Forestry Sector Impact on the Economy of Central Java, Indonesia

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Abstract

In 2016, the forestry sector produced a Gross Regional Domestic Product (GRDP) of Rp. 3.8 trillion or around 0.45% of the total GRDP of the province of Central Java, Indonesia (BPS Central Java, 2017). The Forestry Sector growth has increased, but the role of the sector shows a downward trend in GRDP. By employing the Input-Output analysis, this study intends to identify the structure of the Central Java forestry sector, through backward and forward linkages and mapping the path of the impact of the forestry sector's economic activities through simulations, toward the economy and sectoral income levels in Central Java. This study finds that the forestry sector is intermediate ouput that is used by other sectors to become their production inputs, so this sector has a good multiplier for the economy.

Key words : Input-output, forestry, Economic impact, Backward linkages, Forward linkage.

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INTRODUCTION

Central Java Province, Indonesia has a lot of natural resources in the form of wood and other forest products. The area of government-owned forest is ± 651,020 hectares and ± 635,000 hectares of community forest are used for various purposes, including timber production, non-timber forest products including pine sap, resin, eucalyptus, honey, and so on. The performance of the forestry sector in 2016, based on the figure of Gross Regional Domestic Product (GRDP), is Rp. 3.8 trillion or around 0.45% of the total provincial GRDP (Badan Pusat Statistik Jawa Tengah, 2017). In total, as the agricultural sector, the forestry subsector with the agriculture and fisheries subsector, ranks second in the economic structure of Central Java. In the second quarter 2017 period, The Agriculture, Forestry and Fisheries sectors accounted for 14.36% of Central Java's economic growth or in the second position after the Manufacturing Industry which contributed 34.97% of economic growth. The Forestry sector growth has increased, but the role of the forestry sub-sector of the Central Java's GRDP shows a downward trend. The contribution of the Forestry sector from GRDP recorded continued to decline, which amounted to 0.56% in 2013, then dropped to 0.50% in 2015 and lastly 0.45% at the end of 2016 (Badan Pusat Statistik Jawa Tengah, 2017).

In analyzing the economy of a region, the economic impact and economic contribution is something different. However, the two terms are often used interchangeably, confusing practitioners (Watson et al. 2015, Henderson et al. 2017a). According to Cheney (2018), contribution analysis illustrates changes in the dominance of the structure of the economy, while impact analysis shows the effects of new of Non-Timber Forest products such as honey, food crops grown under stands, and

indicators or indicators that disappear in business activities or economic activities in a sector. Watson et al. (2015) states that the contribution analysis is about looking at how the current sector conditions in supporting the economy, but this contribution has not yet reflected the impact of the indicators, both directly and indirectly on an economic sector. Schminke (1995) argues that the sustainable forest development can only be achieved if all stakeholders work together seriously due to the rapidly changing of world meanwhile the natural resources including forests are under pressure. So that the development of related human resources and technology also must be done immediately and sustainability.

Information regarding the contribution of the Forestry Sector GRDP is believed to not reflect the actual contribution of the Forestry sector. The contribution of the Forestry sector through multipliers is estimated to be quite large for the economy of Central Java, while the contribution of the forestry sector seen in the GRDP data is very small. This is because the linkages and support of the forestry sector in other sectors have not been taken into account, because the GRDP only calculates the final output of a sector or only shows the direct role of the sector. Whereas in the economy, each sector including the Forestry sector has an indirect role in addition to a direct role in the output of the economy. The indirect role is the influence of the Forestry sector on Other Economic sectors in shaping the output of the economy. For the illustration, the estimation of the GRDP from the Forestry sector only calculates roundwood production, while in the downstream sector, the processing of advanced Forest products such as furniture no longer includes output (added value) calculated from the Forestry sector. Likewise in the production

non-extractive products such as recreation and forest tourism

This study identifies the map of the forestry sector structure in Central Java, through backward and forward linkages, by employing the Input-Output Analysis. This study also maps the path of the impact of Forestry sector economic activities through simulations of Central Java and sectoral economies, and the level of sectoral income in Central Java. Input-Output analysis is an analysis that can reflect the contribution of the forestry sector in Central Java Province in terms of its linkages to other sectors. This study is important to provide an analysis of the economic impacts of the Forestry sector and forest products, especially in order to communicate greater economic benefits from industry to policy makers (Henderson and Munn 2013, McConnell 2013, Henderson and Evans 2017, Joshi et al. 2017).

RESEARCH METHODS

The data used in this study are collected from the Central Statistics Agency (BPS), Central Java Provincial Government, which includes the 2013 Central Java Province Input-Output (I-O) Table, several years of macroeconomic indicator, and other data.

The variables used in the analysis are the variables listed in the 2013 Central Java I-O table, which consist of intermediate transactions, final demand variables which consist consumption, government expenditure, gross fixed capital formation, stock changes, and exports, output variables, input, and added value. The description of the Central Java Province I-O sectors in 2013 is presented in Table 1. For the purposes of analysis, the Forestry sector referred to in I-O

Table is the Sectors 24 and 25, namely the Wood sector, and Other Forest Products sectors. Based on the explanation in the 2010 Indonesian I-O Table (Badan Pusat Statistik, 2015), according to Indonesian Commodity Raw Classification (KBKI) 2010, the descriptions of the two sectors are shown in Table 2.The main sectors observed in this study are the sectors related to the forestry, namely the sector of output and the input user sectors; Timber and Other Forest products sectors. The transactions of the 88 Sectors of 2013 Central Java Province I-O Table are total transactions based on consumer prices (million rupiah); total transactions based on producer prices and domestic transactions based on producer prices.

The total transaction table is a table that covers transactions in goods and services sector transactions, both from local production (in the Central Java region itself) and imports (from outside the Central Java region). The table of domestic transactions is a table that covers the transaction value of goods and services between economic sectors that only come from production in the scope of Central Java region. The transaction table which is based on the buyer's price is a transaction table that includes the value of trading margins and transportation costs (which are incorporated in the input value for sectors that buy it) on goods and services transactions between sectors. The table of transaction which is based on the producer prices is a transaction table that includes the value of transactions between goods and servicesbetween sectors that do not contain elements of margin of trade and transportation (it hase been separated as inputs purchased from the trade and transportation sector).

