# Analysis of Input-Output Table: Identifying Leading Sectors in Indonesia (Case Study in 2010, 2016, and 2020)

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**Abstract.** According to Neoclassical theory every country has to maximize their own resources include labor, natural resources also physical resources for developing their economy. Sector-based economic development must be carried out using comprehensive economic indicators, not only looking at the economic structure but also being able to identify and analyze inter-industry relationships. One of the right indicators is through the analysis of the Input-Output Table. The I-O table used is this research are I-O Table 2010, 2016, and 2020 estimated. In this comprehensive analysis, the Forward and Backward Linkage Indexes were calculated so that the sectors that are included in the Leading sector can be identified. In addition, a good multiplier analysis is carried out include output, income, labor, and value-added multiplier to see the amount of output, income, labor, and value-added changes caused by the changes of final demand. The results of the research show that sector that is included as a lever sector is the manufacturing sector (sector 3) and the procurement of electricity and gas (sector 4). Sector 3 is the most potential sector as leading sector due to some reasons this sector has a large output, added value and input structure, and has a high multiplier for four types of multipliers and analysis of Forward linkages and Backward Linkage Indexes shows this sector has high value. Manufacturing industry is a strong leading sector, from this the recommendation is the government can increase output of the manufacturing industry by give subsidy or decrease the tax or government can decrease the price of another sector that be the intermediate sector for manufacturing industry by giving subsidy.

## 1. Introduction

The Neoclassical theory of regional development was driven by Harrod-Domar and Robert Solow (Nugroho, 2019) [10]. Harrod-Domar in Sato (1964) believes that capital must be used effectively, because economic development is strongly influenced by the role of capital formation [16]. Meanwhile, Solow (1956) argues that economic development is a series of activities that originate from humans, capital accumulation, use of modern technology and output [17]. The key to the neoclassical model of development is the aggregate of the production function. According to this theory every country has to maximize their own resources include labour, natural resources also physical resources. The interaction of all resources in the economic system is explained by Barbier (2003) where Kn as natural capital, Kp as physical capital, and Kh as human capital (Figure 1) play a role in the production process that leads to human welfare [2]. Physical capital has a role as a built environment and natural capital as aesthetic life support. On the other side human capital as a labor in the production process also the source of human knowledge that supports welfare.

Moreover, to develop a country economically, the government have to know and understand their potential sector through the simple way using Gross Domestic Product (GDP) as indicator. From this

graph below we know that five sector that have a big share in Indonesia's GDP are manufacturing industry; agriculture, forestry, and fisheries; wholesale and retail trade, car and motorcycle repair; construction; also mining and excavation. On the other hand, as depicted in Figure 2, the sectors with the biggest part contribution is the manufacturing sector with 22.04 percent on 2010 then decrease until 19.88 percent on 2020, the agriculture, forestry and fishery sectors with 13.93 percent on 2010 then decrease until 13.7 percent on 2020, the wholesale and retail trade sector with 13.46 percent on 2010 then decrease until 12.93 percent. From these five sectors with biggest share in GDP only construction that has positive trend from 2010, 2016, and 2020. These five sectors are thought to be potential sectors for economic improvement and development in carrying out good economic development especially with Indonesia condition.

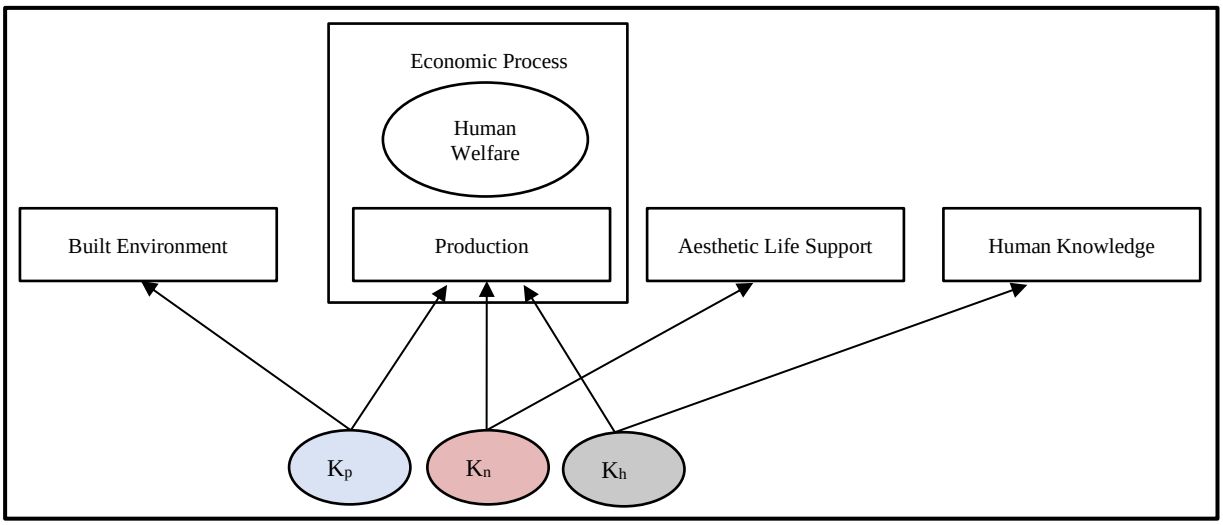


**Figure 1**. Kp, Kn, and Kh in an economic system
Source: The Role at Natural Resources in Economic Development [2]

However, to determine the potential or leading sector is not sufficient when we analyse through GDP value only, other economic indicators are also needed not only to show the economic structure, but also to comprehensively explain the inter-sectoral linkages and multiplier effects caused by the economic activity of the sector. The BPS-Statistics (2021) explains that the development of economic sectors does not only rely on information on the contribution of these sectors to the economy but also looks at the linkages of a sector with other sectors [3]. This relationship is indicated by the level of ability of a sector to power up the economy activities. The tools or economic indicators that can be used for identifying this inter-sectoral linkages and leading sectors is Input-Output table. The Input-Output table presents information on the transaction of goods and services in production activities, the final demand from supply components, and gross value added (BPS-Statistics, 2021) [3]. The aims of this study are to analyze the leading sectors through backward and forward linkage and to explain the economic driving sector (multiplier effect) through output, income, employment, and value-added multiplier.

