Agricultural Industry in West Papua Province: An Analysis of Backward and Forward Linkages

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ABSTRACT
Agriculture, Forestry and Fisheries Sector in West Papua Province contributes significantly to the Gross Regional Domestic Product (GRDP). While on the employment side, this sector also able to absorb a third of the workforce in this province. It indicates the important role of this sector in the economy of West Papua Province. The purpose of this paper is to determine the magnitude of the forward and backward linkage of agricultural industry in West Papua Province. The combination of forward and backward linkage will produce a key industry. The Inter-Regional Input Output (IRIO) model and 2016 IRIO data was used in this study. The findings show that Food Crops Agriculture; Annual Horticultural Crops, Annual Horticulture, others; and Livestock is included in the undeveloped category. Meanwhile, Seasonal and Annual Plantations, Forestry and Logging Industries, and Fisheries are in growing industries category. Gross value-added multiplier of all agricultural industries is below one where the highest value is in the Forestry and Logging Industry whereas Livestock Industry is the lowest.

Keywords: *Forward Linkage, Backward Linkage, Agricultural Industry, Inter-Regional Input Output (IRIO)*

INTRODUCTION

Economic development aims to improve people's living standards, increase incomes, and ensure the availability of jobs, as well as encourage change and renewal in other areas of life. In the era of decentralization, the success of a region's economic development is seen from Human Development Index (HDI), employment opportunities, price stability, and economic growth over time. The regional economic growth i[1]ndicator that is commonly used is the Gross Regional Domestic Product (GRDP). GRDP describes the gross value added which came from all of the economic sector activities in a certain period of time. Thus, sectoral contribution greatly affect the value of GRDP and regional economic growth. In addition, the sectoral contribution in GRDP also explain the gap between sectors, specifically in terms of income gaps and labor gaps (Suryani, 2013). Therefore, the sectoral role is expected not only to contribute income to economic development, but also to create

links with other sectors so that the regional economy as a whole can develop in a balance manner.

The agricultural sector is one of the economic sectors that have a very important role, both in national and regional development. In fact, the agricultural sector is often referred to as a way of life for most Indonesians (Syofya & Rahayu, 2018). Furthermore, the important role of the agricultural sector can be seen from the creation of value added in GDP, job creation, increasing people's income, and contributing to foreign exchange from foreign trade (Marlianti et al., 2017; Widyawati, 2017). Indonesia is often dubbed as an agrarian country, meaning that Indonesia's economic structure is dominated by the agricultural sector. Currently, the contribution of this sector has begun to be shifted by the manufacturing and service sectors. World Bank data from 1983 to 2020 indicates that there has been a decline in the contribution of the agricultural sector by 10.40% or an average decline of 1.32% per year. The small contribution of the agricultural sector to Indonesia's GDP is caused by several things, including relatively small area of cultivation (0.5 ha or often called smallholders), low farmer productivity, lack of farmer access to banking, non – agricultural activities from farmers is increasing (Axelsson & Palacio, 2018; Booth, 2002; Fuglie, 2004, 2010; Marks et al., 2020). In addition, the conversion of agricultural land to the industrial and residential sectors is increasingly triggering this situation (Rondhi et al., 2018).

The Agriculture, Forestry and Fisheries sector in West Papua Province contributed an average of 10.75 percent per year in the last 10 years to Gross Regional Domestic Product (GRDP), as presented in Table 1. Furthermore, before the Covid – 19 pandemics, this sector was able to grow by 3.94 percent per year in the same period. In 2020, this sector experienced a contraction of 2.21 percent in line with the contraction of other sectors due to Covid – 19. This shows the important role of this sector in the economy of West Papua Province.

