

COMPETITIVENESS OF PERUM PERHUTANI CAJUPUT OIL IN ACHIEVING SUSTAINABLE DEVELOPMENT GOALS IN THE FORESTRY SECTOR

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COMPETITIVENESS OF PERUM PERHUTANI CAJUPUT OIL IN ACHIEVING SUSTAINABLE DEVELOPMENT GOALS IN THE FORESTRY SECTOR. Cajuput (*Melaleuca cajuputi*) oil is one of the products developed under Perum Perhutani's Multipurpose Forestry Business. Developing the cajuput oil business remains a challenge; efforts must continue to build both competitive and comparative advantages and to increase revenue. The aim of this research is to analyze the competitiveness of Perum Perhutani's cajuput oil business which can be managed in accordance with the concept of sustainable development goals in the Forestry Sector. In doing this, we use Resources Based Value (RBV) and Value, Rarity, Imitability, and Organization (VRIO) analysis to evaluate the competitive resources of cajuput oil business. SmartPLS was used to test the influence on achieving the Sustainable Development Goals (SDGs). The results show Perum Perhutani has sustainable competitive advantages, namely the quality of its cajuput oil plant seeds, the ability to achieve supply chain certification, and the ability to produce good quality products sustainably. In running the cajuput oil business, Perum Perhutani experiences a significant impact from applying SDG values, which manifest as both economic and ecological benefits. Perhutani's cajuput oil products are more competitive than those of other domestic producers, but less competitive when compared to imported eucalyptus oil products in the global market.

Keywords: forest village communities, multipurpose forestry business, Partial Least Square (PLS), Resources Based View (RBV), Value Rarity Inimitability and Organization (VRIO).

DAYA SAING MINYAK KAYU PUTIH PERUM PERHUTANI DALAM MENCAPAI TUJUAN PEMBANGUNAN BERKELANJUTAN DI SEKTOR KEHUTANAN. Minyak kayu putih (Melaleuca cajuputi) merupakan salah satu bisnis multi usaha kehutanan Perum Perhutani. Pengembangan model bisnis komoditas minyak kayu putih menjadi tantangan untuk dapat terus dikembangkan agar memiliki keunggulan kompetitif dan komparatif dalam rangka meningkatkan pendapatan. Tujuan dari penelitian ini adalah untuk menganalisis daya saing bisnis minyak cajuput Perum Perhutani yang dapat dikelola sesuai dengan konsep tujuan pembangunan berkelanjutan di Sektor Kehutanan. Dalam melakukan hal ini, kami menggunakan analisis Resources Based Value (RBV) dan Value, Rarity, Imitability, and Organization (VRIO) untuk mengevaluasi daya saing bisnis minyak cajuput. SmartPLS digunakan untuk menguji pengaruhnya terhadap pencapaian Tujuan Pembangunan Berkelanjutan (Sustainable Development Goals/SDGs). Hasil penelitian menunjukkan Perum Perhutani memiliki keunggulan kompetitif yang berkelanjutan, yaitu kualitas bibit tanaman minyak kayu putih Perum Perhutani, kemampuan meraih sertifikasi rantai pasok, dan kemampuan menghasilkan produk yang berkualitas secara berkelanjutan. Dalam menjalankan bisnis minyak kayu putih, Perum Perhutani mendapatkan pengaruh nyata dari penerapan nilai-nilai SDGs berupa nilai ekonomi dan nilai ekologi. Produk minyak kayu putih Perhutani di pasar domestik memiliki daya saing yang tinggi, namun di pasar global memiliki daya saing yang rendah dibandingkan dengan produk Ekaliptus impor.

Kata kunci: masyarakat desa butan, multi-usaha kehutanan, Partial Least Square (PLS), Resources Based View (RBV), Value Rarity Inimitability and Organization (VRIO)

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I. INTRODUCTION

The existence of forests is deeply intertwined with human life due to their three essential functions: ecological, social, and economic. Utilizing a multi-product approach presents an appropriate solution for maintaining forest sustainability, as it distributes the ecological production process more evenly and lightly. Current forest management planning is designed to provide dual benefits to communities, enhance ecosystem resilience, improve water yield, protect against soil erosion, conserve biodiversity, promote tree growth and strength, and address the risk of natural disturbances (Baskent, 2018). In Indonesia, this complex approach to managing forest resource is referred to as MUK (Multi Usaha Kehutanan/multipurpose forestry business).

The execution of MUK management activities is in accordances with the Sustainable Development Goals (SDGs). The SDGs aim to promote development that fosters sustainable growth through human rights and equality, while advancing social, economic, and environmental purposes (BAPPENAS, 2020). According to Ma et al. (2022), the SDGs benefit from ecosystem protection, restoration, and the sustainable use of forests, where the level of forest ecosystem service provision is key to supporting the SDGs. Indonesia has established an SDG Transition Secretariat within the Ministry of National Development Planning, categorizing the goals, targets, and indicators of the SDGs into social, economic, environmental, as well as legal and institutional governance pillars (Bastos-Lima et al., 2017). This study highlights how sustainable forestry practices can also drive

economic competitiveness, especially through high-value products like cajuput oil that bridge environmental goals with market opportunities.

Competitiveness is all about how well a company can excel and stay ahead of its competitors. This involves using strategic advantages and managing resources effectively to achieve outstanding performance. That company success can come from either being the low-cost leader or offering something unique and valuable (Porter, 2011). Additionally, the Resource-Based View (RBV) emphasizes the importance of having rare and valuable resources (Barney, 1991). When applied to specific industries, these theories can shed light on how products like cajuput oil are making waves. Derived from the *Melaleuca cajuputi* tree, cajuput oil is gaining popularity due to its unique therapeutic benefits and versatility. Its rising prominence in health and wellness shows how specialized products can leverage their distinct features to stand out and succeed in a competitive market.