Table 1. The Classification of the 2013 Central Java Input-Output (88 sectors)

Code	Sector Name	Code	Sector Name
1	Paddy	45	Yarn Spinning
2	Maize	46	Manufacture of Taxtile
3	Cassava	47	Manufacture of Final Taxtile and Other Taxtile
4	Orther Tubber	48	Manufacture of Wearning Apparel
5	Onion	49	Manufacture of Leather and Footwear
6	Vegetables	50	Manufacture of Wood and Wood Material Construction
7	Banana	51	Manufacture of Wooden Household Furniture
8	Fruits	52	Manufacture of Paper and Paper Goods
9	Peanut	53	Publishing and Printing
10	Other Bean	54	Manufacture of Pharmacy and Herb
11	Other Food Material	55	Manufacture of Fertilizer and Pesticide
12	Rubber	56	Petroleum Refinery
13	Sugarcane	57	Manufacture of Rubber and Rubber Goods
14	Coconut	58	Manufacture of Plastic Wares
15	Tobacco	59	Manufacture of Non Ferrous Basic Metalic Mineral Products
16	Coffe Beans	60	Manufacture of Cement
17	Clove	61	Manufacture of Calcium and Cement Goods
18	Fiber Plant Product	62	Manufacture of Basic Iron and Steel
19	Tea	63	Manufacture of Non Ferrous Basic Metal
20	Other Estate Crops	64	Manufacture of Machine, Electrical Machinery And Apparatus
21	Other Agriculture Product	65	Manufacture of Transport Aquipment and Its Repair
22	Livestock and Its Product	66	Manufacture of Other Products Not Elsewhere Classified
23	Poultry and Its Product	67	Electricity and Gas Supply
24	Wood	68	An Water Supply
25	Other Forestry Product	69	Residential and Non-Reesidential Construction
26	Fish and Other Fishing Products	70	Other Construction
27	Aquaculture and Freshwater Fish Products	71	Trade
28	Agricultur Service	72	Restarurant
29	Mineral Salt	73	Hotel
30	Other Minning	74	Railway Transport
31	Quarrying Product	75	Road Transport
32	Manufacture of Food Processing and Preserving	76	Water Transport
33	Manufacture of Oil And Fat	77	Air Transport
34	Rice Milling	78	Services Allied to Transport
35	Manufacture Of Flour, All Kinds	79	Comonication
36	Bakery And Farinaceous Products	80	Bank
37	Manufacture of Milled Coffee and Peel	81	Other Financial Institution
38	Manufacture of Other Food Products	82	Real Estate and Business Service
39	Manufacture of Food Seasonings and Flavors	83	General Government and Defence
40	Manufacture of Fodder	84	Private Education
41	Cane and Coconut Sugar Factory	85	Private Health
42	Manufacture of Beverages	86	Entertainment Services
43	Manufacture of Cigarettes	87	Other Services
44	Manufacture of Tobacco Processing Besides Cigarettes	88	Unspecified Sector

Source: Badan Pusat Statistik Jawa Tengah (2014)

Table 2. The Description of Wood Sector and Other Forest Products Sectors which based on Indonesian I-O dan KBKI

Indonesia IO Code 2010	KBKI 2010	Description
31		WOOD
	3110	Logs of coniferous trees
	3120	Logs of are not coniferous trees
	3130	Firewood, log, billets, twigs, bonds, branches or similar forms
32		OTHER FORESTRY PRODUCTS
	2910	Natural honey
	3211	Balata, palaquium, guayule, chicle and similar natural sap in the form of origin or plates, sheets or strips
	3219	Lacquer, resin, gum balm, natural sap and other resin, etc.
	3220	Raw or naturally processed cork
	3230	Produk kehutanan yang dapat dimakan yang tumbuh liar
	3250	Vegetal products of the type that are mainly used for webbing or as fillers or layers; vegetable raw materials which are mainly used in coloring or tanning; vegetable products etc.

Source: Badan Pusat Statistik (2015)

IO Table Scheme and the Description of Data, I-O analysis is a general equilibrium analysis, which is based on a table in the form of matrices of transaction of goods and services. The main emphasis of this I-O analysis is on the production side. Transaction matrices in I-O include several blocks grouped in 4 quadrants, namely the intermediate transaction quadrant, final demand quadrant, primary input quadrant, and primary input quadrant to final demand.

In the Table 3, an example of an I-O table is illustrated. Each quadrant is expressed in the form of a matrix. As shown in the table, for example in an economy there are 3 sectors, namely sector 1, sector 2, and sector 3. Suppose that in the economy, all goods in the domestic market come from domestic output from domestic production sectors (X). Furthermore, the interpretation of each number in each cell is double.

Table 3. The Example of Input-Output Table (3 sectors)

Input allocation \ Output Allocation		Intermediate Demand			Final Demand	Output
		Sector 1	Sector 2	Sector 3		
Intermediate Input	Sector 1	Quadrant I x_{11}	x_{12}	x_{13}	Quadrant II Y_1	X_1
	Sector 2	x_{21}	x_{22}	x_{23}	Y_2	X_2
	Sector 3	x_{31}	x_{32}	x_{33}	Y_3	X_3
Primary Input		Quadrant III V_1	V_2	V_3	Quadrant IV	
Input		X_1	X_2	X_3		

Source: Badan Pusat Statistik (2000)

This means that it can be read both in column and row. Each number when viewed horizontally shows the distribution of output, while vertically is the input of a sector obtained from other sectors.

Input Coefficient and Leontief Inverse Matrix, by knowing the input between a sector (x_{ij}) and the total input of the sector (X_j), the input coefficient can be calculated as:

$$a_{ij} = \frac{x_{ij}}{X_j}$$ ....(1)

The input or technology coefficient can be read as the number of sector inputs i need to produce one sector output unit j.

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \cdot & \cdot & \cdots & a_{.n} \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix}$$ ....(2)

The technology coefficient a_{ij}, can be written as:

$$\left. \begin{array}{l} X_1 = a_{11}X_1 + a_{12}X_2 + \ldots + a_{1n}X_n + Y_1 \\ X_2 = a_{21}X_1 + a_{22}X_2 + \ldots + a_{2n}X_n + Y_2 \\ X_3 = a_{31}X_1 + a_{32}X_2 + \ldots + a_{3n}X_n + Y_3 \end{array} \right\} \ldots (3)$$

By shifting all elements to the left, except Y_i, then grouped by X, the equation is obtained:

$$\left. \begin{array}{l} (1 - a_{11})\, X_1 - a_{12}X_2 - \ldots - a_{1n}X_n = Y_1 \\ -a_{21}X_1 + (1 - a_{22})\, X_2 - \ldots - a_{2n}X_n = Y_2 \\ -a_{n1}X_1 - a_{n2}X_2 - \ldots + (1 - a_{nn})\, X_n = Y_n \end{array} \right\} \ldots (4)$$

If the relationship between data is written into matrix notation, the equation in the column becomes:

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{1n} \\ a_{21} & a_{22} & a_{2n} \\ \cdot & \cdot & a_{.n} \\ a_{n1} & a_{n2} & a_{nn} \end{bmatrix}, \ X = \begin{bmatrix} X_1 \\ X_2 \\ \cdot \\ X_n \end{bmatrix}, \ Y = \begin{bmatrix} Y_1 \\ Y_2 \\ \cdot \\ Y_n \end{bmatrix}$$

$(I - A)\, X = Y$...(5)

Where I is an identity matrix of the size of nx while A, X and Y are respectively the technology coefficient matrix with order n x n, column vectors output n x 1 and the final demand column vector n x 1. If there is a change in the final demand in the economy, there will be a change in national output and written as:

$X = (I - A)^{-1}Y$..(6)

The matrix of $(I - A)^{-1}$ is known as the Leontief inverse matrix. It is clear that the level of output depends on the value. Furthermore, how the calculation and interpretation of each of these matrix elements will be discussed in a separate section.

Because the form of the equation is linear, equation (3.11) can also be written as:

$\Delta X = (I-A)^{-1}\Delta Y$ ....(7)

Where ΔY is a vector of changes in the final demand and ΔX is a vector of the changes of output. Multiplier: Output and Income, one of the main purposes of I-O analysis, is to find out the impact of changes in the elements of exogenous variables in the I-O model of the economy. For the example is a change in the element of final demand (such as government spending) in the case above. The general form of measuring the impact is $X = (I - A)^{-1}Y$. The results of these impacts, namely X will depend on $(I - A)^{-1}$ and Y.

The main concern for the formula is the Leontief inverse matrix, which is determined by the matrix A and the transaction intermediate matrix Z. Changes in Y vector are formed from projections on certain final request elements. Furthermore, accuracy in determining the value of these elements will determine the accuracy of the results of the calculation of the impact. The output multiplier of a sector j is the total value of the output produced by the economy to meet (or as a result) a change in one unit of money of the sector's fineal demand. The output multiplier is

the number of columns of the Leontief inverse matrix element. By notation, it formulated as:

$$O_j = \sum_{i=1}^{n} \alpha_{ij} \quad ....(8)$$

For i = 1,2, ..., n

Where O_j is the number of output multiplier of j and α_{ij} is the element of the Leontief inverse matrix, $(I-A)^{-1}$. The change in the amount of income received by the household that created due to the addition of one unit of money to the final demand of a sector. The path of influence of the change in final demand on increasing household income can be explained by, for example, the case of an increase in final demand. An increase in sectoral final demand will increase sectoral and total economic output. This can be measured through output multiplier numbers as explained previously.

An increase in output will increase demand for labor, this will increase remuneration for households that have these workers. The relationship of the total output of each sector with the labor income is indicated by the row (n + 1) of the matrix (which is the component of wages and salaries in the primary input matrix), referred as the coefficient of wages and salaries, which is the ratio between the value of wages and salaries to the total value of input, H_R. So the impact of the final demand on household income is measured by the multiplier of output and the coefficient of household income, which is called the household income multiplier, H_j, Household income multiplier matrix:

$$H_j = H_R . O_j \quad ....(9)$$

Where H_R is the row vector n+1, because it is considered a transaction matrix and the input coefficient matrix has order n x n.

Where $x_{n+1,j}$ in the formula is same with the row v (primary input) on the table 3.

$$HR = \begin{bmatrix} a_{n+1,1} & a_{n+1,2} & .... & a_{n+1,n} \end{bmatrix} ...(10)$$

$$a_{n+1,j} = \frac{X_{n+1,j}}{X_j}, \ j = 1, 2, 3, ...n \quad ....(11)$$

For each sector, the multiplier of the household income becomes:

$$H_j = \sum_{i=1}^{n} a_{n+1,j} \ \alpha_{ij} \quad ....(12)$$

The Simulation of the Impact of Forestry Sector Activities and Development of Shock Scenarios, by developing a shock injection scenario with a certain magnitude, this study simulates the activity impacts on the economy toward total/sectoral output and income. To estimate changes in shock to changes in sectoral output, is calculated by:

$$\Delta X = (I-A)^{-1}\Delta Y \quad ....(13)$$

Where ΔY is a vector of changes in final (including consumption expenditures) and ΔX is a vector of output changes. A is the technology coefficient matrix and $(I-A)^{-1}$ is the Leontief inverse matrix (Firmansyah, 2006). To estimate the changes in sectoral of household income, is calculated by the formula:

$$\Delta H = H_R (I-A)^{-1}\Delta Y \quad ....(14)$$

Where ΔH is a vector of output changes. H_R is the adalah matriks of household income coefficient. (Firmansyah, 2006).

RESULTS AND DISCUSSION

The Development of the Forestry Sector of Central Java , Central Java's economic growth shows a positive trend in the period 2011-2017. This is indicated by the constant rate of economic growth in the range of 5.1-5.5%. In 2017, Central Java's economic growth is 5.3%

(yoy), slowing down compared to 2015 (5.5%), which was caused, among others, by slow
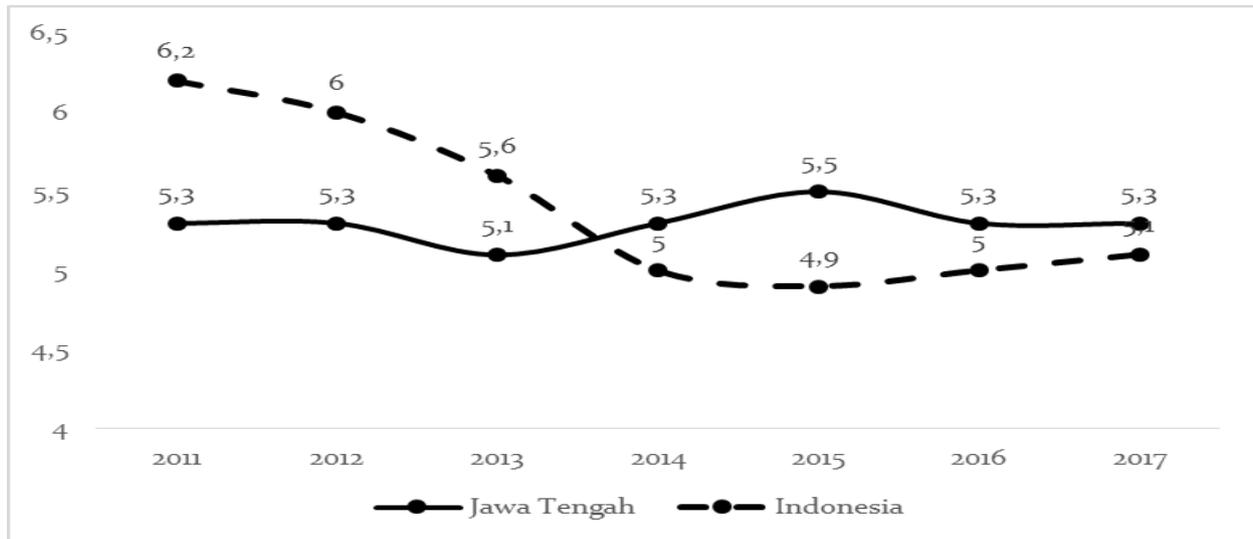
down in the forest and logging sub sectors.