Table 1
The Role of Sectoral Gross Regional Domestic Product of Papua Barat Province by Industry (%)

	Lapangan Usaha	2015	2016	2017	2018	2019
1	Agriculture, Forestry, and Fishing	10.87	10.95	11.02	10.46	10.55
2	Mining and Quarrying	19.49	19.13	17.97	17.98	17.44
3	Manufacturing	28.72	26.40	25.95	26.82	25.74
4	Electricity and Gas	0.04	0.04	0.04	0.04	0.05
5	Water Supply, Sewerage, Waste Management, and Remediation Activities	0.11	0.11	0.11	0.10	0.10
6	Construction	13.94	14.87	15.64	15.39	15.96
7	Wholesale and Retail Trade; repair of motor	6.14	6.58	6.89	7.01	7.47

	Lapangan Usaha	2015	2016	2017	2018	2019
	Vehicles and Motorcycles					
8	Transportation and Storage	2.65	2.83	2.96	2.98	3.19
9	Accommodation and Food Service Activities	0.59	0.62	0.64	0.64	0.68
10	Information and Communication	1.48	1.58	1.64	1.63	1.75
11	Financial and Insurance Activities	1.59	1.57	1.57	1.51	1.59
12	Real Estate Activities	1.16	1.23	1.28	1.29	1.34
13	Business Activities	0.11	0.11	0.12	0.12	0.12
14	Public Administration and Defence; Compulsory Social security	9.71	10.51	10.64	10.61	10.57
15	Education	2.39	2.40	2.44	2.33	2.38
16	Human Health and Social Work Activities	0.74	0.79	0.80	0.79	0.79
17	Other Services Activities	0.27	0.29	0.29	0.29	0.30

Source: (BPS Papua Barat, 2021)

In addition, the agricultural sector is also very important because it absorbs a lot of labor in West Papua Province. During 2017 – 2019, a Bank Indonesia report stated that the agricultural sector was still the largest contributor to employment in this Province. The high absorption of labor in this sector not only indicates a sufficient dependence on the agricultural sector but also indicates the contribution of the agricultural sector is quite large to the high and low level of welfare of the population in West Papua Province. In August 2019, the agricultural sector had the largest share with 30.75% of the total working population in West Papua Province (Table 2). Thus, it is crucial to conduct a more in-depthanalysis about the role of the agricultural sector and its connection with other sectors in the economy of West Papua Province.

Table 2
Labour Force Characteristics by Industry in West Papua Province

Main Job	2017	2018	2019
Agriculture	141,927	140,447	133,257
Industry	21,771	27,814	16,968
Construction	23,483	24,881	30,987
Trade	71,200	74,353	88,177
Social Service	95,068	102,221	112,490

Other*	49,077	47,828	51,522
Total	402,526	417,544	433,401

Source: (Bank Indonesia, 2020)

In Indonesia, IRIO based on the Supply and Use Tables (SUT) framework can be used to see regional disparity. The IRIO table can also show the new growth centers in Indonesia, namely: Medan, Tanjungpinang, Palembang, Balikpapan, Gorontalo, Makassar, and Ternate (Pribadi et al., 2015) and linkages between industries at the regional level with the Indonesian economy (Arifah & Sunarjo, 2021). The IRIO table can be used to see the interrelationships between sectors within a province, where research on aspects of the field is still limited (Arifah & Sunarjo, 2021; Rosyida & Bhakti, 2022; Widyawati, 2017). These various studies have described conditions in several provinces in Indonesia, but none in Papua region. By using the input-output table of West Papua Province, this study aims to analyze the forward linkages and backward linkages of the agricultural sector to the other sector in economic development of west Papua Province. Moreover, the purpose of this research was to identify the gross value-added multiplier (NTB) of the agricultural sector and its impact on the economic growth in West Papua Province.

