

JURNAL EKONOMI KUANTITATIF TERAPAN

Health Policies: Bolstering Human Resources & Healthcare Systems to Reduce Crude Death Rates in 2^e Countries
Mohamed Sesay, Rudi Purwono, Ni Made Sukartini

Downstream of Leading Primary Sector Industries in Papua Island
Albertus Girik Allo, Manda Sarungallo, Roni Bawole

Assessing Efficiency and Productivity of Micro and Small Industries: An Empirical Study in North Kalimantan
Ariani, Charitin Devi, Settingssulistya Rini Pratiwi, Yohanna Thresia Nainggolan, Wong Sing Yun

Are MSMEs the Key to Poverty Reduction? Dynamic Evidence from Indonesia Utilizing ARDL Analysis
Azhari, Musrizal Musrizal, Win Konadi

Financial Inclusion and Welfare: Comparison between Male-Headed and Female-Headed Households
Lita Jowanti, SettingsBudiono, Anhar Fauzan Priyono

The Role of Amenities and Accessibility on Domestic Tourism Demand in Indonesia
Maya Dethan, Khoirunurrofik

Analysis Of Participation Of Persons With Disabilities In The Labor Market
Ida Ayu Gde Dyastari Saskara, Diah Pradnyadewi

Smoking Cessation In Indonesia: Kick The Habit Today Or Is It Wiser To Hold On Forever?
Miftah Amalia Putri, I Dewa Gede Karma Wisana

Measuring Social Capital in Indonesia: An Item Response Theory (IRT) Approach
Nurul Islamy, Rus'an Nasrudin

The Downstream of Leading Primary Sector Industries in Papua Island

ABSTRACT

The downstream policy for several industries in Indonesia is articulated in the Medium-Term National Development Plan of 2020-2024. Downstream can raise a primary product's economic value, create jobs, and reduce raw material exports. This study aims to determine the predominant industries downstream of the primary sector in Papua Island. The Inter-Regional Input Output (IRIO) data utilized in this study are from those of the Central Statistics Agency (BPS). The backward and forward linkage indexes are calculated using the IRIO model developed by Miller and Blair (2009). The findings indicate that the predominant sector in Papua Island is the fisheries industry. The analysis reveals that the fisheries sector possesses both backward and forward linkage indices exceeding one. This condition signifies that the fishing sector significantly influences the advancement of other businesses that utilize its products as inputs. The fisheries business extensively employs outputs from various other industries as inputs for its operations. The conclusions are projected to increase the fishing sector's contribution to GRDP and the Fishermen's Exchange Rate (NTN) in Papua Island.

Keywords: Dominant Sector, Downstream, Primary Industry, IRIO

JEL Classification: L52, O13, R15

Introduction

Intensive capital in primary sectors, such as oil and gas has driven the flow of Foreign Direct Investment (FDI), taxes and royalties to regions possessing these resources. However, in developing countries, compared to manufacturing and service sectors, this has not contributed to the availability of significant job opportunities, skills development, added value, and linkages with various other sectors (Bam & De Bruyne, 2017; Bond, 2013; Morris et al., 2012). Downstream policies could serve as a solution to this. According to Bond (Bond, 2013), three conditions are needed in order to meet these opportunities, namely: (1) geographical and natural resources advantages; (2) private sector investment and ownership to ensure effective management; and (3) competitive processing and subsidies

cut-out. In addition, some challenges in developing downstreaming, (CRIF, 2025), including: (1) need for large investments; (2) high demand for electricity and logistics infrastructure; and (3) environmental and sustainability issues.

Indonesia, through the Medium-Term National Development Plan for 2020-2024, has planned a downstream policy based on the strengths of each province. For the Papua region, the downstream policy specifically focuses on industrial plantations, food crops, and fisheries. Downstream activities are anticipated to facilitate economic growth in Papua Island, achieving 8.1 percent in 2024; therefore, enabling it to align with other regions in Indonesia. Downstream not only stimulates economic growth but also has the capacity to accommodate a

substantial workforce, because it is able to develop other sectors, especially the manufacturing and service industries (Rifa'i, 2025,).

Papua Island is among the largest islands in Indonesia. In 2024, Papua Island comprised of six provinces—covering Papua Province, South Papua, Papua Mountains, Central Papua, West Papua, and Southwest Papua. It contributed 1.97 percent to the Indonesian GDP (BPS, 2025). This contribution is quite insignificant as compared to its natural resource potential and its expanse of 412,214.62 km², which constitutes 21.79 percent of Indonesia's total area. The economy of Papua Island is underpinned by two primary sectors, namely: (1) Agriculture, Forestry, and Fisheries; and (2) Mining and Quarrying. Data from BPS for 2022 indicates that the primary sector was accounted for 48.90 percent of Papua Province's economy and 28.70 percent of West Papua Province's economy. The primary sector in the Papua region not only contributes to the economy but also to the absorption of labor. Data from BPS 2023 indicates that 68.73 percent of the workforce was employed in the primary sector in Papua Province (Moko et al., 2024), whereas 37.31 percent in West Papua Province (Asturi et al., 2024).

The veneer production from Papua Island totals 89,531.81 m³, in which 84,489.46 m³ is from Papua Province and 5,042.35 m³ from West Papua Province. In Papua Island, a total of 204,432.9 m³ of sawnwood is produced, divided between Papua Province (118,831.40 m³) and West Papua (85,601.50 m³). The wood chip

production from Papua Island totals 9,286.89 m³, with 90.89 m³ attributed to Papua Province and 9,196 m³ to West Papua Province (KLHK, 2023). The fisheries potential over three *Wilayah Pengelolaan Perikanan (WPP)* 'Fisheries Management Areas' is 424,703 tons per year (WPP 717), 2,637,564 tons per year (WPP 718), and 715,293 tons per year (WPP 715) (KKP, 2022). Nonetheless, Papua predominantly markets its harvested fish in raw or semi-processed states, lacking adequate processing. In the fisheries sector, downstream refers to the process of transforming fish into products with extended shelf life and enhanced market value, like fillets, canned foods, or frozen items. In 2022, the mining and quarrying sector accounted for 18.25 percent of West Papua's GRDP, ranking just below the processing industry, with the oil, gas, and geothermal mining subcategory providing the most at 87.28 percent (Kardoso, 2024). In 2022, Papua Province's export value reached US\$ 6,273.47 million, predominantly driven by copper concentrate exports (HS26), which amounted to US\$ 6,204.52 million, constituting 98.90 percent of the province's total exports (Kholiq, 2022). In December 2022, mineral fuels (HS27) constituted the highest export value in West Papua Province, amounting to US\$ 294.51 million, representing 99.17 percent of the province's total exports (BPS Papua Barat, 2023).

The downstreaming of the primary sector in the island of Papua is anticipated to yield beneficial effects, specifically by stimulating economic growth through labor absorption and enhancing product competitiveness.

Prior research by Ronalia (2021) indicated that the industrial downstream in Riau is highly suitable, since the processing industry, being a primary sector, may stimulate and promote the development of other sectors. Research by Hidayat (2022) indicates that the sub-sectors of the food and beverage industry, textile and apparel industry, paper and paper goods industry, and printing and reproduction of recorded media exhibit significant forward and backward linkages with other sectors in Banten, establishing them as the region's leading sectors. Among these three sub-business fields, only the paper and paper goods industry and the printing and reproduction of recorded media serve as national leading sectors. Rahayu and Andari (2020) utilized the Location Quotient (LQ), Shift Share Analysis (SSA), and Klassen Typology methods to look at the leading sectors in Papua Province and found that the Mining and Quarrying sector was the leading sector. Meanwhile, research using the LQ method conducted in Southwest Papua shows that each district has different leading sectors (Allo, 2021; Rumere, 2024). Previous research has not determined the leading sectors based on the interrelationships between sectors.

This study aims to identify the principal industry in the island of Papua that is prioritized in the downstream sector. The wealth of the primary sector in the island of Papua serves as the fundamental capital for downstream activities. The study seeks to ascertain the priority of downstream primary sector sectors by employing backward and forward linking

methodologies based on Inter-Regional Input Output (IRIO) analysis. The determination of leading industries is based on previous research using a regional analysis approach with the LQ and SSA methods (Irmawati, 2015; Kharisma et al., 2021; Márquez et al., 2009). A weakness of previous research is that it does not consider how the developed leading sectors can encourage and attract the development of upstream and downstream sectors in a region. The IRIO model approach provides a better picture of the determination of leading sectors based on the backward and forward linkages of each industry. This means that the sector being developed must be a sector that has strong links with input-providing sectors and sectors that use input from that sector (Sahara, 2017).