Figure 1 The Economic Growth of Central Java and Indonesia 2011-2017 (%)
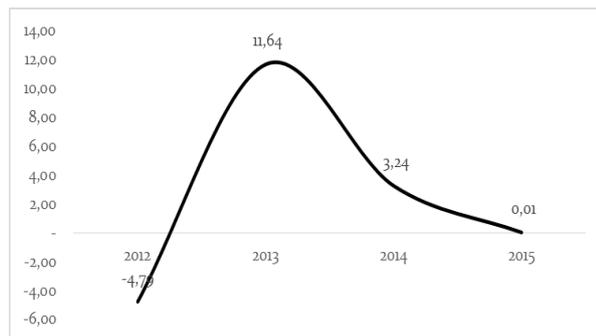Source: BPS Jawa Tengah (2018a), processed

Based on the sectoral composition of the business sector, Central Java's economic growth is driven by the secondary sector and the primary sector.Based on the 2009-2029 Central Java Regional Spatial Planning (RTRW), the land use with the spatial pattern is consists of cultivation areas and protected areas. Allotment of cultivation areas includes production forests, community forests, agriculture, plantations, mining, industry, livestock and settlements covering an area of 2,693,008 hectares and land for allotment of protected areas includes protected forests, border areas, nature reserves, and nature conservation, karst protected areas 561,404 Ha.

The development of production forest designation areas in Central Java Province with an area of 546,290 Ha is divided into 20 Forest Management Units (KPH), with the function of a limited production forest by ± 362,360 Ha and permanent production forests covering ± 183,930 Ha. Limited production forest areas are in 28 districts (all districts

except Sukoharjo Regency) and one city, Semarang City, while production forest areas remain in 28 districts (districts except Karanganyar Regency). Since 2009-2015, the state forest area and the area of Perhutani forest have experienced an increase or expansion. 0.71% for Perhutani land and 0.54% for state forest. However, the conservation forest has decreased / narrowed by 5.88% in the past 6 years as presented in Table 4.The development of community forest areas in 2015 was 640,393.90 in 35 districts/cities in Central Java. Cilacap Regency has the widest community forest area in Central Java, reaching 8.97%. The growth of the area of community forests in Central Java tends to fluctuate with the increasing trend. This is due to public awareness to plant trees on land owned with the hope of obtaining a large return in the future.

The protected forest areas managed by the State are spread in Banyumas, Purbalingga, Banjarnegara, Kebumen, Wonosobo, Magelang, Klaten, Sukoharjo, Wonogiri, Karanganyar, Sragen, Rembang, Pati, Kudus, Jepara, Semarang,

Temanggung, Kendal, Batang, Pekalongan, Pemalang, Tegal and Brebes.For protected forest areas managed by the community, they are encouraged to at least reach a minimum of 10% through unproductive land conversion, which is directed towards development in 29 districts and 3 cities (Magelang, Salatiga, and Semarang).

Source: Pemerintah Provinsi Jawa Tengah (2018a), processed

Figure 3 The Growth of Community Forest Area 2011-2015 (%)

Output and Value Added of Forestry Sector, The Forestry Sector Namely Wood (24) and Other Forestry Products (25), is in the order of 32 and 63 of 88 sectors if the import and distribution are separated. For total transactions with imports and distributions, the Forest and Other Forestry Products sector is in the order of 51 and 77. That is, the order of this sector is better if imports and distributions are separated, in other words this sector is the support sector of the local economy, with low import dependence. In addition, the Manufacture of Wood and Wood Material Construction (50), which is a sector that receives input support from the Forestry sector, ranks 5th.

The value added (VA) shown in I-O represents the percentage of VA of a sector against the sector's corresponding output. The sector that has the largest added value compared to its output (relative to other sectors in the economy) is the Other Mining (30) sector which reached 89.67%. The sector that has a high ranking is the most efficient sector compared to other sectors in the economy. Other forestry products sector (25) has a high composition of VA which ranks 7th, while the Wood Sector (24) is in the order of 11 out of 88 IO Central Java classification sectors. If VA is large compared to other sectors, then sectors that have the biggest VA is the sector that has the best multiplier for the economy. Compared to other sectors, the composition of VA toward the formation of the total VA of Central Java's economy contributed by the Wood (24) and Other Forestry Products (25) sectors was not too high, at 0.39% and 0.12%. Although the VA of forestry sector production (sectors 24 and 25) is not too high compared to other sectors in the Central Java economy, these two forestry sectors are one of the sectors that are attractive to investors. It can be seen in Table 5.4 that the magnitude of the business surplus of the two sectors is 69% and 72% (the average of the two sectors is 70.5%). This means that 70.5% of profits are enjoyed by investors.

According to the 2013 Central Java I-O Table classification, the forestry sector consists two sectors, namely The Wood sector (24) and The Other Forestry products sector (25). The two sectors also have links with other sectors both from input and output side. Other sectors that buy the output of wood and other forestry products, use as inputs in their production process. In terms of input, the activity of the wood and other forestry products sectors drive the demand for their input which are bought from other sectors. In terms of output, the activity of the wood and other forestry products sectors drive the demand of their outputs that used by other sectors as inputs in the production process. So, the activity of the two forestry sectors boosts other sectors through their input

and output channels. In addition, the output value of forestry which can be calculated as GRDP, this sector also plays a role to supports other sectors (which have linkage with forestry sector) in forming the GRDP. As the studies of the impact forestry sector in several regions of the world by Henderson, Standiford, and Evans (2016), Atyi (1998), Lebedys and Li (2014), Nurrochmat et.al. (2015) and Thanger (2014).