One of the companies that has the authority and capability to manage and ensure the implementation of MUK activities in a balanced manner is Perum Perhutani. According to Sianturi (2006), Perum Perhutani, as the operator of forest management activities, must be able to fulfill four essential elements: utilization, rehabilitation, protection, and conservation, in a balanced manner. Cajuput oil is one of Perum Perhutani's products with the potential to significantly contribute to both regional and national economic growth. Table 1 presents the cajuput oil production data of Perum Perhutani.

Tabel 1. Perhutani cajuput oil production data 2019-2023

Year	Production (tons)	Sales (tons)	Domestic Sales (IDR)	Overseas Sales
2019	325	322	85,556,000,000	-
2020	309	309	88,431,000,000	-
2021	346	323	98,996,000,000	-
2022	327	63	17,831,000,000	-
2023	181	33	7,120,000,000	-

Source: Perum Perhutani Annual Report 2019-2023

The production of cajuput oil at Perhutani has decreased, particularly over the past two years, and has not yet be exported (Table 1). Rimbawanto et al. (2017) stated that the current domestic demand for cajuput oil is around 3,500 tons per year. Indonesia is only able to produce less than 500 tons per year, in which 30% of this amount supplied by Perhutani. This indicates that Perhutani plays a significant role in meeting the national demand for cajuput oil. Due to the supply-demand gap, Indonesia still imports eucalyptus oil to fulfill industrial needs.

Eucalyptus oil imports come from China, the United States, and Brazil, with China's import volume being the largest. The data on the realized eucalyptus oil imports from China to Indonesia are shown in Table 2. In 2019, 2020, 2021, 2022, and 2023, Indonesia imported 5.807 tons, 3.583 tons, 4.269 tons, 4.671 tons, and 3.766 tons, respectively, from China. The import amounted to \$ 53.236.400 (2019), \$ 47.255.966 (2020), \$ 51.937.715 (2021), \$ 54.188.137 (2022), and \$ 31.693.394 (2023), with a total exceeding \$ 240 million by the end of 2023. This situation is considered detrimental, as not only does it drain national foreign exchange reserves, but consumers also do not receive pure cajuput oil, which is a non-timber forest product (NTFP) that has a comparative advantage and is closely associated with forest-dependent communities (Rimbawanto et al., 2018).

According to Nilsson et al. (2016), promoting the sustainability of forestry, forests, and forest landscapes within the evolving bioeconomy is challenging due to the numerous high-level targets that are real, potentially conflicting, and sometimes divergent, as reflected in the SDGs. The design of a business in the agricultural sector has been widely carried out by researchers, including in the context of forestry production, and some of this has been researched in the Perhutani work area. Research on Timber Forest Product (TFP) and Non-Timber Forest Product (NTFP) business (Wijayanto et al., 2014), Jati Perhutani (Yanuarti et al., 2019), pine forest environmental services (Endratno et al., 2021), as well as cajuput oil products (Saptenno et al., 2022; Uktolseya et al., 2014; Octavia, 2019). The researcher's search indicates limited research on business for cajuput oil commodities.. Research on cajuput commodities is in the form of business feasibility analysis (Saptenno et al., 2022), production processes (Uktolseya et al., 2014), and cajuput oil business (Octavia, 2019). Research on cajuput business in Octavia's research (2019) which uses the BMC model approach is limited to local areas in Maluku and has not linked the design of cajuput business in order to achieve SDGs.No research has yet been found that examines the cajuput business on a broader scale and further from each indicator of the business model.. The development of the cajuput oil commodity business presents a challenge to continuously improve its

Tabel 2. Import realization of eucalyptus oil (HS 33012910) from China in 2019-2023

Year	Volume (tons)	Total Import Value (IDR)	Total Import Value (US\$)
2019	5,807	752,261,386,566.67	53,236.400
2020	3,583	691,130,316,741.50	47,255.966
2021	4,269	745,042,193,532.08	51,937.715
2022	4,671	808,310,892,594.75	54,188.137
2023	3,766	482,333,839,937.50	31,693.394

Source: Indonesia Ministry of Trade 2019-2023

competitive and comparative advantage to increase the revenues of Perum Perhutani and the national income within the SDGs framework. Economic value, environmental value, social value, and institutional value are groups of SDGs values that can be considered in developing the sustainability of a business (Setianingsih et al., 2019; Rizky & Mashur, 2022). This study aims to analyzing the optimal key resources of Perum Perhutani's cajuput oil business, identifying which SDGs value factors influence the development strategy of Perum Perhutani's cajuput oil business.

II. MATERIAL AND METHOD

A. Time and Location

The research was conducted in August 2023. The study took place in five Forest Management Units (FMU) in Perum Perhutani. The selection of five FMU was based on indicators: a) representation of work units/FMU that have already developed the potential for cajuput oil commodity (FMU Madiun); b) representation of work units/FMU with cajuput oil potential still in the development process (FMU Tuban); c) representation of work units/FMU with limited cajuput oil potential but already developed (FMU Saradan); d) representation of work units/FMU with limited potential for cajuput oil and still in the development process (FMU Sukabumi); and e) representation of

work units/FMU with very limited cajuput oil potential that has not yet been developed (FMU Pematang).

B. Data Collection

The data used in this study consists of both primary and secondary data. Primary data were collected through measurements and observations, questionnaires, structured interviews, Focus Group Discussion (FGD), and in-depth interviews with key informants using the snowball sampling method for resources and capabilities of Perhutani Cajuput oil. Meanwhile, to test the influence of SDGs on the cajuput oil business model Perum Perhutani used purposive sampling. Secondary data were gathered through the documentation of reports and data from relevant agencies, including Perum Perhutani, as well as supporting data related to the research found in the literature. Data validation was conducted using triangulation techniques. This research employs triangulation techniques for data collection by: (1) Comparing data from researchers and interviews; (2) Researchers compare data with what people say and what they personally say; (3) Researchers compare several data points from MKP Perhutani with those from other companies; (4) Researchers compare interview results regarding MKP Perhutani's internal resources with the contents of documents. Table 3 presents the main variables and data sources collected in this study.