1. Material and Methods

This study utilizes the 2016 Indonesian Inter-Regional Input Output (IRIO) Table issued by the Badan Pusat Statistik (BPS). The industry data in the IRIO table encompasses 52 industries and 34 provinces in Indonesia. The industrial classification is based on the classification according to BPS in the IRIO Table. Papua Province and West Papua Province represented the island of Papua before the new autonomous region was divided into six provinces in 2023, with Papua Province becoming four provinces (Papua, South Papua, Central Papua, and Papua Mountains) and West Papua Province becoming two provinces (West Papua dan Southwest Papua).

This study used the Inter-Regional Input Output (IRIO) model, an advancement of Input-Output (IO)

analysis (Sahara et al., 2024). This method was chosen to cover the weaknesses of the LQ and SSA methods in determining leading industries. This will result in a superior industry that is capable of encouraging and attracting the development of upstream and downstream sectors in a region. IRIO is a development of the Input Output method. Input-output analysis was initially presented by Wassily Leontief

in 1973, utilizing a general equilibrium model. For IRIO analysis, an IRIO Table is required in order to (1) illustrate the flows of products and services among economic sectors within a four-sector economy throughout Indonesian provinces and (2) delineate the interconnections among various economic sectors. Miller and Blair (2009) established the IRIO model, which possesses the following fundamental structure.

Table 1. Interindustry, Interregional Flows of Goods and Services

		Region <i>r</i>			Region <i>s</i>	
		1	2	3	1	2
Region <i>r</i>	1	z_{11}^{rr}	z_{12}^{rr}	z_{13}^{rr}	z_{11}^{rs}	z_{12}^{rs}
	2	z_{21}^{rr}	z_{22}^{rr}	z_{23}^{rr}	z_{21}^{rs}	z_{22}^{rs}
	3	z_{31}^{rr}	z_{32}^{rr}	z_{33}^{rr}	z_{31}^{rs}	z_{32}^{rs}
Region <i>s</i>	1	z_{11}^{sr}	z_{12}^{sr}	z_{13}^{sr}	z_{11}^{ss}	z_{12}^{ss}
	2	z_{21}^{sr}	z_{22}^{sr}	z_{23}^{sr}	z_{21}^{ss}	z_{22}^{ss}

There are two regions, *r* and *s*, whereby there are three sectors that buy and sell in region *r* and two sectors in region *s*. The notations z_{ij}^{rr} and z_{ij}^{ss} indicate intraregional flows, while z_{ij}^{sr} dan z_{ij}^{rs} indicate interregional flows. Table 1 can be converted into a matrix model, enabling it to be expressed as follows:

$$Z = \begin{bmatrix} Z^{rr} & Z^{rs} \\ Z^{sr} & Z^{ss} \end{bmatrix}$$

If *X* represents total output and *Y* is final demand, the fundamental structure of IRIO can be expressed in the followong equation:

Region *r*:

$$X_1^r = z_{11}^{rr} + z_{12}^{rr} + z_{13}^{rr} + z_{11}^{rs} + z_{12}^{rs} + Y_1^r \dots\dots\dots(1)$$

$$X_2^r = z_{21}^{rr} + z_{22}^{rr} + z_{23}^{rr} + z_{11}^{rs} + z_{22}^{rs} + Y_2^r \dots\dots\dots(2)$$

$$X_3^r = z_{31}^{rr} + z_{32}^{rr} + z_{33}^{rr} + z_{31}^{rs} + z_{32}^{rs} + Y_3^r \dots\dots\dots(3)$$

Region s:

$$X_1^s = z_{11}^{sr} + z_{12}^{sr} + z_{13}^{sr} + z_{11}^{ss} + z_{12}^{ss} + Y_1^s \dots\dots\dots (4)$$

$$X_2^s = z_{21}^{sr} + z_{22}^{sr} + z_{23}^{sr} + z_{11}^{ss} + z_{22}^{ss} + Y_2^s \dots\dots\dots (5)$$

The equation in region r and s can be streamlined to derive the input coefficient (equation 6 and 8) and the interregional trade coefficient (equation 7 and 9) for region r and s as follows:

$$a_{ij}^{rr} = \frac{z_{ij}^{rr}}{X_j^r} \dots\dots\dots (6)$$

$$a_{ij}^{rs} = \frac{z_{ij}^{rs}}{X_j^s} \dots\dots\dots (7)$$

$$a_{ij}^{ss} = \frac{z_{ij}^{ss}}{X_j^s} \dots\dots\dots (8)$$

$$a_{ij}^{sr} = \frac{z_{ij}^{sr}}{X_j^r} \dots\dots\dots (9)$$

Substituting equations (6) to (9) into equations (1) to (5) yields:

Region r:

$$X_1^r = a_{11}^{rr}X_1^r + a_{12}^{rr}X_2^r + a_{13}^{rr}X_3^r + a_{11}^{rs}X_1^s + a_{12}^{rs}X_2^s + Y_1^r \dots\dots\dots (10)$$

$$X_2^r = a_{21}^{rr}X_1^r + a_{22}^{rr}X_2^r + a_{23}^{rr}X_3^r + a_{21}^{rs}X_1^s + a_{22}^{rs}X_2^s + Y_2^r \dots\dots\dots (11)$$

$$X_3^r = a_{31}^{rr}X_1^r + a_{32}^{rr}X_2^r + a_{33}^{rr}X_3^r + a_{31}^{rs}X_1^s + a_{32}^{rs}X_2^s + Y_3^r \dots\dots\dots (12)$$

Region s:

$$X_1^s = a_{11}^{sr}X_1^r + a_{12}^{sr}X_2^r + a_{13}^{sr}X_3^r + a_{11}^{ss}X_1^s + a_{12}^{ss}X_2^s + Y_1^s \dots\dots\dots (13)$$

$$X_2^s = a_{21}^{sr}X_1^r + a_{22}^{sr}X_2^r + a_{23}^{sr}X_3^r + a_{21}^{ss}X_1^s + a_{22}^{ss}X_2^s + Y_2^s \dots\dots\dots (14)$$

Equation (10) through (14) are formulated in a matrix as follows:

$$\begin{bmatrix} a_{11}^{rr} & a_{12}^{rr} & a_{13}^{rr} & a_{11}^{rs} & a_{12}^{rs} \\ a_{21}^{rr} & a_{22}^{rr} & a_{23}^{rr} & a_{21}^{rs} & a_{22}^{rs} \\ a_{31}^{rr} & a_{32}^{rr} & a_{33}^{rr} & a_{31}^{rs} & a_{32}^{rs} \end{bmatrix} \begin{bmatrix} X_1^r \\ X_2^r \\ X_3^r \end{bmatrix} + \begin{bmatrix} Y_1^r \\ Y_2^r \\ Y_3^r \end{bmatrix} = \begin{bmatrix} X_1^r \\ X_2^r \\ X_3^r \end{bmatrix} \dots\dots\dots (15)$$

It can be expressed in a simplified form as follows:

$$AX + Y = X \dots\dots\dots (16)$$

or

$$X = (I - A)^{-1}Y \dots\dots\dots (17)$$

in which

- I = Identity matrix
- Y = Final demand
- X = Total Output
- $(I - A)$ = Leontief matrix
- $(I - A)^{-1}$ = Inverse Leontief matrix

The Leontief inverse matrix is commonly known as the multiplier. This value is utilized to compute the intraregional and interregional effects. The intraregional effect in the Leontief inverse matrix is determined by summing the columns corresponding to each industry inside the inter-industry transaction matrix for the same region (or direct matrix). The intra-regional effect refers to an increase in output within a region resulting from alterations in final demand from an industry located in that region. The interregional effect is derived by deducting the output multiplier value from the intraregional effect multiplier value for each industry and region. The inter-regional effect refers to an augmentation in output within a region resulting from alterations in final demand from

industries in a different location (Puspita et al., 2021). The Input-Output model elucidates the interconnections across sectors in the production process through the examination of backward and forward linkages. Backward linkage refers to the correlation between alterations in final demand from an industry and the output generated by that industry and others; it is often termed the output multiplier. Forward linkage refers to the connection between variations in final demand from other sectors and the production generated by a certain industry. The linkage value is derived from the Leontief inverse matrix by calculating the column sums for backward linkage and the row sums for forward linkage. The backward linkage value can be computed mathematically as follows:

$$BL(i)_j = \sum_{i=1} I_{ij}$$

in which

$BL(i)_j$ = backward linkage for industry j

I_{ij} = cell values in the row industry i and column industry j of the Leontief inverse matrix

Simultaneously, the forward linkage is computed as follows.

$$FL(i)_i = \sum_{j=1} I_{ij}$$

in which

$FL(i)_i$ = forward linkage for industry i

I_{ij} = cell values in the row industry i and column industry j of the Leontief inverse matrix

Dominant industries can be delineated or recognized from the linkage value by computing the backward linkage index and the forward linkage index. Industries with a backward linkage index above one and a forward linkage index surpassing one are classified as leading industries (key sectors).

