes. However, the transportation of chainsaws in such a complex mountainous terrain and over an average distance of 2 to 3 km from the farmer's house to the bamboo gardens has raised another concern. Therefore, the use of chainsaws can be further considered depending on the harvesting site. Bamboo farmers can cooperate in investment through a cooperative model where financial resources can be mobilised for investment in logging roads, chainsaws and reducing transaction costs. The results were analysed within the forestry cooperative model in the northeast, northwest and north-central regions of Vietnam (Thu et al., 2018). Mohns et al. (2017) argued that there is significant potential for the use of machinery in the harvesting process. For example, tractors could be used to extract bamboo from dense clusters, resulting in a significant eightfold increase in productivity compared to manual operations.

In response to increasing market demand for certified forest products, the Forest Stewardship Council (FSC) certification schemes have included bamboo forests and products in their standards (Lombardo, 2022). Stakeholders receive various benefits from FSC certification, including sustainable forest management, favourable market access and increased income opportunities (Chen et al., 2020; Yadav and Dugaya, 2013). The SCBV project²³ indicates that the selling price from FSC-certified Luong bamboo is up to 20 % higher than the selling price from non-FSC-certified Luong bamboo. In addition, households with FSC-certified bamboo plots have the opportunity to engage in sustainable bamboo harvesting and management practices, and to sign long-term sales contracts with bamboo companies. Bamboo growers

receive financial support from an Oxfam project to cover operating costs, inventory and FSC audit fees. However, when households are responsible for FSC certification costs, the financial return from FSC-certified Luong bamboo plantations becomes less attractive, a finding supported by the acacia value chain in Vietnam (La et al., 2021). Another study on the acacia value chain in Vietnam shows that the high costs associated with the certification process, such as maintaining FSC certification and audit fees, pose significant challenges for small forest owners (Hoang et al., 2019, 2015). Therefore, the joint venture between growers and processing companies as a financial solution for small growers to maintain the FSC certificate, with the processing company covering audit costs, while growers commit to selling certified raw materials to processing companies. The group budget was introduced to maintain FSC certification, with contributions from its members based on the 7 % revenue from the sale of certified raw materials (Hoang et al., 2019).

4.2. Increasing bamboo trader's economic performance

Traders in the timber value chain are often considered to have higher returns compared to other chain actors, as they take advantage of producers' limited market access and lack of market information, allowing them to dominate price negotiations (Perdana and Roshetko, 2015). However, this study shows that traders' value added is the lowest compared to chain actors' value added in the two value chains, mainly due to traders' lack of investment in primary processing of bamboo materials. In order to increase the value added of traders, it is suggested that they participate in primary processing. As confirmed by (Zhaohua and Wei, 2018), companies provide bamboo traders with primary processing machinery to produce specific semi-products according to the requirements of factories dedicated to specific products. Different parts of bamboo culms are used for different purposes. The bottom part of the bamboo culm is used for charcoal, while the middle bottom part of the bamboo culm is used to make flooring and panels. The middle upper part of the bamboo cane is used to make chopsticks while the upper part of the bamboo cane is used to make toothpicks and skewers. Almost every part of the bamboo cane is used; thus, the utilisation rate of the raw material is over 90 %.

Our study suggests that traders play a facilitating role in Luong bamboo transactions, acting as intermediaries between bamboo growers and enterprises due to their strong relationships with both bamboo growers and processors. Bamboo traders provide financial support to

² <https://vietnam.oxfam.org/latest/image-story/first-forest-nghe-achieve-fsc-certificate>

³ <https://vietnam.oxfam.org/five-year-journey-towards-sustainable-and-inclusive-value-chains>

both bamboo growers and enterprises. For example, farmers receive advance payments to cover their children's school fees, while enterprises benefit from flexible payment terms that can extend from two to three weeks. Similar results have been reported from Ethiopia (Erifo et al., 2016; Maraseni et al., 2018), Lao PDR (Greijmans et al., 2007; Maraseni et al., 2018), and Vietnam (La et al., 2021).