There are several previous researches related with the topic of this study, Sapanli et al (2020) used the IO table to analyse the dynamics and policies of marine economic development in Indonesia [15] and Widyawati (2017) who identified the linkages of the agricultural sector and its influence on the Indonesian economy [18]. Also Manase et al (2020) that conduct a research to identify the impact of lockdown economy to the economy activities as a whole using Input-Output Table [9]. This research concluded that the lockdown of industries such as construction, real estate and manufacture of basic metals reveal a very conservative preferences in terms of the target share of output of essential activities (below 85 percent).

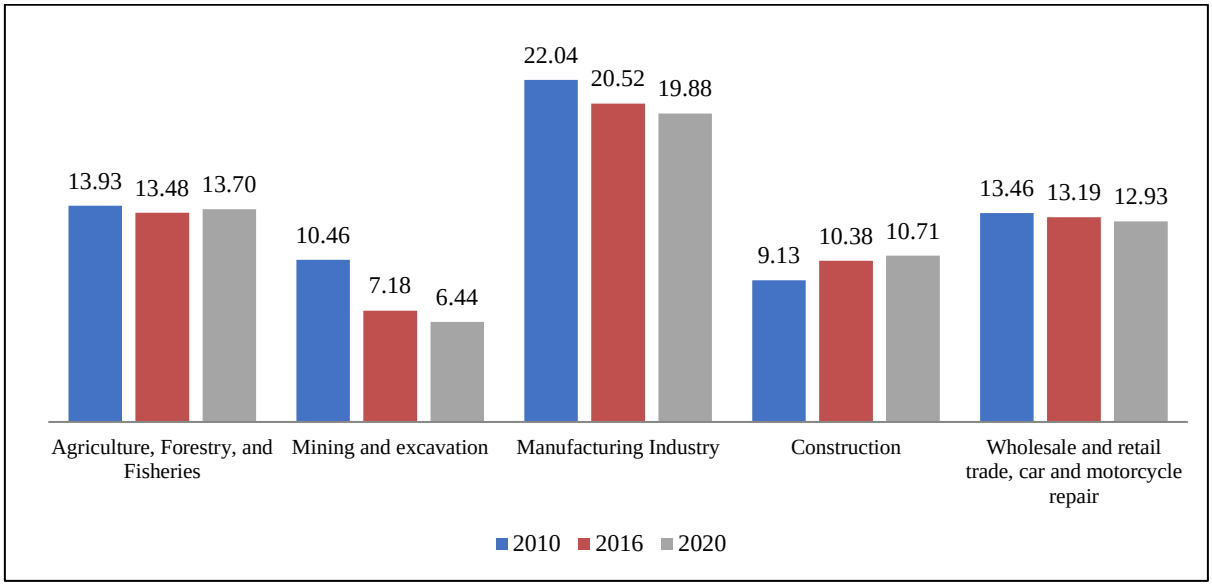


**Figure 2**. Five Sector with Biggest Share in GDP (2010,2016, and 2020)
Source : GDP of Indonesia by Production, BPS-Statistics

## 2. Methodology

### *2.1. Data Sources*

The data used in this research were sourced from publications and dynamic tables published by BPS. The data and variables collected are as follows:

1. Input-Output Table 2010, 17x17 sectors
2. Input-Output Table 2016, 17x17 sectors
3. Gross Domestic Product (GDP) by production at constant price, 2016-2020
4. Labour of industry by field 2016-2020
5. Average wages for workers/employees by field in 2016-2020

### *2.2. Neoclassical Model of Regional Economic Development*

This model is based on the idea that regional development depends on the availability of resources (Dunford, 2009) [4]. The assumptions underlying this model include constant return to scale where production costs do not change with changes in the amount of output produced, the market is perfectly competitive where the economy consists of many companies so that nothing can affect market prices, there is a re-employment of resources so there is no there are resources that are not empowered (Yuniasih, 2013) [19]. The Neoclassical model adds technological development factors that can affect revenue growth (Solow, 1956) [17]. Capital and labor are assumed to be able to take advantage of technological developments. The production function with technological developments according to Solow (1956) on Dunford (2009) is as follows [4]:

$$Y_t = f(A_t, K_t, L_t) \tag{1}$$

where $Y$ is real income, $A$ is technological development, $K$ is capital stock, $L$ is labor, $t$ is a subscript for time. This theory explains that capital and labor will move between regions until the value of the capital-output ratio and the ratio of wage and rent rates is the same between regions. In the end, the less developed regional economy is expected to grow or approach steady state faster than the more developed regional economy.

Approaching the steady state condition is influenced by the diminishing return to capital and constant return to scale where at a certain level of technological progress the condition states that the increase in labor productivity will be smaller as the amount of capital per worker increases. The increase in labor productivity stops when the steady state equilibrium level of capital per labor is reached. Different

regions at the initial level of labor productivity will converge at the same level of labor productivity. In addition, this is also influenced by the view that technology is a public good that is available at no cost to everyone so that the process of diffusion of technology and knowledge from more developed areas to less developed areas will close the technology and productivity gap.

*2.3. The Structure of Input-Output Table*

BPS (2021) explains that Table I-O presents information on transactions of goods and services that occur between economic sectors in the form of a matrix [3]. The values in the rows of Table I-O indicate the allocation of output produced by a particular sector to meet intermediate demand and final demand. In addition, the value in the value-added row explains the composition of the sectoral value added formation. For the fields along the column, it shows the input structure used by each sector in the production process, both in the form of intermediate inputs and primary inputs. The basic assumptions in the preparation of Table I-O are uniformity, proportionality, and addition.