METHODOLOGY

This research used the Interregional Input – Output (IRIO) model. The IRIO model was first introduced by Isard in 1951 so it is known as the "Israd Model". This model was later developed by Miller and Blair with the following basic structure:

Table 3
Basic Structure of IRIO Models

Selling Sector		Purchasing Sector					Output Total
		Regional r			Regional s		
		1	2	3	1	2	
Regional r	1	z_{11}^{rr}	z_{12}^{rr}	z_{13}^{rr}	z_{11}^{rs}	z_{12}^{rs}	X_1^r
	2	z_{21}^{rr}	z_{22}^{rr}	z_{23}^{rr}	z_{21}^{rs}	z_{22}^{rs}	X_2^r
	3	z_{31}^{rr}	z_{32}^{rr}	z_{33}^{rr}	z_{31}^{rs}	z_{32}^{rs}	X_3^r
Regional s	1	z_{11}^{sr}	z_{12}^{sr}	z_{13}^{sr}	z_{11}^{ss}	z_{12}^{ss}	X_1^s
	2	z_{21}^{sr}	z_{22}^{sr}	z_{23}^{sr}	z_{21}^{ss}	z_{22}^{ss}	X_2^s
Input Total		B_1^r	B_2^r	B_3^r	B_1^s	B_2^s	

Note: There are two regions, r and s, let there be three purchasing sector (1, 2, 3) in region r and two (1, 2) in region s. Notation z_{ij}^{rr} and z_{ij}^{ss} are intraregional flows, z_{ij}^{sr} and z_{ij}^{rs} are interregional flows, while X_j^r and X_j^s are output total (Miller & Blair, 2009).

If Table 3 can be written in matrix form, then it is obtained:

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

The notations Z^{rr} dan Z^{ss} are called intraregional linkages, while Z^{rs} dan Z^{sr} are called interregional linkages. If it known that X is the total output and Y is the final demand, then the basic structure IRIO in a matrix form is:

$$\begin{vmatrix} a_{11}^{rr} & a_{12}^{rr} & a_{13}^{rr} & a_{11}^{rs} & a_{12}^{rs} \\ a_{21}^{rr} & a_{22}^{rr} & a_{23}^{rr} & a_{21}^{rs} & a_{22}^{rs} \\ a_{31}^{rr} & a_{32}^{rr} & a_{33}^{rr} & a_{31}^{rs} & a_{32}^{rs} \\ a_{11}^{sr} & a_{12}^{sr} & a_{13}^{sr} & a_{11}^{ss} & a_{12}^{ss} \\ a_{21}^{sr} & a_{22}^{sr} & a_{23}^{sr} & a_{21}^{ss} & a_{22}^{ss} \end{vmatrix} \begin{vmatrix} X_1^r \\ X_2^r \\ X_3^r \\ X_1^s \\ X_2^s \end{vmatrix} + \begin{vmatrix} Y_1^r \\ Y_2^r \\ Y_3^r \\ Y_1^s \\ Y_2^s \end{vmatrix} = \begin{vmatrix} X_1^r \\ X_2^r \\ X_3^r \\ X_1^s \\ X_2^s \end{vmatrix}$$

Or to simplify can be written as follows:

$$AX + Y = X, \text{ or}$$
$$X = (I - A)^{-1}Y$$

where, I is identity matrix, Y describe final demand, and X show total output. Leontief matrix denote $(I - A)$ and Leontief inverse

matrix symbolized$(I - A)^{-1}$. This study used data from the Indonesian Inter Regional Input – Output (IRIO) table based on domestic transactions on the basis of producer prices according to 34 Provinces and 52 Industries in 2016. The agricultural industry group in the Indonesian IRIO table for 52 industries consists of 7 (seven) types of industry, namely:

1. Food crops (I-01)
2. Horticultural crops (I-02)
3. Plantation crops (I-03)
4. Livestock (I-04)
5. Agriculture services and hunting (I-05)
6. Forestry and logging (I-06)
7. Fishing (I-07)