4.3. Increasing bamboo processor's economic performance

Recent studies suggest a link between technology and equipment and labour productivity, firm performance and growth. Companies that invest in modern machinery can achieve higher labour productivity and improve business performance compared to companies with less advanced technology (Jasra et al., 2012; Le, 2010; Tambunan, 2007). However, bamboo companies use outdated technology and machinery; therefore, they find it difficult to meet the norms and safety standards of international markets, as well as large orders in a short period of time (Sass, 2018; DOFA, 2015; Tran, 2010; Fanchette and Nicholas, 2009). The outdated machinery is the reason why chopstick companies are left behind by other international competitors in terms of product innovation and price, which is consistent with the findings of other studies (Hampel-Milagrosa, 2014; Hiep, 2021a; Nguyen and Martin, 2016; Sass, 2018). Some previous studies indicate that one of the main reasons why bamboo enterprises struggle to invest in technology and modern machinery is the difficulty in accessing external finance (Hiep, 2021b; Ramalho et al., 2018). Significant barriers to accessing finance for bamboo enterprises are the lack of sufficient collateral and consultations with financial institutions; this finding also supports the findings of previous studies (Appiah-Kubi et al., 2014; Harash et al., 2014; Nguyen et al., 2019; Tekpetey et al., 2015; Yang et al., 2019). Loan procedures need to be streamlined and local governments should send experienced staff to enterprises to help them complete loan applications (Ramalho et al., 2018). Diversified financial instruments provide more opportunities for enterprises to access loans, such as venture capital funds, financial cooperatives, credit unions, financial leasing and insurance companies (Macqueen, 2008; Yoshino and Taghizadeh-Hesary, 2018).

Employees are said to be one of the most important production factors of a business, as they are the drivers that increase productivity, create innovation and competitive advantage, and have the most significant impact on the business performance of SMEs compared to other sub-elements of intellectual capital (Muda and Rahman, 2016). Lack of availability of trained labour is one of the major constraints to the modernisation of the bamboo industry in India (Baksy, 2013). The education and skills of employees are the most important factors affecting the growth of bamboo processors in Ethiopia, and employee training was found to be a key factor affecting the ability of bamboo enterprises to innovate (Endalamaw, 2015). On the other hand, in our study, processors suffer from a shortage of skilled labor and therefore rely mainly on seasonal, casual labor. In part, this is due to the unattractive working conditions they offer under the UN Labor Code. Social insurance coverage is poor and workplace safety standards are low. As a result, companies find it difficult to retain and attract skilled workers. The findings were highlighted in the bamboo supply chain study (WWF, 2015b). In order to attract skilled labour to bamboo enterprises, the joint efforts of all stakeholders are essential. Companies should establish long-term contracts with workers, improve working conditions and provide health insurance. In addition, vocational training programmes to improve workers' skills could be beneficial, which can be facilitated by local authorities and international organisations (Appiah-Kubi et al., 2014; Tekpetey et al., 2015).

Marketing capabilities have been assessed as an essential resource of enterprises that can play an important role in determining export performance and business direction (Liu et al., 2015; Nalcaci and Yagci, 2014; Khurshid et al., 2013; Nath et al., 2010; Weerawardena, 2003). Many companies use social media such as Facebook, Twitter, Instagram, Google+, Pinterest, LinkedIn and other social platforms. These are

useful marketing tools that support enterprises in disseminating information about products and services to customers, as well as receiving feedback from customers to make appropriate adjustments to their respective business plans (Becić et al., 2018; Mathews et al., 2019; Yusufarto and Pambekti, 2019). However, bamboo enterprises in Thanh Hoa province have failed to do the marketing activities, including the absence of trade fairs, promoting products on social media, developing website (Hiep, 2021b; Nguyen and Martin, 2016; Renard and GRET, 2009). Previous studies have shown that the government plays an important role in guiding and supporting enterprises in market research, establishing international business centres, organising regular trade fairs and developing websites (Hoque, 2018; Ibrahim and Mustapha, 2019; Osei et al., 2016). With the support of the local government in annual trade fairs, Chinese bamboo enterprises are able to introduce their new products and establish business partnerships with domestic and international traders. The Chinese government initiated promotion centres to familiarise enterprises with foreign trade procedures and international market trends (Zhaohua and Wei, 2018).

