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Article

Value Chain Analysis of Medicinal Plants in Geoparks: Livelihoods of Ethnic Minorities based on Non-Timber Forest Products (NTFPs) in Vietnam

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Abstract: Non-timber forest products (NTFP) have contributed in various ways to the living, livelihoods, and trading of households and communities who live in rural and urban areas all over the world. This paper analyses the value chain of Jiaogulan (*Gynostemma pentaphyllum*) in the Cao Bang Geopark, Vietnam. 106 actors were surveyed using a semi-structured questionnaire: experts (agricultural extension officers, farmers' associations), harvesters, traders, primary processors, processors, distributors, and consumers. The results show that a map of Jiaogulan value chain, value added of households in main market channels, and impact of value added and distribution of Jiaogulan products on household income.

Keywords: value chain analysis; medicinal plants; Jiaogulan; ethnic minority; NTFPs; geopark; transboundary landscape; Vietnam

1. Introduction

Non-timber forest products (NTFPs) contribute positively to the life and livelihoods of households and communities inhabited in rural areas and local economies world-wide (Angelsen et al. 2014; Shackleton et al. 2018). NTFPs are estimated contributing significantly to from a few to over 50% of the total income of households (Vedeld et al. 2007; Angelsen et al. 2014). NTFPs are accounted for the highest proportion of total income of the poor households and underdeveloped communities, especially in mountains and remote areas (Shackleton, 2015). Besides, the commercialization of NTFPs at local, national and regional levels tends to increase and to bring income in cash to households (Welford et al., 2008; Cunningham, 2011). For example, in the southwestern Malawi, most households trades at least one type of NTFP which provided an annual income between 20 and 456 USD per year (Sophie et al. 2019). However, the sustainability of NTFPs trading is challenged by the short value chain and the domination of traders and middle actors in the value chain.

The concept of value chain has been applied to NTFPs enterprises (Belcher 1998), such as the honey value chain in the Philippines (Matias et al. 2018), the agarwood value chain in Sudan (Abtew et al. 2012), the palm fruit value chain in Brazil (De Sousa et al. 2018), and the spice value chain in Cameroon (Ndumbe et al., 2019). The value chain map of NTFPs describe the links among all the actors and transactions of NTFP from producers or harvesters to final consumers. It also presents a sequence of stages of purchasing and selling a product from the harvesters, processors, and traders, to the final consumers (Belcher 1998; Lundy et al. 2008). Value chain analysis helps to describe the market for NTFPs and to assess the value chain performance

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(Kaplinsky et al. 2000; Marshall et al. 2006b; Velde et al. 2006). Value chain analysis also provides information on mapping actors along value chain and the market share of price or the final value that each party guarantees. This information is very useful, especially in understanding barriers for poor people to take optimal benefits from their production activities. This helps researchers and policymakers suggest effective solutions to improve the distribution of outcomes more equally (Mitchell et al. 2011; Wynberg et al. 2014). Although most NTFP markets require small input capital, especially in local markets, the profits from trading NTFP tends to be very low per unit (Velde et al. 2006). A large volume of trading could bring a better income but it requires more capital, stores, and transport products (Velde et al. 2006).

For economies in mountainous and remote areas, value chain theory has been applied in the agricultural sector to promote local economic development, household and community livelihood development, and community development and support poverty reduction (Berg van den et al. 2007; Bolwig et al. 2008, 2010; Gereffi and Fernandez-Stark 2016; Humphrey and Memedovic 2006; Tallontire et al. 2009). Adapting to major changes in agricultural commodities and the participation of smallholder farmers in the value chain is considered a new strategy for poverty alleviation (Gereffi and Fernandez-Stark 2016; Ruben 2017). Developing agricultural value chains not only encourage smallholder farmers' ability in assessing the market, inputs, and credit but also improves productivity and production efficiency (Burkitbayeva et al. 2018; Haggblade et al. 2012; Thorpe et al. 2017). In Vietnam, many governmental and non-governmental organizations have applied the approach of the value chain in research and projects on rural development with the participation of farmers such as CASRAD, IPSARD, MALICA, GIZ, Oxfam, ADB, M4P/M4P2, etc. (Dao et al. 2020). The Vietnamese government is also paying more attention and priority to develop agricultural value chains in mountainous areas. Over the past years, the project of restructuring Vietnam's agriculture has been implemented towards enhancing value and sustainable development. Many models of agricultural production toward the value chain have been established and developed in mountainous areas. As of 2021, 56 provinces have issued policies to encourage linkages in the production and consumption of agricultural products. 4,028 agricultural cooperatives have been established and participated in association with 1,867 enterprises in producing, harvesting, processing, and consuming agricultural products (Hai and Phuc 2021).

