Jurnal Dinamika
Sosial Ekonomi

Print ISSN (1411-593X) | Online ISSN (2721-3137)
Volume 26 Issues 2, December 2025
DOI: https://doi.org/10.31315/jdse.v26i2.16041

A Regional Competitive Framework for Indonesian Sectoral Strategy: Enhancing Plantation Potency in West Papua

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Article History:
Submitted: Nov 30, 2025
Approved: Dec 24, 2025

Keywords:
Regional Economy,
Sustainable Production,
Agriculture,
Copra.

Page:
185-194

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ABSTRACT

This study examines the structure and dynamics of the regional economy of West Papua Province by identifying base and non-base sectors using the Location Quotient (LQ) and Shift Share approaches. The analysis is based on district- and city-level Gross Regional Domestic Product (GRDP) data at constant prices for the period 2012–2022. The LQ estimates indicate that the agricultural sector particularly the plantation subsector exhibits a strong comparative advantage, with 10 out of 13 administrative regions recording LQ values greater than one. The Shift Share analysis reveals substantial heterogeneity in regional competitiveness. Fak-Fak, Kaimana, Manokwari, and Teluk Wondama are classified in Quadrant I, indicating that the plantation subsector in these regions functions not only as a base sector but also demonstrates relatively faster growth compared to the provincial average. In contrast, South Manokwari, Maybrat, Raja Ampat, South Sorong, Tambrauw, and Pegunungan Arfak fall into Quadrant IV, suggesting base sectors with relatively lagging growth performance. Based on these findings, this study emphasizes the development of the coconut industry as a strategic driver of a renewable natural resource–based economy. Nevertheless, the sector continues to face major constraints, including low productivity, high post-harvest losses, and limited market access. Therefore, policies aimed at strengthening value chains, adopting green technologies, and advancing digital governance are essential prerequisites for enhancing regional competitiveness and ensuring the long-term economic sustainability of West Papua.

INTRODUCTION

The forests of West Papua represent a distinctive tropical ecosystem that plays a crucial role in supporting local livelihoods in Indonesia (Ministry of Agriculture, 2025). According to the Nusantara Atlas, the loss of primary forest in West Papua increased by 10% from 2023 to 2024, amounting to 25,300 hectares, with data from 2025 indicating further declines (Gaveau, 2025). Historically, the region's challenging terrain provided a degree of protection; however, recent infrastructure developments have facilitated the expansion of plantation agriculture (Austin et al., 2019). The deforestation process results in carbon emissions and the loss of essential ecosystem services, including biodiversity habitats, water regulation, and climate stabilization. The degradation of Papua's forests is indicative of economic systems that overlook environmental sustainability, leading to soil degradation, water pollution, biodiversity loss, and increased emissions, thereby undermining resilience and welfare.

Sustainable forest management (SFM) offers a means to harmonize development with conservation through effective governance and land use strategies (Pretty & Bharucha, 2014; Schuler et al., 2022). Implementing SFM in Papua necessitates addressing the interplay between economic specialization and sustainability (Djafar et al., 2023; Jain et al., 2023). Environmental economic instruments aim to internalize externalities by incorporating environmental costs into policy frameworks (Ji et al., 2022). By integrating competitiveness analysis with environmental management, it is possible to facilitate evidence-based

conservation planning that addresses both development and sustainability, identifying regions suitable for sustainable economic specialization and those requiring protection (De Janvry & Sadoulet, 2002). Environmentally extended LQ-shift share analysis is utilized to calculate environmental costs and identify priority sectors, thereby establishing frameworks for green growth policies. Traditional management approaches often fail to optimize economic potential while neglecting ecosystem services. Advancing sector development in forest-based economies necessitates consideration of ecological conditions, market dynamics, and community capacity (Barañano et al., 2022; Malik et al., 2024; Ernah et al., 2024)

An environmental improvement recommendation provides the foundation for sustainable regional development. Therefore, analysing basic and non-basic sectors using the LQ and Shift-Share approaches is crucial to ensure that the economic agenda aligns with ecological goals (Sausan et al., 2022). Location Quotient (LQ) and Shift Share (SS) analyses measure sector concentration relative to larger reference economies, identifying dominant sectors (Sausan et al., 2022). LQ analysis aids in identifying leading sectors that drive regional growth but often overlooks ecosystem services. Techniques such as Location Quotient (LQ) and Shift-Share Analysis are employed to identify high-impact sectors and evaluate the region's capacity for sustainable intensification.