Table 4. Value Added (VA) of Wood Sector and Other Forestry Sector in Jawa Tengah based on Total Transaction in Consumer Price

I-O Code	Sector	Value	Share	Value	Share
		(Million Rp)	(%)	(Million Rp)	(%)
		Wood		**Other Forest Products**	
201	Wages and Salaries	50,9379	20.9	161,509.1	22,1
202	Business Surplus	1,680,987	69.0	526,671.3	72,0
203	Depreciation	134,047.3	5.5	22,972.2	3,1
204	Indirect Tax	110.875.7	4.6	20,662.1	2,8
205	Subsidy	0	0	0	0
	Total	2,435,289	100.0	731.814,7	100.0

Source: Badan Pusat Statistik (2014), processed

Which state the sector forestry will have an impact on the economy because it has relevance to other sectors, both as input and output. The Impact of Forestry Sector on Central Java Economy,. From the results of the data processing, it is known which sectors use the most inputs from the two sectors.

Table 5. 10 Users of Wood Sector Output based on I-O Total Transactions on Consumer Prices

No	Code	Sector	Output Composition (%)
1	70	Other Construction	42.572
2	50	Manufacture of Wood and Wood Material Construction	36.24
3	51	Manufacture of Wooden Household Furniture	9.394
4	69	Residential and Non-Reesidential Construction	7.986
5	33	Manufacture of Oil and Fat	0.739
6	24	Wood	0.693
7	38	Manufacture of Other Food Products	0.548
8	49	Manufacture of Leather and Footwear	0.286
9	73	Hotel	0.281
10	32	Manufacture of Food Processing and Preserving	0.185

Source: BPS (2014), processes

Five large users of the output of the Wood sector (24) are Other Contruction (70), Manufacture of Wood and Wood Material Construction (50), Manufacture of Wooden Household Furniture (51), Residential Non-Residential Constructions (69), Manufacture of Oil and Fat (33). Other Construction sector absorb up to 42.57% of the output of the Wood sector, and the Manufacture of Wood and Wood Material Construction absorbs up to 36.25% of the output of the Wood sector.

Table 6. 10 Users of Output of Other Forestry Product based on I-O Total Transactions on Consumer Prices

No	Code	Sector	Output Composition (%)
1	51	Manufacture of Wooden Household Furniture	87.472
2	49	Manufacture of Leather and Footwear	4.075
3	54	Manufacture of Pharmacy and Herb	3.877
4	50	Manufacture of Wood and Wood Material Construction	1.764
5	87	Other Services	1.303
6	24	Wood	0.377
7	73	Hotel	0.269
8	38	Manufacture of Other Food Products	0.194
9	66	Manufacture of Other Products Not Elsewhere Classified	0.149
10	26	Fish and Other Fishing Products	0.110

Source: BPS (2014), processed

Five large users of output from Other Forestry Products sector (25) are Manufacture of Wooden Household Furniture (51), Manufacture of Leather and Footwear (49), Manufacture of Pharmacy and Herb (54), Manufacture of Wood and Wood Material Construction (50), and Other Services (87). Manufacture of Wooden Household Furniture absorbs up to 87.47% of the output of the Other Forest Products sector

Table 7. 10 Users of Wood + Other Forestry Sector Output based on I-O Total Transactions on Consumer Prices

No	Code	Sector	Output Coeff. 24+25 (%)
1	51	Manufacture of Wooden Household Furniture	96.866
2	70	Other Construction	42.572
3	50	Manufacture of Wood and Wood Material Construction	38.009
4	69	Residential and Non-Reesidential Construction	8.070
5	49	Manufacture of Leather and Footwear	4.361
6	54	Manufacture of Pharmacy and Herb	3.890
7	87	Other Services	1.339
8	24	Wood	1.070
9	38	Manufacture of Other Food Products	0.741
10	33	Manufacture of Oil and Fat	0.739

Source: BPS (2014), processed

If both sectors 24 and 25 are combined, the top 5 output users of the two sectors are Manufacture of Wooden Household Furniture (51), Other Construction (70), Manufacture of Wood and Wood Material Construction (50), Residential and Non Construction (69), and Manufacture of Leather and Footwear (49). Sector 51 as the largest user of output from the two forestry sectors (24 and 25), reached 96.87%, followed by Sector 70, by 42.57%.

Table 8. The Use of Inputs in Industrial Furniture for Household Furniture from Wood (51)

No	Code	Sector	Input Coeff (%)
1	50	Manufacture of Wood and Wood Material Construction	51.474
2	25	Other Forestry Product	10.968
3	51	Manufacture of Wooden Household Furniture	8.846
4	24	Wood	5.979
5	55	Manufacture of Fertilizer and Pesticide	3.278
6	56	Petroleum Refinery	2.653
7	75	Road Transport	1.948
8	18	Fiber Plant Product	1.826
9	76	Water Transport	1.388
10	67	Electricity and Gas Supply	1.361

Source: BPS (2014), processed

From Table 8, it is known that Manufacture of Wooden Household Furniture (51) uses its inputs derived from Other Forestry Products sector by 10.97% (2nd place) and from the Wood sector by 5.98% (4th place). The largest use of inputs (1st place), which reached 51.48% by Sector 51, come from Sector 50 (Manufacture of Wood and Wood Material Construction). It shows that Sector 51 is the largest user of inputs in the form of materials from other wood processing industries wich is from Sector 50, not logs. However, it also can be seen that the Manufacture of Wood and Wood Material Construction also buys Wood sector output reach 19.21% of the total input used. This means that the Wood sector contributes to the Sector 51 production process in two ways namely directly and indirectly through the production of Sector 50. The same explanation for Other Forestry Products Sectors.

Table 9. The Use of Input of Other Construction Sector (70)

No	Code	Sector	Input Coeff. (%)
1	56	Petroleum Refinery	14.374
2	50	Manufacture of Wood and Wood Material Construction	13.695
3	64	Manufacture of Machine, Electrical Machinery And Apparatus	12.316
4	31	Quarrying Product	10.758
5	63	Manufacture of Non Ferrous Basic Metal	10.572
6	62	Manufacture of Basic Iron and Steel	7.355
7	24	Wood	5.908
8	59	Manufacture of Non Ferrous Basic Metalic Mineral Products	4.847
9	61	Manufacture of Calcium and Cement Goods	3.602
10	82	Real Estate and Business Service	3.012
63	25	Other Forestry Product	0.000

Source: BPS (2014), processed

Table 9 shows that the input of Other Construction sector (70) originating from the Wood sector is only 5.9% (the 7th order in the use of sector 70 inputs) and which comes from the Other Forestry Products sector is almost zero.

However, the main input provider of Sector 70 is Sector 50 – which also buys inputs from Wood sector. So the Wood and Other Forestry Products sectors contribute directly and indirectly to the production of Sector 70.