The structure of I-O table is divided into three quadrants where Quadrant I denoted with red block color is an intermediate transaction, namely transactions of goods and services used in the production process, this quadrant shows the interrelationships between economic sectors in the production process. Quadrant II denoted with blue block color shows the final demand, the fields along the lines show the composition of the final demand in a production sector. While the fields along the column indicate the distribution of each component of the final demand. The Quadrant III denoted with green block color shows the primary input component or added value. On the other hand, value-added consists of labor compensation, gross operating surplus, and taxes minus other subsidies on production. In Figure 3, sectors are reflected by industries that have same meaning. This is the structure of I-O Table:

| | | Intermediate Uses | | | | Final Uses | | | | | | Gross Output |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Industry 1 | Industry 2 | ... | Industry n | Households | NPISH | Government | GFCF | CIIs | Export | |
| Domestic | 1 | $Z_{11}$ | $Z_{12}$ | ... | $Z_{1n}$ | $f_{11}$ | $f_{11}$ | $f_{11}$ | $f_{11}$ | $f_{11}$ | $e_1$ | $x_1$ |
| | 2 | $Z_{21}$ | $Z_{22}$ | ... | $Z_{2n}$ | $f_{21}$ | $f_{21}$ | $f_{21}$ | $f_{21}$ | $f_{21}$ | $e_2$ | $x_2$ |
| | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| | n | $Z_{n1}$ | $Z_{n2}$ | ... | $Z_{nn}$ | $f_{n1}$ | $f_{n2}$ | $f_{n3}$ | $f_{n4}$ | $f_{n5}$ | $e_n$ | $x_n$ |
| Imports | | $Zm_1$ | $Zm_2$ | ... | $Zm_n$ | $fm_1$ | $fm_2$ | $fm_3$ | $fm_4$ | $fm_5$ | | |
| Value-Added | | $v_1$ | $v_2$ | ... | $v_n$ | | | | | | | |
| Total Inputs | | $x_1$ | $x_2$ | ... | $x_n$ | | | | | | | |

**Figure 3**. Structure of I-O Table
Source : Economic Indicators for Eastern Asia: Input–Output Tables, ADB (2018) [1]

The Intermediate Uses section of Figure 3 depicts consumption ($Z_{nn}$) of goods and services by the n (column) produced by industry n (row). Imported inputs of industry n are denoted as $Z_{mn}$. Adding intermediate consumption to value-added ($v_n$) is equal to the total inputs $x_n$. The Final Uses depicts the consumption of households ($f_{n1}$), Non-profit Organizations and Institutions Serving Households or NPISH ($f_{n2}$), government ( $f_{n3}$), Gross Fixed Capital Formation or GFCF ($f_{n4}$), Changes in Inventories or CIIs ($f_{n5}$), and exports ($e_n$). Imported goods and services, denoted by ($f_{m1}$ until $f_{m5}$), are products consumed ultimately as final products. The sectors that reflected by industries in first quadrant of Table are the 'selling' sectors, while the sectors shown across the top are the 'buyers'. Thus, each row adds up to the gross output that is equal to its corresponding total input, demonstrating the absorption of the output of each industry, while each column shows the input sources of each industry.

The process of estimating the 2020 Table I-O carried out in this study is as follows:

1. Calculating the input structure from Table I-O 2016. From this result, a matrix of input structures will be obtained which will later be applied to Table I-O 2020.
2. Using information on GDP growth per industry for 2017, 2018, 2019 and 2020 to grow the total intermediate inputs and their gross added value.

3. For the final demand component, the expenditure GDP growth is used to grow the output value by adjusting the inventory component as a balancing component.
4. As for the compensation of workers for each field of business, the growth of the average wage of labor by field or 17 sectors of the business field is used according to the GDP by production.
5. Then check the consistency and balance of the inputs and outputs. If it is still unbalanced between input and output, adjustments are made so that the input and output components are balanced.

*2.4. Forward and Backward Linkage*

Information on the impact of linkages between production sectors can be analyzed into the Impact of Backward Linkage and Forward Linkage Impacts. The two impacts of this relationship can be measured based on the index of dispersion power (IBL) and the degree of sensitivity (IFL). IBL shows the comparison of the total impact on the output of each sector due to changes in the final demand of a sector to the average impact of all sectors. If the IBL value is more than one, it means that the final demand from the sector in stimulating production growth is relatively higher than the average for other sectors. It can be said that this sector is a strategic sector because it has a strong driving force in spurring economic growth. Then IFL shows the comparison of the total impact of changes in final demand of each economic sector to the output of a sector to the average impact of all sectors. If the IFL is more than one, it means that the sector is relatively able to meet the final demand from other sectors above the average capacity. In the other hand, when IFL and IBL equal to one have meaning that the sector has similar inter-sectoral linkages compare to the average or the sector cannot stimulate the production growth from the average of other sector also cannot fulfill the final demand from other sector. The formula as follows (BPS-Statistics, 2021) [3]:

$$IFL_i = \frac{\sum_{j=1}^{n} b_{ij}}{\sum_{i=1}^{n}\sum_{j=1}^{n} b_{ij}}\, n \qquad IBL_j = \frac{\sum_{i=1}^{n} b_{ij}}{\sum_{i=1}^{n}\sum_{j=1}^{n} b_{ij}}\, n \tag{2}$$

Where,

$IFL_i$ : Index of forward linkage of i sector
$b_{ij}$ : elements of invers Leontief matrix for row i and column j
$IBL_j$ : Index of backward linkage of j sector
$n$ : number of sectors
i : number of sectors in input structure and index of row in matrix
j : number of sectors in demand structure and index of column in matrix

*2.5. Multiplier Analysis*

Multiplier analysis aims to measure the total effect on output, income, labor, and value added when there is an increase in one unit of input in a certain industry output. Pribadhi (2019) explains that multiplier analysis is useful for knowing the impact of changes in exogenous variables on the economy [13]. To calculate the value of the multiplier, a Leontif Matrix is needed, the Leontif I-O model equation can be written as follows (BPS-Statistics, 2021) [3]:

$$\boldsymbol{X = (I - A)^{-1} Y} \tag{3}$$

Where, X is the output vector, Y is the final demand vector, I is the identity matrix, A is the input coefficient matrix and **(I-A)$^{-1}$** is the Leontief inverse matrix. The formulas for the four types of multipliers are as follows:

**Table 1.** Formula for multiplier analysis

| Output Multiplier | Income Multiplier | Labor Multiplier | Value Added Multiplier |
|---|---|---|---|
| $\Delta X = (I - A)^{-1}\Delta Y$<br>With $\Delta Y$ = I, so:<br>$O_j = \sum_{i=1}^{n} b_{ij}$ | $I_j = \sum_{i=1}^{n} a_{n+1,i} b_{ij}$<br>Where, $a_{n+1,i}$ as the ratio between wage and total input | $L_j = \sum_{i=1}^{n} w_{n+1,i} b_{ij}$<br>Where, $w_{n+1,i}$ as the ratio between labor and total output | $V_j = \sum_{i=1}^{n} v_{n+1,i} b_{ij}$<br>Where, $v_{n+1,i}$ as the ratio between value added and total output |

Source: (Nugroho and Murti, 2020) [11]

## 3. Result and Discussion

### *3.1. Forward and Backward Linkage*

The impact analysis of inter-sector linkages can be analyzed by calculating the dispersion power index or known as Index of Backward Linkage (IBL) and the degree of sensitivity or known as Index of Forward Linkage (IFL). Based on the results of the IFL and IBL calculations, a quadrant analysis is carried out to map sectors and identify sectors that are included in the leading sector. Table 2 shows the result of calculation for IBL and IFL. In 2010, there are seven sectors that have IBL value greater than 1 also there are four sectors that have IFL greater than 1. From this condition only two sectors that have both IBL and IFL greater than 1. Those sectors are sector 3 (Manufacturing Industry) and sector 4 (Procurement of Electricity and Gas). Similar with this condition, in 2016 and 2020 number of sectors that have IBL greater than 1 is seven sectors and IFL greater than 1 is four sector.

The differences between 2010 and 2016, 2020 are sector 17 (Other services) in 2010 have IBL greater than 1 then in 2016, 2020 less than 1. On the other side, sector 13 (Company Services) in 2010 has IBL less than 1 and in 2016, 2020 has IBL greater than 1; sector 14 (Government Administration, Defense and Mandatory Social Security) in 2010 has IFL less than 1 and in 2016, 2020 has IFL greater than 1. From this condition we can analyze that there are structure changes especially for sector 13, 14, and 17 from 2010 until 2016 and 2020. The interpretation of IFL for instance in 2020 The manufacturing industry has the highest forward linkage index with 4.09. This value has a meaning that if the final demand experience a decrease by 1 million rupiahs then the output of the manufacturing industry sector which will be allocated to other sectors and this sector itself will also experience a decrease by 4.09 million rupiahs. In other words, an increase of output in the manufacturing industry can encourage the increase of output in another sector especially sector that use the manufacturing industry's output as its intermediate consumption. On the other side, the interpretation of IBL for instance, the electricity and gas supply sector has the highest backward linkage index with 1.57 in 2010. This value means that if the final demand for this sector is increasing by 1 million rupiahs, then the input demand of this sector against other sectors will also increase by 1.57 million rupiahs. Actually, electricity and gas supply used by another sector as one of the fixed inputs that must be fulfilled. In other words, if there is a decrease or deficit in this sector can impact a significant problem in the production process of another sector.

**Table 2.** Value of IBL and IFL in 2010, 2016, and 2020

| Sectors | 2010 | | 2016 | | 2020 | |
|---|---|---|---|---|---|---|
| | IBL | IFL | IBL | IFL | IBL | IFL |
| 1 | 0.72 | 1.46 | 0.76 | 1.35 | 0.75 | 1.33 |
| 2 | 0.80 | 1.27 | 0.88 | 1.23 | 0.85 | 1.21 |
| 3 | 1.18 | 4.09 | 1.18 | 3.64 | 1.15 | 3.64 |
| 4 | 1.57 | 1.19 | 1.54 | 1.30 | 1.51 | 1.30 |
| 5 | 0.73 | 0.58 | 0.88 | 0.57 | 0.89 | 0.57 |
| 6 | 1.28 | 0.75 | 1.20 | 0.72 | 1.20 | 0.72 |
| 7 | 0.89 | 0.61 | 0.85 | 0.63 | 0.84 | 0.63 |

| Sectors | 2010 | | 2016 | | 2020 | |
|---|---|---|---|---|---|---|
| | IBL | IFL | IBL | IFL | IBL | IFL |
| 8 | 1.17 | 0.70 | 1.14 | 0.92 | 1.11 | 0.91 |
| 9 | 1.10 | 0.66 | 1.09 | 0.69 | 1.06 | 0.69 |
| 10 | 0.92 | 0.96 | 0.93 | 0.96 | 0.99 | 0.99 |
| 11 | 0.81 | 0.85 | 0.80 | 0.92 | 0.81 | 0.92 |
| 12 | 0.73 | 0.57 | 0.78 | 0.69 | 0.79 | 0.69 |
| 13 | 0.97 | 0.77 | 0.97 | 1.04 | 0.99 | 1.05 |
| 14 | 0.96 | 0.60 | 1.03 | 0.60 | 1.02 | 0.60 |
| 15 | 0.92 | 0.57 | 0.90 | 0.57 | 0.91 | 0.57 |
| 16 | 1.14 | 0.60 | 1.08 | 0.56 | 1.13 | 0.56 |
| 17 | 1.10 | 0.77 | 0.98 | 0.60 | 1.00 | 0.61 |

After knowing the values of IBL and IFL we are moving forward to determine the leading sector through quadrant analysis to make clearly what is the leading sector. Quadrant I is a quadrant with more than one IBL and IFL characteristics, the sectors that fall into this quadrant are sectors that enter or are identified as lever sectors or superior sectors (Leading sector). This is because the sectors in Quadrant I are capable and have great capabilities in driving the economy both in terms of sectors that are inputs and sectors that utilize the output of the sector so that sectors that fall into this category are classified as superior sectors (able to leverage the economy well). The sectors that fall into this category are sector 3 (Manufacturing Industry) and sector 4 (Procurement of Electricity and Gas). This condition constantly happens in 2010, 2016, and 2020 as depicted in Figures 4, 5, and 6.