2. Result

The multiplier effect in the IRIO model can be decomposed into two, namely the intra-regional effect and the inter-regional effect. Intraregional effect is the impact of changes in final demand in an industry in a particular region on the output of that industry and other industries in that region. In other words, it can be defined as an increase

in output that occurs in a region due to changes in final demand from an industry in that region. Meanwhile, the interregional effect is the impact of changes in final demand in an industry in a particular region on the output of industries in other regions. It

can also be defined as an increase in output that occurs in a region due to changes in final demand from an industry in another region. The intra-regional and inter-regional effect values for the primary industry in the Papua area are as follows:

Table 2. Intra-Regional and Inter-Regional Impacts in Papua Island Regarding Primary Industries

Code	Industries	Papua Province			West Papua Province		
		Intra Effect	Inter Effect	Total Effect	Intra Effect	Inter Effect	Total Effect
I-01	Agricultural Cultivation of Food Crops	1,1590	0,0518	1,2108	1,0876	0,1179	1,2055
I-02	Seasoning, Perennial Agriculture, and Other Crops	1,1477	0,1132	1,2610	1,1109	0,1386	1,2496
I-03	Seasonal and Annual Plantations	1,0875	0,1533	1,2409	1,0877	0,0877	1,1754
I-04	Cattle CATTLE/Livestock	1,2325	0,1277	1,3601	1,3597	0,1360	1,4958
I-05	Agricultural Services and Hunting	1,1281	0,0705	1,1986	1,1724	0,1243	1,2968
I-06	Forestry and Logging	1,1600	0,0346	1,1947	1,0972	0,0640	1,1612
I-07	Fisheries	1,3335	0,0682	1,4017	1,1962	0,1427	1,3389
I-08	Oil, Gas and Geothermal Mining	1,0000	-	1,0000	1,1726	0,1781	1,3507
I-09	Coal and Lignite Mining	1,0000	-	1,0000	1,0000	0,0000	1,0000
I-10	Metal Ore Mining	1,2941	0,0761	1,3702	1,2616	0,2185	1,4801
I-11	Other Mining and Quarrying	1,2680	0,1212	1,3891	1,2797	0,3374	1,6170

The table shows that the total effect's value is greater than one, implying that investment in the primary sector industry has the potential to boost the area economy beyond the investment itself. The total effect is split between intra-regional and inter-regional effects. The intra-regional effect is bigger than the inter-regional effect, indicating that investment in the primary sector in Papua Island will benefit the island more than other regions. The examination of Table 2 indicates that the fishing industry in

Papua Province has the most significant intra-regional effect, quantified at 1.3335. The rise in final demand within the fisheries industry in Papua Province results in a substantial augmentation of both the fisheries industry's output and that of other sectors in the region. An increment of IDR 10,000 in final demand within the fisheries sector will result in a total output gain of IDR 13,335 in Papua Province. The predominant inter-regional impact in Papua Province pertains to seasonal

and annual plantation industries, quantified at 0.1533. This indicates that a rise in final demand of IDR 10,000 within the seasonal and annual plantation sector will yield an increase in total output of IDR 1,533 in regions beyond Papua Province. The total effect encompasses both intra- and inter-regional influences in Papua Province. The industry with the greatest value is fisheries, valued at 1.4017. For each IDR 10,000 rise in final demand within the industry, there is a corresponding total output increase of IDR 14,017, applicable to both Papua Province and other regions. This signifies that the fishing sector is not only vital for the economy of Papua Province but also substantially contributes to the economies of neighboring regions. It might be inferred that the fisheries industry is a principal sector in Papua Province, significantly influencing both the local economy and that of other regions.

West Papua Province exerts the most significant intra-regional impact on the cattle/livestock industry, with a value of 1.3597. An escalation in final demand within the livestock sector of West Papua Province results in a substantial augmentation of output in both the livestock industry and other sectors in the province. An increment of IDR 10,000 in ultimate demand inside the cattle sector will elevate the total production by IDR 13,597 in West Papua Province. The other mining and quarrying industries exhibit the most significant inter-regional effect in West Papua Province, with a value of 0.3374. This indicates that an increase in final demand by IDR 10,000 in these industries will result in a total output increase of IDR 3,374 in regions

outside West Papua Province. West Papua Province exhibits both intra-regional and inter-regional impacts. The other mining and quarrying industries holds the highest value, at 1.6170. This indicates that for each IDR 10,000 rise in final demand within this industry, there is a corresponding IDR 16,170 increase in total output, applicable to both West Papua Province and other regions beyond West Papua Province. This figure suggests that the other mining and quarrying industries in West Papua Province is crucial not only for its own economy but also for the economies of other regions. Thus, it can be concluded that the other mining and quarrying industries is a primary industry in West Papua Province, significantly influencing the economy of both West Papua and external regions.

The output multiplier study seeks to assess the effects of alterations in final demand of a specific industry in the economy of a given region throughout all industries, both within that region and across other regions. The income multiplier indicates that the quantity of family income is generated from the introduction of one unit of final demand currency in the industry or region. The production multiplier quantifies the total output generated by a one-unit increase in final demand; meanwhile, the household income multiplier assesses the rise in final demand as a result of increased household income. The gross value added multiplier quantifies the entire income generated by a one-unit alteration in final demand within a sector. Loizou et al. (Loizou et al., 2019) assert that a decline in

production across agricultural sectors, resulting from diminished productivity or trade intensity, adversely affects the performance of the regional sector, subsequently impacting household income in both agricultural and non-agricultural sectors.

Output multiplier analysis aims to see how changes in final demand in an industry affects the economy of a particular region throughout all industries, both in that region and in

other regions. The gross value added multiplier measures the total income created by a one-unit change in final demand in a sector. The income multiplier shows the amount of household income created by adding one unit of final demand in that industry or region. While the output multiplier measures the total output created by a one-unit increase in final demand, the household income multiplier measures the increase in final demand in the form of household income.

Table 3. Multiplier Value of Output, Gross Value Added, and Household Income in Papua and West Papua for Primary Industry.