Table 10. The Use of the Input of Manufacture of Wood and Wood Material Construction Sector (50)

No	Code	Sector	Input Coeff. (%)
1	50	Manufacture of Wood and Wood Material Construction	41.690
2	24	Wood	19.214
3	56	Petroleum Refinery	9.173
4	55	Manufacture of Fertilizer and Pesticide	5.016
5	64	Manufacture of Machine, Electrical Machinery And Apparatus	4.468
6	76	Water Transport	3.539
7	67	Electricity and Gas Supply	2.777
8	75	Road Transport	2.740
9	80	Bank	1.920
10	87	Unspesified Sector	1.398
23	25	Other Forestry Product	0..184

Source: BPS (2014), processed

From Table 10 it can be seen that the Wood sector is the second largest sector of input for Manufacture of Wood and Wood Material Construction (50), reaching 19.21% of the input used by Sector 50. While the largest sector contributing inputs to Sector 50 is the Sector 50 it self. Other Forestry Products sector contributes to Sector 50 inputs by 0.18%.

Table 11. The Use of Input of Residential and Non Residential Construction Sector (69)

No	Code	Sector	Input Coeff (%)
1	56	Petroleum Refinery	14.397
2	63	Manufacture of Non Ferrous Basic Metal	12.971
3	64	Manufacture of Machine, Electrical Machinery And Apparatus	10.315
4	31	Quarrying Product	10.066
5	60	Manufacture of Cement	9.548
6	50	Manufacture of Non Ferrous Basic Metalic Mineral Products	9.448
7	62	Manufacture of Basic Iron and Steel	8.826
8	82	Real Estate and Business Service	4.518
9	59	Manufacture of Non Ferrous Basic Metalic Mineral Products	4.182
10	61	Manufacture of Calcium and Cement Goods	3.113
12	24	Wood	2.030
36	25	Other Forestry Product	0.004

Source: BPS (2014), processed

Wood and Other Forestry Products sectors contribute to the Sector 50 production process directly or indirectly. The use of output of Wood and Other Forestry Products sector is 2.03% and 0.004 % respectively, not too significant in supporting Sector 69 (Residential and Non Residential Construction Sector) (Table 11). However, the second support of the Forestry sector was also carried out indirectly in addition to directly.

Table 12. The Use of Input of Manufacture of Leather and Footwear Sector (49)

No	Code	Sector	Input Coeff (%)
1	32	Manufacture of Food Processing and Preserving	36.114
2	49	Manufacture of Leather and Footwear	34.533
3	12	Rubber	3.161
4	55	Manufacture of Fertilizer and Pesticide	2.615
5	58	Manufacture of Plastic Wares	1.968
6	64	Manufacture of Machine, Electrical Machinery And Apparatus	1.912
7	56	Petroleum Refinery	1.865
8	67	Electricity and Gas Supply	1.854
9	57	Manufacture of Rubber and Rubber Goods	1.735
10	47	Manufacture of Final Taxtile and Other Taxtile	1.587
19	25	Other Forestry Product	0.588
27	24	Wood	0.210

Source: BPS (2014), processed

The description of the analysis of the forestry sector in Central Java is in line with the research of Henderson, Standiford and Evans (2016), which states that the economic contribution of the forest products industry is very different in each region for two reasons. That is, the total value of the effect or contribution reflects the value of the direct effect (eg the size of the forest product industry) and the value of the multiplier (eg how the economy responds to expenditure). Forestry provides many economic benefits for the local economy (eg sales, employment, income), and the ability to practice forestry depends on access to publicly managed infrastructure (eg roads and bridges) to transport forest products that are harvested and produced. However, the economic benefits resulting from forestry-related harvesting and manufacturing are not always fully understood or valued. An analysis of the impact of the forestry sector on the economy of Central Java is explained as follows. Impact analysis of the forestry sector on the economy of central java, analysis of direct, indirect, and total impact of the forestry sector on the Economy of Java, in this impact analysis, the Central Java I-O Table used is aggregated to 87 sectors from 88 sectors so that the output multiplier matrix (Leontief inverse matrix) can be calculated. Sector 88 is aggregated with Sector 87 become Sector 87. The influence of a sector through input purchase is called the backward linkage of a sector, while the influence of a sector through the supply of output to other sectors is called forward linkages. The effect of a sector is triggered by changes in the final demand (in the Input-Output analysis known as the final demand approach). In summary, to understand the impact of the movement of a sector, for example the impact that occurs activities the final change in demand, namely changes in investment or consumption. For example, an increase in final demand (eg investment) in

Sector A will increase the output created in the sector and in other sectors directly related

to sector A, both as input providers and output buyers.

Table 13. Direct, Indirect and Total Backward Impact in Central Java

Code	Sector	Direct Impact	Indirect Impact	Total Impact
24	Wood	0.169	1.181	1.351
25	Other Forestry Product	0.158	1.190	1.348

Sourcee: BPS (2014), processed

Other sectors that are directly related also increase their output. If the impact comes from the additional output of Sector A created coupled with an increase in the output of other sectors which are providers of sector A inputs, then it is called the direct backward impact of Sector A. If the impact comes from the output of Sector A created plus output of other sectors which are buyers of sector A output, hence the direct impact of Sector A.

Indirect impacts are the impact of the next round. For example, the indirect backward impact is the output of sectors that provide input to the sector of direct input sector A. This impact continues backward in terms of the linkages. For total impact, is the sum of direct and indirect impacts. Similar explanations for future impacts are indirect. Sectors 24 and 25 have a direct, indirect and total backward impact that is smaller than the sectoral average. This means that if the sector moves fthe impact through its input channels is not as large as the other sectors on average in the direct, indirect and overall economic output (Table 13).From Table 14 it can be seen that Sectors 24 and 25 have a direct, indirect and total impact that is smaller than the sectoral average. This means that if the sector moves for example by making additional investments, the impact through its output path is not as large as the other sectors on average at the economic

output both directly and indirectly and overall. In fact, the sectors in the economy do not move individually, but together simultaneously, so that the support of the Forestry sector can also be done through the movement of other related sectors, as explained in the following section. Analysis of the Impact of Changes in Sectoral Activities on Sectoral Outputs and the Total Economy of Central Java 2018-2023.

This section is analyzed based on the case that the Forestry sector (Sector 24 and 25) get a shock or injection at the final demand, and the impact is calculated on the creation of economic output. In addition, if several other sectors that use inputs derived from the Forestry sector output also get an injection at their final demand, it can be seen that the creation of output the sectors (where the Forestry sector plays a role), and also known how the Wood and Other Forestry sectors role in the formation of the outputs.