RESULT AND DISCUSSION

The agricultural sector is one of the most important industry for the economy of West Papua Province. Industry's share of total exports shows that the Coal and Oil and Gas Refining Industry dominates at 87.74%, while the agricultural industry is only able to contribute 0.09%. This shows that most of the agricultural products produced are only sufficient for consumer demand in the West Papua region. In addition, it also illustrates that the orientation of production tends to only meet family needs. On the import side, the share of the agricultural industry to total imports is 3.11% or ranks eighth out of 52 industries. The agricultural industry is able to contribute 6.41% of the total output of West Papua. When compared to the absorption of labor (Table 2) it can be seen that the agricultural sector is able to absorb 33.21% labor force per year, consequently it can be stated that the workforce in Indonesia is less productive than Malaysia, Philippines and Thailand (Bappenas, 2018). For the agricultural sector, specifically rice farmers, results of the previous studies show that the return per person-day is lower than Thailand, Vietnam, China, and Philippines (Bordey et al., 2016). The low productivity of labor in the agricultural sector in West Papua is thought to be due to relatively limited management capabilities. Each stage of cultivation carried out by farmers has free time that is not used. In addition, the relatively small scale of business also affects this condition.

Several factors which have contributed to the low productivity of the agricultural sector in West Papua Province, namely: changes in economic structure, low levels of farmer welfare, low arable land area (<0.5ha) and expensive production factor prices. The agricultural sector workforce in West Papua Province tends to shift following changes in the economic structure. The economic structure of West Papua Province is currently dominated by the manufacturing and construction sectors, so workers in the agricultural sector prefer to work those sectors. This shift is due to the income obtained in the Agricultural Sector which is a non-continuous income each month. Farmers' income is very dependent on the high and low production produced in each planting season. In addition, the price of agricultural products tends to fluctuate and tends to harm farmers when the commodity produced is abundant in the market. On the other hand, farmers cannot avoid the necessities of life and that of their families. The demands of these needs cause farmers to inevitably have to work in other sectors. The same thing occurred in Indonesia generally, where the movement of labor in agricultural sector was in line with the creation of many jobs in other sectors. Farmer's exchange rate (Nilai Tukar Petani/NTP) is an indicator which used to measure the level of farmer's welfare. The NTP of West Papua Province in 2020 ranged from 99.86 – 101.79. These numbers show that the agricultural sector in West Papua Province has not been able to provide welfare to the farmers. The very high dependence on inputs from outside West Papua has been one of the triggers for this condition. Based on BPS Data in 2018, the percentage of farm households that have a land area of less than 0.5 ha is 74.95% (BPS Papua Barat, 2019). Most of the factors of production except land are imported from the outside the province, this condition causes the production cost become expensive.

Table 4
Share of the Agriculture Industry to Export, Imports, and Outputs in West Papua Province Economy

Agriculture Industry	Code	Share to Export	Share to Import	Share to Output
Food Crops	I-01	0.00%	0.14%	0.25%
Seasonal Horticultural Crops, Annual Horticultural Crops, and others	I-02	0.00%	0.19%	0.31%
Seasonal Plantation Crops and Annual Plantation Crops	I-03	0.00%	0.44%	1.08%
Livestock	I-04	0.00%	0.30%	0.62%
Agriculture Services and Hunting	I-05	0.00%	0.01%	0.03%
Forestry and Logging	I-06	0.06%	0.27%	0.95%
Fishing	I-07	0.03%	1.74%	3.17%
Total		0.09%	3.11%	6.41%

Source: (BPS, 2021)

The results of the analysis using Input-Output model approach in order to obtain the value of backward linkages, forward linkages, and the output value added multipliercan be seen in Table 5. The largest backward linkages value is found in the Electricity Industry with 0.9082. This means that an increase u final demand of Rp1,000 in Electricity Industry is able to increase output in the raw material supply sector (input providers) by Rp908.2. Meanwhile for forward linkages, the largest value is in Coal Industry and Oil and Gas Refining at 1.1804. This number means that an increase in final demand of Rp1,000 in Coal and Oil and Gas Refining Industry is able to increase output in the downstream industry by Rp1,180.4. The largest gross value-added multiplier is in Forestry and Logging at 0.9035. It means that an increase in final demand of Rp1,000 in the Forestry and Logging Industry will have an impact on the formation of gross value added in West Papua economy by Rp903.5.