Actors along the value chain cooperate to improve economic performance and value-added distribution, thereby reducing adaptation costs (Abteu et al., 2014; Hiep, 2021a; Jia et al., 2012; Librelotto et al., 2019; Makosa, 2015; To, 2017; van der Lugt and King, 2019). This study shows that votive paper companies purchase production waste from chopstick companies as raw materials. Chopstick production waste has great potential as there are 23 chopstick factories in the province and coordination could improve bamboo utilisation, minimise production waste, reduce transaction costs and increase value addition to the bamboo value chain.

4.4. Limitation

This study used a case study approach focusing on local value chains, which makes the findings more suitable for analytical insights rather than statistical generalisation (Yin, 2013). The study provides a brief overview of value chain participants; however, with the exception of bamboo processing enterprises, there are no official records for bamboo growers and traders. As a result, data on costs and benefits are based on recall, which may affect the reliability of the data. However, rigorous and transparent data collection methods facilitated data triangulation, which increased the reliability of the results. Potential risks such as forest fires, natural disasters and pandemics were not considered. In addition, competitor analysis and consumer perspectives were insufficiently explored, limiting a comprehensive understanding of their influence on chain actors' performance. The analysis of value-added at the farmer level excluded the opportunity cost of land, which was accounted for in the producers' cost stream as land rental value. The opportunity cost of plantation was included in labor, seeding, and fertilizer.

Sustainable chain management requires an integrated economic, social and environmental assessment (Cambero and Sowlati, 2014; Santibañez-Aguilar et al., 2011). Given the undeniable environmental impacts of chopstick and votive paper production, a thorough analysis must comprehensively consider both social and environmental costs and benefits.

5. Conclusion

Vietnam is blessed with a large area of bamboo, ideal for long-term industrial production. However, the combination of manual harvesting methods and challenging mountainous terrain has driven up harvesting costs, discouraging bamboo farmers from expanding their areas. Furthermore, high value-added bamboo products such as flooring, decking and furniture have gained popularity in recent years as an alternative to wood products, but have not received sufficient focus for development in Vietnam (Marsh and Demestre, 2008b; Sass, 2018).

All actors in the two value chains generate positive returns, but there's a considerable disparity in the distribution of benefits between

them. Processing companies generate the highest net profits compared to other actors, while traders generate the lowest value added, despite their crucial role in linking bamboo growers with bamboo companies. In addition, the value added for most actors is mainly due to labour costs, suggesting that labour is used intensively in most stages of production.

Thanh Hoa Province has promulgated a strategy to develop the bamboo industry up to 2020 and a vision up to 2030, which subsidises farmers to buy seedlings and fertilizers, and provides free land lease and preferential loans to enterprises for the first 15 years (Đặng, 2014; DOFA, 2015). However, the transformation from a low-value-added model to a high-value-added model is a major challenge because of uncertain favourable conditions for the development of industrial bamboo production in Vietnam, such as the lack of quality of bamboo materials, cooperation among chain actors, advanced technology required for bamboo processing, financing for small-scale producers, and marketing activities.

CRedit authorship contribution statement

Tran Van Hiep: Writing – review & editing, Writing – original draft, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **La Thi Tham:** Visualization, Conceptualization. **Le Minh Thong:** Methodology, Formal analysis.

Declaration of competing interest

The authors declare the following financial interests/personal

Appendix A

Fig. A1, Fig. A2, Table A1, Table A2

Table A1

Comparison on financial and economic performance of actors in two VCs.

