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Analysis of Potential and Value Chains as a Strategy for Developing Non-Timber Forest Products in Central Kalimantan Forests

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Abstract: Non-Timber Forest Products (NTFPs) have great potential in supporting the economy of forest communities through sustainable utilization based on local wisdom. This study aims to analyze the potential of NTFPs, identify value chains, and formulate development strategies to improve the welfare of forest communities. The study was conducted in three villages: Tuwung Village, Luwuk Kanan Village, and Sei Gohong Village in Central Kalimantan. The research method used a qualitative and quantitative approach through interviews, observations, Focus Group Discussions (FGDs), and market analysis. The development strategy analysis used SWOT. The results showed that NTFPs: rattan (Calamus spp.), stingless bee honey (Trigona sp.), and medicinal plants: bajakah (Uncaria gambir Roxb.), Dayak onion/lemba onion (Eleutherine bulbosa) are the types of NTFPs most dominantly utilized by the community, both for personal use, sale, or partly for personal use and partly for sale. However, the NTFP value chain is still weak in post-harvest aspects, processing, and market access. The SWOT analysis results show that the NTFP product development strategy falls into Quadrant IV (defensive strategy). This defensive strategy involves rationalizing activities, focusing on one or two potential superior products. Tuwung Village focuses on stingless bee honey, Luwuk Kanan Village on rattan, and Sei Gohong on medicinal plants (bajakah, Dayak onions/lemba onions). Furthermore, strengthening community capacity, improving group institutions, diversifying products, and supporting policies are key to realizing a sustainable NTFP-based economy. This study confirms that value chain development and appropriate strategies for selecting NTFP products are crucial for promoting inclusive and sustainable economic development for communities surrounding forests in Central Kalimantan.

Keywords: Defensive strategy; Flagship products; SWOT strategy; Value chain

Introduction

The forestry subsector's contribution to the National Gross Domestic Product (GDP) from timber production shows a stagnant, even declining, trend (Koulelis et al., 2023). In 2022, Finance Minister Sri Mulyani Indrawati stated that this subsector's contribution to the economy was only around 0.66% of National GDP in 2021. This figure is considered very small considering the vastness of Indonesia's tropical

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forests. Furthermore, data on current price growth in the forestry subsector also shows a downward trend, from 6.9% in 2019 to 3.1% in 2021. This indicates serious challenges to the sustainability and profitability of the timber-focused industry.

This decline is further exacerbated by unsustainable practices. Deforestation rates in Indonesia remain a serious concern. Although the government claims a decline in deforestation rates, data from various sources indicates that forest cover loss remains significant. For example, a report from Auriga Nusantara (2024) recorded 257,384 hectares of deforestation in 2023. Illegal logging practices and forest conversion for plantations and other industries continue to threaten the sustainability of timber resources.

Entering a new paradigm of forest management in Indonesia, forest benefits are prioritized not only for timber but also for other environmental services such as Non-Timber Forest Products (NTFPs), carbon stocks, and biodiversity. Furthermore, the utilization of non-timber forest products is expected to reduce pressure on forests and mitigate forest damage due to reduced tree density. Ministerial Regulation No. P35/Menhut-II/2007 defines NTFPs as biological forest products, both plant and animal, along with their derivative and cultivated products, except for wood, as a material (not wood) that is utilized for economic activities and improving community welfare. The FAO defines Non-Timber Forest Products as native biological products other than wood, taken from forests, timberlands, and trees outside forests (Amusa et al., 2024). The term NTFPs means non-timber forest products which include all biological materials other than wood that are tapped from forests for human needs (Wulandari & Sarjan, 2024).