Quadrant II is a quadrant containing sectors with IBL values < 1 and IFL > 1, sectors included in this quadrant have the ability for driving sectors that are lower inputs when compared to the total economy average but have the ability to absorb output by the economy. From the analysis results (in 2010, 2016, and 2020), there are three sectors in this quadrant, namely, the Agriculture, Forestry and Fisheries sector, the Mining and Quarrying sector, and the Enterprise Services sector. The low IBL value can be caused by various things, namely the high import of intermediate inputs which illustrates that the region's inability to provide input factors to produce the sector. Such conditions are clearly unfavorable, especially for the Indonesian economy. If the Indonesian economy experiences an increase in demand, the sectors included in this quadrant are considered less able to provide added value, especially for the sectors that are inputs for the sector. Finally, with this condition, the benefits received if the increase in demand occurs is small for other sectors.

Next, Quadrant III, the sector that is included in this quadrant shows IFL and IBL values < 1. This indicates that this sector has the ability to move or leverage sectors that are inputs and sectors that utilize the output of this sector are below the average total economy so that this sector is usually less favored. The number of sectors included in this quadrant are seven sectors, namely, sector 5, 7, 10, 11, 12, 15, and 17 in 2016 and 2020. Condition in 2010 is almost the same as in 2016 and 2020 which also included sector 16 so that there are eight sectors in this quadrant. From the results of the analysis, the sectors covered in this quadrant are less superior sectors for further development. The sectors included in this quadrant show that they are still low, especially in terms of interrelationships between sectors that are inputs and sectors that utilize the output of these sectors.

Moreover, Quadrant IV shows sectors with IBL >1 and IFL<1. This shows that this sector has a special ability to move sectors with inputs above the total economy average. On the other hand, the ability of the sector to utilize the output of the sector is still low and below the average total economy of a region. Quadrant IV shows as many as five sectors (in 2016 and 2020) that are included in this quadrant, namely, sectors 6, 8, 9, 14, and 16 and four sectors in 2010, namely the same sectors as on 2016 and 2020 except for sector 16. The sectors included in Quadrant IV show the ability of backward linkages above the total average of the entire economy so that this condition explains that the sector in Quadrant IV is able to absorb various intermediate inputs within a region very well (quite high). The

sectors covered in this quadrant still have potential to be developed with the characteristics of having the power to encourage sectors that supply greater inputs (backward linkage is greater than the strength of the forward linkage).