The magnitude of injection in this study is assumed to be an investment of 1 trillion rupiahs in each sector. Table 15 shows changes in economic output that occur if the final demand (in this case investment) is the Wood (24) and Other Forestr Products sector (25), is increased by 1 brillion rupiahs (simulations are carried out alternately, when Sector 24 received a shock of 1 trillion, Sector 25 and other sectors did not get investment or zero investment value).

Table 14 Direct, Indirect and Total Forward Impact in Central Java

Code	Secktor	Direct Impact	Indirect Impact	Total Impact
24	Wood	0.263	1.223	1.486
25	Other Forestry Product	0.085	1.023	1.108

Source: BPS (2014), processed

In addition, it is also simulated if 5 selected sectors (Sectors 51, 70, 50, 69 and 49) that have a backward linkage with Sector 24 and 25 are given alternately (such as the simulation above) shock investment of 1 trillion rupiahs, is known how the economic output occurs due to the shock, and what part of the contribution from Sectors 24 and 25 in the formation of the output. Table 16 to 20 are the simulation results from an increase in investment of 1 trillion rupiahs in each of these sectors. The choice of the 5 sectors are based on 5 sectors that use the Wood and Other Forestry Products sectors as inputs.

Table 15. Impact of Investment Increase 1 Trilion Rupiah on each of the Wood and Other Forestry Product Sectors towards Central Java Economic Output

Code	Sector	Total Effect (juta Rp)
24	Wood	1.350.951,35
25	Other Forestry Product	1.348.407,16
24+25	Wood and Other Forestry Product	2.699.358.51

Source: BPS (2014), processed

From Table 15 it can be seen that if the Wood sector is invested 1 trillion rupiahs (other sectors have not changed), then the economic output increase by 1.35 trillion rupiahs. If the Other Forestry Products sector is invested by 1 trillion rupiahs (other sectors have not changed), then the economic output increase by 1.348 trillion rupiahs. If the two sectors are simultaneously investing by 1 trillion rupiahs in each sector (other sectors have not changed), then the economic output increase by 2.699 trillion rupiahs.

Tabel 16. Impact of Investment Increase 1 Trilion Rupiahs on Manufacture of Wooden Household Furniture Sector (51) toward the Central Java Economic Output

Rank	Code	Sector	Leontief	Share
1	51	Manufacture of Wooden Household Furniture	1,060,412.50	47.43
2	50	Manufacture of Non Ferrous Basic Metalic Mineral Products	459,531.02	20.56
3	30	Other Minning	105,716.27	4.73
4	24	Wood	96,059.48	4.30
5	56	Petroleum Refinery	77,973.00	3.49
6	25	Other Forestry Product	73,001.13	3.27
7	64	Manufacture of Machine, Electrical Machinery And Apparatus	66,640.05	2.98
8	55	Manufacture of Fertilizer and Pesticide	47,079.44	2.11
9	75	Road Transport	23,510.85	1.05
10	67	Electricity and Gas Supply	22,549.44	1.01

Source: BPS (2014), processed

Table 16 shows that if in the industrial furniture sector of wood households (51) is invested 1 trillion rupiahs (other sectors have not changed), the economic increases by 2.236 trillion rupiahs. In other words, the economy will grow 2,236 times investment in sector 51. From these results, the Wood and Other Forestry Products sectors including the 6 biggest contributors to the economic output. Sector 24 contributed 4.30%, and Sector 25 contributed 3.27% from the increase in economic output due to investment increase in Sector 51.

Table 17. Impact of Investment Increase 1 Trilion Rupiahs on Other Construction Sector (70) toward the Central Java Economic Output

Rank	Code	Sector	Leontief	Share
1	70	Other Construction	1,000,587.52	43.72
2	30	Other Minning	221,614.05	9.68
3	64	Manufacture of Machine, Electrical Machinery And Apparatus	190,175.50	8.31
4	56	Petroleum Refinery	138,429.76	6.05
5	50	Manufacture of Non Ferrous Basic Metalic Mineral Products	128,269.88	5.60
6	63	Manufacture of Non Ferrous Basic Metal	81,905.94	3.58
7	31	Quarrying Product	78,121.13	3.41
8	62	Manufacture of Basic Iron and Steel	68,862.69	3.01
9	24	Wood	56,293.04	2.46
10	59	Manufacture of Non Ferrous Basic Metalic Mineral Products	36,160.35	1.58
58	25	Other Forestry Product	417.85	0.02

Source: BPS (2014), processed

Table 17 shows that if in the Other Construction Sector (70) invest 1 trillion rupiahs (other sectors have not changed), then the economic output increases by 2.289 trillion rupiahs. In other words, the economy grows by 2,289 times investment in Sector 70. From these results, the Wood and Other Forestry Products sectors contribute 2.46%, and 0.02% of the increase in economic output due to investment increase in Sector 70.

Table 18. Impact of Investment Increase 1 Trilion Rupiahs on Manufacture of Non Ferrous Basic Metalic Mineral Products Sector (50) toward the Central Java Economic Output

Rank	Code	Sector	Leontief	Share
1	50	Manufacture of Non Ferrous Basic Metalic Mineral Products	1,355,001.20	61.65
2	24	Wood	165,155.77	7.51
3	30	Other Minning	138,409.42	6.30
4	56	Petroleum Refinery	117,901.87	5.36
5	64	Manufacture of Machine, Electrical Machinery And Apparatus	101,583.34	4.62
6	55	Manufacture of Fertilizer and Pesticide	52,222.22	2.38
7	76	Water Transport	32,902.01	1.50
8	67	Electricity and Gas Supply	29,021.57	1.32
9	75	Road Transport	25,727.29	1.17
10	80	Bank	20,551.51	0.94
28	25	Other Forestry Product	2,297.55	0.10

Source: BPS (2014), processed

From Table 18, it is known that if investment increase by 1 trillion rupiahs in the Manufacture of Wood and Wood Material Construction sector (50) (other sectors have not changed), then the economic output increases by 2.198 trillion rupiahs. In other words, the economy grows by 2,198 times investment in Sector 50. According to these results, the Wood and Other Forestry Products Sectors contribute 7.51% (the second largest contributor after Sector 50), and 0.10% (the 28th biggest contributor) from the increasing economic output due to the investment increasein Sector 50.