From an economic and socio-cultural perspective, the utilization of NTFPs is the result of cultural and natural acculturation in fulfilling the basic needs of the community for food, medicine, fuel and cultural needs such as religious rituals ((Izan, 2025). Forests not only function as a provider of wood, but also store various natural resources in the form of Non-Timber Forest Products (NTFPs) which have high economic, social and ecological value. NTFPs include various products such as forest honey, rattan, resin, bamboo, forest fruits, and medicinal plants. Unlike the utilization of wood, NTFPs can be managed sustainably without damaging the forest ecosystem (Masya et al., 2025). In the context of sustainable development, NTFPs play an important role in supporting a green economy, namely an economic system that encourages growth while maintaining environmental sustainability (Muliyani et al., 2023). However, the utilization of NTFPs often faces obstacles in the form of weak value chains, limited market access, and low community capacity in product processing (Maryudi et al., 2021).

Central Kalimantan is one of the provinces in Indonesia with extensive forest areas. According to Minister of Forestry Decree No. 512/Menhut-II/2012, the forest area in Central Kalimantan is approximately 12,719,707 hectares. With such vast forest area, Central Kalimantan has a very diverse and abundant potential for non-timber forest products (NTFPs). This potential has long been an important part of the lives and economies of local communities (Paramita et al., 2018). Despite this significant potential, the utilization of NTFPs in Central Kalimantan still faces several challenges.

The utilization and conservation of NTFPs (Non-Wood Forest Products) can be a strategy for sustainable economic development for the people of Central Kalimantan. Central Kalimantan Province's mandate in the 2025-2045 Regional Long-Term Development Plan (RPJPD) is to become an international conservation center. This can be realized through the utilization of NTFPs, implementing conservation efforts while still considering the needs of local communities. In Central Kalimantan, particularly in the villages of Tuwung, Luwuk Kanan, and Sei Gohong, the potential for NTFPs is thought to be enormous, but its utilization is not yet optimal. One of the challenges faced in NTFP product development is understanding the NTFP value chain (Baguna & Kaddas, 2021; Sahidu et al., 2018). The value chain is a series of activities carried out by business actors, from inputs to producing value-added products or services (Damayanti et al., 2021). In the context of forestry or NTFPs, the value chain encompasses all activities from collection, processing, distribution, and marketing, involving various actors, from communities and entrepreneurs to end consumers (Siddik, 2023). By understanding the value chain, communities can identify potential areas for value-added enhancement, such as through further processing, brand development, or product diversification (Syofya, 2024).

Method

Research Location and Timeline

The research was conducted in three villages surrounding the forest in Central Kalimantan: Sei Gohong Village (Palangka Raya City), Luwuk Kanan Village (Katingan Regency), and Tuwung Village (Pulang Pisau Regency). The research period was April–July 2025.

Research Type

This research used a mixed-methods approach with a descriptive-analytical approach to explain and analyze

a phenomenon, focusing on describing the characteristics and relationships between variables (descriptive) and further analyzing them to understand their meaning and context (Creswell & Clark, 2017).

Research Population and Sample

The population in this study comprised communities with certain characteristics consistent with the research focus (Modjo et al., 2025), namely communities whose daily activities revolve around the forest and utilize non-timber forest products (NTFPs) as part of their daily activities and as a source of livelihood. In addition, the research population also included community leaders with knowledge, experience, and significant roles in NTFP management, as well as market actors involved in the NTFP distribution and trade chain. These populations were selected because they were considered capable of providing relevant information regarding the potential, prospects, and dynamics of NTFP development in improving the economy of communities surrounding the forest. After the population was determined, purposive sampling was conducted. The sample consisted of several groups: (1) NTFP collectors and processors, (2) community leaders who understand the socio-economic and cultural context of NTFP utilization, and (3) market actors involved in the NTFP value chain. The number of respondents per village was 25, resulting in a total of 75 respondents. This approach was taken to obtain a comprehensive perspective, encompassing NTFP production, management, and marketing aspects.

Data Collection Techniques

Data collection techniques were carried out using the following methods (Creswell & Creswell, 2018; Emon, 2024; Sugiyono, 2016). Structured interviews and focus group discussions (FGDs) with the community, NTFP business actors, and stakeholders; Field observations to identify potential NTFP types; Questionnaires to determine the NTFP value chain in the community economy; and Market analysis through studies of prices, distribution chains, and product prospects.