Industry	Papua Province			West Papua Province		
	Output	Gross Value Added	Household Income	Output	Gross Value Added	Household Income
Agricultural Cultivation of Food Crops	1,1590	0,9611	0,6419	1,0876	0,9211	0,3724
Seasoning, Perennial Agriculture, and Other Crops	1,1477	0,9124	0,5476	1,1109	0,9111	0,2834
Seasonal and Annual Plantations	1,0875	0,8851	0,4564	1,0877	0,9425	0,4908
Cattel/Livestock	1,2325	0,9225	0,4323	1,3597	0,9105	0,6054
Agricultural Services and Hunting	1,1281	0,9483	0,5000	1,1724	0,9232	0,5000
Forestry and Logging	1,1600	0,9751	0,6433	1,0972	0,9560	0,3062
Fisheries	1,3335	0,9497	0,5084	1,1962	0,9136	0,2743
Oil, Gas and Geothermal Mining	-	-	-	1,1726	0,8786	0,2436
Coal and Lignite Mining	-	-	-	-	-	-
Metal Ore Mining	1,2941	0,9411	0,8066	1,2616	0,8579	0,5524
Other Mining and Quarrying	1,2680	0,8905	0,6056	1,2797	0,7825	0,3350

A multiplier impact value on output, gross value added, and household income bigger than one means that the investment generates more benefits than the investment itself. If the value is less than one, it means that the investment exceeds the impact. The analytical results in Table 3 reveal that the fisheries industry in Papua Province possesses the highest production multiplier, measured at 1.3335. This number indicates that an increase of IDR 10,000 in final demand for the fisheries industry will elevate the economic production in West Papua Province by IDR 13,335. The fisheries business ranks third among the eleven primary industries in Papua Province, with a gross value added multiplier of 0.9497. This statistic shows that an increase of IDR 10,000 in final demand for the fisheries industry will elevate the gross value added of Papua Province's economy by IDR 9,497. The household income multiplier for the fishing industry in Papua Province is 0.5084, ranking it sixth among the eleven primary industries. An increase of IDR 10,000 in final demand for the fisheries industry will result in a IDR 5,084 rise in household income in Papua Province. Simultaneously, the forestry and logging industries contributes the highest gross value-added multiplier to the economy of Papua Province, quantified at 0.9751. A rise of IDR 10,000 in final demand for food crops in the agriculture sector will elevate the gross value added of Papua Province's economy by IDR 9,751. The metal ore mining industry in Papua Province exhibits the highest household income multiplier, measuring 0.8066, in comparison to

other sectors. An increase of IDR 10,000 in final demand within the metal ore mining sector will result in a corresponding rise of IDR 8,066 in household income in Papua Province.

West Papua Province exhibits the highest output and family income multipliers from the cattle/livestock industry, recorded at 1.3597 and 0.6054, respectively. The production multiplier of 1.3597 signifies that a IDR 10,000 rise in final demand for the cattle/livestock industry will elevate the economic output in West Papua Province by IDR 13,597. The household income multiplier value of 0.6054 indicates that a IDR 10,000 rise in final demand within the cattle/livestock industry will result in a IDR 6,054 increase in household income in West Papua Province. The cattle/livestock business ranks seventh among eleven primary industries in West Papua Province, with a gross value-added multiplier of 0.9105. This result indicates that an increase of IDR 10,000 in final demand for the cattle industry will elevate the gross added value of the economy in West Papua Province by IDR 9,105. Simultaneously, the forestry and logging sector contributes the highest gross value-added multiplier to the economy of West Papua Province, amounting to 0.9560. A rise of IDR 10,000 in final demand within the forestry and logging sector will elevate the gross value added economy in West Papua Province by IDR 9,611.

The forward linkage value demonstrates the extent to which changes in output within a certain sector or location are influenced by

heightened final demand from other industries or regions. The backward linkage value relates to the relative impact of increased final demand from

specific sectors or regions on output changes in other industries or locations.

Table 4. Backward and Forward Linkage Index Values of Primary Industries in the Papua dan West Papua Province

Industry	Papua Province		West Papua Province	
	Forward Linkage	Backward Linkage	Forward Linkage	Backward Linkage
Agricultural Cultivation of Food Crops	1,3671	1,2108	1,1960	1,2055
Seasoning, Perennial Agriculture, and Other Crops	1,0473	1,2610	1,0723	1,2496
Seasonal and Annual Plantations	1,3975	1,2409	1,3974	1,1754
Cattel/Livestock	1,0598	1,3601	1,3256	1,4958
Agricultural Services and Hunting	1,0537	1,1986	1,0593	1,2968
Forestry and Logging	1,9549	1,1947	1,8280	1,1612
Fisheries	2,0942	1,4017	1,7815	1,3389
Oil, Gas and Geothermal Mining	1,0000	1,0000	3,3433	1,3507
Coal and Lignite Mining	1,0000	1,0000	1,0000	1,0000
Metal Ore Mining	2,4261	1,3702	1,0055	1,4801
Other Mining and Quarrying	1,4175	1,3891	1,5122	1,6170

IRIO analysis is quite beneficial to determine strong connections among economic sectors across regions (Gao et al., 2020). The interrelationships between economic sectors across geographies are classified into two types: forward linkage and backward linkage. A forward linkage value greater than one indicates that investment in the primary industry has a greater impact on the downstream sector than the investment. Meanwhile, a backward connection value greater than one indicates that investment in a primary industry has a stronger link to the upstream sector than to the investment. Table 4 points out that the highest forward linkage index value in

Papua Province pertains to the metal ore mining industries, recorded at 2,4261. This means that a IDR 10,000 rise in final demand in sectors excluding the metal ore mining business will result in a IDR 24,261 increase in output in industries outside the ore mining sector in Papua Province. In Papua Province, the fishing industry possesses the greatest backward linkage index value, measuring 1,4017. This indicator demonstrates that a IDR 10,000 rise in final demand for fisheries will result in a IDR 14,017 increase in the total output of Papua Province. The predominant industry in West Papua Province with the highest forward linkage index value is the oil, gas, and

geothermal mining sector, which has a score of 3,3433. This pinpoints that a IDR 10,000 rise in final demand in sectors excluding the oil, gas, and geothermal mining industry will result in a IDR 33,433 increase in output in the same sectors. In West Papua Province, the other mining and quarrying industry possesses the greatest backward linkage index value, recorded at 1.6170. This information implies that an increase of IDR 10,000 in final demand within the mining and other excavation sectors will result in a total output rise of IDR 16,170 for West Papua Province.

The analytical results in Tables 2, 3, and 4 reveal that the downstreaming of the primary sector on Papua Island affects the household and regional economies. Intra-regional and inter-regional data demonstrate that primary industries in Papua Island have a major effect on the development of related industries in Papua Island while having a minor impact on the economy outside of Papua Island. Furthermore, the influence of primary industry on Papua Island has a considerable macroeconomic advantage in terms of economic output (Gross Regional Domestic Product/GRDP), but has minimal effect on added value and household income. Thus, downstreaming the primary sector on Papua Island is the solution to for this gap. Backward and forward linkages data analysis hint that Papua Island's primary industries can drive upstream and downstream industries.

The forward and backward linkage values help identify the dominant industry downstream of the primary

sector in the Papua area. An industry exhibiting a forward linkage index value exceeding one and a backward linkage index value surpassing one demonstrates robust connections with other industries, encompassing both those utilized in production and those that will employ it as input. Quadrant I is classified as a major industry due to its forward and backward linkage index values exceeding one ($1>$). Quadrants II and III are industries with growth potential due to their multiple forward and backward linkage index values ($1>$). Quadrant IV represents an underdeveloped industry, characterized by a forward or backward linkage index value of less than one ($1<$). In this study, the average forward and backward linkage values are determined at the province and national levels. The provincial average represents the average forward and backward linkage values for the Papua and West Papua provinces only. The national average represents the average forward and backward linkage values across all provinces in Indonesia. These discrepancies in average values reflect regional differences in Indonesian industrialization policies.

The identification results indicate that all main industries in Papua Province, with the exception of the Oil, Gas, and Geothermal Mining industry and Coal and Lignite Mining, as well as in West Papua Province, specifically Coal and Lignite Mining, are classified as superior commodities (refer to Table 4). To determine which priority will be emphasized, the average forward and backward linkage values at the national level (Figures 1 and 3) for each province are incorporated, in

addition to the aforementioned requirements. Additionally, the mean forward linkage and backward linkage in Papua Province will be employed

(Figure 2) and West Papua Province (Figure 4).