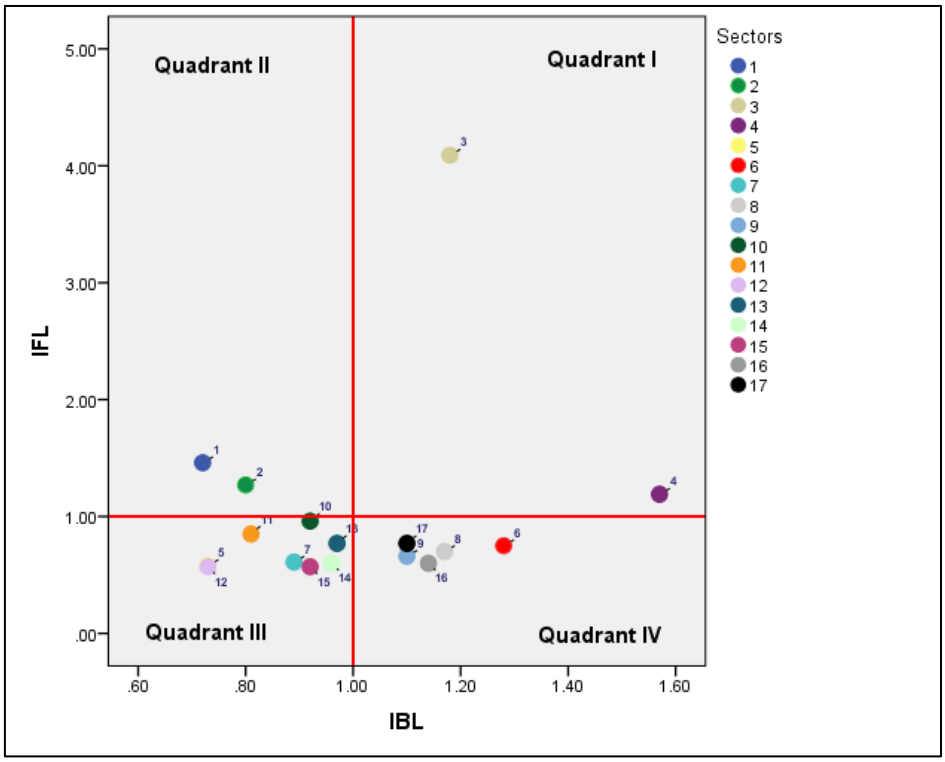


**Figure 4**. Quadrant Analysis of IFL and IBL, Table I-O 2010

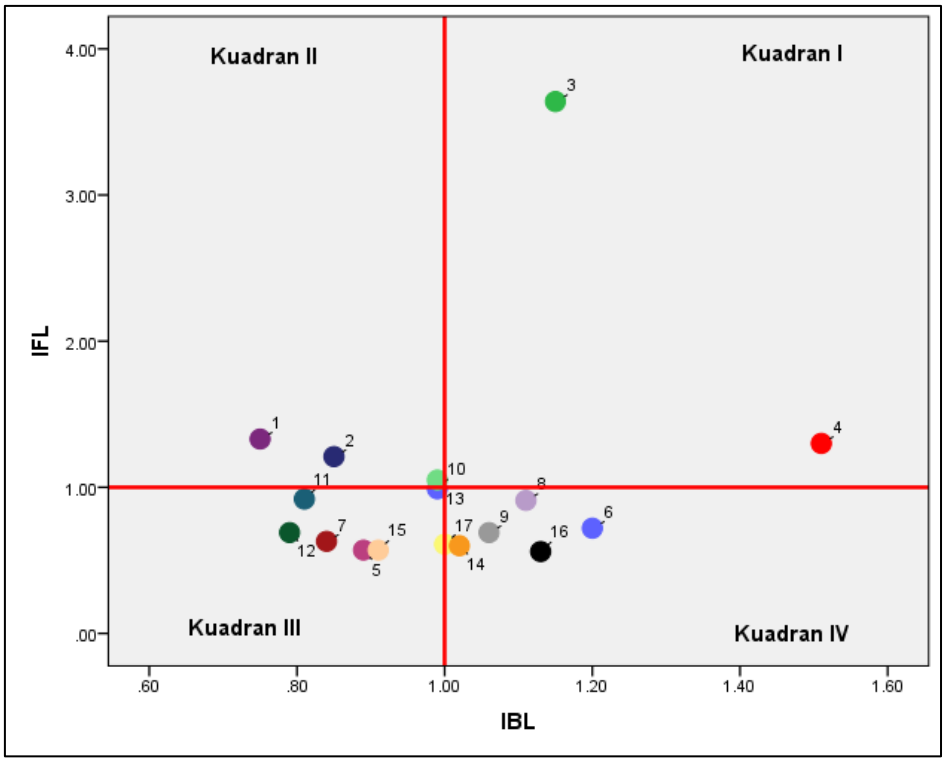


**Figure 5**. Quadrant Analysis of IFL and IBL, Table I-O 2016

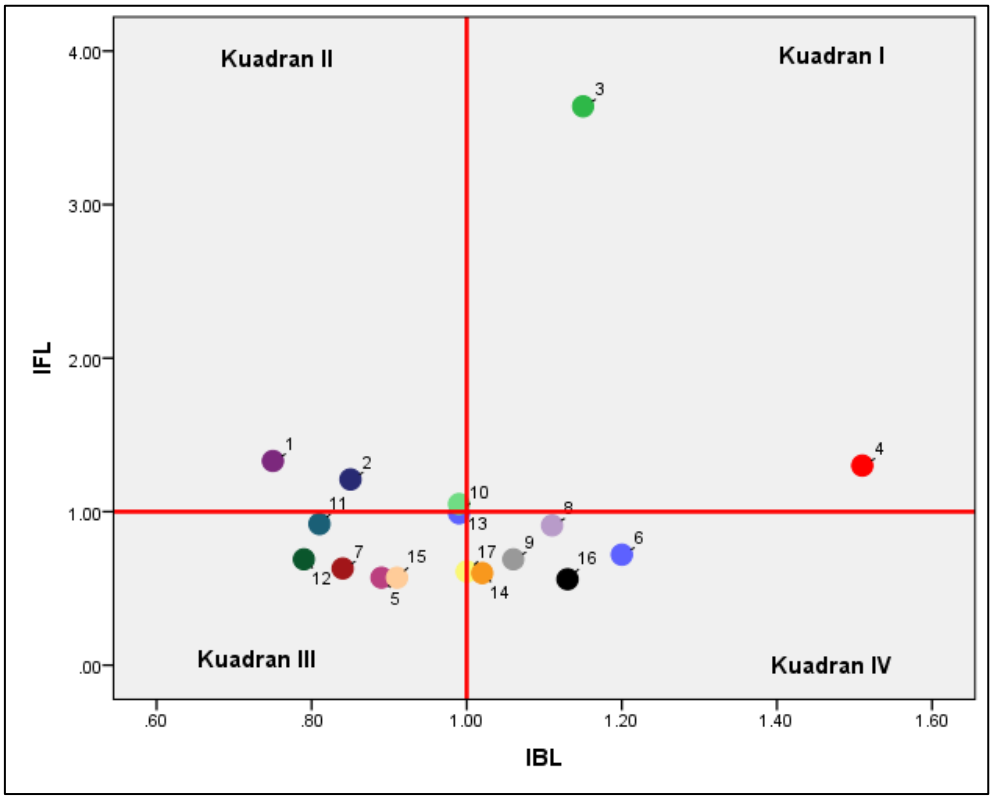


**Figure 6**. Quadrant Analysis of IFL and IBL, Table I-O 2020

**Code of Sectors :**

1: Agriculture, Forestry, and Fisheries
2: Mining and excavation
3: Manufacturing Industry
4: Procurement of Electricity and Gas
5: Water Supply, Waste Management, Waste and Recycling
6: Construction
7: Wholesale and Retail Trade, Car and Motorcycle Repair Activities
8: Transportation and Warehousing
9: Provision of Accommodation and Food and Drink
10: Information and Communication
11: Financial Services and Insurance
12: Real estate
13: Company Services
14: Government Administration, Defence, and Mandatory Social Security
15: Educational Services
16: Health Services and Social
17: Other services

So, from the IFL and IBL values, the leading sector is a sector that has IFL > 1 and IBL > 1 or sector that is included in Quadrant I. There are two sectors that are included in this quadrant, namely sector 3 (manufacturing industry) and sector 4 (Procurement of Electricity and Gas). The leading sector means a potential sector that needs to be improved because play an important role in the economic activity, especially in Indonesia. Then, the sector that have biggest power leverage is sector 3. So, this sector is definitely a leading sector that has big potential to be developed.