Analytical Level	Variables	Chopstick VC	Votive paper VC
Farmers	Value added (USD/ton), compared with total value added (%)	15.2 (8.3 %)	15.2 (6.2 %)
	Producers' share (% of gate factory price)	5.3	7.8
	Net profit margin (%)	2.4	2.4
Local traders	Value-added (USD/ton), compared with total value-added (%)	7.3 (4 %)	7.3 (3 %)
	Net profit margin (%)	6.9	6.9
Enterprises	Value added (USD/ton), compared with total value-added (%)	160 (87.7 %)	221.5 (90.8 %)
	Net profit margin (%)	4.2	34.5
Value chains	Total value added (USD/ton)	182.5	244
	Value added per final sales (%)	32	62
	Local value addition	Very low (almost all farmers and traders sell Luong bamboo without processing)	

Note: Some figures could vary due to rounding error.

Table A2

Summary of selected company profiles in 2023.

Description	Unit	Chopstick company	Votive paper company
Company type		Private	Private
Year of establishment	Year	2005	2007
Total asset	USD	604,783	1167,391
Average annual revenue	USD	287,076	2013,160
Number of employees	Person	36	135
Female employees	Person	29	107
Male employees	Person	7	28
Total annual salary	USD	74,640	367,390
Market		Domestic	Taiwan (90 %), domestic (10 %)

Note: Some figures could vary due to rounding error.

- Net profit margin

$$Net\ profit\ margin\ (\%) = \frac{Net\ profit}{Total\ revenue} * 100\%$$

relationships which may be considered as potential competing interests:

Hiep Tran Van reports financial support was provided by Hanoi University of Mining and Geology. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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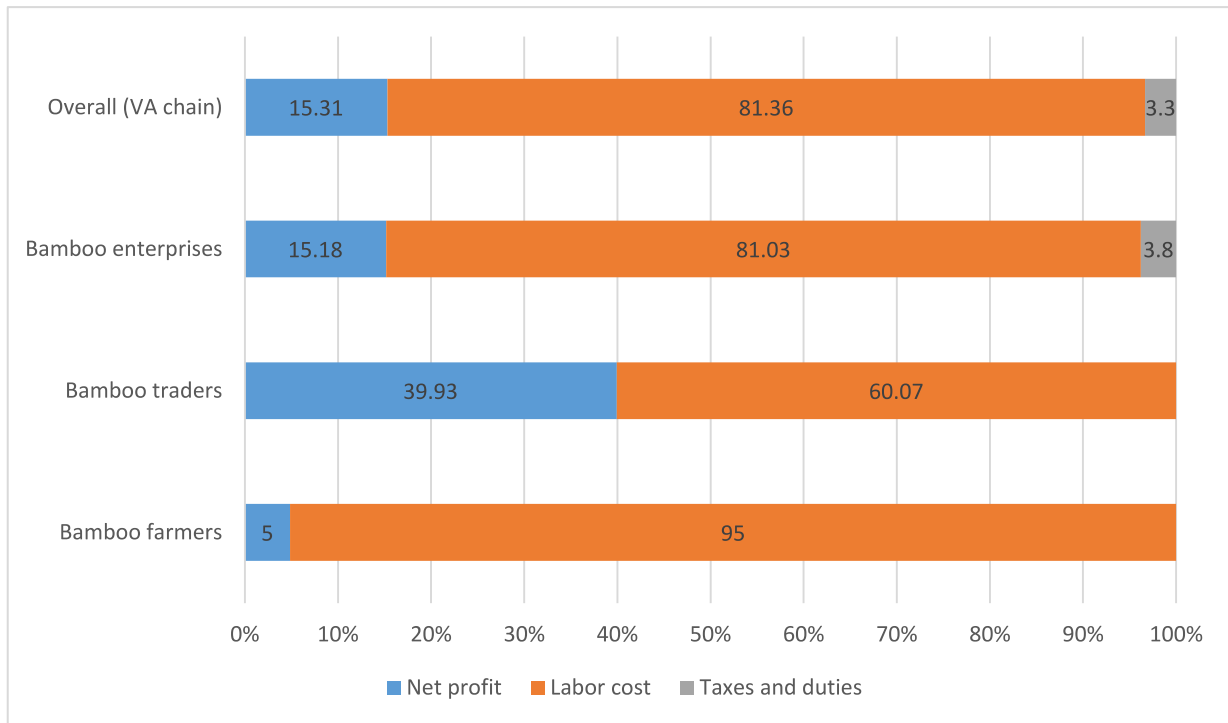


Fig. A1. Distribution of value-added across the bamboo chopstick value chain.