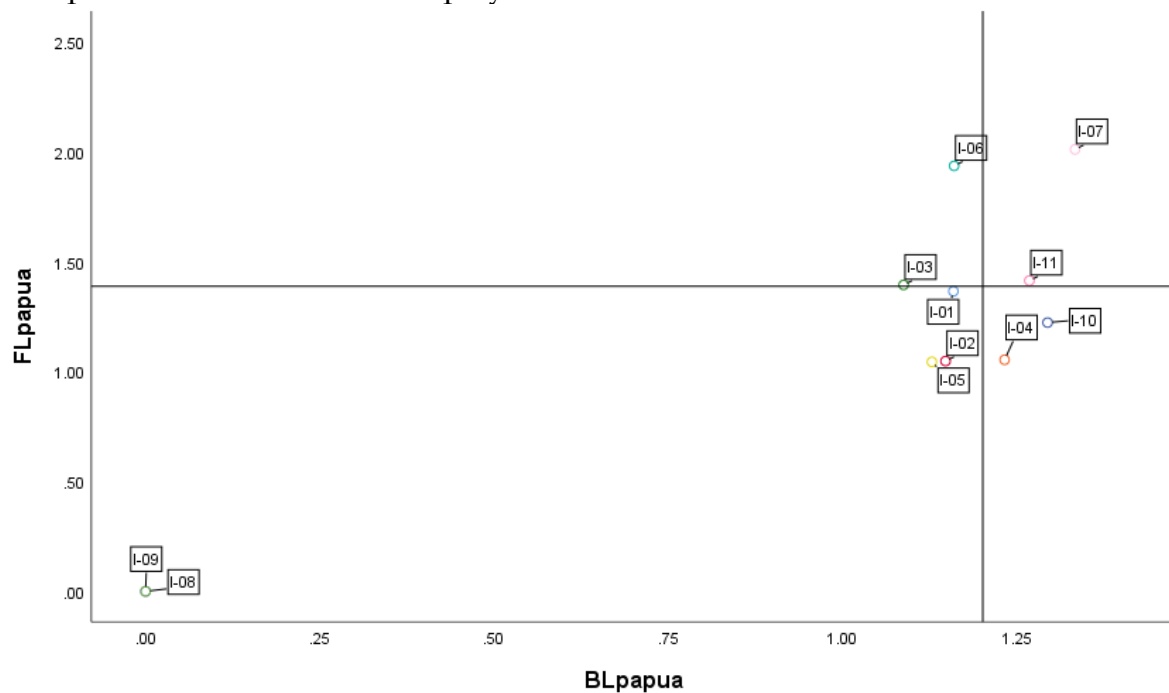


Figure 1. Identification of priority leading industries of Papua Province at the national average level.

The primary sector industry of Papua Province, located in quadrant I, exhibits a forward linkage value exceeding one ($1>$) and a backward linkage value surpassing one ($1>$) as well. Both levels are above those of the national average. The sectors include mining and other excavation businesses, as well as the fishing industry. The two industries are the principal focuses in the advancement of the primary sector in Papua Province. The second priority category consists of entities with both forward and backward linkage values

exceeding one ($1>$) and at least one of these values surpasses the national average. This group comprises of (1) seasonal and perennial plantations; (2) livestock; (3) forestry and logging; and (4) metal ore mining. The third priority group relates entities exhibiting both forward and backward linkage values over one ($1>$) while remaining below the national average. Sectors belonging to this group are (1) food crop agriculture; (2) seasonal horticultural agriculture, permanent horticulture, and related sectors; and (3) agricultural and hunting services.

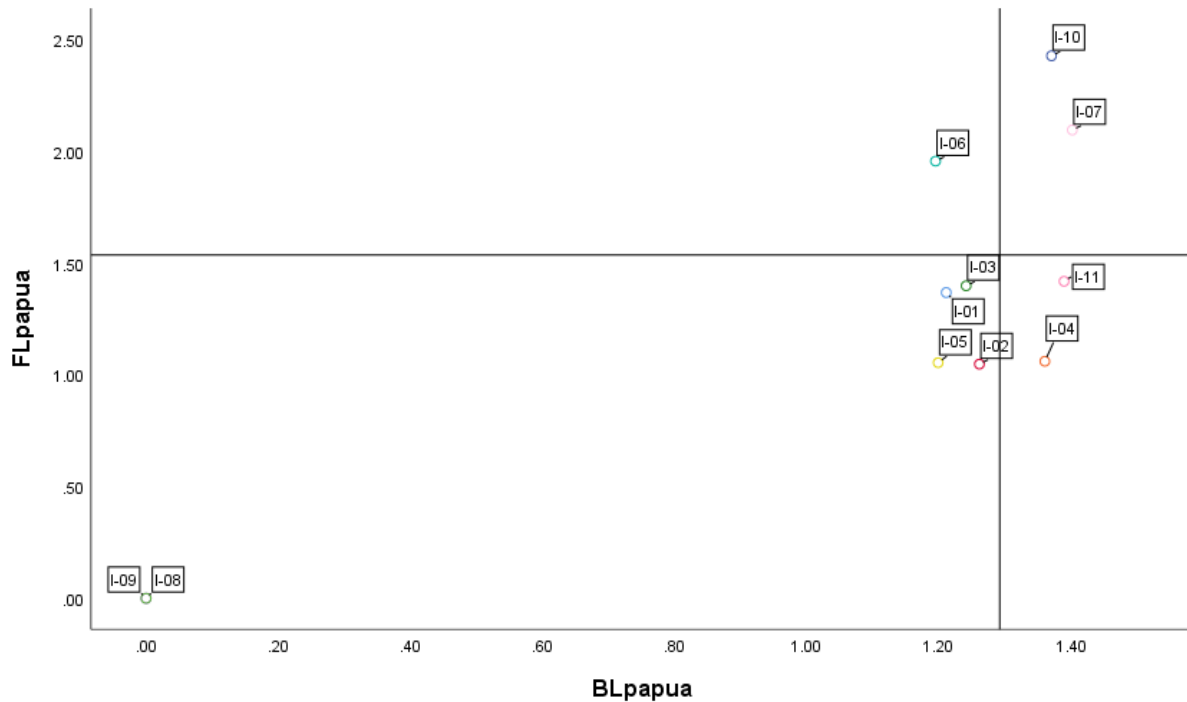


Figure 2. Identification of priority leading industries of Papua Province at the province average level

The outcomes differ when employing the mean forward linkage and backward linkage values of Papua Province (Figure 2). The prioritized industries are (1) fisheries and (2) metal ore mining. The secondary priority is as follows: (1) the cattle sector, (2) forestry and logging, and (3) additional mining and excavation activities. The sectors in the third priority include: (1) food crop agriculture; (2) annual horticultural crop agriculture, perennial horticulture, and related fields; (3) annual and perennial plantations; and (4) agricultural and hunting services. The industry's significance is illustrated by the disparity in defining the priority of the predominant primary sector industries in Papua Province when comparing the national average to the provincial average.

Mining and other excavation industries are the primary focus at the national level and the secondary priority at the provincial level. This signifies that this industry has a greater impact on sectors beyond Papua Province than within it. The metal ore mining industry ranks second nationally and first provincially. The significance of the metal ore mining business in Papua Province surpasses its impact in regions outside Papua. The difference in analysis results between the Papua Province average and the national average illustrates the industry's competitiveness on both the national and provincial levels. Because of its national and provincial competitiveness, the fishing industry is a major priority for downstream.

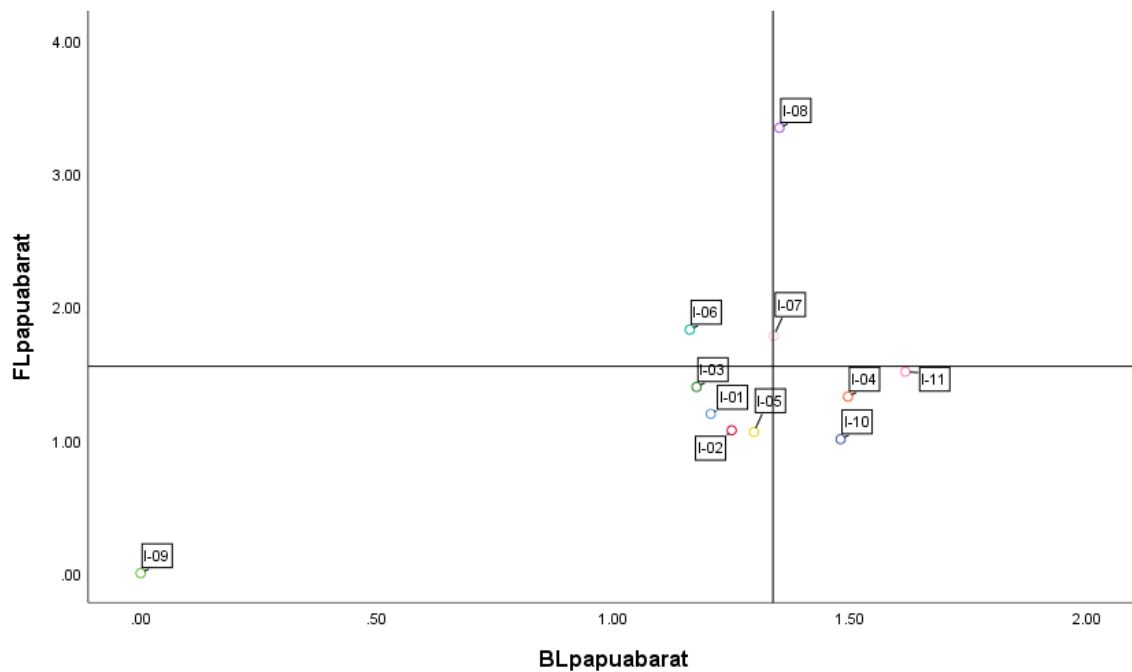


Figure 3. Identification of priority leading industries of West Papua Province at the national average level