Table 3. Variables and data sources collected

Variables	Indicators	Data Resources	Methods
Resources and capabilities of Perhutani Cajuput oil company	-Tangible resources -Intangible resources -Human resources -Capability	Researcher Observation and Interview of Cajuput oil Business Manager of Perum Perhutani	RBV & VRIO Barney, (1991)
SDGs value on Cajuput oil forestry business management in Perhutani	-Economic value -Social value -Environmental value, -Institutional value	Questionnaire with Cajuput oil Business Manager of Perum Perhutani Region, Farmers and Community Leaders	SEM - <i>PLS Analysis</i> (Ghozali, 2008)

Table 4. VRIO analysis framework for resources

Valuable (V)	Rare (R)	Inimitable (I)	Organization (O)	Implication
No (0)	No (0)	No (0)	No (0)	Competitive disadvantage
Yes (1)	No (0)	No (0)	Yes (1)	Balanced competitive
Yes (1)	Yes (1)	No (0)	Yes (1)	Temporary competitive advantage
Yes (1)	Yes (1)	Yes (1)	Yes (1)	Sustainable competitive advantage

C. Analysis

1) Resource Based View (RBV) and Valuable, Rarity, Imitability, Organization (VRIO)

RBV approach was used to evaluate the resources and competitive strategies of Perhutani's cajuput oil business including tangible and intangible resources. Tangible resources consist of cajuput silviculture and adequate infrastructure. Intangible resources include the quality of cajuput seedlings, the use of advanced technology, and the strategic location of the factory. According to Pearce and Robinson (2005), resources are divided into three categories: (1) tangible assets, which are the physical and financial tools used by a company to create value for customers; (2) intangible assets, which are invisible but often critical to achieving a competitive advantage; (3) organizational capabilities, which combine assets, people, and processes to transform inputs into outputs. This study incorporates these variables based on Pearce & Robinson, (2005) which are modified by adding a human resources variable was added as an asset to achieve competitive advantages. Human resources include the number of personnel, employee management, and a comfortable work environment. Organizational capabilities include the speed of sending and receiving raw materials, factory capacity, the ability to address current issues, warehouse capability, customer handling, product quality control, and human resource development.

Value, Rarity, Imitability, and Organization (VRIO) framework helps businesses determine whether their resources are not only valuable but also unique, hard for others to imitate, and

well-managed to take full advantage of them. By evaluating resources through these lenses, companies can identify which assets are their strongest and how to use them effectively to stay ahead in the market and maintain a lasting competitive edge. The VRIO framework was applied to identify whether Perhutani's resources for the cajuput oil business represent weaknesses or strengths. The VRIO analysis framework is presented in Table 4.

2) Structural Equation Modeling (SEM) Analysis with Partial Least Square (PLS) Approach

PLS model analysis was conducted to assess the impact of Perhutani's cajuput oil business in relation to the SDGs in the forestry sector. The PLS model consists of two stages: the evaluation of the measurement model (outer model) and the evaluation of the structural model (inner model). The measurement model evaluation explains the relationship between the observed variable indicators, while the structural model evaluation explains the relationships between latent variables.

The number of respondents in this study was 362 respondents based on representation from five research locations: FMU Pematang, Sukabumi, Saradan, Tuban, and Madiun. The minimum sample size for PLS-SEM should be equal to or greater than ten times the number of the largest formative indicators used to measure a single construct (Hair et al., 2011). According to Hair et al. (2011) the minimum number of respondents in this study was 60 people. respondents

The variables used in this study consist

of latent variables and their corresponding indicators. In this research, the structural equation model was built to analyze how the latent variables (X) related to forestry—specifically, four out of the 17 SDGs latent variables—impact the field: economic value (X1), social value (X2), environmental value (X3), and institutional value (X4). The dependent variable (Y) was constructed based on competitiveness, consisting of Customer Segments (Y1), Value Propositions (Y2), Channels (Y3), Customer Relationships (Y4), Revenue Streams (Y5), Key Resources (Y6), Key Activities (Y7), Key Partnerships (Y8), and Cost Structure (Y9) (Government Regulations No: 59 2017; Presidential Decree No: 111 2022; Setianingsih et al., 2019; Rizky & Mashur, 2022).

a) Evaluation of measurement model (Outer model)

The measurement model is used to test the validity of variables and the reliability of indicators. Validity testing is carried out to determine the ability of research indicators to measure what should be measured. Convergent validity testing can be seen from the loading factor value and Average Variance Extrated (AVE). An indicator can be said to meet validity if the outer loading value is > 0.5. The AVE is considered sufficient if the correlation is between 0.5 and 0.6, and it is deemed high if the loading factor value exceeds 0.7(Ghozali 2008). The next validity test that can be used is discriminant validity. Discriminant validity is assessed based on the squared correlation value between the construct pairs. According

to Ghozali (2008) the cross loading value for each variable must be > 0.70. Reliability testing can be carried out using the cronbach alpha and composite reliability criteria. A construct is declared reliable if the composite reliability has a minimum value of > 0.60 (Ghozali, 2008).

b) Structural model evaluation (Inner model)

Ghozali (2008) divides the R2 value into three categories, namely R2 value> 0.67 is categorized as a good model, 0.32 <R2 <0.66 is categorized as a moderate model and R2 <0.19 32 is categorized as a weak model. In addition, in the evaluation of the structural model, hypothesis testing (resampling bootstrapping) is also carried out. Hypothesis testing is carried out to see the significance between variables in the structural model. The statistical test used is the t-test. The hypothesis is accepted if the t-statistic value is greater than the t-table value with an alpha of 5%.