Data Analysis

In this study, data validity is crucial to ensure that the information collected reflects the reality on the ground. To test validity, the validity coefficient value formula (Fraenkel et al., 2019) was used as follows Formula 1.

$$r_{xy} = \frac{n(\sum x_i y_i) - (\sum x_i)(\sum y_i)}{\sqrt{\left(n(\sum x_i^2) - (x_i^2)^2\right)\left(n(\sum y_i^2) - (y_i^2)^2\right)}} \quad (1)$$

r_{xy} = correlation coefficient
n = number of respondents
x_i = score of each item on the instrument
y_i = score of each item on the criteria

Meanwhile, reliability testing is conducted to assess the consistency and reliability of the measurements. Reliability testing using Cronbach's alpha is performed on instruments with more than one correct answer (Adamson & Prion, 2013). The formula for the Cronbach's alpha reliability coefficient is as follows Formula 2.

$$r_i \frac{k}{(k-1)}\left\{1 - \frac{\sum s_i^2}{s_t^2}\right\} \quad (2)$$

r_i = Cronbach's Alpha reliability coefficient
k = number of test items
$\sum s_i^2$ = the sum of the variances of each item's scores
s_t^2 = total variance

Item variance and total variance Formulas 3.

$$s_i^2 = \frac{JKi}{n} - \frac{JKs}{n^2} \quad (3)$$

$$s_i^2 = \frac{\sum X_t^2}{n} - \frac{(\sum X_t)^2}{n} \quad (4)$$

s_i^2 = variance of each item
JKi = sum of the squares of all item scores
JKs = sum of squares of subjects
n = number of respondents
s_t^2 = total variance
X_t = total score

Once the data is confirmed to be valid and reliable, it can be further analyzed to generate robust recommendations for developing the NTFP value chain. The data was analyzed using: Descriptive analysis to explain, summarize, and illustrate the existing data for easier understanding; Value chain analysis (VOC) was conducted to map the NTFP flow from collection, processing, distribution, and marketing; and SWOT analysis is a technique used to evaluate strengths, weaknesses, opportunities, and threats to design strategies and make informed decisions.

Results and Discussion

Validity and Reliability Test

This test was conducted on all interview sections, covering four main areas: (1) NTFP potential and prospects, (2) market and marketing opportunities, (3) MSME capacity needs, and (4) NTFP development strategies. The results of the validity and reliability tests are shown in Table 1.

Table 1 indicates that all interview sections had a high to very high level of validity. This means that the questions and answers provided by the respondents were meaningfully aligned with the context and objectives of the study. The validity of the questionnaire for analyzing NTFP governance was tested. Similarly, reliability testing demonstrated that the interview data obtained was consistent and reliable for further analysis, based on thematic analysis of the interview results to achieve the research objectives. Further thematic analysis can be conducted if it meets the criteria of credibility, transferability, dependability, and confirmability (Nowell et al., 2017).

Table 1. Validity and Reliability Test Scores from Interview Results with Respondents

Question Types	Scores			
	Validity Test	Interpretation	Reliability Test	Interpretation
NTFP Potential and Prospects (10 items)	0.950	Very high validity	0.950	Very consistent
Market and Marketing Opportunities	0.875	High validity	0.850	Quite consistent
MSME Capacity Needs	0.875	High validity	0.800	Quite consistent
Development Strategy	0.900	Very high validity	0.850	Quite consistent

NTFP Potential

Based on the data analysis, it was found that the dominant NTFP types utilized by communities around the forest in three villages: Sei Gohong, Luwuk Kanan, and Tuwung were 12 types, including rattan, forest honey/kelulut honey, and medicinal plants (bajakah, Dayak onion/lemba onion). However, the distribution of NTFP types utilized varies from village to village. For example, in Luwuk Kanan Village, the dominant NTFP types utilized are rattan, stingless bee honey, agarwood, resin, and medicinal plants (bajakah, shallots/Dayak onions). In Sei Gohong, the dominant types are medicinal plants (bajakah, shallots/Dayak onions), and in Tuwung, the dominant types are rattan, medicinal plants (bajakah, shallots/Dayak onions), and pandan leaves. The distribution of Non-Timber Forest Products utilized by the community, based on interviews with respondents and field surveys, is detailed in Table 2.