In the Vietnamese mountainous areas, Jiaogulan (Gynostemma pentaphyllum) is one of the most notable NTFP which originates naturally in sparse forests with low humidity and cold climates such as Korea, Japan, China, etc. In Vietnam, Jiaogulan is found under the forest canopy in high limestone mountains in Lao Cai, Hoa Binh, and Cao Bang provinces (cite). Jiaogulan is known as bring benefits to human health and is used as a medicinal herb (cite). In Cao Bang province, a border province between Vietnam and China, the Tay community has processed Jiaogulan as tea for a long time ago (Lam et al., 2015). It was estimated that Cao Bang province can exploit annually 5-7 tons of Jiaogulan (Quang et al. 2019). However, Jiaogulan with many used purposes such as being a raw material for medicinal products, teas, and functional foods, so the natural source of Jiaogulan has been overexploited and has led to its scarcity. According to the Vietnam Red Book in 2007, Jiaogulan is classified as endangered (EN A1a, c, d). Analyzing the Jiaogulan value chain provides a scientific basis for improving economic efficiency for local people who harvest and produce Jiaogulan, and at the same time contributes to hunger eradication and poverty alleviation in remote areas.

2. Methodology

2.1. Study area

The study was conducted in Cao Bang geopark (CBGP) which is located entirely within the administrative boundary of Cao Bang province, in the mountainous region of Northern Vietnam. The park

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covers Ha Quang, Trung Khanh, Ha Lang, and Quang Hoa districts and a part of Hoa An, Nguyen Binh, and Thach An districts. The area of CBGP is more than 3,390 km2, which was recognized as a global geopark by UNESCO on April 12, 2018. CBGP has a natural area of 6,724.6 km2, with an average altitude of over 200 m, and the border area has an elevation of 600 - 1,300 m. Sloping land occupies more than 90% of the natural area of CBGP. CBGP has over 333 km of border with China, with border crossings of Ta Lung (Vietnam) - Thuy Khau (China); Tra Linh (Vietnam) - Long Bang (China); and Soc Giang (Vietnam) - Binh Mang (China).

The recognized values of CBGP include the historical value of the Earth (about 500 million years) with discovered vestiges such as marine sediments, fossils, minerals, and volcanic rocks. The limestone landscape has 214 cultural-historical sites and more than 130 unique geological heritage sites typical for tropical karsts: Ban Gioc waterfall, Nguom Ngao cave (Chong Khanh district); Ho Thang hen (Tra Linh district); Phja Oac – Phja Den National Park (Nguyen Binh District), etc. CBGP is the resident place of 250,000 people from 9 ethnic minorities such as Tay, Nung, Dao, etc. Two intangible cultural heritages of these ethnic groups are recognized at the national level: Then Ritual of the Tay ethnic community and the Nang Hai Festival (Phuc Hoa district).

Local culinary specialties associated with local agricultural products such as Phja Den vermicelli (Nguyen Binh district), pears and black jelly (Thach An district), chestnuts and white jelly (Chong Khanh district), and Khau Sli Na Giang cake (Ha Quang district); Banh Cuon, Pho Chua, Coong Phu cake, Khao cake, roasted duck, Jiaogulan tea, red Polygonum tea, etc. CBGP has a high biodiversity with 857 species of medicinal plants, of which many species have large reserves and high economic value such as Dang ginseng, Cat ginseng, Hoang Tinh, Ba Kich, Ramulus Ampelopsis tea, bitter tea, honeysuckle, Eleutherococcus trifoliatus; and Artemisia annua,... Especially, indigenous populations of Jiaogulan with relatively large reserves growing wild on limestone mountains have been found in CBGP.