In this study, we examine leading economic sectors based on LQ and Shift Share measurements, with a particular focus on coconut plantations for copra production in West Papua. The focus on coconut is justified by its strong socio-economic relevance, as coconut cultivation is predominantly undertaken by smallholder farmers and constitutes an important source of rural livelihoods. Copra, the dried white flesh of the coconut (Cocos nucifera), is widely used for coconut oil extraction and represents a significant export commodity for Indonesia (Ministry of Agriculture, 2025).

At the national level, major coconut cultivation areas are concentrated in Riau (Sumatra), East and Central Java, Southeast Sulawesi, Maluku, and North Maluku. Although West Papua is not categorized as a primary national center of coconut production, coconut remains strategically important at the regional scale. This region contributes 0.58% to the national copra production, with 16,292 hectares of coconut plantations (Ministry of Agriculture, 2025), reflecting a relatively modest national share but a substantial local economic role.

The coconut sector in West Papua is closely associated with forest-based and smallholder production systems, making it particularly relevant for inclusive and environmentally sustainable development strategies. Nevertheless, the sector continues to face structural constraints, including declining productivity, high post-harvest losses, limited market access, and the insufficient adoption of sustainable management practices. These conditions underscore the relevance of focusing on coconut plantations as a representative subsector for strengthening regional competitiveness while simultaneously supporting ecological sustainability and community-based economic development in West Papua.

In the context of West Papua, empirical studies examining regional economic development from an ecological perspective remain limited, despite the region’s substantial potential in plantation-based economic activities. Coconut plantations for copra production represent a strategic sector of this study, as they are predominantly managed by smallholder communities and closely embedded within forest-based production systems.

Accordingly, this research examines leading and non-leading sectors using LQ and Shift Share analyses to reflect the sectoral structure and growth dynamics of West Papua’s regional economy. The contribution of this study lies in its sectoral interpretation of the regional economy, in which LQ and Shift Share analyses are applied not only as descriptive measures but also as an analytical basis for environmentally responsible development planning. By framing sectoral competitiveness and regional growth dynamics as key determinants of development orientation, this study bridges conventional regional economic analysis with ecological responsibility, particularly in the context of forest-based plantation economies.

Through this approach, the novelty of this study provides an evidence-based framework for aligning regional economic development with environmental sustainability objectives, offering policy-relevant insights for subnational development planning in West Papua while maintaining the integrity of forest ecosystems.

RESEARCH METHODOLOGY

Data Collection

This study employs macroeconomic data on the Gross Regional Domestic Product (GRDP) at both the provincial and regency/city levels in Papua from 2012 to 2022 to identify leading sectors. The study period commences in 2012, aligning with the implementation of Minister of Trade Regulation No. 35/M-DAG/PER/8/2010 concerning Copra Export and Import, and concludes in 2022, prior to the administrative expansion of West Papua Province. The study area encompasses 12 regencies and 1 city in West Papua: Sorong City, Fakfak Regency, Kaimana Regency, Manokwari Regency, South Manokwari Regency, Maybrat Regency, Arfak Mountains Regency, Raja Ampat Regency, Sorong Regency, South Sorong Regency, Tambrauw Regency, Teluk Bintuni Regency, and Teluk Wondama Regency. West Papua was selected as the study area due to its unique regional economic structure, which is characterized by a strong dependence on natural resource–based sectors, particularly plantation and forest-related activities, alongside high ecological significance. Moreover, West Papua represents a relevant case for examining environmentally responsible development, as the region possesses extensive forest coverage, relatively low industrialization, and a predominance of smallholder-based agricultural systems.