The forward and backward linkage values for the primary sector industry in Papua Province exceed one and above the national average. These values pertain to the oil, gas, geothermal mining, and fishing industries. The two industries are the principal focuses in the advancement of the primary sector in Papua Province. The second priority group comprises entities with both forward and backward linkage values exceeding one ($1>$) and at least one of these values surpasses the national average. This group encompasses the following industries: (1) cattle; (2) forestry and logging; (3) metal ore mining; and (4) other mining and excavation. The third priority group consists of entities exhibiting both forward and backward linkage values over one ($1>$) while remaining below the national average. This group encompasses (1) food crop agriculture; (2) annual horticultural crop agriculture, annual horticulture, and

related sectors; and (3) agricultural and hunting services.

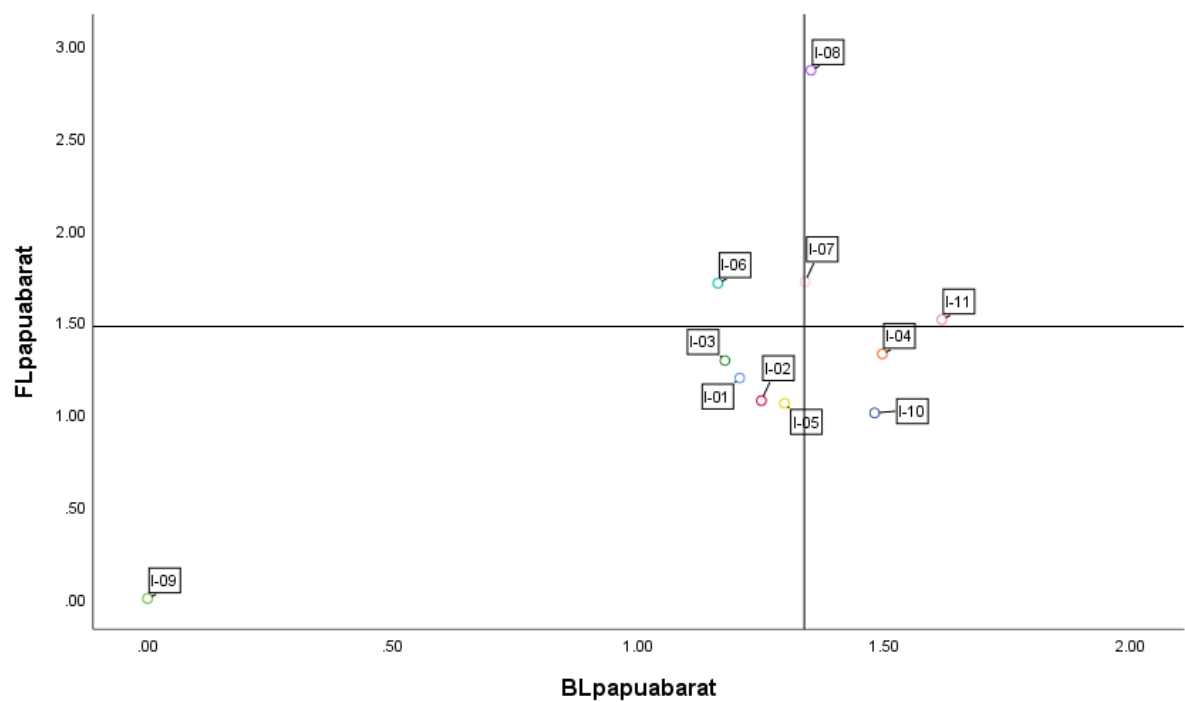


Figure 4. Identification of priority leading industries of West Papua Province at the province average level

The outcomes differ when employing the mean forward and backward linkage values of West Papua Province (Figure 4). The prioritized industries are (1) fisheries; (2) oil, gas, and geothermal extraction; and (3) more mining and excavation activities. The secondary priorities are (1) the cattle sector, (2) forestry and logging, and (3) metal ore extraction. The sectors in the third priority are (1) food crop agriculture; (2) seasonal and annual horticulture; (3) seasonal and annual plantations; and (4) agricultural and hunting services. The difference in analysis results between the West Papua Province average and the national average demonstrates the industry's competitiveness at both the national and provincial levels. The fisheries industry is one of the top industries prioritized for downstream due to its national and provincial competitiveness.

3. Discussion

The preceding analyses show that the foremost priority for the advancement of the principal primary sector industries in *Tanah Papua* is the

fisheries industry, along with the metal ore mining, oil, gas, geothermal mining, and other mining and excavation industries. This result differs from previous research (Rahayu & Andari, 2020) in which the mining and quarrying sector was the leading sector in Papua Province. Meanwhile, research from (Allo, 2021; Rumere, 2024) supports the results of this study, since the agriculture, forestry, and fisheries sectors are the leading sectors for several districts in West Papua Province.

In 2022, the mining sector constituted 38.60 percent of the Gross Regional Domestic Product (GRDP) of Papua Province (Chairani, 2023) and 18.25 percent of the GRDP of West Papua Province (Manurung & Kardoso, 2023), establishing it as a cornerstone of the economy in the land of Papua. The land of Papua's economy is heavily reliant on the mining sector, although this reliance presents hazards to the regional economy. This is so since the mining sector is susceptible to variations in commodity prices, the effects of

global policy, and finite natural resources that might affect the local economy. The cost of mining commodities ALSO varies in the international market. Falling commodity prices may result in a reduction in regional income. International policies, including trade rules and carbon emission standards, can affect the demand and export value of mining products. AS natural resources like mining, oil, and gas are non-renewable, they have their finite availability and slow replenishment rate. Moreover, the development of these resources needs an extensive geological timeframe, spanning millions to billions of years. Another constrain is that excessive mining exploitation can deplete natural resource supplies, resulting in diminished regional income for places reliant on this activity. What is more, inadequate oversight of mining operations can result in environmental degradation, including water contamination, soil erosion, and diminished soil fertility. Environmental degradation resulting from mining operations can impede other sectors, like agriculture and fisheries.

Papua Island's reliance on the mining sector must be alleviated to establish a more stable and sustainable economy through the diversification and development of alternative, more sustainable businesses. Among the three industries assessed by forward linkage and backward analysis, the fisheries sector is prioritized for the advancement of a more sustainable primary industry in Papua Island. This corresponds with the concept of a leading industry as specified in the West Papua Governor Regulation Number 9 of 2023, pertaining to the West Papua Province Industrial Development Plan for 2023-2043. The predominant sectors are non-oil and gas processing industries that

substantially contribute to the regional economy. These sectors are classified as national priority industries, and possess considerable value and potential to satisfy either domestic or export markets, thereby supporting the established vision and mission of regional development priorities. Papua Island, abundant in fishing resources, has the capacity to enhance the fisheries industry. This finding aligns with the study's results, which indicate that the advancement of key industries in the downstream primary sector in Papua Island is prioritized in the fishing sector. The agriculture sector, including the fisheries industry, plays a significant role in employment generation (Khan et al., 2020), increasing economy of communities especially in coastal areas (Ho, 2022), increasing small and medium industries (Arhas & Suprianto, 2024), and maintaining food security and nutrition for coastal communities (IFAD, 2017).