III. RESULT AND DISCUSSION

A. Key Resource Assessment of Perum Perhutani's Cajuput Oil Business

Based on the RBV analysis using the VRIO model and data collection through interviews, the results indicate that Perum Perhutani's cajuput oil business has advantages in several resources (Table 5). The competitors considered in the VRIO analysis are domestic competitors involved in cajuput oil production, namely cajuput oil from Maluku Province (Buru Island) and cajuput oil from Yogyakarta Forestry Service.

Table 5. VRIO Analysis Framework of Perhutani Cajuput oil with Domestic Cajuput oil

Resources	Description	V	R	I	O	Category
Tangible Resources	Production Facility					
	Cajuput oil production facilities	1	1	0	1	Temporary competitive advantage
Intangible Resources	Plant seed quality of Cajuput oil	1	1	1	1	Sustainable competitive advantage

Resources	Description	V	R	I	O	Category
Capability	Factory capability					
	Ability to produce good quality products	1	1	1	1	Sustainable competitive advantage
	Warehouse capability					
	Ability to maintain quality and quantity during storage	1	1	0	1	Temporary competitive advantage
	Product quality control					
	Ability to achieve supply chain certification	1	1	1	1	Sustainable competitive advantage
	Product quality control capability	1	1	0	1	Temporary competitive advantage
	Human resources improvement capability					
Ability to improve employee competence	1	1	0	1	Temporary competitive advantage	

A value of '1' for Value (V) indicates that the resource at Perum Perhutani is a 'valuable resource.' A value of '1' for Rareness (R) indicates that the resource at Perum Perhutani is a 'rare resource.' A value of '1' for Imitability (I) indicates that the resource at Perum Perhutani is 'a resource that cannot be perfectly imitated by competitors.' A value of '1' for Organization (O) indicates that the resource at Perum Perhutani represents 'organizational capabilities in managing resources to maximize their potential.' Meanwhile, a value of '0' indicates that Perum Perhutani lacks this attribute.

Based on data from the RBV & VRIO analysis, without looking at the declining state of Perum Perhutani's Cajuput oil, in fact Perum Perhutani's cajuput oil are three indicators showing 'sustainable competitive advantage' namely (1) the quality of Perum Perhutani's cajuput oil seedlings, (2) the ability to achieve supply chain certification, and (3) the ability to produce high-quality products. Currently, efforts to increase cajuput oil production at

Perum Perhutani are being carried out through intensification (breeding cajuput plants to produce superior seeds) and extensification (expansion of cajuput plantations). The superior clones of cajuput oil seedlings—Clones 13, 39, and 71—are closely related to producing high-quality yields. This gives Perum Perhutani's cajuput oil business an advantage because it has superior seedlings that can be propagated by the company itself. These superior cajuput seedlings have better yields and a higher 1,8-cineole content (Prastyono et al., 2020). Cajuput oil production is a function of leaf production and oil yield. According to Prastyono et al. (2020), the larger the leaf production and the higher the oil yield from the leaves, the greater the oil production from the cajuput plants. Perum Perhutani's supply chain management capabilities are a competitive advantage for the cajuput oil business.

Cajuput leaves are harvested from cajuput plantations and transported to the cajuput oil factory for distillation, serving as the raw material

for cajuput oil production. The cajuput oil is then stored at the cajuput oil factory warehouse for further processing and packaging. The capacity of each supplier and processor, the trucks for transportation, and the cost components of each operation in Perum Perhutani's cajuput oil business are carefully considered. According to Prastyono et al. (2020), the largest component of supply chain costs in the cajuput oil business in Rimbajaya Village, East Biak, is labor wages and firewood purchases for distillation, which account for 86% of the total costs. Meanwhile, Perum Perhutani is currently able to reduce distillation fuel costs by using briquettes made from dry cajuput leaf waste as a competitive advantage.

On the other hand, there are 'temporary competitive advantages' in four indicators namely (1) Perum Perhutani's cajuput oil production facilities, (2) the ability to maintain quality and quantity during storage, (3) the ability to supervise product quality, and (4) the ability to improve employee competencies. The company's capability to manage its business effectively is a factor that enhances quality and competitiveness. Perum Perhutani's capabilities in this regard are valuable resources that contribute to optimal quality (Table 8). Resources related to human resources and all other detailed indicators show 'balanced competition' when competing in the domestic market with cajuput oil Yogyakarta Forestry Service and cajuput oil Buru Island. So that cajuput oil Perhutani has good competitiveness, especially for the domestic market, but it has been destroyed

by the low price of eucalyptus oil imports. If these conditions are not addressed, consumer preferences may shift toward eucalyptus oil in the long term. However, developing the cajuput oil industry is actually more efficient in terms of foreign exchange, and more beneficial socially and environmentally.

B. SDGs Value Factors in the Development of Perum Perhutani's Cajuput Oil Business Model

1) Evaluation of the Reflective Measurement Model

The loading factor value for all indicators is considered valid if it is greater than 0.7, and the AVE value is acceptable if each construct has a value greater than 0.5 (Avkiran & Ringle, 2018). An AVE value greater than 0.5 means that 50% or more of the variance of the indicators must be accounted for. Internal consistency is measured using Cronbach's alpha and composite reliability. A Cronbach's alpha and composite reliability value greater than 0.70 is used as a benchmark for reliability, particularly in the early stages of research (Vinzi et al., 2010). The AVE, Cronbach's alpha, and composite reliability values for all variables in this study meet the required thresholds, meaning that each indicator used in this study can be used for further structural testing (Table 6). In the other, discriminant validity, according to Fornell and Larcker (1981), the AVE value exceeds the squared correlation value between the construct pairs (Table 7).