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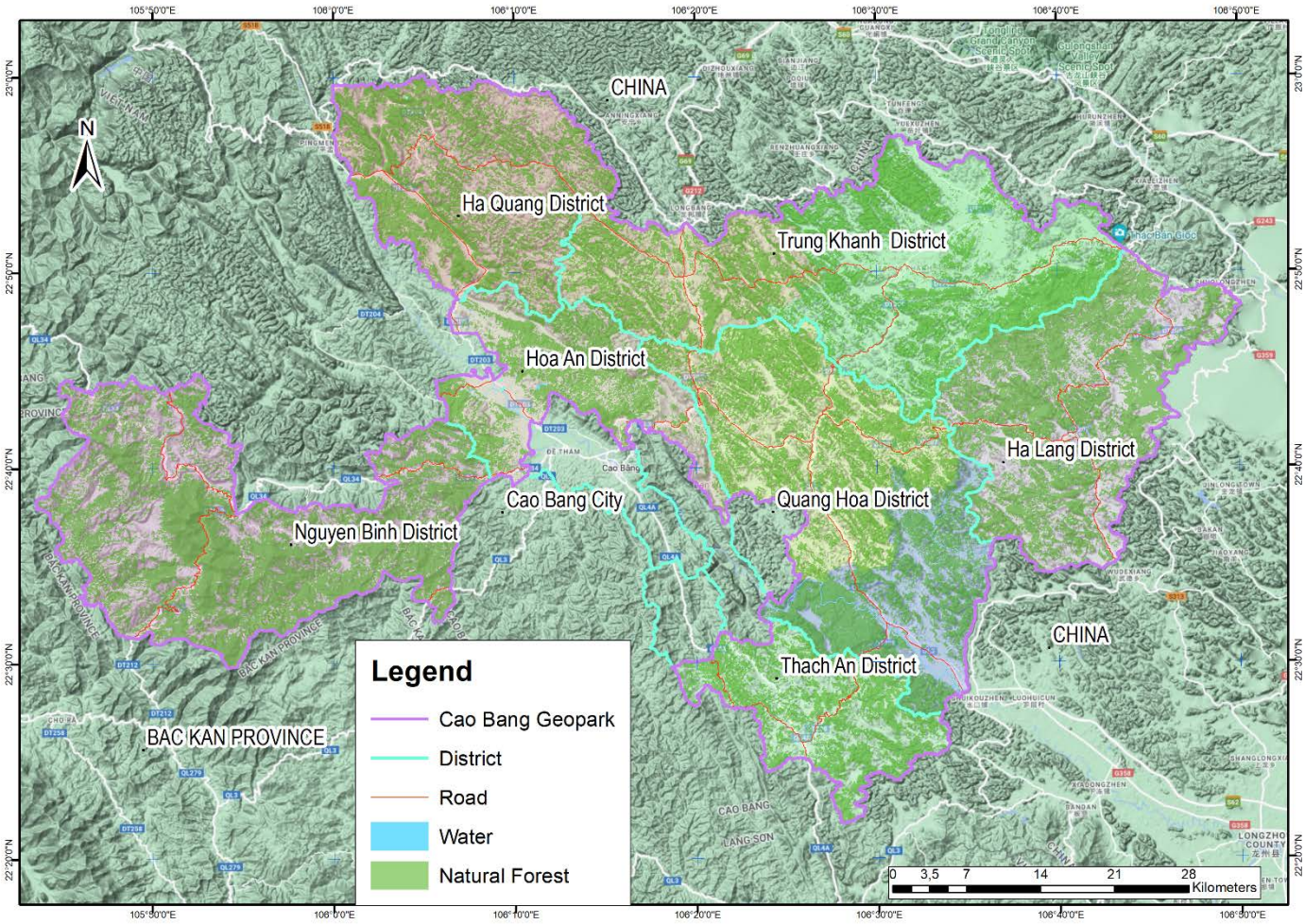

Figure 1. Location of the CBGP in the Cao Bang province (Vietnam)

2.2. Data collection

The study applied the value chain theory of Kaplinsky et al. (2001) to solve 3 main contents: (1) Mapping the value chain: determining the steps of production and business activities of actors involved in the chain and their linkages, as well as supporters in this value chain; (2) Quantifying and describing detail the Jiaogulan value chain: Based on the map of the value chain to quantify the parameters of stakeholders participating to steps of the chain, the volume of production and consumption of specific market segments; and (3) Analyzing economic of the value chain: Total value added ?? (GTGT???) created in the value chain and the distribution of GTGT of different stages in the chain, intermediaries cost production costs and additional costs at each stage, and the operating ability of actors (production capacity, output, profit). Data was collected by direct interviewing stakeholders in the Jiaogulan value chain in Cao Bang province. For ensuring the representativeness of primary data, the method of conditional quota sampling toward the value chain approach was applied to collect data from stakeholders and supporters of the Jiaogulan product value chain.

The survey was conducted in April 2022 - the middle of the Jaogulan harvesting season (from March to May). Participants include 7 groups of stakeholders: Experts, harvesters, traders, primary processors, processors, distributors, and consumers (table 1). Participants were randomly chosen and required over 18 years old.

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The steps of conducting the interview: (1) Identify the interviewing issues; (2) Planning, design, and guide the interview; (3) Interview - conduct an interview based on a guide; (4) Take notes - prepare interview documents for analysis (?); (5) Analysis - decide on the appropriate purpose, subject, nature and method of analysis; (6) Verification - determining the validity of the interview results, and (7) Report Writing - communicating the findings based on scoring criteria. Groups of interview criteria include: The interview criteria were analyzed based on the method of descriptive statistics, value chain mapping, analyzing linkages among actors, and analyzing financial indicators.