The backward linkage analysis shows the impact of a particular sector on the sectors that provide input to the other sector, the impact that occurs id called backward linkages, namely pulling the sectors behind it (upstream), meaning changes in downstream sector which attracts the upstream sector to also develop (Tarigan, 2009). The higher value of the backward linkage of a sector, it means that the sector is increasingly needed as a user of the output of other sectors. In addition, an increase in the output of a sector will encourage an increase in the output of the other sectors, especially for sectors that its output is used as input between a sector.

The results of the backward linkages analysis in Table 5 for the agriculture industry indicates that the seven-agriculture industry are still below the average contribution of all industries in Wes Papua economy. Livestock industry is an industry that has the highest backward linkages value, which is 0.3283. It means that if there is an increase in final demand of Rp1,000 in the Livestock Industry, it will increase the output of the upstream industry (input) by Rp328.3. The increase in final demand can be through increased investment in this industry. Meanwhile, the downstream industries related to the Livestock Industry include the feed industry, the wood processing industry (cage), the financial industry, and service industry. Industry that has the smallest backward linkages value in the agricultural

industry group is the Forestry and Logging Industry with a value of 0.0962. This means, if there is an increase in final demand by Rp1.000 in Forestry and Logging Industry, the output of upstream industry (input) will increase Rp96.2.

These findings are in line with research in West Java Province (Zendrato et al., 2020). In their study, they found that the role of Forestry and Logging sub-sector in the economy of West Java Province was very low. Furthermore, a study in East Java found the same thing, namely the food crop subsector has a low backward linkage value when compared to other sectors in the economy (Choiroh et al., 2020). In addition, a study on the role of the fishery found that the fishery sector has a low backward linkage index, indicating that the fisheries sector has a low role to play in driving regional economic sectors directly. The results of this research indicate that the role of the agricultural sector which is seen from the backward linkage value of several agricultural sub-sectors which is very low when compared to other economic sectors indicates that the sector in attracting the development of the

upstream sector is very weak because the agricultural sector uses more imported raw materials than the agricultural sector utilize the production of other economic sectors in West Papua region. This can be proven by chicken feed which must be purchased from other regions outside West Papua because there is no animal feed processing industry yet. Furthermore, the food crop agriculture sub-sector also shows a very low backward linkage with a value of 0.1475. This is because the current condition of food needs, especially rice produced in West Papua Province, is not sufficient to meet the needs within the region, so it still has to be imported from outside the region. The same study in Central Java also shows the same thing, where the value of forward and backward linkages in the agricultural sector is still relatively smaller than other sectors in the economy (Rafiqah et al., 2017). Even nationally, the trend of the same condition is also depicted where the forward and backward linkages of the agricultural sector are relatively low when compared to other sectors (Widyawati, 2017).

Table 5
Analysis result of *backward linkages (BL), forward linkages (FL),* and gross value-added multiplier (NTB) from 52 industries

Industry	Code	BL	FL	NTB
Food Crop Farming	I-01	0.1475	0.1491	0.8522
Seasonal Horticulture Crop Farming, Annual Horticulture, and Others	I-02	0.1726	0.0647	0.8270
Seasonal Plantations and Annual Plantations	I-03	0.1192	0.3057	0.8803
Livestock	I-04	0.3283	0.2478	0.6717
Agricultural and Hunting Services	I-05	0.1698	0.0487	0.8300
Forestry and Logging	I-06	0.0962	0.6845	0.9035
Fisheries	I-07	0.2012	0.5167	0.7984
Oil, Gas and Geothermal Mining	I-08	0.2039	0.7305	0.7896
Metal Ore Mining	I-10	0.2994	0.0054	0.7004
Mining and Other Quarrying	I-11	0.3665	0.4720	0.6318
Coal Industry, Oil and Gas Refining	I-12	0.6168	1.1804	0.3797
Food and Beverage Industry	I-13	0.6448	0.4752	0.3543
Textile and Apparel Industry	I-15	0.6444	0.0049	0.3394
Leather, Leather Goods and Footwear Industry	I-16	0.4998	0.0045	0.4999