Table 6. Convergent validity and reliability testing

Constructs	Loading factor	AVE	Composite reliability	Cronbach's alpha
Economic value (X1)		0.606	0.902	0.869
Community Income	0.776			
Perhutani Income	0.748			
Providing employment opportunities	0.829			
New economic opportunities	0.799			
Market Access	0.808			
Infrastructure Improvement	0.704			

Constructs	Loading factor	AVE	Composite reliability	Cronbach's alpha
Social Value (X2)		0.645	0.845	0.726
Addressing poverty levels	0.823			
Improving Formal Education	0.801			
Improving Food Security	0.785			
Environtmental Value (X3)		0.593	0.853	0.773
Soil fertility	0.811			
Natural disaster reduction	0.777			
Climate responsive society	0.763			
Community participation in protecting forests	0.725			
Institutional Value (X4)		0.854	0.921	0.828
Community group companion	0.924			
Business and area governance	0.924			
Customer Segments (Y1)		1.000	1.000	1.000
Diversified market segmentation	1.000			
Value Proportion (Y2)		0.586	0.876	0.822
Design	0.704			
Cost Reduction	0.760			
Risk Reduction	0.858			
Accessibillity	0.743			
Convenience	0.753			
Channels (Y3)		0.609	0.862	0.786
Awarness	0.755			
Evaluation	0.769			
Purchase	0.798			
Delivery	0.799			
Customer Relationships (Y4)		0.619	0.907	0.877
Personal Assistance	0.834			
Dedicated Personal Assistance	0.756			
Self Service	0.752			
Automated Service	0.763			
Communities	0.806			
Co-creation	0.806			
Revenue Streams (Y5)		1.000	1.000	1.000
Asset Sale	1.000			
Key Resources (Y6)		0.710	0.907	0.864
Physical	0.842			
Intellectual	0.855			
Technology	0.836			
Channel	0.837			
Key Activities (Y7)		0.783	0.878	0.725
Production	0.858			
Problem Solving	0.910			

Constructs	Loading factor	AVE	Composite reliability	Cronbach's alpha
Key Partnerships (Y8)		0.607	0.861	0.784
Alliance	0.776			
Competition	0.805			
Joint venture	0.803			
Buyer-supplier relationship	0.732			
Cost Structure (Y9)		0.652	0.882	0.821
Fix cost	0.760			
Variable cost	0.804			
Cost-driven	0.868			
Value-driven	0.794			

Tabel 7. Discriminant validity testing.

	Y7	Y5	Y4	Y8	X1	X4	X3	X2	Y2	Y3	Y1	Y9	Y6
Y7	0.885												
Y5	0.518	1.000											
Y4	0.759	0.470	0.787										
Y8	0.665	0.431	0.707	0.779									
X1	0.520	0.580	0.475	0.405	0.778								
X4	0.359	0.446	0.326	0.448	0.608	0.924							
X3	0.523	0.558	0.559	0.532	0.687	0.490	0.770						
X2	0.482	0.504	0.346	0.395	0.739	0.540	0.698	0.803					
Y2	0.531	0.539	0.667	0.546	0.659	0.443	0.702	0.598	0.766				
Y3	0.577	0.525	0.650	0.472	0.715	0.488	0.642	0.615	0.765	0.780			
Y1	0.368	0.422	0.443	0.338	0.478	0.360	0.584	0.459	0.528	0.516	1.000		
Y9	0.760	0.625	0.742	0.641	0.644	0.444	0.587	0.563	0.668	0.664	0.411	0.807	
Y6	0.740	0.503	0.809	0.656	0.541	0.380	0.550	0.468	0.662	0.697	0.431	0.772	0.842

Remark: economic value (X1), social value (X2), environmental value (X3), and institutional value (X4). The dependent variable (Y) was constructed based on competitiveness, consisting of Customer Segments (Y1), Value Propositions (Y2), Channels (Y3), Customer Relationships (Y4), Revenue Streams (Y5), Key Resources (Y6), Key Activities (Y7), Key Partnerships (Y8), and Cost Structure (Y9)

2) Structural Model Evaluation

The evaluation of the structural model involves testing the hypotheses regarding the influence between research variables, which is conducted in three stages. First, multicollinearity between variables is examined using the inner Variance Inflated Factor (VIF) measurement. An inner VIF value above 5 indicates multicollinearity issues between variables (Hair et al., 2021). The inner VIF values in this study meet the required standards (Table 8).

Second, if the t-statistic is greater than the t-table value or if the p-value of the test is less than 0.05, there is a significant influence between variables with a 95% confidence interval. Significant relationships can be seen in Table 9. Third, the f-square value is used to assess the direct influence of a variable at the structural level, with the following criteria: $0.02 \leq f \leq 0.15$ = low, $0.15 \leq f \leq 0.35$ = moderate, and $f \geq 0.35$ = high (Hair et al., 2014).

Table 8. Inner VIF Values

	Economy (X1)	Institution (X4)	Environment (X3)	Social (X2)
All dependent Variables	2.829	1.641	2.239	2.641

Remark: All dependent Variables: From Y1-Y9

Based on the results of the tests, the management of Perhutani's cajuput oil business has considered environmental aspects in every operational activity, including at the factory or in marketing management. In the social context, only the customer relationship indicator is related to cajuput oil business management, and most other operational business indicators do not address social values. This implies that Perhutani's activities in the cajuput oil business involve customers (buyers of cajuput oil) in creating social value, as indicated by helping reduce poverty and improving food security in forest village communities. Similarly, institutional value in the cajuput oil business is only influenced by indicators related to revenue streams and key

partners, indicating that Perhutani's support for community groups in forest villages as business partners has a positive impact on Perum Perhutani's revenue. However, economic value in the cajuput oil business does not influence customer segmentation or key partners, but it does influence other indicators. The economic value of Perum Perhutani's cajuput oil business has not yet expanded geographically or to the export market, and it remains limited to the domestic market in Indonesia. Moreover, the buyer-supplier relationship between Perum Perhutani and its customers has not yet shown strong connections, as evidenced by the replacement of cajuput oil purchases with imported eucalyptus oil.