Table 1. Sampling and collecting information

No.	Actors	Sample	Interview methods
1	Experts (agricultural extension officers, farmers' associations)	6	Direct interview
2	Harvesters	12	Direct interview
3	Traders	15	Direct interview
4	Primary processors	16	Direct interview
5	Processors	15	Direct interview
6	Distributors	12	Direct interview
7	Consumers	30	Direct interview
	Total	106	

3. Results

3.1. Description of the Jiaogulan value chain

The actors who involve in Jiaogulan value chain in CPGP include: (1) The farmers harvest herbs; (2) Local collectors; (3) Out-of-province collectors; (4) Preliminarily processors; (5) Domestic processors; (6) Wholesalers; (7) Retailers; (8) Local consumers; and (9) Out-of-province consumers. While some actors directly involved in the process of harvesting, processing, and trading are only local people, other actors who might both local people and neighboring province people provide inputs factors, support finance and technical, transport and distribute to consumers. Especially, unlike many agricultural value chains in Vietnam generally and in the Northern mountainous region particularly, Chinese and other foreign actors are not involved in the Jiaogulan value chain (Figure 2).

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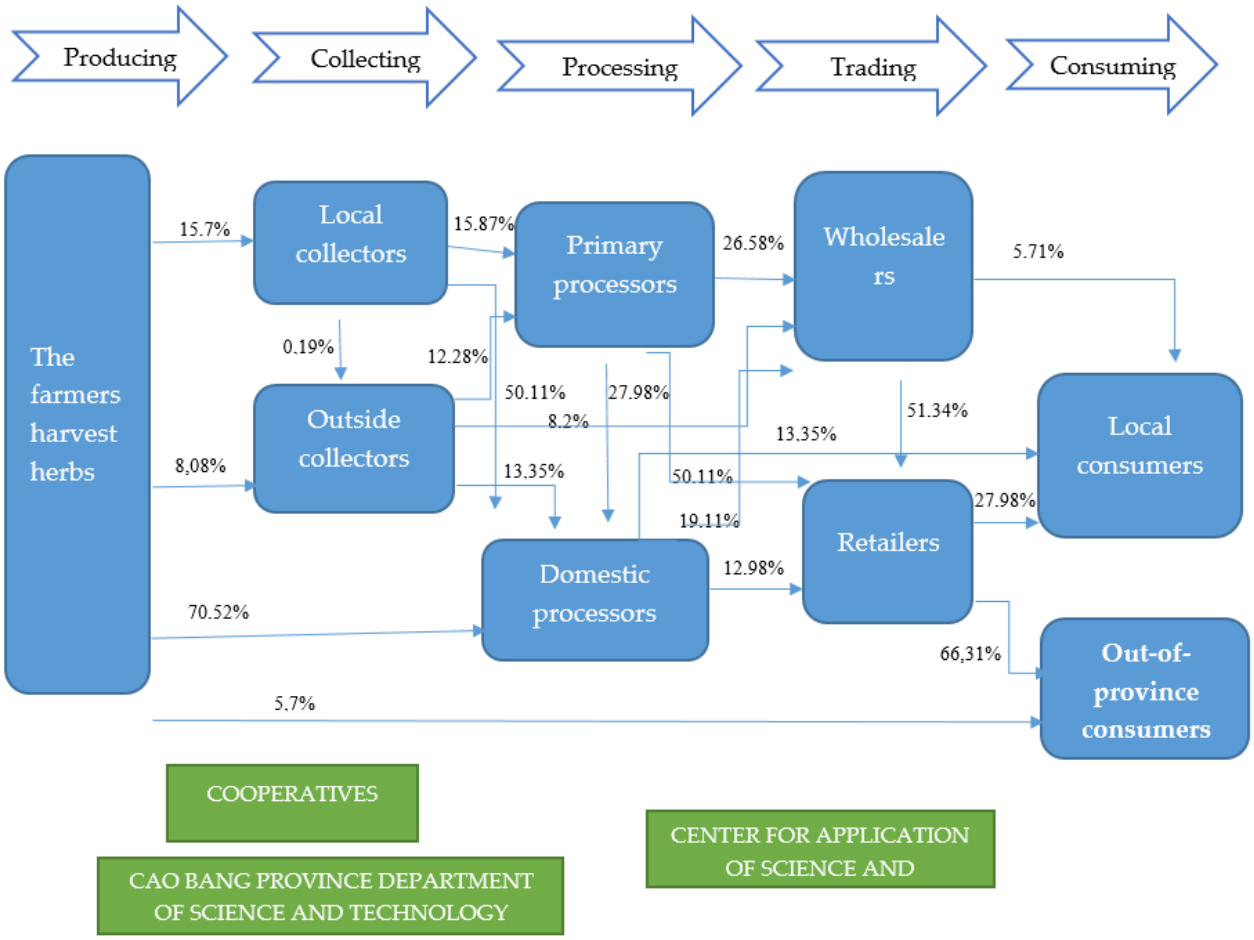