Location Quotient (LQ) and Shift Share Analysis (SSA)

The Location Quotient (LQ) analysis is used to determine basic and non-basic sectors in order to identify a region's comparative advantages and leading sectors (Pominova et al., 2021). A basic sector drives the regional economy, typically characterized by its capacity to export or attract buyers from outside the region. The LQ formulation follows Eq. 1:

$$LQ = \frac{(\frac{Vi}{Vt})}{(\frac{Yi}{Yt})}$$

Where LQ refers to Location Quotient, Vi and Vt refer to total output of sector i in region and total output all sector in the region respectively, while Yi and Yt refer to total output for sector i and total output of all sectors in the reference area. If the LQ value is greater than 1, it indicates that the level of specialization of a sector in a regency/city is higher than that of the same sector in the provincial economy, meaning it is classified as a basic/leading sector. Conversely, if LQ < 1, the level of specialization of a sector in a regency/city is lower than the provincial specialization level, and it can be categorized as a non-basic sector (less potential). Meanwhile, if LQ = 0, the sector is only sufficient to meet the needs of its own region. To complement the LQ, estimations are also carried out using Shift-Share Analysis (SSA), as follows:

$$\Delta Y_{r,i,t} = Y_{i,r,0,} x\, g_{prov} + Y_{i,r,0} x\, (g_{i,prov} - g_{prov}) + Y_{i,r,0} x\, (g_{i,r} - g_{i,prov})$$

Where ΔY_(r,i,t) refers to a change in total output, Y_(i,r,0,) x g_prov refers to the provincial total growth rate where Y_(i,r,0,) refers to the total output per region and g_prov represents the provincial total growth rate. Y_(i,r,0) x (g_(i,prov)-g_prov) reflects the industrial variation where g_(i,prov) refers to the provincial growth rate of the sector i, while Y_(i,r,0) x (g_(i,r)-g_(i,prov)) explains the competitive effect with g_(i,r) is the regional growth rate of the sector i. By combining the results of the Location Quotient and Shift Share analyses, this study formulates development recommendations aimed at strengthening sectoral

competitiveness in the plantation subsector, particularly the copra industry. Rather than directly assessing ecological outcomes, the LQ–SSA framework is used to identify economically strategic sectors that are predominantly managed by local communities, thereby providing an economic basis for promoting development pathways that are aligned with, rather than measuring, ecological sustainability and resilience within copra-based agroforestry systems.

RESULTS AND DISCUSSION

The results of the LQ analysis in 12 regencies and 1 city in West Papua during 2012-2022. Throughout this period, the observation focused on sectors contributing to GRDP. An LQ value greater than 1 indicates that the sector is basic or leading (Pominova et al., 2021; Sausan et al., 2022), determined by comparing its contribution to the GRDP of West Papua. Based on Table 1, the economies of 10 out of 13 regencies/cities in West Papua are driven by the Plantation, Forestry, and Fisheries sector, with contributions from coconut plantation as one of the key components. When compared across regions, South Manokwari consistently recorded the highest LQ score of 6 points. In contrast, the plantation, forestry, and fisheries sectors in Teluk Bintuni, as well as Sorong City and Sorong Regency, are not considered leading sectors, with LQ values ranging between 0.2 and 0.9. For Teluk Wondama Regency, GRDP data availability only allowed measurements from 2016 to 2022, during which the plantation sector emerged as the leading commodity of the region.

Table 1. Contribution Location Quotient (LQ) of Plantation, Forestry, and Fisheries in West Papua (2012-2022)