Industry	Code	BL	FL	NTB
Wood Industry, Goods Made of Wood and Cork and Woven Goods From bamboo, Rattan and Its Kind	I-17	0.4508	0.5484	0.5478
Paper and Paper Goods Industry, Printing and Reproduction of Recording Media	I-18	0.6336	0.0248	0.3459
Chemical, Pharmaceutical and Traditional Medicine Industries	I-19	0.6041	0.0042	0.3939
Rubber Industry, Rubber and Plastic Goods	I-20	0.6322	0.0044	0.3611
Non-Metallic Mineral Industry	I-21	0.5441	0.0254	0.4515
Metal Goods Industry, Computers, Electronics, Optics and Electrical Equipment	I-23	0.3441	0.0079	0.5604
Transportation Equipment Industry	I-25	0.5497	0.0015	0.4340
Furniture Industry	I-26	0.4552	0.1807	0.5439
Other Manufacturing Industry, Repair and Installation Services for Electrical Machinery and Equipment	I-27	0.3649	0.0057	0.5684
	I-28	0.9082	1.1265	0.0878
Gas Procurement and Ice Production	I-29	0.4926	0.0008	0.5057
Water Supply, Waste Management, Waste, and Recycling	I-30	0.3137	0.2802	0.6775
Construction	I-31	0.4124	0.1388	0.5599
Cars and Motorcycles Trade and Repairs	I-32	0.2547	0.1773	0.7385
Wholesale and retail Trade, not cars and Motorbikes	I-33	0.2362	1.1020	0.7601
Land Transportation	I-35	0.4463	0.3722	0.5417
Sea Freight	I-36	0.5727	0.1052	0.4124
River and Lake Transportation and Crossings	I-37	0.4881	0.0026	0.5049
Air Freight	I-38	0.5526	0.2786	0.4379
Warehousing and Supporting Services for Transportation, Post and Courier	I-39	0.4649	0.1203	0.5249
Accommodation	I-40	0.3249	0.0835	0.6661
Food and Beverage	I-41	0.5767	0.2190	0.4213
Information and Communication Services	I-42	0.3651	0.5553	0.6281
Other Financial Intermediary Services Besides Central Bank	I-43	0.1936	0.1914	0.8011
Insurance and Pension Funds	I-44	0.2367	0.0725	0.7591
Other Financial Services	I-45	0.2913	0.1759	0.7067
Financial Support Services	I-46	0.2477	0.0288	0.7516
Real Estate	I-47	0.2524	0.8376	0.7218
Company Services	I-48	0.3881	0.3777	0.6011
Government Administration, Defense and Compulsory Social Security	I-49	0.5388	0.1757	0.4556
Education Services	I-50	0.4125	0.0238	0.5767
Health Services and Social Activities	I-51	0.5966	0.0398	0.3992
Other Services	I-52	0.4420	0.2787	0.5537

Notes: Coal and Lignite Mining (I-09), Tobacco Processing Industry (I-14), Base Metal Industry (I-22), Machinery and Equipment Industry YTDL (I-24), and Rail Transport (I-34) are industries that are not included in the analysis because these industries do not exist in West Papua.

The results of the forward linkages analysis in Table 5 for the agricultural industry show that there are three industries which its value above the average and four industries below the average contribution of all industries in West Papua economy. The three industries that are above the average score are Forestry and Logging Industry, Fishing Industry, Seasonal and Annual Plantations. Meanwhile, the four industries that are below the average value are the Livestock Industry, Food Crops Agriculture Industry, Seasonal Horticultural Crop Agriculture, Annual Horticulture, and Others, as well as Agricultural and Hunting Services Industry, Forestry and Logging are industries which have the highest forward linkages value of 0,6845. That means if there is an increase in final demand by Rp1,000 in the Forestry and Logging Industry, the output of the downstream industry (input) will increase by Rp684.5. The relatively high contribution of the Forestry and Logging Industry is due to the availability of a large number of wood processing industries in West Papua. On the other hand, the low contribution of the Livestock Industry, Food Crops Agriculture Industry, Seasonal Horticultural Crop Agriculture, Annual Horticulture, and Others, as well as Agricultural and Hunting Services is due to the limited processing industry in West Papua that utilizes raw materials from the four sectors which indicates low investment in West Papua. The increase in final demand can be through increased investment in this industry. Meanwhile, downstream industries related to the Forestry and Logging Industry include the wood industry, furniture industry, and others. The industry that has the smallest forward linkages value in the agricultural industry group is Agricultural and Hunting Services Industry with a value of 0.0487. This means, if there is an increase in final demand by Rp1,000 in Forestry and Logging Industry, the output of the downstream industry (input) will increase by Rp48.7.