The potential of fishery resources on the island of Papua is spread across three Fisheries Management Areas (WPP), namely WPP 717 which covers the northern waters of Papua, WPP 718 which covers the Arafura waters and WPP 715 which covers the waters of Berau Bay, Sorong and Raja Ampat. Consecutively, the fisheries potential in Papuan is 424,703 tons/year, 2,637,564 tons/year and 715,293 tons/year (KKP RI, 2022). However, this potential has not been utilized optimally. In 2021, production of fish catch in Papua Province reached 247,238 tons, while aquaculture reached 22,144 tons (Azhar, 2024). Meanwhile, West Papua Province produced 192,025 tons of fish catch and 9,939 tons of aquaculture during the same time period. Other industries provide inputs such as gasoline, fishing and farming equipment, and

transportation to the fishing sector. Because of the numerous economic activities that these inter-industry interactions generate, they also have substantial production multipliers. The fishing industry in Papua Island has a high output multiplier but a low value-added multiplier. This is because the majority of Papua Island's fishery products are marketed in raw form, with no additional processing to boost their selling value. FOR example: Papua Province's Micro and Small Scale Fish Processing Units generated a total of 1,461 tons of processed products. According to these findings, just 0.312 percent of the entire production of capture fisheries and aquaculture is processed to boost the added value of fishery products.

The majority of fish-producing areas are in Eastern Indonesia, accounting for 64.41 percent of total production, whereas the processing industry is primarily located in Western Indonesia. This circumstance indicates that fish producers and downstream fish processing facilities are separated by distance. This will raise transportation costs in the processing industry's production cost structure. Ultimately, this will reduce the competitiveness of processed items in overseas markets. The percentage of fisheries transportation logistics costs remains at 28.7 percent; high logistics costs induce comparatively low fish prices at the fisherman level but relatively high consumer prices (Dahiri & Kusumawardhani, 2021). Because of the high transportation expenses, fishermen's profit margins will be limited, resulting in low net income and a low household income multiplier.

Nonetheless, numerous impediments obstruct the advancement of the fisheries sector in Papua Island. First,

Infrastructure Constraints. Geographical constraints and inadequate infrastructure are among the issues faced BY downstream in the fisheries sector. Papua Island is an island characterized by rugged terrain, valleys, and lowlands, which complicates the development of transportation infrastructure. This constraint hinders fishermen's access to ports, fish processing facilities, and markets, hence obstructing logistics and elevating operational costs. Second, Constraints of Infrastructure in the Cold Chain. The perishable nature of fishery goods necessitates a cold chain in the fisheries business. The cold chain, as articulated by Simatupang, constitutes a segment of the supply chain designed to preserve temperature, ensuring product integrity throughout the collection, processing, and transportation of commodities until they reach consumers. Cold chain management incorporates all activities related to the cold chain that are examined, measured, regulated, documented, and validated to ensure their technical and economic effectiveness and efficiency. Insufficient cold chain infrastructure, including cold storage facilities, ice production plants, and refrigerated transportation, constitutes a significant challenge in the downstream sector of the fisheries business in Papua Island.

Third, Restricted Amenities and Processing Technology. One purpose of downstream operations is to enhance the value of products through processing. Inadequate processing facilities and technology hinder the advancement of downstream fisheries in Papua Island. Fourth, Human Resource Competencies. The downstream sector of the fisheries industry needs skilled human resources to guarantee an effective and efficient processing operation. The human resources in

Papua Island are lacking in contemporary processing procedures, marketing, and company management skills. This in the end brings disadvantage to the advancement of the downstream fisheries sector in Papua Island.

The following strategic measures can be used to address downstream issues in the fishing business in Papua Island. First, Infrastructure Advancement. Infrastructure development is essential to boost the downstream sector of the fishing industry. This includes the construction or improvement of fishing ports by incorporating auxiliary facilities, such as fish auction sites and refrigerated storage units. Enhancing road and transportation infrastructure can optimize the distribution of fish captures and processing, thereby lowering distribution expenses. Second, Enhancing Cold Chain Infrastructure. The cold chain is essential to maintain the quality of harvested and processed items until they reach consumers. Consequently, it is vital to enhance cold chain infrastructure by constructing cold storage warehouses and ice production facilities, in addition to acquiring refrigerated vehicles and containers to preserve the quality of fishing products. Enhancing infrastructure in the agricultural sector, particularly in the fisheries industry for remote regions, is justifiable due to the substantial advantages it offers to farm or fisheries households (Shamdasani, 2021). Investment in the agricultural industry will positively influence the output of both the agricultural sector and other sectors (Humbatova & Hajiyeu, 2020; Nyiwul & Koirala, 2022; Sahara et al., 2022).

Third, Establishment of fish processing facilities and acquisition of

advanced fish processing technology. The establishment of fish processing facilities and the acquisition of advanced technology for fish processing are fundamental to push the downstream sector of the fisheries industry in Papua Island. Establishing sufficient processing facilities and employing advanced technology can highly increase the value of the fishing products. The establishment of fish processing facilities can be achieved by creating a fish processing unit that includes areas for processing, packaging, and refrigerated storage. The utilization of contemporary processing technologies, including fish fillet cutting machines, fish grinding machines, fish drying machines, blast freezers, and packaging machines, is essential for enhancing the efficiency and quality of fisheries products. The advancement of the agricultural sector, including the fisheries industry, should align with long-term economic growth objectives and prioritise investment in supportive equipment (Zaman et al., 2021). Fourth, Enhancing Human Resource Competencies. Competent human resource skills are crucial for the advancement of the downstream fisheries sector. Competent professionals are needed in the processing of fishing products, marketing, and business administration. Educational institutions, including universities and affiliated organizations, can strengthen human resource competencies through education, training, and mentorship. Specialised support and attention from the government are IMPERATIVE, as the government plays a pivotal role in promoting agricultural development and enhancing productivity growth within this sector (Morley et al., 2019).

4. Conclusion

From the preceding discussion, it can be concluded that there are nine predominant industries in Papua Province exhibiting both forward and backward linkage values exceeding one, as follows: (1) Food Crop Agriculture; (2) Seasonal Horticultural Crop Agriculture, Perennial Horticulture, and Others; (3) Seasonal and Perennial Plantations; (4) Animal Husbandry; (5) Agricultural Services and Hunting; (6) Forestry and Logging; (7) Fisheries; (8) Metal Ore Mining; and (9) Other Mining and Excavation. The fishing industry is highly prioritized according to both average forward and backward linkage value assessments at national and provincial levels.

In West Papua Province, there are ten principal industries: (1) Food Crop Agriculture; (2) Seasonal Horticultural Crop Agriculture, Perennial Horticulture, and Others; (3) Seasonal and Perennial Plantations; (4) Livestock; (5) Agricultural and Hunting Services; (6) Forestry and Logging; (7) Fisheries; (8) Oil, Gas, and Geothermal Mining; (9) Metal Ore Mining; and (10) Other Mining and Excavation. Of all, the key sectors refer to the fisheries sector and the Oil, Gas, and Geothermal Mining industries, utilizing both the average forward and backward linkage methodologies at both the national and provincial levels.

Based on the results and discussion session, it was found that the foremost priority for advancing the primary sector in Papua Island is the fisheries industry. The fisheries industry significantly influences the advancement of other businesses, most specifically those depending on its products as inputs. The fishing

business actively use outputs from other sectors as inputs. The fisheries industry in Papua Island emphasizes the advancement of prominent industries within the downstream primary sector. The strategic initiative for downstream implementation in the fisheries sector in Papua Island involves establishing fish processing facilities for products, such as fish fillets, canned fish, fish meal, fish oil, fish nuggets, fish floss, and fish-based ready-to-eat meals. The establishment of cold storage facilities is imperative in order to maintain the quality of fisheries goods. Another aspect to consider is the improvement of the transportation connectivity from the fishery production centers to the markets or ports. Provision of refrigerated transportation methods, including vehicles and ships, to ensure optimal fish quality upon arrival at their destination is also needed. In addition, the advancement of the fisheries sector needs skilled human resources, achievable through community training in aquaculture techniques, fishery product processing, and business management.

The downstream primary sector of Papua Island recognizes the fisheries industry as a pivotal sector capable of fostering local economic development. Focusing on the advancement of the fisheries sector in Papua Island can enhance the value of fishery products, hence stimulating regional economic growth through job creation, income augmentation, and the expansion of ancillary economic sectors such as logistics, distribution, and commerce.