No.	Region/City	Location Quotient (LQ)										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1	Manokwari	1.47	1.43	1.39	1.37	1.37	1.38	1.42	1.40	1.49	1.43	1.41
2	Sorong	0.84	0.87	0.88	0.89	0.91	0.90	0.89	0.90	0.91	0.90	0.92
3	Pegunungan Arfak	2.52	4.58	4.42	4.30	4.32	4.38	3.98	3.87	3.26	2.99	2.35
4	Sorong City	0.85	0.82	0.80	0.78	0.77	0.74	0.74	0.93	0.93	0.93	0.97
5	Fak-fak	1.91	1.84	1.80	1.79	1.80	1.75	1.76	1.72	1.77	1.77	1.74
6	Kaimana	3.28	3.20	3.06	2.91	2.89	2.79	2.86	2.84	2.87	2.89	2.91
7	South Manokwari	6.50	6.49	6.39	6.38	6.43	6.19	6.37	5.95	5.99	5.99	6.11
8	Raja Ampat	2.40	2.41	2.41	2.48	2.56	2.67	2.69	2.60	2.67	2.34	2.09
9	Maybrat	3.57	3.51	3.46	3.35	3.28	3.10	3.14	3.06	3.04	2.91	2.87
10	South Sorong	2.86	2.80	2.72	2.65	2.60	2.47	2.51	2.45	2.44	2.41	2.56
11	Teluk Wondama	0.00	0.00	0.00	0.00	3.57	3.40	3.49	3.44	3.46	3.40	3.25
12	Tambrauw	3.90	3.83	3.76	3.67	3.66	3.44	3.46	3.32	3.40	3.32	3.27
13	Teluk Bintuni	0.27	0.26	0.26	0.26	0.27	0.26	0.26	0.26	0.27	0.26	0.26

Source: Statistic Indonesia, 2025

Table 2. Shift-Share Analysis of Agriculture, Forestry, and Fishery Commodities in West Papua (2012-2022)

No	Region/City	Shift-Share Analysis (SSA)			
		Regional Share (Pr)	Regional Shift (Ps)	Differential Shift (Dr)	Sectoral Economic Growth ($\Delta Y_{r,i,t}$)
1	Manokwari	0.41	-0.11	0.11	0.41
2	Sorong	0.41	-0.11	-0.08	0.22
3	Pegunungan Arfak	0.41	-0.11	-0.39	-0.10
4	Sorong City	0.41	-0.11	-0.21	0.08
5	Fak-fak	0.41	-0.11	0.52	0.82
6	Kaimana	0.41	-0.11	0.02	0.31
7	South Manokwari	0.41	-0.11	-0.18	0.11
8	Raja Ampat	0.41	-0.11	-0.04	0.25
9	Maybrat	0.41	-0.11	-0.53	-0.24
10	South Sorong	0.41	-0.11	-0.16	0.13
11	Teluk Wondama	0.41	-0.11	0.05	0.35
12	Tambrauw	0.14	-0.04	-0.09	0.01
13	Teluk Bintuni	0.41	-0.11	-0.12	0.17

Source: Statistic Indonesia, 2025

The results of the SSA in Table 2 reveal significant variations in sectoral performance across regions. The Regional Share (Ps) component appears relatively uniform at 0.41, except for Tambrauw Regency, which recorded a lower value (0.14). This indicates that most local economies generally follow the provincial growth pattern, while Tambrauw's contribution to the provincial GRDP remains limited. For the Regional Shift (Pr) component, all regencies/cities show negative values ranging from –0.11 to –0.04. This suggests that the sectoral economic structures at the local level have not developed as rapidly as the average provincial growth. The Differential Shift (Dr) component shows more striking variations. Fak-fak (0.52), Teluk Wondama (0.05), Manokwari (0.11), and Sorong City (0.21) recorded positive values, indicating the presence of sectoral competitive advantages compared to the province. In contrast, Pegunungan Arfak (–0.39), Maybrat (–0.53), and South Sorong (–0.16) exhibited negative values, suggesting that sectors in these regions grew more slowly than the provincial average, possibly due to limited production factors or infrastructure constraints.

