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Mapping Agricultural, Forestry, And Fisheries Products In Indonesia: The Input-Output Approach

Agustono
Agribisnis Program UNS

ABSTRACT: Economic growth is a goal of economic development. To achieve strong growth, sound planning is essential. Accordingly, product mapping is crucial. Production activities in the agriculture, forestry, and fisheries sectors are part of the economy that produces both food and non-food products needed by humans. Input-output (I-O) analysis is used as a tool for mapping sectors and products. The data used are the 17x17 I-O table for 2020 and the 185x185 I-O table for 2020. The analysis results indicate that the agriculture, forestry, and fisheries sector is not a key sector but rather a sector with weak attractiveness and strong driving power. The sector lacks superior products, possessing only nine products with a strong sensitivity index (SEI).

KEYWORDS: sector, product, SPI, SEI

INTRODUCTION

Production activities in the agriculture, forestry, and fisheries sectors are part of the economy that produces both food and non-food products. Growth in agriculture, forestry, and fisheries in 2025 is projected to be 5.33%. The contribution of the agriculture, forestry, and fisheries sectors to the Indonesian economy is 13.10% (BPS, 2026a). Economic growth is a goal of economic development. To achieve sound growth, sound planning is also required. In line with this, product mapping is essential. One analytical tool commonly used in economics to achieve sound regional development planning that is integrated with other activities is the input-output (IO) analysis technique (Maidalena, 2023). The input–output (IO) model can be used to examine the flow of products and services within an economy (An et al., 2024). The input-output table provides a comprehensive and detailed description of the national economic system with its complex economic relationships, incorporating information on supply and demand across industrial sectors (Xing, 2017). The method for mapping products using the I-O model involves calculating the dispersion power and the degree of sensitivity. According to Yusfi et al. (2024), a sector with an index of sensitivity (SEI) > 1 has linkages to upstream sectors with above-average degrees of sensitivity across the entire sectoral economy, and vice versa. A sector with an index of dispersion (SPI) > 1 has linkages to downstream sectors with above-average degrees of dispersion across the entire sectoral economy, and vice versa.

The agriculture, forestry, and fisheries sector also has an SPI (dispersion power) value of 0.84 and an SEI (degree of sensitivity) of 1.03 (Budhi, 2024). The results of this study indicate that the agriculture, forestry, and fisheries sector exhibits low dispersion and high sensitivity. These results are still common in agriculture, forestry, and fisheries activities at the provincial level, specifically in Central Java. The agriculture, forestry, and fisheries sector comprises many products. According to the 185x185 I-O table, there are 36 products associated with the agriculture, forestry, and fisheries sector (BPS 2026b). The difference from previous studies lies in the larger study area and the greater number of products examined.

The objective of this study is to map the sectors and products of agriculture, forestry, and fisheries in Indonesia based on SPI and SEI. The benefit of this study is to promote the growth of the agriculture, forestry, and fisheries sectors by prioritizing the development of products from these sectors.

RESEARCH METHOD

A production function relates a sector's inputs to the maximum output that sector can produce. The Leontief production function is based on three main assumptions: (1) Sectors use inputs in fixed proportions (so that one input cannot be substituted for another, and there is no change in efficiency); (2) There is a linear relationship between inputs and output; (3) Sectors produce a single homogeneous good (Mair & Druckman, 2023). The dataset for the input-output model consists of monetary values (Miller & Blair, 2022).

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The data used consists of 2020 input-output data for 185 products from BPS (BPS, 2026b). The data used consists of 2020 input-output data for 17 sectors from BPS (BPS, 2026c). The software used for the analysis is excel. Steps in the data analysis: (1) calculate the technical coefficients; (2) create an identity matrix; (3) subtract the technical coefficients from the identity matrix; (4) invert the matrix resulting from subtracting the technical coefficients from the identity matrix; (5) calculating the SEI and SPI; (6) mapping products based on their SEI and SPI values. Interdependence analysis is designed to identify the interdependencies among sectors and products. These interdependencies consist of: direct forward linkages, direct backward linkages, direct and indirect forward linkages, and direct and indirect backward linkages. Forward linkages indicate the impact of a particular sector or product on the sectors or products that contribute to a portion of that sector's or product's output, measured directly per unit increase in total demand (Hilman & Ester, 2019). This type of linkage is formulated as follows:

$F(d)i=\sum_{i=1}^{n}(a_{ij})$;

F(d)i represents the direct forward link of sector or product i; aij is an element of the technical coefficient matrix. Direct backward linkages indicate the impact of a particular sector or product on the sectors or products that provide intermediate inputs to that sector or product, measured per unit increase in total demand. This type of link can be formulated as follows:

$B(d)j = \sum_{j=1}^{n}(\mathrm{a_{ij}})$;

B(d)j represents the backward linkages of a sector or industry, and aij represents an element of the technical coefficient matrix. Direct and indirect forward linkages indicate the impact of a particular sector on the sectors that use its output—both directly and indirectly—per unit increase in total demand. These types of linkages are formulated as follows:

$F(d+i)i=\sum_{i=1}^{n}(\alpha_{ij})$;

F(d+i)i represents the direct and indirect forward linkages of sector i; αij is an element of the Leontief inverse matrix for the open-economy model. Direct and indirect backward linkages indicate the impact of a particular sector or product on the sectors or products that supply intermediate inputs to that sector or product, either directly or indirectly, per unit increase in total demand. This type of linkage is formulated as follows:

$B(d+i)j =\sum_{j=1}^{n}(\alpha_{ij})$;

B(d+1)j represents the direct and indirect backward linkages of sector or product i, and αij is an element of the Leontif inverse matrix for the open-economy model. Neither direct nor indirect forward or backward linkages alone are sufficient to serve as the basis for selecting priority sectors; therefore, further analysis is required.

The follow-up analysis is a spillover analysis, specifically backward spillover. The concept of spillover sensitivity is useful for determining the degree of sensitivity of a sector or product to related sectors or products through input-output market mechanisms. The concept of spillover is often defined as the ability of a sector or product to drive production growth in related sectors or products. The output of related sectors or products serves as production input for that sector or product. The concept of sensitivity is defined as the ability of a sector or product to drive production growth in related sectors or products. The output of a sector or product serves as input for related sectors or products. A sector or product is said to have strong spillover or sensitivity if its index value is greater than one. A sector is classified as having strong spillover or sensitivity if it exceeds the average spillover or sensitivity of sectors or products (Tarigan, 2012). A sector or product is said to have low spillover or sensitivity if the index value is less than one. Furthermore, Tarigan (2012) states that a sector or product is classified as having low spillover or sensitivity because it has spillover or sensitivity below the average for sectors or products. The formulas used to calculate the spillover index and sensitivity index are: SPI=∑jαij/((1/n) x ∑j∑iαij)) dan SEI=∑iαij/((1/n) x ∑j∑iαij)).

SPI as spread index dan SEI as sensitivity index

RESULTS AND DISCUSSION

Based on the results of the 17x17 I-O table analysis, the agriculture, forestry, and fisheries sector has an SPI of 0.77 and an SEI of 1.45. These indices indicate that the agriculture, forestry, and fisheries sector has weak pull and strong push. These results are consistent with those of Budhi's (2024) study in Central Java. Thus, a similar pattern is observed in Indonesia as in Central Java. Next, how are the products produced by the agriculture, forestry, and fisheries sectors positioned? To answer this, a further analysis

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was conducted using the 185x185 I-O table. Based on the 185x185 I-O table, there are 36 products covered in the agriculture, forestry, and fisheries sectors. These 36 sectors are presented in Table 1.

Table 1. Products from the Agriculture, Forestry, and Fisheries Sectors in Indonesia Based on the 2020 185x185 I-O Table.

Sector	Sector
1 Rice	19 Coconut
2 Corn	20 Palm Oil
3 Sweet Potatoes	21 Coffee
4 Cassava	22 Tea
5 Other Tubers	23 Cocoa
6 Peanuts	24 Cloves
7 Soybeans	25 Cashews
8 Other Legumes	26 Livestock and Livestock Products, excluding Fresh Milk
9 Cereals and Other Foodstuffs	27 Fresh Milk
10 Vegetables	28 Poultry and Poultry Products
11 Ornamental Plants and Other Horticultural Crops	29 Other Animal Products
12 Sugarcane	30 Agricultural, Forestry, and Fisheries Services
13 Tobacco	31 Timber
14 Fiber Crops	32 Other Forest Products
15 Other Plantation Crops	33 Fish
16 Fruits	34 Shrimp and Other Crustaceans
17 Medicinal Plants	35 Other Aquatic Organisms
18 Rubber	36 Seaweed and Similar Products

Source: BPS 2026b

Figure 1 shows 36 products, or 19.5% of the 185 related products. The extent of direct and indirect backward and forward linkages is presented in Figure 1. Figure 1 shows direct and

Indirect backward linkages have lower multiplier values compared to the multiplier values of direct and indirect forward linkages. The highest direct and indirect backward linkages are found in the “other grain and food products” sector, with a multiplier of 1.15, while the lowest are in the “other animal husbandry products” sector, with a multiplier of 0.95. The lowest direct and indirect forward linkages are found in the “other animal husbandry products” sector with a multiplier of 1.02, palm oil products have the highest multiplier at 3.69.