*3.2. Output, Income, Labor and Value Added Multiplier*

Analysis of leading sectors will use analysis that is often used, namely, analytical tools that can explain a sector as a unit that gives influence on the economy through multiplier analysis (Hidayat and Suahasil, 2005) [6]. Multiplier analysis that conducts in this study includes output, income, labor, and value added multiplier. In addition, Malba and Taher (2016) explain that the output multiplier shows the magnitude of the impact that occurs on output when there is an increase in final demand (either in the form of

investment or others) in each sector [8]. The results of the calculation of the output multiplier shown especially multiplier analysis in 2020 show that the sector with the largest output multiplier is sector 4, namely, the Procurement of Electricity and Gas sector and the sector with the smallest output multiplier is the sector 1, namely, the Agriculture, Forestry, and Fisheries sector. The output multiplier for sector 4, Procurement of Electricity and Gas, which is 2.86, which indicates the final demand from this sector has increased by one million rupiah, the total output of all sectors in the economy will increase by 2.92 million rupiah.

Furthermore, the income multiplier explains the magnitude of the impact or multiplier that occurs on income when there is an increase in final demand (either in the form of investment or others) in each of the constituent sectors, namely 17 business sectors. Not much different from the output multiplier, the amount for the income multiplier with the highest value is sector 4, namely, Procurement of Electricity and Gas with a value of 6.00. This shows that if the final demand from this sector increases by 1 million rupiah, the total income of all sectors in the economy will increase by 6 million rupiah. On the other hand, the sector with the lowest income multiplier values are the 1st sector, namely, the Agriculture, Forestry, and Fisheries sector and the 15th sector, namely, the Education Services sector with a multiplier value of 1.25, respectively.

On the other hand, the labor multiplier explains the value of the magnitude of the impact on employment or labor if the final demand increases (either in the form of investment or others) in each sector. The labor multiplier with the highest score is sector 4, namely, Procurement of Electricity and Gas with a value of 8.01. This shows that if the final demand from this sector increases by 1 million rupiah, the absorbed workforce/jobs from all sectors in the economy will increase by absorbing 8-9 workers. The sector with the lowest labor multiplier values are the 1st sector, namely, the Agriculture, Forestry, and Fisheries sector and the 7th sector, namely, the Wholesale and Retail Trade, Car and Motorcycle Repair sectors with multiplier values of 1.13 and 1.21, respectively.

The Value Added multiplier in Table 3 then describes the magnitude of the number as the impact that arises on the increase in added value when the final demand increases (either in the form of investment or otherwise) in each sector. For the Value Added multiplier with the highest value is sector 4, namely, Procurement of Electricity and Gas with a value of 4.56. This shows that if the final demand from this sector increases by 1 million rupiah, the added value of all sectors in the economy will increase by 4.56 million rupiah. The sector with the lowest Value Added multipliers are the 1st sector, namely, the Agriculture, Forestry, and Fisheries sector and the 12th sector, namely, the Real Estate sector with the multiplier values of 1.27 and 1.30, respectively.

The results of the multiplier analysis are in accordance with the analysis of the impact of linkages (IFL and IBL) which shows that sectors with high IFL and IBL values also have high multiplier effects. The sectors that can be identified as lever sectors in the context of economic development in Indonesia are the 3rd sector, namely, the Manufacturing Industry Sector and the 4th Sector, namely, the Procurement of Electricity and Gas Sector. This result when compared with the value of the structure of the previous Table I-O shows that the sector that has a high share of the total economy has not enough evidence and cannot necessarily be called a lever sector.

**Table 3.** Value of Multiplier Analysis 2010 and 2020

| Sector | 2010 | | | | 2020 | | | |
|---|---|---|---|---|---|---|---|---|
| | Oj | Ij | Lj | Vj | Oj | Ij | Lj | Vj |
| 1 | 1.40 | 1.24 | 1.11 | 1.21 | 1.40 | 1.25 | 1.13 | 1.27 |
| 2 | 1.63 | 1.57 | 2.69 | 1.36 | 1.63 | 1.66 | 2.80 | 1.43 |
| 3 | 2.17 | 2.54 | 4.50 | 2.82 | 2.17 | 2.60 | 3.81 | 2.58 |
| 4 | 2.86 | 4.17 | 12.70 | 4.27 | 2.86 | 6.00 | 8.01 | 4.56 |
| 5 | 1.62 | 1.47 | 1.29 | 1.21 | 1.62 | 2.06 | 1.34 | 1.46 |
| 6 | 2.23 | 2.30 | 3.69 | 2.91 | 2.23 | 2.16 | 3.05 | 2.56 |
| 7 | 1.57 | 1.46 | 1.29 | 1.48 | 1.57 | 1.35 | 1.21 | 1.41 |
| 8 | 2.11 | 2.02 | 2.00 | 2.26 | 2.11 | 2.18 | 2.23 | 2.10 |

| Sector | 2010 | | | | 2020 | | | |
|---|---|---|---|---|---|---|---|---|
| | Oj | Ij | Lj | Vj | Oj | Ij | Lj | Vj |
| 9 | 2.01 | 1.94 | 2.48 | 2.21 | 2.01 | 1.86 | 1.73 | 2.06 |
| 10 | 1.72 | 1.68 | 3.72 | 1.60 | 1.72 | 1.90 | 3.43 | 1.75 |
| 11 | 1.48 | 1.39 | 1.75 | 1.38 | 1.48 | 1.34 | 1.84 | 1.39 |
| 12 | 1.45 | 2.22 | 3.88 | 1.21 | 1.45 | 2.39 | 4.24 | 1.30 |
| 13 | 1.80 | 1.66 | 1.88 | 1.69 | 1.80 | 1.62 | 2.24 | 1.78 |
| 14 | 1.90 | 1.21 | 1.63 | 1.61 | 1.90 | 1.41 | 1.72 | 1.78 |
| 15 | 1.67 | 1.21 | 1.32 | 1.54 | 1.67 | 1.25 | 1.33 | 1.52 |
| 16 | 2.00 | 1.73 | 2.30 | 2.25 | 2.00 | 1.79 | 1.83 | 2.22 |
| 17 | 1.81 | 1.70 | 1.51 | 2.02 | 1.81 | 1.41 | 1.26 | 1.80 |