Table 9. P-Value, T statistics and F-square

	T statistics (O/STDEV)	P values	F-Square	Desc.
Economic Value (X1) -> Key Activities (Y7)	2.067	0.039	0.032	low
Economic Value (X1) -> Revenue Streams (Y5)	2.691	0.007	0.052	low
Economic Value (X1) -> Customer Relationship (Y4)	2.119	0.034	0.040	low
Economic Value (X1) -> Value Proportion (Y2)	3.146	0.002	0.074	low
Economic Value (X1) -> Channels (Y3)	4.876	0.000	0.168	moderate
Economic Value (X1) -> Cost Structure (Y9)	3.744	0.000	0.101	low
Economic Value (X1) -> Key Resources (Y6)	2.497	0.013	0.045	low
Institutional Value (X4) -> Revenue Streams (Y5)	2.157	0.031	0.013	-
Institutional Value (X4) -> Key Partnerships (Y8)	3.730	0.000	0.068	low
Environmental Value (X3) -> Key Activities (Y7)	2.525	0.012	0.051	low
Environmental Value (X3) -> Revenue Streams (Y5)	3.023	0.003	0.056	low
Environmental Value (X3) -> Customer Relationship (Y4)	5.103	0.000	0.186	moderate
Environmental Value (X3) -> Key Partnerships (Y8)	4.587	0.000	0.139	moderate
Environmental Value (X3) -> Value Proportion (Y2)	5.756	0.000	0.203	moderate
Environmental Value (X3) -> Channels (Y3)	3.858	0.000	0.064	low
Environmental Value (X3) -> Customer Segmentation (Y1)	4.802	0.000	0.152	moderate
Environmental Value (X3) -> Cost Structure (Y9)	2.494	0.013	0.047	low
Environmental Value (X3) -> Key Resources (Y6)	3.170	0.002	0.075	low
Social Value (X2) -> Customer Relationshi (Y4)	2.720	0.007	0.032	low

3) Evaluation of the Reflective Measurement Model

The model fit evaluation can be assessed using R-square, SRMR, and NFI. The coefficient of determination (R-square) is used to measure the degree of variation in the independent variable's influence on the dependent variable and to empirically assess the 'goodness of fit.' According to Ghozali, (2008), the R² value is categorized into three levels: R² > 0.67 indicates a good model, 0.32 < R² < 0.66 indicates a moderate model, and R² < 0.19 indicates a weak model. The R-square values for this study's model can be seen in Table 10. According to Yamin (2021), the model is still considered fit and acceptable if the SRMR value is less than 0.08. Meanwhile, the closer the Normal Fit Index (NFI) is to 1, the better the model.

The R-square values in this study range from 0.326 to 0.558. According to Ghozali (2008), all of these models fall within the moderate category. This means that 33% to 56% of Perum Perhutani's management of the cajuput oil business is influenced by economic, social, environmental, and institutional values. Another external factors that are thought to affect cajuput oil business management include market demand, government policies in supporting cajuput oil business, supporting institutions managing cajuput oil trade, and low export value of cajuput oil compared to other essential oils (Utami et al., 2023). Meanwhile, management factors within the company itself can also be a factor such as quality, total revenue, and markets as the main factor (Rahmayanti et al., 2022). The data processing results show that

the Standardized Root Mean Square Residual (SRMR) value is 0.078, which indicates that the model is acceptable as a good fit. Meanwhile, the model has an NFI value of 0.665, meaning that it is 66.5% fit (Table 11).

Hypotheses were tested using SEM via SmartPLS as presented in Fig 1. Based on this analysis, all SDG forestry values have a significant relationship, with a low to moderate degree of influence. This indicates that Perhutani needs improvements to a moderate to high influence a portion of the achievement of forestry-related SDGs in decision-making for Perum Perhutani's cajuput oil business management. Perum Perhutani has implemented a balanced approach between economic and environmental values in the production of cajuput oil, but it still requires improvement. According to the impact tests, Perum Perhutani has incorporated sustainable economic value into its cajuput oil business management, including improving community income, increasing Perum Perhutani's revenue, creating jobs, opening new economic opportunities, and expanding market access.

Furthermore, Perhutani has also paid attention to sustainable environmental values, such as soil fertility, disaster prevention, climate-responsive communities, and community participation in forest conservation. These aspects of value are incorporated into the management of Perum Perhutani's cajuput oil business, which currently involves planting, pruning, production, and sales activities. Forest village communities involved in Perum Perhutani's cajuput oil business benefit from the use of agroforestry land while cultivating

Table 10. R-Square

	R-square		R-square
Key Activities (Y7)	0.326	Value Proportion (Y2)	0.553
Revenue Streams (Y5)	0.393	Channels (Y3)	0.558
Customer Relationships (Y4)	0.349	Customer Segments (Y1)	0.355
Key Partnerships (Y8)	0.332	Cost Structure (Y9)	0.459
Key Resources (Y6)	0.354		

Table 11. Model Fit

	Saturated model	Estimated model
SRMR	0.078	0.138
NFI	0.665	0.585

cajuput plants. Some of the agroforestry crops grown alongside cajuput include corn (*Zea mays*), cassava (*Manibot esculenta*), rice (*Oryza sativa*), and various types of spices. Agroforestry development has promising prospects for contributing to increased farmer incomes around the forest as a livelihood, ensuring food security, providing firewood, and supporting sustainable agriculture (Maguire et al., 2013). However, the extent to which agroforestry is beneficial to Perum Perhutani requires further research to create greater economic benefits for forest village communities. Additionally, forest village communities receive wages for collecting cajuput leaves, which are processed into cajuput oil through distillation. These communities earn

daily wages ranging from IDR 50,000 to IDR 100,000, either for harvesting or processing cajuput leaves. Structural Equation Model of SDGs Business Model of Perum Perhutani Cajuput Oil can preview in Figure 1.