Table 2. Distribution of Non-Timber Forest Products Utilized Based on Interviews with Respondents

Types of Non-Wood Crops	Number of Village Respondents (people)			Total Respondents
	Luwuk Kanan	Sei Gohong	Tuwung	
Rattan	8	5	9	22
Bajakah	2	13	2	19
Kelulut Honey	5	2	10	17
Bawang Lemba	2	16	5	20
Medicinal Plants	3	14	3	20
Fern Root	10	0	0	10
Masisin	2	6	0	8
Taro	2	1	0	3
Pandan Leaves	0	0	7	7
Agarwood	3	0	0	3
Resin	3	0	0	3
Puri Leaves/Kratom	0	0	2	2

Table 3. NTFP Utilization Based on Community Needs

Types of Non-Wood Products	Saved (people)	For sale (people)	Processed by myself/some sold (by other people)
Rattan	2	16	5
Bajakah	4	3	12
Kelulut Honey	2	10	5
Bawang Lemba	3	13	4
Medicinal Plants (Other)	3	12	5
Fern Root	10	0	0
Masisin	8	0	0
Taro	3	0	0
Pandanus Leaves	3	1	3
Agarwood	0	3	0
Resin	0	3	0
Puri/Kratom Leaves	0	2	0
Total	39	61	36

Utilization of NTFPs based on community needs is divided into: personal use, sale, some for personal use, and some for sale. NTFP utilization can be classified as: direct consumption, sale, or a combination. More details on NTFP utilization based on community needs are provided in Table 3.

Table 3 informs that the most common use of NTFPs is for sale. This indicates that NTFPs serve as a source of household income. NTFPs also have cultural and ecological value. Cultural values from NTFP utilization include: identity, local knowledge, arts and crafts (Pandey et al., 2016). Meanwhile, ecological value can be seen from the utilization of NTFPs, which is often accompanied by the principles of balance and sustainability (Shackleton et al., 2015). This is an important cultural value that forests are not only an economic resource, but also a heritage that must be preserved for future generations. As an identity, NTFP products are often associated with traditional practices and the identity of a community. For example, the use of rattan, bamboo, or purun in weaving and handicrafts with distinctive motifs that reflect the cultural identity of the Dayak people. As local knowledge, communities possess inherited knowledge about harvest times, processing techniques, and the use of NTFPs to support sustainability. This knowledge is part of local wisdom passed down across generations.

Field surveys show a high level of sustainability in the potential of NTFPs. Rattan, Dayak onions/lemba onions, and stingless bee honey can already be cultivated. While bajakah and other medicinal plants are still obtained from the forest, the community applies regulations in their collection to ensure sustainability. Communities recognize that the existence of the forest ensures the availability of bajakah and other medicinal plants to support their family's livelihood, and therefore participate in forest conservation.

NTFP Value Chain

The NTFP value chain describes the entire process, from harvesting/collecting, processing, to marketing the product to the end consumer. The NTFP value chain is necessary to identify critical points of added value for NTFPs. In the study area of Sei Gohong, Luwuk Kanan, and Tuwung villages, the NTFP value chain is still simple, with most people harvesting/collecting NTFPs for their own consumption or selling directly to local collectors. The NTFP utilization value chain by the community can be explained from producers (farmers/collectors) to the market, including direct consumption, sales through informal and formal channels, and processing for added value.

Most NTFPs (non-timber forest products) have not yet progressed through the processing stage due to a lack of appropriate technology and human resource capacity. Commodities such as rattan, stingless bee honey, and medicinal plants (bajakah, Dayak onions/lemba onions) demonstrate a fairly active flow of goods, but most transactions are still conducted informally without clear price standards. Interviews with farmer collectors revealed that prices are largely determined by collectors, as transactions are conducted individually rather than within farmer groups/cooperatives. Furthermore, the distribution chain and value-added are suboptimal, including at the processing and marketing stages, creating a gap between production and market integration.