The Location Quotient (LQ) analysis indicates that the economy of West Papua is predominantly driven by the plantation, forestry, and fisheries sectors. In ten out of twelve regencies/cities, LQ values exceed one, signifying that these sectors constitute the economic foundation. South Manokwari exhibits the highest LQ scores (above 6), reflecting a pronounced specialization in these sectors. Regions with significant specialization necessitate careful environmental management to avert resource overexploitation. Sorong City, Sorong Regency, and Teluk Bintuni display LQ values below one (0.2–0.9), attributed to limited production factors and urban-oriented activities (Pretty & Bharucha, 2014). A comparison of LQ with Shift-Share Analysis (SSA) reveals patterns of regional competitiveness. Fak-fak Regency, with an LQ above 2.0, demonstrates a positive Differential Shift (Dr=0.52) and the highest total growth (∑SSA=0.82), indicating both specialization and competitiveness. Teluk Wondama exhibits similar advantages despite limited data availability. However, Maybrat and Pegunungan Arfak, despite high LQ values, exhibit negative Differential Shifts, suggesting a lack of competitiveness due to infrastructure and market access constraints (Djufry et al., 2022; Pominova et al., 2021). Sorong City and Sorong Regency, despite low LQ values, recorded positive Dr values, indicating potential for competitive growth. Figure 1 presents the quadrant diagram of average annual LQ (2012-2022) and Differential Shift, illustrating four patterns of regional economic performance in West

Papua's plantation, forestry, and fishery sectors. The results reveal four different patterns of regional economic performance for plantation, forestry, and fishery sectors in West Papua:

Quadrant I (LQ > 1; Dr > 0): Leading and Competitive Sectors

Regions within this quadrant exhibit comparative advantages and dynamic growth, including Fak-fak, Manokwari, Kaimana, and Teluk Wondama. These areas possess robust base sectors and regional competitiveness, rendering them priority zones for development. The classification of these regions in Quadrant I (LQ > 1 and positive differential shift) is consistent with the findings of Barañano et al. (2022) who identified agriculture, forestry, and fisheries as predominant sectors in West Papua, significantly contributing to the regional GRDP. The agricultural sector's average LQ value of 1.91 during 2005–2013 corroborates its status as a regional base, while Shift-Share analysis demonstrated regional competitiveness across several regencies. These findings underscore the necessity of integrating technological transformation into leading sectors. Digital plantation governance and IoT-based monitoring are strategic tools for distributing the added value of coconut and agricultural products beyond core regions, potentially mitigating structural inequality while sustaining West Papua's forest-based economies.

Quadrant II (LQ < 1; Dr > 0): Non-Base but Growing Sectors

No region falls into this category, indicating that all areas with a positive differential shift already possess an LQ greater than 1, thereby strengthening their status as strategic sectors.

Quadrant III (LQ < 1; Dr < 0): Non-Base and Less Competitive Sectors

Sorong, Sorong City, and Teluk Bintuni belong to this group. Their plantation, forestry, and fishery sectors lack competitiveness and regional advantages, requiring structural transformation. This aligns with previous study in Sorong and South Sorong Regency, which found Sorong Regency had a strong manufacturing base (LQ 2.33) (Sausan et al., 2022). The study by Pominova et al. (2021) showed sectors in Quadrant III face structural weaknesses, including poor competitiveness and limited value chain integration. These weaknesses match Teluk Bintuni's situation, where agriculture and fisheries show low specialization despite vast natural resources.

Quadrant IV (LQ > 1; Dr < 0): Base but Less Competitive Sectors

Regions such as South Manokwari, Raja Ampat, Maybrat, South Sorong, Tambrauw, and Pegunungan Arfak are included in this quadrant. These sectors are dominant contributors to the regional economy but experience declining competitiveness, possibly due to productivity constraints, infrastructure gaps, or market limitations.

The mapping of regions across LQ–SSA quadrants requires differentiated development strategies. Quadrant I regions should function as growth centers (color: green), serving as anchors for regional economic expansion. Quadrant II regions should be targeted for capacity building and sectoral strengthening (color: purple), as these areas exhibit positive-growth dynamics despite not yet being base sectors, indicating potential for transition into leading sectors. Quadrant III regions require economic diversification (color: pink) to reduce structural dependency and enhance resilience. Meanwhile, Quadrant IV regions (color: yellow) must undergo technological transformation through digital agribusiness adoption and value-added processing to sustain competitiveness in sectors that are already dominant but experiencing declining growth (Sausan et al., 2022).