Figure 2. A map of Jiaogulan value chain at CBGP (% represents the rate of displacement of Jiaogulan volume from the previous actor to the subsequent actor)

The results of interviews with district and provincial officials and locals at CBGP show that all stakeholders involved in the Jiaogulan value chain play an equally important role, in ensuring the maintenance of a stable structure of the value chain. The Jiaogulan value chain at CBGP currently covers Cao Bang province, some neighboring northern mountainous provinces (Bac Kan, Lang Son provinces), and Hanoi city.

The most important factors affecting the value chain are the local climate, transport infrastructure, and accessibility. Jiaogulan at CBGP is mainly harvested from the wild (grown products accounting for a small proportion). The herb harvesters are ethnic minorities with ages 45-50 years old. Jiaogulan is mainly collected on sloping land and connected by poor-quality transport infrastructure. The disadvantages of weather such as rain might bring more difficulty for harvesting. Harvesters reside in remote areas with low accessibility to socio-economic services supporting the collection, transportation, and delivery to consumers. After harvesting and collecting, Jiaogulan has been dried by preliminary processors. Then, Jaugulan products will sell to wholesalers from northern mountainous provinces

There were many different market channels but most Jiaogulan at CBGP are delivered through four main market channels. These channels transport large volumes of products and generate high added value for the entire chain. The other channels are intermediate or delivery a small volume. Of the four main channels, channel two delivers fresh products with the highest proportion of total Jiaogulan within Cao Bang province. And channel four responds to delivery mainly processed products to the province market.

** Channel 1: Famers harvesting herb → retailers → local consumers (Cao Bang province)*

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This channel is the fastest channel for delivery from farmers to consumers. Jiaogulan is harvested from the wild then directly collected by retailers and sold to consumers at the province markets (commune and district markets). Mainly products delivered through this channel are fresh and directly used as food in the household.

** Channel 2: Famers harvesting herb → processors → retailers → local consumers (Cao Bang province)*

After harvesting, Jiaogulan will be preliminarily processed by manual-drying methods at households. Then, it will be directly sold to processing facilities in the province, such as processing facilities under the Department of Science and Technology of Cao Bang province (accounting for 70.52%). Approximately 12.98% of the total output of the chain will be sold directly to retailers in Cao Bang province and distributed Jiaogulan to consumers at the retail market (commune, district markets, vendors, and grocery stores).

** Channel 3: Famers harvesting herb → outside collectors → wholesalers → retailers → outside consumers*

About 8.08% volume of Jiaogulan will be sold to collectors from other provinces. After that, products will be purchased by wholesalers and transported to other provinces by large tonnage trucks and delivered to outside consumers.

** Channel 4: Famers harvesting herb → local collectors → processing facilities → wholesalers → retailers → outside consumers*

Through this channel, farmers sell harvested Jiaogulan to both local collectors and outside collectors. Fresh products will be purchased outside processors that account for 50.11% of total products in the chain. Preliminarily processed Jiaogulan is processed into final products such as tea bags and dried tea, which is distributed by wholesalers and then retailers to final consumers out of provinces (accounting for 27.98%).

3.2. Value added of households in main market channels

Harvesters/farmers participate in all market channels of the Jiaogulan value chain. In each channel, the cost of farmers has not changed, the main difference among market channels is the value added per 1 kg of Jiaogulan. Table 2 shows the information on VA and net value added (NVA).