Annotation :
Oj : Output Multiplier
Ij : Income Multiplier
Lj : Labor Multiplier
Vj : Value-Added Multiplier

*3.3. Discussion : Leading Sector, COVID-19, and Recovery the Indonesia Economic Condition*

Analysis result from the IBL and IFL also multiplier analysis explain that the leading sectors are Manufacturing Industry and Procurement of Electricity and Gas. If we move forward for analyzing the result, Procurement of Electricity and Gas is important or key input for the production process of other sectors. Pruitichaiwiboon (2011) et al explain that output of electricity distributes as a final demand [12]. Furthermore, electricity is used internally in the production process of power generation. So, electricity is important input as a fuel to turn on the machine also for lighting in production process. In the other hand, all institution include government, NPISHs, companies, household also need electricity for their daily and operational activity. From this, we can understand why the procurement of electricity and gas categorized as leading sector, because the demand is high also needed by all institution or sectors.

In addition, the manufacturing industry also categorized as leading sectors this is because of the share output also the demand and supply structure both in a big proportion. From figure 2, we know that the manufacturing industry share almost 20 percent of Total GDP. From the structure of demand in I-O Table 2016, BPS-Statistics (2021) explain that The Manufacturing Industry shows the biggest values compared to all sectors around Rp11,030 Trillion Rupiah [3]. From this total demand, 46.84 percent is used for production process (intermediate input), 38.76 percent for domestic final demand, and 14.40 percent for export. From the structure of the supply, manufacturing industry also has the biggest values compared to all sectors with Rp6,819 Trillion Rupiah. From this supply, 61.82 percent can be produced by domestic, 16.15 percent provided by import, and from taxes on product (3.37 percent) plus trade and transport margin (18.66 percent). From this explanation, the manufacturing industry categorized as leading sector because has biggest value of both input and value also has biggest lever power.

Since the pandemic COVID-19, the performance of all sectors in the economic activity are run unwell or decline. Rahman et al (2020) explain that there are six economic sectors with the potential to be heavily impacted by the pandemic included manufacturing industry [14]. This condition have driven the government to take good strategy and suitable policies to make the leading sector still perform well also can support the recovery of Indonesia economy. Institute for Economic and Social Research, Universitas Indonesia (2020) in their research, the efficient use of resources in the manufacturing industry sector is one important key to sustaining businesses affected by COVID-19 pandemic [7]. Fankhauser et al. (2013) stated that transformation to a green economy is a strategic policies to recover the economy [5]. These strategies cover cleaner industrial processes, the supply chain for electricity generation and other industrial processes (turbine, steam, motor, and transformer), and the demand sector which requires energy efficiency.

In order to strive for Indonesia's economic recovery in the future, various policies and stimulus were applied to accelerate the recovery of the national economy. The several policies of Indonesia

government for maintaining this leading sector (manufacturing industry) in pandemic situation as follows:

a. *Industrial Estate Development*. Until now, there are 128 industrial estates that already have Industrial Estate Business Permits and already operational. Meanwhile, there are 38 industrial estates that are currently under construction.
b. *Boosting the competitiveness of the national industry*. The way government to boost the competitiveness of national industry through the implementation of the "Making Indonesia Roadmap". This program is to prioritize the development of seven industrial sectors in implementing digital technology in their production processes to make them more efficient and competitive. The seven priority sectors are the food and beverage, chemical, textile and clothing, automotive, electronics, pharmaceutical, and medical devices industries.
c. *e-Smart for Small and Medium Enterprises (SMEs).* This program has goals to encourage the acceleration of the application of industrial technology 4.0 in the manufacturing sector.
d. *Partner country* Hannover Messe 2021. Indonesia joins partner country Hannover Messe 2021 to attract global investment and expand export markets and branding of national industrial products.
e. *Import Subtitution Program.* The government stated which is 35 percent import substitution program in 2022, which is carried out simultaneously with increasing production utilization, encouraging deepening of industrial structure, and increasing investment.
f. "Pemulihan Ekonomi Nasional (PEN)" or National Economic Recovery Program that has purpose for reducing the impact of COVID-19 to the economy. This program purposes to protect, maintain, and improve the economic capacity of the business actors in carrying out their business during the Covid-19 pandemic through tax Incentive, interest subsidy, guarantee for new working capital loans for SMEs also SMES Credit Stimulus.

**4. Conclusion and Recommendation**

From the explanation of the research result above, the conclusions of this research are manufacturing industry (sector 3) and procurement of electricity and gas sector (sector 4) are the leading sectors and most potential sectors to support the economic development of Indonesia. But the sector that has the most power to recover the economy is the manufacturing industry, because of the structure of demand and supply that is very big in amount compared to all sectors. Moreover, both sectors according to the result of forward linkage (IFL) and backward linkage (IBL) have the greatest value compare to another sector. In line with linkage analysis, multiplier analysis from four different approaches shows that both sectors also have the greatest value. When we compared the IFL and IBL from I-O table 2010, 2016, and 2020 there is no significant difference because only two sectors that included in Quadrant I (leading sectors) which is mentioned before. On other hand, when we analyze more details from multiplier analysis results in 2010, 2016, and 2020 the structure and value also there is no significant difference and stated that manufacturing industry also procurement of electricity and gas both are the sectors with the biggest multiplier values for each type of multiplier.

From these result of this research several suggestion or policies recommendation as follows :

a. The government should pay attention to the manufacturing industry from intermediate consumption sight. The government can increase output of the manufacturing industry by give subsidy or decrease the tax or government can decrease the price of another sector that be the intermediate sector for manufacturing industry by giving subsidy. This method can increase the output of manufacturing industry that also increase output of another sector.
b. Furthermore, the government should pay attention to electricity and gas supply from input demand sight. The government can decrease the price of this sector by giving the subsidy so other sectors can give higher value added for GDP share.
c. Then the government applied the efficient use of resources in the manufacturing industry sector, because this is an important key to sustaining businesses affected by COVID-19 pandemic through green economy.

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