Cajuput planting can improve the welfare of forest communities and create jobs in marginal areas adjacent to them, making it a beneficial option for reducing poverty and creating employment (Ernawati et al., 2021). Furthermore, Perhutani plays a role in assisting communities, providing outreach, acting as a discussion partner, offering training, and solving problems that communities cannot resolve on their own. Coordinating the role of cajuput oil producers with the local community and

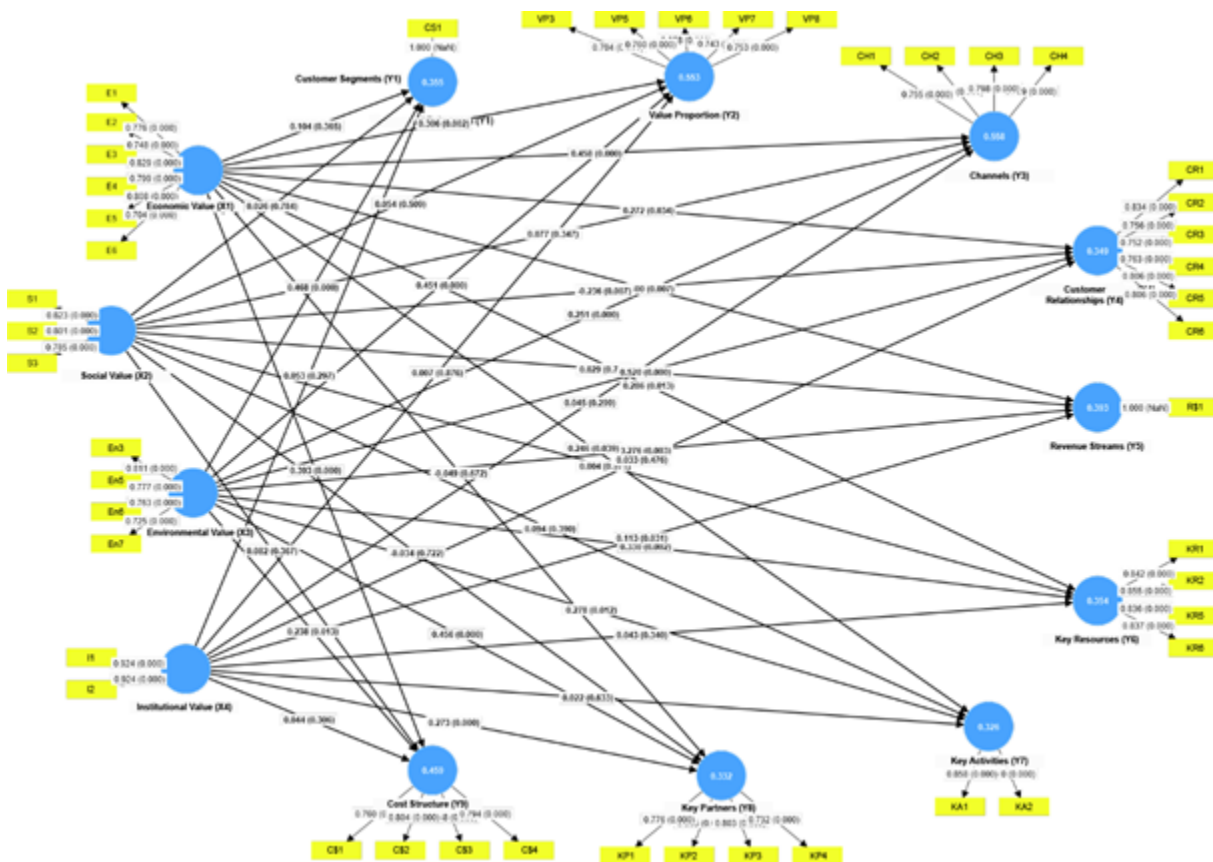


Figure 1. Structural Equation Model of SDGs Business Model of Perum Perhutani Cajuput Oil

environment in terms of adaptation, disaster mitigation, and land restoration is one of the strategies for enhancing the capacity of cajuput oil producers (Ernawati et al., 2021). As a result, more people will believe that purchasing cajuput oil products also contributes to improving social, economic, and environmental sustainability in Indonesia. These developments will foster the mindset that buying cajuput oil products means supporting environmental, economic, and social sustainability. To align with the concept of environmental sustainability, a paradigm shift in company behavior and human resources is necessary (Alikodra, 2020). Meanwhile, if Indonesia continue to import eucalyptus produced by other countries, then those who get added economic, social and environmental value are eucalyptus exporting countries. Based on the above analysis, Perum Perhutani's management of the cajuput oil business still faces many challenges, particularly in ensuring the economic sustainability of the cajuput oil business and increasing competitiveness to become more competitive

C. Competitiveness Study of Perum Perhutani's Cajuput Oil in Supporting Sustainability (SDGs) in the Forestry Sector

The resources and capabilities of Perum Perhutani's cajuput oil business, analyzed using RBV and VRIO theories, demonstrate several competitive resources compared to other domestic companies in Indonesia. The competitive resources of Perum Perhutani's cajuput oil business include tangible, intangible, and capabilities (Table 5). Furthermore, based on the structural test, economic and environmental values have a significant influence on the key resources of Perum Perhutani's management of the cajuput oil business (Table 7).