Table 19. Impact of Investment Increase 1 Trilion Rupiahs on Residential and Non-Reesidential Construction Sector (50) toward the Central Java Economic Output

Rank	Code	Sector	Leontief	Share
1	69	Residential and Non-Reesidential Construction	1,007,557.36	44.78
2	30	Other Minning	260,477.48	11.58
3	64	Manufacture of Machine, Electrical Machinery And Apparatus	154,534.48	6.87
4	56	Petroleum Refinery	131,653.11	5.85
5	63	Manufacture of Non Ferrous Basic Metal	95,291.31	4.23
6	50	Manufacture of Non Ferrous Basic Metalic Mineral Products	87,523.08	3.89
7	62	Manufacture of Basic Iron and Steel	79,200.07	3.52
8	31	Quarrying Product	72,228.32	3.21
9	60	Manufacture of Cement	64,191.66	2.85
10	82	Real Estate and Business Service	38,602.49	1.72
13	24	Wood	24,557.32	1.09
58	25	Other Forestry Product	312.63	0.01

Source: BPS (2014), processed

Construction Sector (69) (other sectors have not changed), the economic output increases by 2,250 trillion rupiahs. In other words, the economy grows 2,250 times investment in Sector 69. Based on these results, the Wood and Other Forestry Products Sectors contribute 1.09% and 0.01% of the increase in economic output due to the investment increase in Sector 69.

Table 20. Impact of Investment Increase 1 Trilion Rupiahs on Manufacture of Leather and Footwear (49) toward the Central Java Economic Output

Rank	Code	Sector	Leon-tief	Share
1	49	Manufacture of Leather and Footwear	1,301,055.67	52.84
2	32	Manufacture of Food Processing and Preserving	350,884.40	14.25
3	30	Other Minning	102,906.09	4.18
4	26	Ikan Laut Dan Hasil Laut Lainnya	74,004.69	3.01
5	56	Petroleum Refinery	58,959.67	2.39
6	64	Manufacture of Machine, Electrical Machinery And Apparatus	57,273.78	2.33
7	55	Manufacture of Fertilizer and Pesticide	48,679.88	1.98
8	12	Rubber	39,507.33	1.60
9	67	Electricity and Gas Supply	27,206.76	1.10
10	8	Buah-Buahan	24,915.78	1.01

Rank	Code	Sector	Leon-tief	Share
37	25	Other Forestry Product	5,334.57	0.22
40	24	Wood	3,768.67	0.15

Source: BPS (2014), processed

From the Table 20, it is known that if in the Manufacture of Leather and Footwear Sector (49) an investment of 1 trillion rupiahs is invested (other sectors have not change), then the economic output will increase by 2.462 trillion rupiahs. In other words, the economy grows by 2,462 times investment in Sector 49. From these results, the Wood and Other Forestry Products Sector contribute 0.15% and 0.22% from the increase in economic output respectively due to the investment increase in Sector 49.

Table 21. Impact of Investment Increasing 1 milion Rupiahs to Sectoral and Total Income of Central Java

Code	Sector	Income Impact
24	Wood	0.258
25	Other Forestry Product	0.206

Source: BPS (2014), processed

Impact of Changes in Sectoral Activities towards Sectoral and Total Income in Central Java. Table 21 shows a simulation result of the investment increase by 1 million rupiahs in each sector (while other sectors have not changed) towards sectoral and total income in Central Java. With an increase by 1 million rupiahs of investment in the Wood Sector (while other sectors have not changed) will increase the income of the entire sector by 0.258 million rupiahs, and an increase of 1 million rupiahs in Other Forestry Sector (while other sectors have not changed) increases the all sector income by 0.206 million rupiahs

CONCLUSION

From the component of the forming value added of the Wood and Other Forestry Products Sector, it shows that two sectors of forestry are attractive sectors for investors because they have a portion of the business surplus of 69% and 72% of all value added.

The Wood and Other Forestry Products sector product is mostly the intermediate output, which is above 97% and 88% of its products are used by other sectors as the production inputs, so these sectors have a high multiplier for the economy.

In terms of exports, the products of the Wood Sector and Other Forestry Products Sectors export only 6.6% and 36.14% of their products, respectively. The Wood Sector exports of its products to other provinces, while the Other Forestry Products Sector exports 82.52% to other provinces and 17.48% to other countries. Based on this data, the Central Java Forestry Sector also acts as a source of foreign exchange income for the country. The Wood and Other Forestry Products Sector drives the economy directly and indirectly. The impact of the activities of the forestry sector can be traced through a linkage scheme between sectors both through the input purchase path (backward linkages) and the sale of output (forward linkages) to other sectors.

The top five sectors of output users of the two sectors are the Manufacture of Wooden Household Furniture (51), Other Construction (70), Manufacture of Wood and Wood Material Construction (50), Residential Buildings and Non-Residential Construction (69), and Manufacture of Leather and Footwear (49). Manufacture of Wooden Household Furniture (51) as the largest user of output from the two forestry sectors (24 and 25), reached 96.87%, followed by Other Construction (70), at 42.57%.

These sectors are the five largest sectors that use the output of the Wood and Other Forestry Products Sector, and there are still other user sectors. That is, if these five sectors (and other sectors) increase (for example, get a capital injection), then they buy more output of the Wood and Other Forestry Products Sector. In other words, these sectors require the Wood and Other Forestry Products Sector to provide more output for their production processes.

Inputs of the Manufacture of Wooden Household Furniture (51) which originating from the Other Forestry Products Sector by 10.97% (2nd place) and from the Wood sector 5.98% (4th place). The largest use of inputs of Sector 51 (1st place), which reached 51.48%, come from Sector 50 (Manufacture of Wood and Wood Material Construction). Manufacture of Wood and Wood Material Construction the also buys Wood sector output by 19.21% of it total input used. This means that the Wood Sector contributes to the Sector 51 production process in two ways; directly (to Sector 51) and indirectly through the production of Sector 50. The same explanation for the other 4 main sectors.

Besides contributing directly to the economic output of Central Java, the Wood and Other Forestry Products Sectors also contribute indirectly through other sectors.

Through the formation of economic output by the Manufacture of Wooden Household Furniture (51), an increase in investment of 1 trillion rupiahs in this sector increases the economic output by 2.236 trillion rupiahs. Sector 24 contributes 4.30%, and Sector 25 contributes 3.27% from the increase in economic output due to increased investment in Sector 51.

The Wood and Other Forestry Products Sectors contribute respectively by 2.46% and 0.02% of the increase in economic output due to the investment increase in the Other Construction (70). They contribute 7.51% (Wood sector as the second largest contributor), and 0, 10% of the increase in economic output due to investment increase in the Manufacture of Wood and Wood Material Construction (50), contributing 1.09% and 0.01% of the increase in economic output due to investment increase in the Residential and Non-Residential Contruction (69), and contributed 0.15% and 0.22% of the increase in economic output due to investment increase in the Manufacture of Leather and Footwear (49).

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