Table 3. Mapping of Regional Advantages in West Papua

Regency / City	LQ Status	Dr	Quadrant	Sectoral Status	Indication
Fak-fak	> 1	+	I	Base & Competitive	Priority growth area
Manokwari	> 1	+	I	Base & Competitive	Strong growth momentum
Kaimana	> 1	+	I	Base & Competitive	Inclusive plantation economy
Teluk Wondama	> 1	+	I	Base & Competitive	Forest-based advantage
South Manokwari	> 1 (high)	−	IV	Base, less competitive	High specialization, low growth
Raja Ampat	> 1	−	IV	Base, less competitive	Infrastructure constraints
Maybrat	> 1	−	IV	Base, less competitive	Market access limitations
South Sorong	> 1	−	IV	Base, less competitive	Weak value-chain integration
Tambrauw	> 1	−	IV	Base, less competitive	Low productivity
Pegunungan Arfak	> 1	−	IV	Base, less competitive	Infrastructure gap
Sorong Regency	< 1	+	III	Non-base, emerging	Potential competitiveness
Sorong City	< 1	+	III	Non-base, emerging	Urban-driven growth
Teluk Bintuni	< 1	−	III	Non-base, less competitive	Structural weakness

Source: Data Processed, 2025

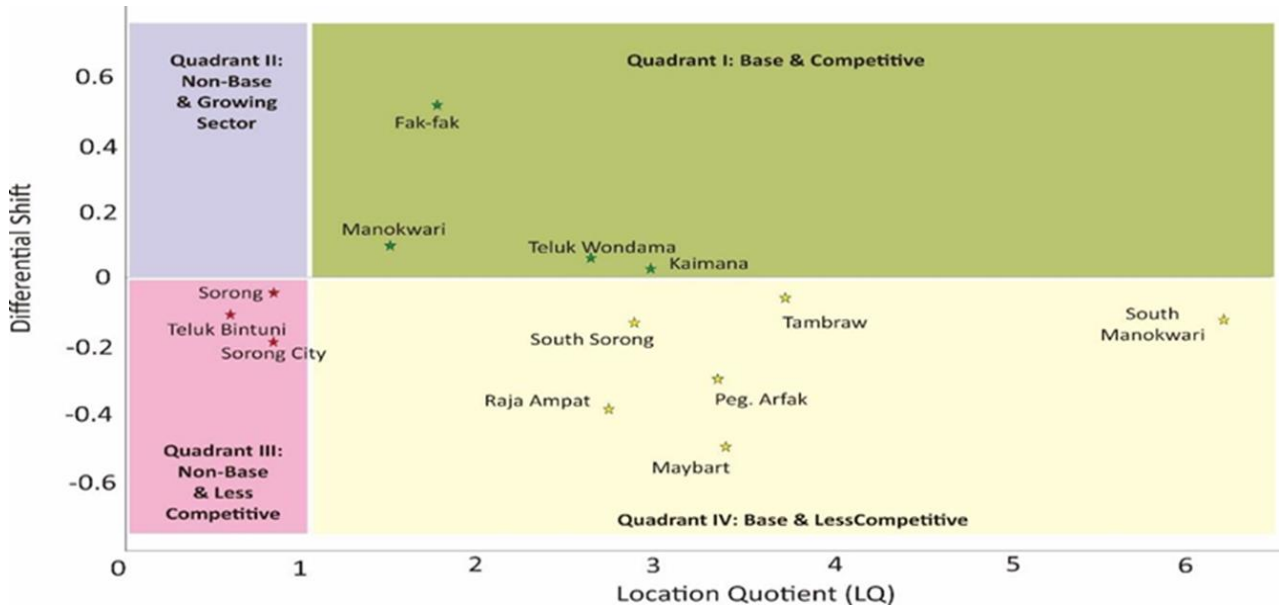

Figure 1. The Quadrant Diagram of Location Quotient(LQ) vs Different Shift (Dr) of Agriculture, Forestry, and Fishery Sectors in West Papua (2012-2022)
Source: Statistic Indonesia, 2025