The results of the analysis of gross value-added multiplier (NTB) in Table 5 for the agricultural industry show that the seven industries are above the average contribution of all industries in West Papua economy. This shows that the agricultural industry in West Papua Province has important role in the economy. Forestry and Logging Industry is an industry that has the highest gross added value multiplier, which is 0.9035. This means, if there is an increase in final demand by Rp1.000 in Forestry and Logging Industry, it will increase the output of the entire economy of West Papua Province by Rp903.5. The industry that has the smallest gross value-added multiplier in the agricultural industry group is the Livestock Industry with a value of 0.6717. This means, if there is an increase in final demand by Rp1,000,- in Forestry and Logging Industry, it will increase the output of the entire economy of West Papua Province by Rp671.7.

The values of backward linkages and forward linkages are used to analyze and determine the key sectors that will be developed in economic development in a region (Aldasoro & Angeloni, 2015; Nguyen, 2021). The combination of backward linkages and forward linkages values will produce four industry groups. First, the undeveloped industrial group, is the group with the backward linkages and forward linkages values below the average. Second, the potential industry group, is the group with the backward linkages value being above the average and the forward linkages being below the average. Third, the growing industry group, is the group with the backward linkages values below the average and the forward linkages being above the average. Fourth, the priority industry group is the group with the backward linkages and forward

linkages values above the average. The results of the analysis in Figure 1 indicate that there are four agricultural industries which are belong to undeveloped group and three industries are included in the growing industry group. Agricultural industries that are included in undeveloped industrial group are: Food Crops Agriculture; Agriculture of annual Horticultural Crops, Annual Horticulture, and Others; Farm; agricultural and Hunting Services. Meanwhile, the agricultural industry which is included in the growing industry category is Seasonal and Annual Plantation; Forestry and Logging; and Fisheries.
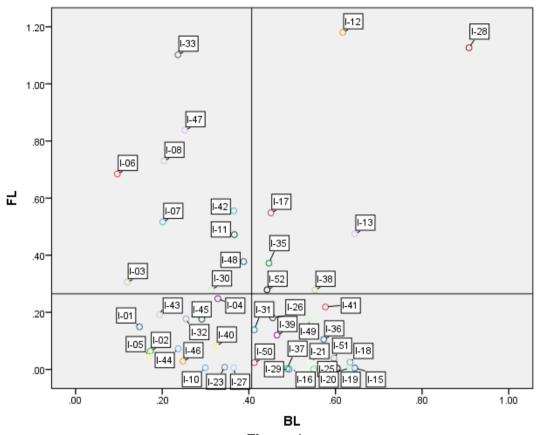