In terms of physical resources, Perum Perhutani's cajuput oil production relies on raw material facilities and factories. Perum Perhutani's cajuput plantations cover approximately 32,000 hectares, with around 39.6 million cajuput trees spread across 27 Forest

Management Units. Perum Perhutani's cajuput oil factories made 29,142 tons of dried cajuput leaves in 2022. The average yield was 0.61%, which means they made about 182.8 tons of cajuput oil. Perum Perhutani has adequate and complete facilities and infrastructure for running the cajuput oil business. The storage of raw materials is aligned with the factory's processing capacity to prevent the quality degradation of cajuput leaves. On average, annual cajuput oil production is approximately 200–390 tons. Overall, the factory's production capacity meets the cajuput leaves supply. The total installed factory capacity at Perum Perhutani is 48,300 tons, and for example the real production used in 2022 is 29,142 tons so that only 60% of the capacity is produced.

Perum Perhutani's cajuput oil has relatively stable prices and better and more stable 1,8-Cineole content compared to the cajuput oil produced by the Forestry Office of Yogyakarta and cajuput oil from Buru Island (Table 8). While Perum Perhutani's cajuput oil is competitive in the domestic market, it requires attention for its development in the international market. The presence of imported eucalyptus oil is a factor that should be considered as a competitor to Perum Perhutani's cajuput oil resources. Imported eucalyptus has advantages in terms of price and 1,8-Cineole content. Perum Perhutani's cajuput oil is priced more than 1.5 times higher than imported eucalyptus oil and has lower 1,8-Cineole content, which results in weaker competitiveness in the international market compared to eucalyptus from China and Australia. The Import BM tax value for eucalyptus is 5%. This tax is imposed to protect domestic industries and provide incentives for domestic business. The BM Raw Material and Capital Goods Tax Rate ranges from 0% to 7.5%. The difference in value of eucalyptus imports with Perum Perhutani's eucalyptus oil is IDR 122,500/kg or \$ 7.87 per kg. Recently, the influx of imported eucalyptus oil in the market has increased. If Perum Perhutani does not make efforts to develop its competitiveness against imported eucalyptus,

it may face sustained losses. The behavior of Perum Perhutani's cajuput oil industry is still product-driven rather than market-driven. According to Hendrawan (2022), a market-driven strategy that a company can implement includes market orientation, differentiating characteristics, customer value, and superior performance. Among these strategies, customer value is crucial for Perum Perhutani's cajuput oil, particularly in terms of product price and quality, where Perum Perhutani's cajuput oil is not yet superior in international competition. Table. 12 illustrates the advantages of imported eucalyptus over Perum Perhutani's cajuput oil.

In terms of competitiveness, according to Porter (2011), companies achieve competitive advantage through either cost leadership, differentiation, or focus strategies. Cost leadership involves becoming the lowest-cost producer in the industry, while differentiation entails offering unique products or services that are valued by customers. These strategies enable firms to outperform competitors and achieve superior profitability. In addition to cost leadership and differentiation, the focus strategy emphasizes targeting a specific market segment or niche, which allows businesses to tailor their offerings and gain a competitive edge in that specific segment (Porter, 2011).

Perum Perhutani's cajuput oil demonstrates competitiveness in the domestic market, with prices set below the domestic market average and maintaining high cineole content, ensuring product quality. However, the global

market presents significant challenges, as eucalyptus producers often operate as low-cost manufacturers that produce high-quality products with the added value that consumers seek. In this context, a focus strategy can complement Perhutani's existing efforts by concentrating on specific market segments, such as organic or sustainable product consumers, who prioritize environmental and social responsibility in Indonesia, eucalyptus imports are produced by other countries, thus benefiting the exporting country economically, socially, and environmentally. Business system innovation should use both qualitative and quantitative approaches (Kajanus et al., 2019)

By leveraging its focus on sustainability, Perhutani's cajuput oil contributes to broader societal sustainability and taps into niche markets where consumers are increasingly conscious of the environmental and social impacts of the products they purchase. This focus on ethical production can set Perhutani apart from global competitors who may prioritize cost leadership. Furthermore, Perhutani has expanded its focus by developing derivative products from cajuput oil, such as telon oil, medicines, and cosmetics, which cater to specific customer needs in pharmaceuticals and the wellness sector. Such a focused approach enables Perhutani to maintain relevance in competitive niches that are not solely driven by cost but by the value-added qualities of the product (Batubara et al., 2016).

Table 12. Comparison of Perum Perhutani's Cajuput Oil with Market Competitors.

	Cajuput oil Perum Perhutani	Forestry Office of Yogyakarta	Buru Island	Eucalyptus impor
Price (IDR/kg)	295.000	290.000 – 300.000	288.000 – 355.000	130.000 – 225.000
1,8-Cineole (%)	57 – 65	53 – 56	24 – 64	77 – 81
Yield (%)	0,6 – 0,8	0,7 – 0,8	0,6 – 0,8	1,5 – 2,0

Source: RnD of NTFP Commercial Division of Perum Perhutani, (2023); Torry & Idrus, (2016); Center for Facilitation of Implementation of Standardized Instruments of the Environment and Forestry, (2023).

IV. CONCLUSION

The key resources of Perum Perhutani's cajuput oil business that provide a sustainable competitive advantage are the quality of Perum Perhutani's cajuput oil seedlings, the ability to achieve supply chain certification, and the ability to produce high-quality products. The factors that significantly influence Perhutani's cajuput oil business are economic and environmental values, indicating that the management of the cajuput oil business has considered all indicators of tangible and intangible resources, capabilities, and assets. Cajuput oil from Perhutani has excellent competitiveness, especially in the domestic market, but it has been undermined by cheap imported eucalyptus oil. If this trend continues, consumer preferences may shift toward eucalyptus oil, even though the development of the MKP (cajuput oil) industry is actually more cost-effective, socially responsible, and environmentally friendly. This study has limitations that only generally relate SDGs to the Perhutani Cajuput oil business, so the suggestion for further research is to look for relationships with indicators that are not comprehensive in this study or to focus more on one indicator that is more in-depth, whether social, ecological, or economic.

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