Table 2: Value added and net value added of Famers in the main channel of Jiaogulan value chain

Items	**Famers**	**Collectors**	**Wholesalers**	**Retailers**
Channel 1: Famers harvesting herb® retailers ® local consumers				
Price(1)	0.000209			0.000399
Intermediary costs(2)	0.000029			0.000300
VA(3)	0.000180			0.000098
Added cost(4)	0.000070			0.000069
NVA(5)	0.000110			0.000029
%NVA(6)	79,06			20,94
Channel 2: Famers harvesting herb® processors ® retailers® local consumers				
Price(1)	0.000209	0.000285		0.000394
Intermediary costs(2)	0.000029	0.000209		0.000285

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VA(3)	0.000181	0.000076		0.000109
Added cost (4)	0.000070	0.000023		0.000016
NVA(5)	0.000110	0.000052		0.000094
%NVA(6)	43,03	20,39		36,58
Channel 3: Famers harvesting herb ® outside collectors® wholesalers ® retailers ® outside consumers				
Price(1)	0.000209	0.000297	0.000409	0.000496
Intermediary costs(2)	0.000029	0.000209	0.000297	0.000409
VA(3)	0.000181	0.000087	0.000113	0.000087
Added cost (4)	0.000070	0.000023	0.000027	0.000016
NVA(5)	0.000110	0.000064	0.000085	0.000072
%NVA(6)	33,28	19,31	25,80	21,61
Channel 4: Famers harvesting herb ® local collectors ® processing facilities ® wholesalers ® retailers ® outside consumers				
Price(1)	0.000207	0.000258	0.000409	0.000496
Intermediary costs(2)	0.000029	0.000207	0.000296	0.000409
VA(3)	0.000178	0.000051	0.000113	0.000087
Added cost(4)	0.000070	0.000015	0.000027	0.000016
NVA(5)	0.000108	0.000036	0.000086	0.000072
%NVA(6)	33,66	11,19	26,84	22,41

Table 2 shows that, among four channels of Jiaogulan, the products delivered through channels two and four have the highest value added. Famers sell Jiaogulan to processing facilities at 0.000209 USD/kg, they generated a value added at 0.00018 USD/kg and earn a net value added at 0.00011 USD/kg after minus intermediary costs and cost added. Processors at CBGP directly buy fresh Jiaogulan (not through the collectors), so the added costs are reduced. Local collectors well understand the psychology of local harvesters, therefore, the purchase price of Jiaogulan by local collectors is lower than outside collectors and processing facilities.

In channel 4, farmers sell to local collectors at 0.000207 USD/kg, lower than the selling price to processing facilities of 2.68289E-06 USD/kg. Farmers directly sell Jiaogulan to retailers at 0.000208 USD/kg. The VAT generated by the farmers in this channel is 0.00018 USD/kg and the received NVA is 0.000109 USD/kg. Considering the distribution rate of VAT in all four main market channels, farmers receive the highest percentage of VAT, ranging from 33.28% to 79.6%. Although there is no significant difference in VAT and NVA among market channels, in channel 2, when selling directly to processing facilities, farmers receive more VAT. This reflects that the direct distribution channel (farmers - processing enterprises) brings more benefits for farmers. In other words, developing a market channel for processed Jiaogulan will help farmers increase their income.

3.3. Impact of value added and distribution of Jiaogulan products on household income

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VA and NVA (calculated for 1kg Jiaogulan) that are generated by farmers keep the most important role in households' income at CBGP. Table 3 presents the results of calculating the sensitivity of VAT to households' income. It reflects the impact of VAT and NVA of Jiaogulan products on the income of local people.

Table 3. Impact of value-added and distribution of Jiaogulan products on the income of farmers

Impacts	**Value added (USD/kg)**	**Increase 1%**	**Increase 5%**	**Increase 10%**	**Increase 15%**	**Increase 20%**
Impacts of value added and net value added	Income (USD/1000m2)	0.0031	0.0155	0.0310	0.0464	0.0619
	Income from Jiaogulan (USD/household)	0.0281	0.1406	0.2812	0.4218	0.5624
	Income (USD/1000m2)	0.0019	0.0094	0.0189	0.0283	0.0377
	Income from Jiaogulan (USD/household)	0.0171	0.0856	0.1712	0.2568	0.3425
Impacts of distribution value added and net value added	Income (USD/1000m2)	0.0048	0.0241	0.0482	0.0723	0.0964
	Income from Jiaogulan (USD/household)	0.0452	0.2261	0.4521	0.6782	0.9043
	Income (USD/1000m2)	0.0054	0.0270	0.0539	0.0809	0.1079
	Income from Jiaogulan (USD/household)	0.0506	0.2531	0.5062	0.7593	1.0124

(Note: * Average value added through market channels)

Table 3 shows that, if VA increases by 1%, farmers' income will increase by 0.0031 USD/1000m2. Similarly, if VA increases by 20%, people's income will increase by 0.0619 USD/1000m2. Considering the income in the total harvested Jiaogulan area , if the VA increases by 1%, the households' income will increase by 0.0281 USD/household. Similarly for VAT, if NVA increases by 1%, farmers' income will increase by 0.0019 USD/1000m2 and by 0.0171 USD/household. People living at CBGP are mainly from ethnic minority groups with low quality of living. The increase in VA and NVA improves local people's income. Therefore, the Jiaogulan product value chain contributes significantly to escaping poverty and the sustainability of the local economy.