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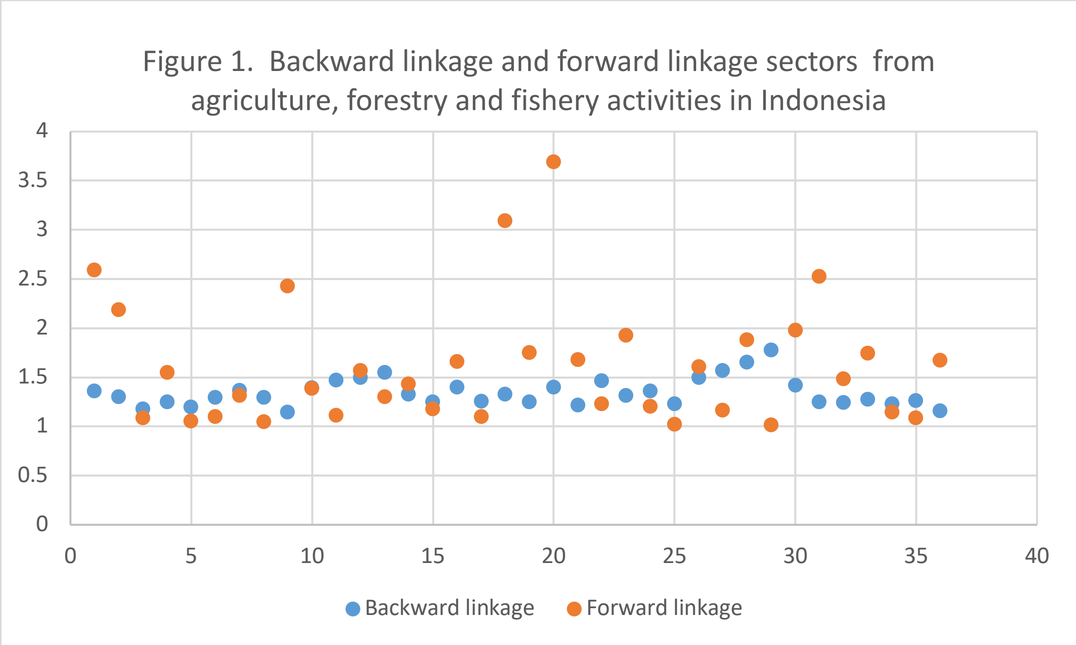