References

Allo, A. G. (2021). Pola Aktivitas Kabupaten/Kota di Provinsi Papua Barat dengan Pendekatan Static Location Quotient (SLQ). *Lensa Ekonomi*, 15(01), 11–31.

Arhas, S. H., & Suprianto. (2024). The Role of Office Administration in Downstream Fisheries. *Jurnal Office*, 1–10.

Asturi, Y., Adriani, L., Hasbiollah, M., & Wadu, S. (2024). *Indikator Pasar Tenaga Kerja 2023 Provinsi Papua Barat* (1st ed., Vol. 10). BPS Papua Barat.

Azhar, A. (2024). *Provinsi Papua Dalam Angka 2024*. Badan Pusat Statistik Provinsi Papua.

Bam, W., & De Bruyne, K. (2017). Location policy and downstream mineral processing: A research agenda. *The Extractive Industries and Society*, 4(3), 443–447.

Bond, J. (2013). *Downstream processing in developing countries: Opportunity or mirage?* Columbia FDI Perspectives.

BPS. (2025). *Distribusi Persentase Produk Domestik Regional Bruto Atas Dasar Harga Berlaku Menurut Provinsi (persen)*, 2024. Badan Pusat Statistik.

BPS Papua Barat. (2023). *Perkembangan Ekspor dan Impor Papua Barat, Desember 2022*. Badan Pusat Statistik Provinsi Papua Barat.

Chairani, I. (2023). *Provinsi Papua Dalam Angka 2023*. Badan Pusat Statistik Provinsi Papua.

CRIF. (2025). Indonesia’s Mining Industry Transformation: Opportunities, Challenges, and Downstream Prospects for 2025. In *PT. CRIF Indonesia*.

Dahiri, & Kusumawardhani, R. T. (2021). *Budget Issue Brief Industri dan Pembangunan*. Pusat Kajian Anggaran, Badan Keahlian Sekretariat Jenderal DPRD RI Vol 01, Ed 8, Mei 2021, Hal 1-2.

Gao, T., Fang, D., & Chen, B. (2020). Multi-regional input-output and linkage analysis for water-PM2. 5 nexus. *Applied Energy*, 268, 115018.

Hidayat, S. (2022). Analisis Peranan Sektor Industri Pengolahan Banten Dalam Perekonomian Banten dan Nasional. *Jurnal Bina Bangsa Ekonomika*, 15(2), 466–480.
<https://doi.org/10.46306/jbbe.v15i2.182>

Ho, C.-H. (2022). Climate risks and opportunities of the marine fishery industry: a case study in Taiwan. *Fishes*, 7(3), 116.

Humbatova, S., & Hajiyeve, N. (2020). Investment and loaning in Azerbaijan agriculture. *Bulgarian Journal of Agricultural Science*, 26(6), 1116–1128.

IFAD. (2017). *The Marine Advantage: Empowering coastal communities, safeguarding marine ecosystems*. International Fund for Agricultural Development (IFAD).

Irmawati, S. (2015). The Analysis on Leading industries in Central Java Province. *JEJAK: Jurnal Ekonomi Dan Kebijakan*, 8(2), 215–228.

Kardoso, S. (2024). *Provinsi Papua Barat Dalam Angka 2024*. Badan Pusat Statistik Provinsi Papua Barat.

Khan, W., Jamshed, M., & Fatima, S. (2020). Contribution of agriculture in economic growth: A case study of West Bengal (India). *Journal of Public Affairs*, 20(2).
<https://doi.org/10.1002/pa.2031>

Kharisma, B., Remi, S. S., Wardhana, A., Roseline, H., & Rosiyan, M. B. P. (2021). The Determination of Leading Sectors to Improve Bandung City’s Competitiveness. *Economics Development Analysis Journal*, 10(3), 270–285.

Kholiq, M. A. (2022). *Statistik Ekspor Impor Papua Tahun 2022*. Badan Pusat Statistik Provinsi Papua.

- KKP. (2022). *Potensi Sumber Daya Ikan WPP*. Kementerian Kelautan Dan Perikanan.
- KKP RI. (2022). Keputusan Menteri Kelautan dan Perikanan Nomor 19 Tahun 2022 tentang Estimasi Potensi Sumber Daya Ikan, Jumlah Tangkapan Ikan yang Diperbolehkan, dan Tingkat Pemanfaatan Sumber Daya Ikan di Wilayah Pengelolaan Perikanan Negara Republik Indonesia. In *Kementerian Kelautan dan Perikanan*.
- KLHK. (2023). *Statistik Direktorat Jenderal PLH 2022*. Kementerian Lingkungan Hidup dan Kehutanan.
- Loizou, E., Karelakis, C., Galanopoulos, K., & Mattas, K. (2019). The role of agriculture as a development tool for a regional economy. *Agricultural Systems*, 173, 482–490. <https://doi.org/10.1016/j.agsy.2019.04.002>
- Manurung, B., & Kardoso, S. (2023). *Provinsi Papua Barat dalam Angka Tahun 2023*. Badan Pusat Statistik Provinsi Papua Barat.
- Márquez, M. A., Ramajo, J., & Hewings, G. J. D. (2009). Incorporating sectoral structure into shift–share analysis. *Growth and Change*, 40(4), 594–618.
- Miller, R. E., & Blair, P. D. (2009). *Input-output analysis: foundations and extensions*. Cambridge university press.
- Moko, F., Nada, A., & Susanto, D. (2024). *Profil Ketenagakerjaan Provinsi Papua 2023* (1st ed.). BPS Provinsi Papua.
- Morley, S., Kennedy, A., Pradesha, A., & Hadiwidjaja, G. (2019). *The role of agriculture in the structural transformation of Indonesia*. <https://doi.org/10.2499/p15738coll2.133263>
- Morris, M., Kaplinsky, R., & Kaplan, D. (2012). “One thing leads to another” — Commodities, linkages and industrial development. *Resources Policy*, 37(4), 408–416.
- Nyiwul, L., & Koirala, N. P. (2022). Role of foreign direct investments in agriculture, forestry and fishing in developing countries. *Future Business Journal*, 8(1), 50. <https://doi.org/10.1186/s43093-022-00164-2>
- Puspita, C., Pratiwi, K., Yunita, & Jannah, M. (2021). *Tabel Interregional Input-Output Indonesia Tahun 2016*. Badan Pusat Statistik.
- Rahayu, M. D., & Andari, Y. (2020). *Analisis Sektor Unggulan Provinsi Papua Tahun 2010-2019*. Tugas Akhir D3 Ekonomi Terapan Univeritas Gadjah Mada. Jogjakarta.
- Ronalia, P. (2021). Potensi Hilirisasi Industri di Provinsi Riau (Perspektif Tabel Interregional Input Output). *Jurnal Ekonomi Dan Statistik Indonesia*, 1(3), 182–197. <https://doi.org/10.11594/jesi.01.03.06>
- Rumere, V. (2024). Identifikasi Sektor dan Komoditas Ekonomi di Papua Barat Daya. *Jurnal Dinamika Sosial Ekonomi*, 25(1), 82–94.
- Sahara. (2017). *Analisis Input Output: Perencanaan Sektor Unggulan*. IPB Press.
- Sahara, S., Pratinda, W. N. A. S., & Djaenudin, D. (2022). THE IMPACTS OF INVESTMENT IN THE FORESTRY SECTOR ON THE INDONESIAN ECONOMY. *Indonesian Journal of Forestry Research*, 9(2), 251–263. <https://doi.org/10.20886/ijfr.2022.9.2.251-263>
- Sahara, Siregar H, Pratinda W, Purnama I, Zhafira E, Rahmah A, & Saban A. (2024). *Inter Regional Input-Output*. IPB Press.
- Shamdasani, Y. (2021). Rural road infrastructure and agricultural production: Evidence from India. *Journal of Development Economics*, 152, 102686. <https://doi.org/10.1016/j.jdeveco.2021.102686>

- Zaman, S. B., Ishaq, M., & Niazi, M. A. (2021). Contribution of Agriculture Sector in Economic Growth of Pakistan: An Empirical Analysis. *Journal of Applied Economics and Business Studies*, 5(2), 103–120.
<https://doi.org/10.34260/jaebs.527>