When the distribution rate of value added increases by 1%, the income of farmers will increase by 0.0048 USD/1000 m2. In case the VA distribution rate increases by 20%, people can earn a higher income of 0.0964 USD/1000 m^2. For income/household, when the VAT distribution rate increases by 1%, the income of farmers will increase by 0.0452 USD/household. Considering the ratio of VA distribution, if this distribution rate increases by 1%, farmers' income will increase by 0.0054 USD/1000 m2. Research results show that when

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the VA distribution rate increases by only 1%, the household's income will be significantly improved. Farmers generate VA and if they are distributed that VA more, their income will increase.

4. Discussion

Strengthening value chain linkages is an inevitable trend of agricultural production, especially agricultural value chains with the participation of smallholder farmers. A theoretical overview of linkages in agricultural value chains in the world and Vietnam has shown that there exist two basic forms, the chain structure (including horizontal and vertical linkages between actors joining the chain) and the legitimacy of the link (written contract and unwritten agreement). How close among actors of a chain is a decisive factor for its sustainability. Horizontal linkage is formed mainly through the cooperation of the groups of actors that play a similar role in the chain. In regions, where market-oriented production is newly developed for agricultural commodities, the horizontal linkages are found mainly in the production stage through the creation of agricultural cooperatives of small-scale farmers. The vertical links are more diverse through formal contracts (contract farming, agreements) conducted by businesses or organizations in the chain. Those help to ensure flows of the commodity from input to output become transparent and product quality is well controlled. Development of the vertical linkage is an effective strategy for value chain upgrading, especially in developing countries with the goal of poverty reduction. The close linkage between actors helps to reduce production costs, increase the volume of outputs, add more value to agricultural products, and distribute equally benefits among actors.

The Jiaogulan value chain in CBGP has created market-accessed opportunities and income for local farmers. Farmers have generated the highest value-added in the chain, followed by the wholesalers and the processors. Depending on each market channel, the distribution of the NVA in the chain varies among actors. In the main market channels, farmers gain the highest NVA among actors in the value chain. The VA and NVA generated from the Jiaogulan collection in CBGP have a great contribution to farmers' total income (income structure). The share of VA and NVA for farmers of the total chain's VA and NVA also positively affects farmers' income structure in CBGP. However, in terms of investment efficiency, farmers are the least efficient actor that is lower than the traders. Therefore, promulgating and implementing policies to increase the gain of farmers collecting Jiaogulan is needed.

The Government of Vietnam has issued policies on agricultural development with the following objectives: effective and sustainable agricultural development; development of high-value agricultural products; development of agricultural value chains; prioritizing the development of organic and circular agriculture. Value chain development help to increase VA of agricultural products, manage market risks, and reduce the impacts of climate change. In recent years, national agricultural policies have been promulgated including policies to encourage the development of cooperation and linkage the production and consumption of agricultural products in Vietnam (2018); the policy of renewing the agri-business activities in the period of 2021-2025 with a vision to 2030 (2021); policy on restructuring Vietnam's agricultural sector in the period of 2021 - 2025 (2021); policies on sustainable development of agriculture and rural sectors the period of 2021 - 2030, with a vision to 2050 (in 2022).

The Government of Vietnam also promulgates and implements policies to develop the value chain of medical plants for the following purposes: developing medical plants towards market-oriented production; prioritizing the development of domestically produced pharmaceutical and pharmaceutical technology; taking the advantages of precious and endemic medicinal plants with high economic value, towards the supply and competitiveness in the domestic and international markets; encourage all economic sectors to participate in

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investment and development. The most recent policies include the Law on Forestry 2017; a master plan for the development of herbal medical plants in Vietnam to 2020 with a vision to 2030 (2013); To develop the pharmaceutical and herbal medicine industry produced in Vietnam by 2030, with a vision to 2045 (2021); Vietnam's forestry development strategy for the period of 2021-2030, with a vision to 2050 (2021).

Agriculture is the key economic sector in the economy of Cao Bang province. Rare and precious medicinal plants are important natural resources of the province's agriculture. The local government has issued policies for agricultural development such as policies to support linkages in the production and consumption of agricultural products in Cao Bang province (2018); policies to support enterprises and cooperatives to invest in agriculture and rural areas in Cao Bang province (2019); smart agriculture development policy in Cao Bang province in the period of 2020 - 2025, vision to 2030 (2019); policies to support agricultural and forestry development in Cao Bang province (2020).