According to Porter's value chain concept, every activity in the production chain can create added value if managed efficiently and innovatively (Chyi Lee & Yang, 2000). The NTFP Value Chain is necessary to identify critical points of NTFP value-added. In the context of NTFP products, the value chain consists of five main stages: production (harvesting/collection), collection, processing, distribution, and marketing. However, in the field, most NTFPs (non-timber forest products) have not yet progressed to the processing stage due to a lack of appropriate technology and human resource capacity. Commodities such as rattan, stingless bee honey, and medicinal plants (bajakah, Dayak onions/lemba onions) show a fairly active flow of goods, but most transactions are still conducted informally without clear price standards. This situation indicates that the distribution chain and value-added are not yet optimal, particularly at the processing and marketing stages, resulting in a gap between production and market integration. This results in NTFP products being sold only in their raw form at relatively low prices. For example, bajakah and lemba onions, which have potential value as raw materials for herbal medicines, are only sold in limited quantities without quality and packaging standards, requiring interventions throughout the value chain to achieve added value (Shackleton et al., 2015).

Nevertheless, opportunities for developing the NTFP value chain remain wide open. Communities have shown significant interest in processing products such as packaged stingless bee honey, rattan crafts, and medicinal plant packaging. This can be strengthened through training, the provision of production facilities, and the development of local and online marketing networks. A participatory approach is crucial in building an inclusive and sustainable NTFP value chain. By strengthening community-based institutions, integrating NTFPs into the local tourism sector, and supporting policies from local governments, the NTFP value chain has the potential to not only increase

community income but also maintain forest sustainability.

NTFP Product Development Strategy

The development of Non-Timber Forest Products (NTFPs) in the study area requires an appropriate approach to provide optimal benefits to the community while preserving the forest ecosystem. In this context, the use of Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis is very important as a basis for strategic decision-making (David et al., 2019; Yudha & Pancasakti, 2022). SWOT not only helps in formulating NTFP development methods that are appropriate to local conditions, but also ensures that the chosen strategy is adaptive, based on real potential, and able to minimize potential risks (Phadermrod et al., 2019). The results of the SWOT analysis based on interviews, questionnaires and focus group discussions (FGD) obtained an internal factor evaluation (IFE) matrix including: strengths and weaknesses, and an external factor evaluation (EFE) matrix including: opportunities and threats (Banihashemi & Rejaei, 2016). The results of the IFE and EFE matrices in the study area are as shown in Table 4.

Table 4. IFE and EFE Matrices

Internal Factors	Weight	Rating	Weighted x Rating
Strengths			
1. Availability of diverse and abundant NTFPs	0.10	4	0.40
2. Local knowledge of NTFPs	0.08	3	0.24
3. Community interest and enthusiasm for entrepreneurship	0.07	3	0.21
4. NTFP products are well-known in the local market	0.06	3	0.18
5. Availability of land and access to forests	0.06	2	0.12
Weaknesses			
6. Weak product processing and packaging capabilities	0.12	2	0.24
7. Lack of business institutions (cooperatives, business groups)	0.12	1	0.12
8. Low digital literacy for marketing	0.10	2	0.20
9. Dependence on collectors	0.10	2	0.20
10. Lack of technical and entrepreneurial training	0.09	1	0.09
Total	1.00		2.00
External Factors			
Opportunities			
1. Increasing market demand for natural and herbal products	0.10	4	0.40
2. Program support from the government and partners (NGOs, universities)	0.10	3	0.30
3. Digital marketing trends	0.08	3	0.24
4. Potential added value from product processing and certification	0.07	3	0.21
5. Potential partnerships with cooperatives or village-owned enterprises	0.05	3	0.15
Threats			
1. Dependence on collectors	0.10	2	0.20
2. Price fluctuations and uncertainty Market	0.10	2	0.20
3. Challenges in licensing and legality of NTFP businesses	0.10	2	0.20
4. Competition from products from outside the region	0.08	2	0.16
5. Potential for unsustainable NTFP exploitation	0.12	1	0.12
Total	1.00		2.18

Figure 1. Position of HHBK Development Strategy based on the SWOT Quadrant

An IFE score of 2.00 indicates that an organization or community is relatively weak in leveraging internal strengths. Addressing these weaknesses requires strengthening internal capacity, particularly institutional and technical skills. Meanwhile, an EFE score of 2.18 indicates that external opportunities are quite strong, but have not been optimally addressed. Development strategies need to be directed toward maximizing external opportunities.