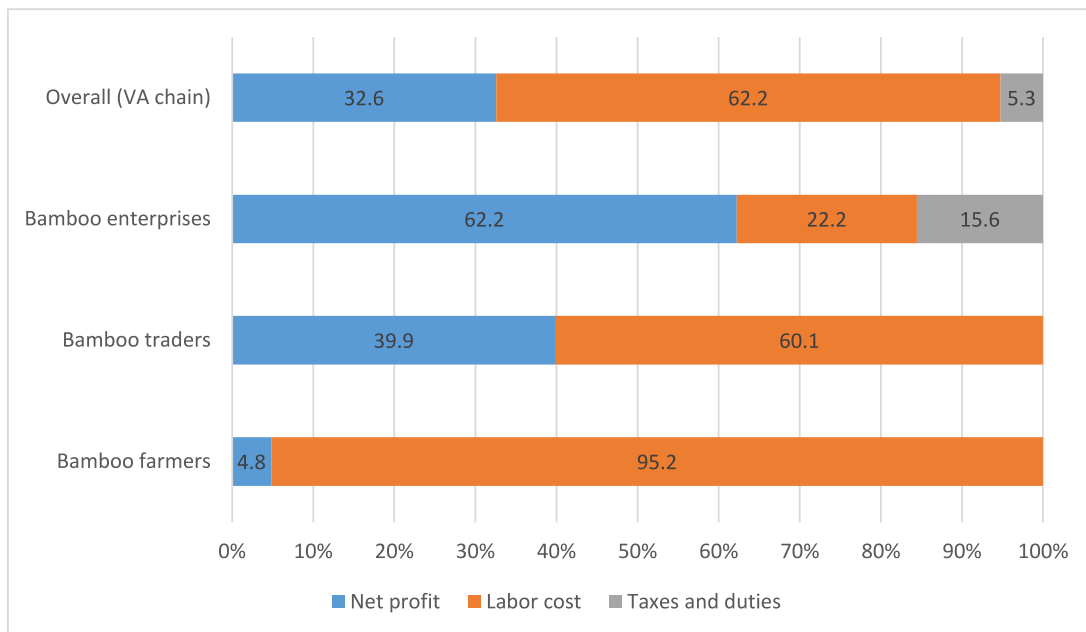


Fig. A2. Distribution of value-added across the bamboo votive paper value chain.

The gross margins is calculated by deducting total costs, excluding labor costs, from total revenue (Armengot et al., 2016).

Appendix B

Fig. B1, Fig. B2, Fig. B3, Fig. B4, Fig. B5, Fig. B6, Fig. B7, Fig. B8



Fig. B1. Bamboo garden, Ba Thuoc, Thanh Hoa province.



Fig. B2. Manual transportation at garden gate, Quan Hoa, Thanh Hoa province.



Fig. B3. Bamboo transported by small trucks, Quan Hoa, Thanh Hoa provi.



Fig. B4. Bamboo stored by local traders, Quan Hoa, Thanh Hoa province.



Fig. B5. Bamboo chopstick production, Quan Hoa, Thanh Hoa province.



Fig. B6. Chopstick production waste for producing votive paper, Ba Thuoc, Thanh Hoa province.



Fig. B7. Semi-finished chopsticks, Quan Hoa, Thanh Hoa province.



Fig. B8. Bamboo votive paper production, Ba Thuoc, Thanh Hoa province.

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