Figure 1
The Relationship between Backward Linkages and Forward Linkages

If we want to examine deeper from the results of the backward and forward linkage analysis, it is known that there are three agricultural industries which belong to growing industries in the economy of West Papua Province, namely Annual Plantations, Forestry and Logging, Fisheries. The characteristics of these three agricultural sub-sectors have low backward linkages but high forward linkages, such as the forestry and logging sub-sectors which have a forward linkages value of 0,6845 but only 0,0962 backward linkage. This due to the nature of the forest resource itself as a renewable natural resource where forest aremulti-purpose assets that not only produce products such as wood, charcoal, pulp, and others, but also function as heat shields, windbreaks, and soil protectors from erosion. In addition, forest are also a habitat for animals and other animals that are important in maintaining the balance of ecosystem and biodiversity (Fauzi, 2010; Von Rintelen et al., 2017). In other words, forest not only provide benefits when they are cut down (exploitation benefits). But also provide many benefits when these resources are left alone (conservation benefits). The economic model of forest management used to date only focuses on the economic value of forest products (especially timber). Ecosystem functions and forest environmental services have not been taken into account so that their management can be sustainable. The second reason is if there is illegal logging by investors or companies that directly cooperate with the local communities, the income to the state will not be tracked so it cannot be counted as the region income. The next reason is the complicated problem of customary rights and the payment mechanism. Therefore, this condition makes it difficult to invest in West Papua region.

Furthermore, the fisheries sub-sector also has the same characteristics as the forestry and logging sector, which has a backward linkages value of 0.12, while a higher linkage value of 0.5167. This means that various facilities which are input factors for exploiting (catching fish) in the waters of West Papua region such as labor, boats, nets, fishing gear and so on are used from within the West Papua region. In addition, most of the local fishing communities mostly still use traditional rowing boats and motorboats which are donations or assistance from the local government. On the other hand, the high forward linkages value of fisheries subsector in West Papua is supported by the development of a downstream fishery product subsystem, namely through a modern fish processing factory located in Sorong region of West Papua.

Then the seasonal and annual plantation sub-sectors also have characteristics that are similar to the previous two agricultural sub-sectors which support the economy of West Papua region. The seasonal and annual plantation sub-sectors also have a backward linkage value of 0.1192 and a forward linkage value of 0.3057. Plantation plants found in west Papua region that is palm oil, coconut, coffee and cocoa, the low backward linkage value is due to the production factors used I the plantation industry such as fertilizers and pesticides are not from the West Papua region but imported from outside the region. However, this sub-sector has a high future linkage because it is supported by the abundant production so that it can be exported to the other region and also become input for a number of other downstream sectors in West Papua region.

Meanwhile, the agricultural industry which is included in undeveloped industrial group i.e. Food Crop Agriculture, Seasonal horticultural Crop Agriculture, Annual Horticulture and Others; Farm; Agricultural and Hunting Services. All this time, the use of local food as an alternative source for the rice substation is still limited. Agriculture in West Papua needs accelerated technology adoption starting from cultivation pattern, post-harvesthandling to the marketing stage, so that product of local food can be a buffer for food security in West Papua region (Tapi et al., 2021). Community cultivation pattern which is traditional and subsistent, small land area, amount of production

which is unable to meet inside the regional needs, product quality, and reasonable price in the market are the main causes of these four sub-sectors categorized as undeveloped industries. This also indicates low investment in the sector, both in terms of supplying production inputs and in the manufacturing industry. Therefore, there needs to be a policy instrument issued by the local government of West Papua to encourage the growth of these three sectors. There are several things that can be done, including the establishment of production centers for food crops, horticultural crops and plantation crops, followed by the provision of security guarantees for investment in all areas of West Papua accompanied by regulations.

CONCLUSION

Analysis results show that the agricultural industry is a sector has an important role in the economy of West Papua which can be seen from the multiplier of the highest gross value added compared to other industries. However, this sector is not yet a priority sector in west Papua Province because the backward linkages value of agricultural industry is still below the average for all industries, meaning that most of the inputs productions for the agricultural industry in West Papua are still obtained from outside the region nationally and internationally. Agricultural industry has a potency as the main economic driver in the economy of West Papua Province which can be seen from the value of forward linkages that are above the average several types of industry in economy. The urgency of developing agricultural industry in West Papua Province can be started by preparing a roadmap for agricultural industry policies that must be in line with the direction of development policies, namely sustainable development. The next step is to encourage the agricultural industry which is in the growing group into a priority industry and developing industry into a growing and potential industry. This can be done by utilizing current national priority programs in West Papua Province, namely Special Economic Zone which is located in

Sorong Regency and Bintuni Industrial Estate which is located in Teluk Bintuni Regency.

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