Based on this sectoral diagnosis, regional development efforts can be directed toward optimizing existing strengths in agriculture, plantation, and fisheries rather than introducing entirely new economic drivers. Among these sectors, the plantation subsector, particularly coconut cultivation for copra production, emerges as a strategic focus due to its strong linkage with community-based livelihoods, its compatibility with forest-based agroforestry systems, and its potential for value-added processing (Malik et al., 2024; Ernah et al., 2024). Copra production is predominantly managed by smallholder farmers, making it a relevant entry point for inclusive economic development while maintaining ecological considerations (Firmandani et al.,

2024). By integrating the LQ–SSA results with a technological transformation perspective, differentiated development pathways can be formulated according to each quadrant of regional performance.

In this study, the formulation of policy recommendations for copra development becomes essential. These recommendations must address both upstream and downstream dimensions, including agroforestry-based intensification, processing technology adoption, value-chain strengthening, and institutional support mechanisms (Ji et al., 2022). Therefore, the following table presents a structured set of recommendations for copra development in West Papua, aligned with regional characteristics identified through the LQ–SSA analysis and oriented toward sustainable, community-based economic development (Jain et al., 2023).

Table 4. Recommendation of Transformation Technology for the Sustainable Copra Industry in West Papua

Quadrant	Regency/City	Recommendation
I (Base and Competitive)	a. Fak-fak, b. Manokwari, c. Teluk Wondama, d. Kaimana	Integration of IoT-based Monitoring Systems and Precision Agriculture Technologies These tools can optimize input use, monitor crop health in real time, and improve yield predictability, thereby maintaining productivity and competitiveness while safeguarding ecological integrity.
II (Non-Base but Growing)	-	Digital Innovation and Incubator Support By connecting local producers to e-commerce platforms, fostering start-ups, and providing incubation facilities, these sectors can scale more rapidly and begin to make significant contributions to the regional economy. The transition from non-base to base status requires targeted support in technology adoption, market access, and skill development.
III (Non-Base and Less Competitive)	a. Sorong, b. Sorong City, c. Teluk Bintuni	Diversification and Renewable Energy Integration Diversification may involve introducing alternative crops, livestock, or non-timber forest products within agroforestry systems to reduce dependency on underperforming commodities. At the same time, renewable energy solutions such as biomass or biogas drying systems for copra from agricultural residues can create new economic value while lowering production costs. This integrated approach can reposition declining sectors into more resilient and adaptive contributors to the regional economy. The sustainable copra industry-based agroforestry and waste-to-energy are optional livelihoods besides the manufacturing and mining sectors.
IV (Base but Less Competitive)	a. South Manokwari b. Raja Ampat, c. Maybrat, d. South Sorong, e. Tambrauw, f. Pegunungan Arfak	Value-added Processing and the Development of Smart Supply Chains Transforming copra into higher-value products such as virgin coconut oil, bioenergy, or nutraceuticals can significantly enhance profitability and market relevance. Coupled with smart logistics and digital supply chain management, these measures can reduce inefficiencies, enhance quality standards, and restore a competitive edge.

Source: Data Processed, 2025

CONCLUSION

Given the growing need to align regional economic development with environmental sustainability in resource-dependent regions, this study concludes that West Papua's economy is structurally anchored in the plantation, forestry, and fisheries sector, as indicated by the dominance of base sectors identified through Location Quotient and Shift Share analyses, although competitiveness varies across regions. The findings show that sectoral specialization alone is insufficient to ensure sustained growth, underscoring the importance of differentiated, region-specific development strategies. Within this framework, the copra-based coconut industry emerges as a viable catalyst for regional development due to its strong linkage with smallholder livelihoods, compatibility with forest-based agroforestry systems, and potential for downstream value creation. By positioning LQ and Shift Share as an analytical foundation for development planning, this study offers evidence-based insights to support inclusive and environmentally responsible subnational development in West Papua.

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