Based on research findings, to promote linkages among actors of the Jiaogulan value chain, there are some solutions suggested to the authorities of Cao Bang province:

- Strengthening production resources and linkage capacity for stakeholders involved in the Jiaogulan value chain: through investing in technical training for farmers on production, preliminary processing, and distribution of Jiaogulan products to improve productivity and quality product. Planning the Jiaogulan production area in the agricultural development area. Integrating the plan of the Jiaogulan production area in the socio-economic development plan of Cao Bang province to 2030, with a vision for 2050. Building an eco-label for Jiaogulan products. Expanding linkages to access market segments such as supermarkets or safe food stores.

- Developing cooperation between production and distribution: Strengthening vertical and horizontal linkages of input and output actors by legal economic contracts and binding mutual benefits. Diversify Jiaogulan distribution channels for producers, and develop these channels in a sustainable and organized manner. Promoting transparency product quality: Retailers are important actors in the connection: The retailer is an important link in the connection between the production and final consumers. Therefore, it is necessary to have complete and accurate information about the quality of the product, product source, the relationship between the previous actors, and the requirement for quality of the product, to provide consumers with the most accurate information. Besides, encourage actors who are both collectors and wholesalers to keep their roles in organizing the Jiaogulan value chain. This actor is an important bridge between the producers and other actors in the chain. Currently, the scale of these actors' activities is very large, but the trading and exchanging are still mainly based on the form of oral contracts. To better control product quality and increase product prices, this actor needs to promote transactions through commercial contracts, which are legal and binding on the responsibilities and obligations of the parties involved.

- Improve infrastructure and technical: The local government should invest in agricultural infrastructure systems such as irrigation, electricity, communication, traffic, warehouses, and markets,... Promulgating and implementing policies on infrastructure planning in Cao Bang province, policies to connect Cao Bang province with provinces in the northern mountainous region and the Red River Delta. The local government needs to issue and implement preferential policies on credit and loans for infrastructure development, agricultural technology, and the development of the herbal medicinal value chain to attract capital from the society.

- Develop an e-commerce trading platform for agricultural products: The Cao Bang government should issue and enforce a policy on developing the trademark of Jiaogulan products associated with the locality such

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as geographical indications and eco-labels. The local authorities should support both producers and consumers in accessing information about the market. Especially building a digital-based information system for actors through e-commerce agricultural product trading floors, market news updates on mass media, applications (apps) on production, and market information on mobile devices. Diversifying forms of product promotion, which connect quality with cultural and regional factors in market access. Besides, actively expanding market share, ensuring a transparent system of market information and high economic efficiency for agricultural value chains. Local government also should issue and implement policies to manage the development of local agricultural products trading e-commerce platforms to support farmers to connect with e-commerce platforms, train, and support in accessing science and technology, and the ability to pay online.

- Promoting the value chain of medicinal products: The Government of Cao Bang province should issue and implement policies to encourage cooperation development, the linkage between production and distribution stages of medicinal products, policies on land, taxes, credits, loans, etc. Creating favorable conditions for local governments, businesses, and people to participate in the conservation and development of medicinal plants, including Jiaogulan. Encourage to development of growing areas of herbal medicinal products according to principles and standards of good practice in the cultivation and collection of medicinal plants. Associating to support trading products to protect the benefits of herbal medicinal producers. Besides, the policies on registration and delivery of medicinal herb products should be a priority.

5. Conclusions

The linkages in the Jiaogulan value chain at CBGP have the common characteristics of the value chain with the participation of smallholder farmers. The research results show that the linkages in the Jiaogulan value chain are quite weak, the cooperation in production is not tight, the actors who play as leading actors, and the transparent market information system have not yet been established. The main reasons are caused by some limitations in production capacity and the development of trademarks and market access of producers. Besides, cooperative economic organizations are limited in organizing and enhancing production capacity. Producing planning is incomplete and asynchronous; information infrastructure is still weak, and especially the level of digital technology application in product consumption is still low.

To strengthen linkages in the Jiaogulan value chain, the government of Cao Bang province should issue and implement policies to strengthen production resources and linkage capacity for actors and develop various economic forms in cooperation between production and distribution. Policies to improve infrastructure and technology, development of an electronic agricultural product trading platform, and promotion of the value chain of herbal medicinal products. To maintain and develop linkage in the value chain, it is required producers and other actors involved in the value chain have recognized and assess the opportunities and challenges posed by changing consumers' preferences and markets' needs for agricultural products in different markets segments, different seasons and the ability to adapt to market fluctuations, natural disasters, and epidemics.

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