To determine the SWOT quadrant position, the scores are then mapped onto the SWOT Matrix (quadrant 4 cells). The total weighted score for the IFE is 2.00 and the EFE is 2.18. The values for the X and Y axes are as follows: X-Axis Value (IFE): Total IFE Weighted

Score = 2.00, therefore the X-Axis value = 2.00 – 2.50 = -0.50 (negative); Y-Axis Value (EFE): Total EFE Weighted Score = 2.18, therefore the Y-Axis value = 2.18 – 2.50 = -0.32 (negative). Based on the X and Y-axis values, the SWOT Matrix (4 quadrants) is positioned in Quadrant IV (defensive strategy), as shown in Figure 1.

The NTFP product development strategy indicates a strategic position in Quadrant IV. Therefore, the most appropriate approach is a defensive strategy. This means that internal conditions are weak (low IFE score), while external conditions present many threats and few opportunities (also low EFE score). This position indicates that the organization or community needs to defend itself, minimize risks, and avoid further losses. Strategies appropriate for Quadrant IV (Defensive).

Rationalization of Activities (Low Scale of Operations):

Reducing inefficient or impactless activities; Focusing only on core programs or areas that still have strategic value. Example: Reducing NTFP types that have no market value and focusing on one or two potential superior products. In this case, the potentially valuable products are rattan in Luwuk Kanan village, medicinal plants such as Bawang Lemba/Dayak Bawang in Sei Gohong, and Kelulut honey in Tuwung village.

Strategic Alliances

Building partnerships with other institutions (NGOs, universities, government, and the private sector) to address internal weaknesses. Example: Partnering with supporting institutions for training and market access for NTFPs.

Minimal Product Diversification Based on Existing Assets

Leveraging existing resources to develop new products that do not require significant new investment. Example: Processing NTFPs into simple value-added products such as mini-packaged stingless bee honey or herbal tea.

Internal Capacity and Governance Improvement

Focus on improving group management, providing basic training, strengthening local institutions, and increasing community motivation. Example: Basic accounting training for NTFP groups, or establishing village cooperatives.

Asset Protection

Maintaining and securing existing resources to prevent further degradation or loss. Example: Protecting forest areas from fire or conversion, even if they cannot yet be optimally developed.

Strengthening Local Advocacy and Regulation

If the threat is external (such as overlapping permits or pressure from external parties), defensive strategies can also include advocacy efforts and regulatory reform. Example: Conducting participatory mapping of community-managed areas to strengthen legitimacy.

Conclusion

Non-timber forest products (NTFPs) have significant potential to improve the economy of forest-dwelling communities in Central Kalimantan while supporting forest sustainability. However, the NTFP value chain remains weak in post-harvest, processing, and market access. With proper value chain development, NTFPs can contribute significantly to community welfare and forest sustainability. The NTFP product development strategy, based on a SWOT analysis, falls into quadrant IV, or Defensive Strategy. A Defensive Strategy requires rationalization of activities by eliminating NTFP types with low market value and focusing on one or two potential superior products. Tuwung Village focuses on stingless bee honey, Luwuk Kanan Village focuses on rattan, and Sei Gohong Village focuses on medicinal plants (bajakah, Dayak onions/lemba onions). The NTFP product development strategy also needs to focus on strengthening community institutions, increasing processing capacity and product innovation, utilizing digital markets, and supporting regional regulations and policies. With these steps, NTFPs can provide greater added value, improve the welfare of communities surrounding forests in an inclusive manner, while simultaneously maintaining forest sustainability as a long-term ecological asset.

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Author Contributions

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Conflict of Interest

The authors have declared that there is no conflict of interest regarding the publication of this paper.

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