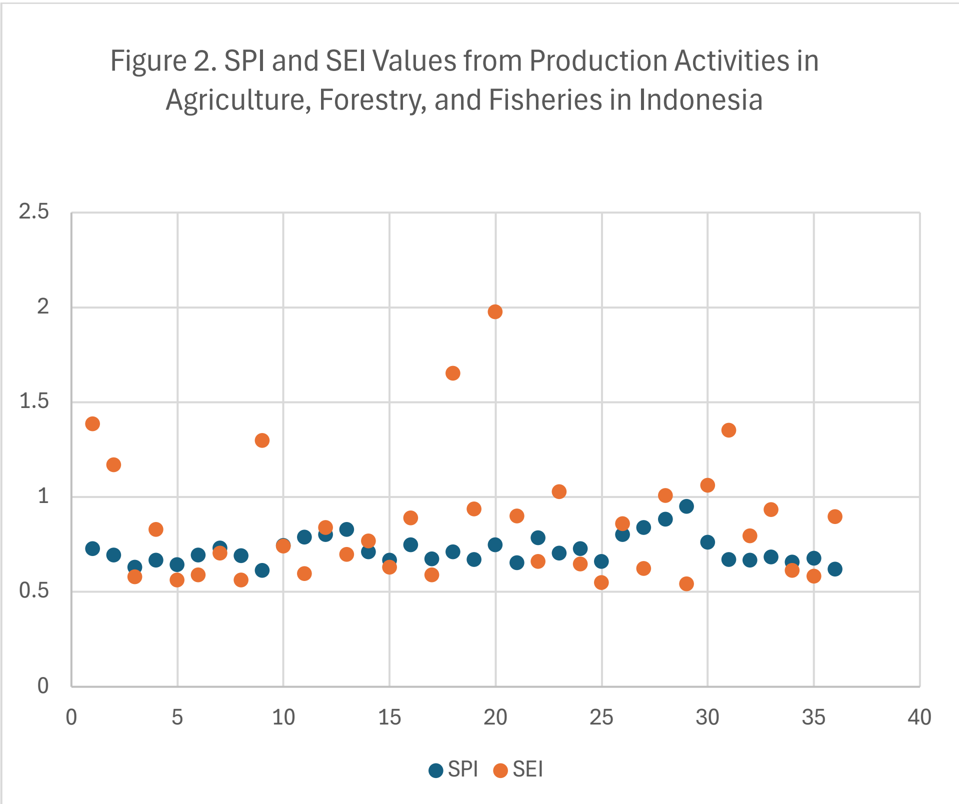

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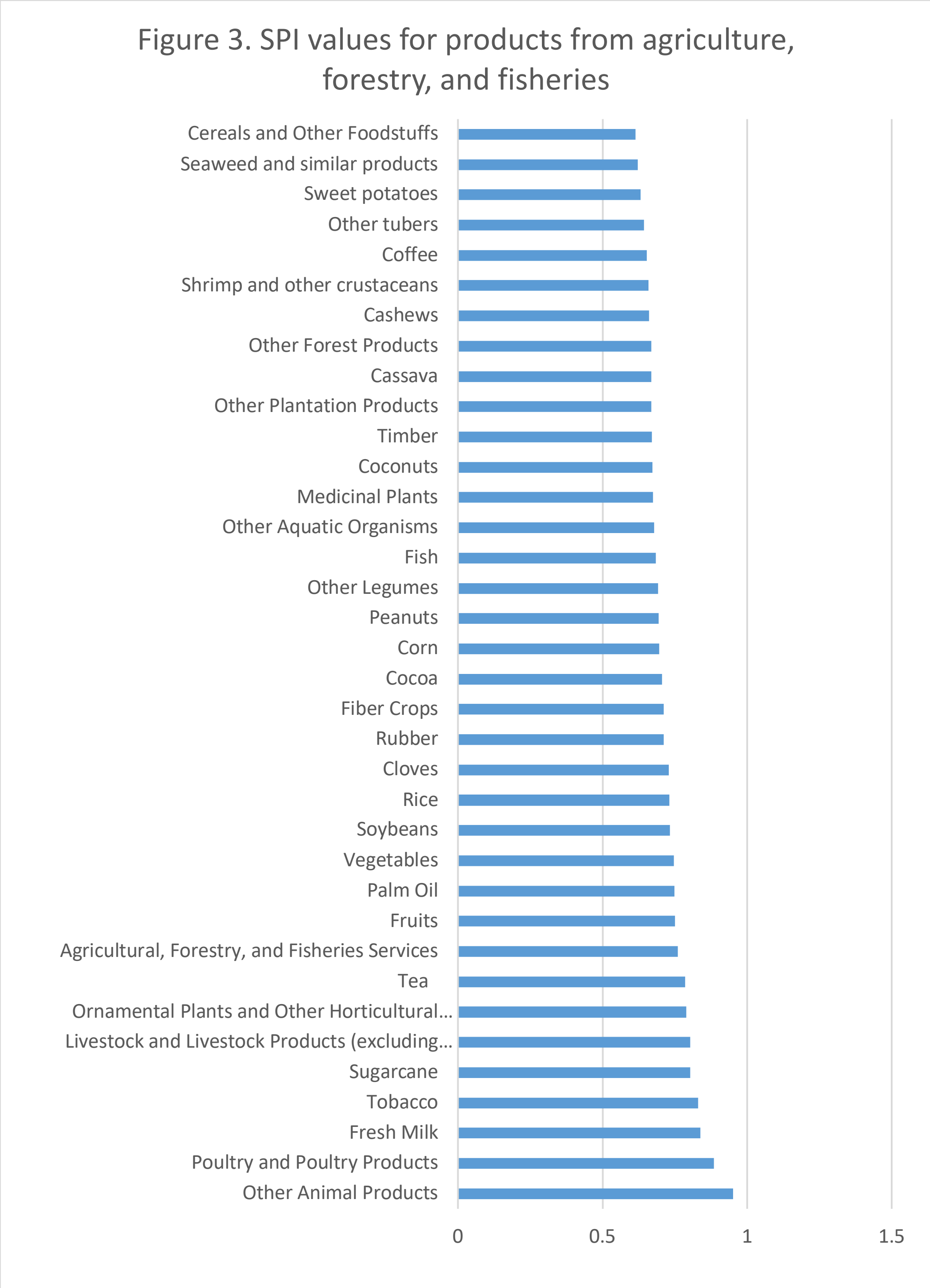

Figure 3 shows that all 36 types of products have a low SPI. This is indicated by an index value less than 1. This is consistent with the results of the analysis of the agriculture, forestry, and fisheries sectors. Thus, the sectors and products are on an equal footing.

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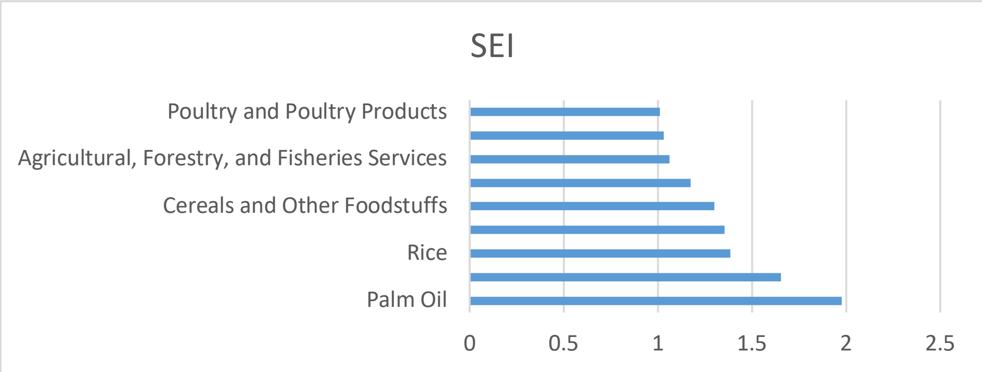

Figure 4 shows that only 9 products, or 25%, have an SEI greater than 1. These nine products can be developed as priorities that will help accelerate growth in Indonesia's agriculture, forestry, and fisheries sectors. The ranking of priority products is presented in Figure 4. The product with the highest SEI is palm oil. This indicates that palm oil can be made a top priority in supporting economic growth in the agriculture, forestry, and fisheries sectors. Palm oil has a strong multiplier effect on other products. Based on Table I-O185x185 (2020), the value of palm oil used as an input in the production process of related products is IDR 319,310,342 million, with the largest portion IDR 270,438,688 million, or 84.7% required for the production of animal and vegetable oils.

The next priority is rubber products. The total value of rubber products required for related production processes is IDR66,830,207 million, with the largest portion IDR43,382,924 million or 64.9% required for the production of crumb rubber and smoked rubber. Rice products, with a total of IDR284,843,813 million required for related production processes, with the largest portion IDR246,375,356 million or 86.5% allocated to the production of milled rice and polished rice. Timber products required for related production processes totaled IDR101,794,287 with the largest portion IDR16,087,213 million or 12.8%used for the production of plywood and similar products, and IDR10,568,624 (10.4%) for the production of wood-based building materials. The demand for cereal and other foodstuffs for related production processes totaled IDR41,253,180 million. The production process with the highest demand was for the production of wheat flour, starch, and starch products, amounting to IDR25,408,585 million or 61.6%. The demand for corn in related production processes totaled IDR65,643,950 million. The production process with the highest demand was for processed animal feed, amounting to IDR27,817,233 million or 42.4%. The output of agricultural, forestry, and fishery services required for related production processes amounted to IDR38,589,857 million. The largest demand was for palm oil production, at IDR13,662,328 million or 35.4%. The output of cocoa required for related production processes amounted to IDR41,544,726 million.

The largest demand was for chocolate and confectionery production, totaling IDR11,781,162 million or 28.4%. The last category is poultry and poultry products. Poultry and poultry products required for related production processes amounted to IDR112,991,163 million. The largest share of demand was for the production of meat products, totaling IDR80,269,264 million or 71.0%.

In this regard, the development of sectors and products in agriculture, forestry, and fisheries must also include the development of related sectors or products particularly those that utilize their outputs as inputs for related sectors or products. The illustration above shows that the main related sectors or products also need to be developed. Related sectors are those engaged in the processing industry.

CONCLUSION

The agriculture, forestry, and fisheries sectors are not key sectors; rather, they are sectors with weak attractiveness but strong driving forces. These sectors do not have any superior products; they only have nine products with a strong sensitivity index (SEI). Priority recommendations for development in agriculture, forestry, and fisheries should focus on the following nine products: oil palm, rubber, rice, timber, cereals and other foodstuffs, corn, agricultural, forestry, and fisheries services, cocoa, and poultry and poultry products.

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