

Indonesia Agricultural Transformation: How Far? Where Would It Go?

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Abstract

This research examined the inequality that emerges as Indonesia's economy shifts from an agricultural to a non-agricultural sector at the subnational level. These research questions include: (1) How has the agricultural sector in the Indonesian provinces changed over the past two decades? (2) What was the widespread impact of several socioeconomic variables on the transformation of agriculture? (3) How has the agricultural sub-sector responded to the dynamics of these socioeconomic factors over the last decade? The scope of the analysis was the whole province of Indonesia, with time series between 2001-2018. The shift in agriculture at the provincial level was mapped using indicators of poverty and the sector's economic contribution to each province. The logistic regression method was used to see the impact of socioeconomic factors on the agricultural transformation. In contrast, the panel regression was applied to respond to the dynamics of the agricultural sub-sector in terms of socioeconomics in the last ten years. According to the findings of agricultural transformation mapping, there were no changes in the distribution of rural poverty or the agricultural contribution factors between the provinces. Several macroeconomic, social, and infrastructure development factors also significantly contributed to encouraging agricultural transformation and enhancing the added value of the agricultural sector as a whole. It was important to better efficiently utilize the economic potential, which was done by taking production efficiency into account. Furthermore, consumer behaviour and the level of worker productivity had to be considered in attempts to boost economic productivity.

Keywords: provincial disparity; agricultural transformation; agricultural sector development.

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1. Introduction

1.1. Background Analysis

The development of Indonesia's agriculture sector over the preceding two decades highlighted some interesting trends (2001–2018). Based on its structure, the agriculture sector's contribution to the economy was decreasing. In 2018, the total contribution of this sector to the national economy was only around 12.23% or Rp. 1,672.35 trillion. It was below the total miscellaneous manufacturing sectors (33.74%) and even the miscellaneous service sectors (45.71%).¹ In aggregate, this number seemed good because it denoted a shift in economic structure from the agricultural sector to the non-agricultural sector. However, if we go down to the subnational level, we would find different interpretations in each region. According to average data from 2011 to 2018, the agriculture sector in Java and Bali contributed 36% of the entire national agricultural sector. Ten years earlier (2000–2010), the share reached 45%, whereas the land area of Java–Bali was only about 10.26% of the total national land area. We will find a contrasting picture when we compare activities in this sector in the Eastern Region of Indonesia (KTI)², which covers 65% of the total land area of Indonesia, with the Western Region of Indonesia (KBI). KTI's average annual contribution to the agricultural sector (2011–2018) was only about 25% of its GRDP, while at the same time most of the KTI people still live in rural areas. As an illustration, from 2000 to 2010, the average proportion of the agricultural sector in KTI's economy was around 68%, although it fell slightly to 64% from 2010 to 2018. Unfortunately, around 80% of the poor people in KTI (out of a total of 6.58 million people) were also trapped in rural areas. Due to the low competitiveness of the agricultural sector in rural areas, the poverty trap may indicate that the transformation process was not inclusive. It happened at the same time that the agriculture sector failed to become the basis of capital accumulation to create sectors that provide greater added value for the economy. Therefore, studying this pattern of change was something interesting to do.

¹ Since 2010, BPS has increased the number of economic sector classifications for its GRDP data from nine to seventeen. This modification reflected the adjustment in the base year's calculations from 2000 to 2010. The 2010 base year method was developed using the 2008 National Accounts System as a reference (SNN). Since the SNN is the application of international standards in producing indicators that correspond to economic principles, the calculation of Indonesia's GRDP can be regarded as being in agreement with international standards. Multiple data modifications could be applied across the 17 sectors to either make things simpler or get a particular perspective. One of them was the three-sector analysis applied by BPS in the publication of employment data. (see: <https://www.bps.go.id/statictable/2021/07/15/2141/rata-rata-pendapatan-bersih-berusaha-sendiri-menurut-provinsi-dan-lapangan-pekerjaan-utama-2021.html>). In that report, 17 sectors were simplified into three: the Agricultural Sector, Manufacturing, and Services. The following sectors were merged to form the service sector: Trade, Restaurant, and Accommodation Services; Transportation; Warehousing and Communications; Financial Institutions; Real Estate; Rental Business and Company Services; and Community, Social, and Individual Services. The Manufacturing Sector represents the following sectors: Mining and Quarrying; Processing Industry; Electricity and Gas Procurement; Water Supply, Waste Management, and Waste & Recycling; Construction. Meanwhile, the Agricultural sector was independent (it did not consist of a combination of other sectors).

In this paper, the Mining and Quarrying sector was separated from the manufacturing sector category and left to stand alone. So there would be four sectors in the economy of each province. However, the focus of the study in this paper remained on the three sectors of agriculture, manufacturing, and services. The sectors of mining and quarrying were omitted from this analysis to avoid bias. This was because the mining and quarrying reserves in each province vary.

² Kalimantan, Sulawesi, Nusa Tenggara, Maluku, and Papua.

Stages of development, based on neoclassical theory, start from the agricultural sector and develop into manufacturing sectors and service sectors. Each stage added more value than the sector below it. It was as Lewis (1954) described it.³ Ranis and Fei (1961) simplified it further.⁴ Lewis (1954) said that there were two economic sectors: the traditional sector, which predominated in rural regions, and the agricultural sector. Then there was the modern sector, which was primarily located in urban areas and comprised both manufacturing and services. An economy with the traditional sector as its primary sector arose from underdeveloped conditions. Lewis described rural farmers working with a subsistence ethic, assuming labor was the primary resource in production. It was demonstrated in activities based on basic food needs with a zero marginal production value. It implied that these farmers earn an average wage. Over time, businesses in urban areas (manufacturing and services) began to grow and offer higher wages than the agricultural sector, while also being profit-oriented. Assuming that farmers have thought rationally, when urban sector activities expand and require labor as input, it would be met in abundance by taking it from the agricultural sector. Lewis (1954, in Ranis & Fei (1961)) also described how profitable urban sector activities would increase the amount of capital available for production operations. The production will then be done on a larger scale in the following cycle, which will enable the absorption of additional rural workers. These workers' mobility from the traditional sector (agriculture) to the modern sector (urban) was what caused the structure of the economy to shift, from an economy dominated by the agricultural sector to an economy dominated by the modern sector.

Based on Lewis's hypothesis, the various contributions of the agricultural sector at the subnational level of the Indonesian economy in the last two decades have become interesting to study. This diversity could signal economic stagnation rather than a blessing. This paper contributed to the study of structural transformation by addressing the significance of the agriculture sector to Indonesia's economy (Syrquin, 2008⁵). This study would later be useful in providing additional information in the formulation of well-targeted strategic policies for regional development in Indonesia amidst the shifting economic structure that is currently taking place.

1.2. Context of Indonesia's Agricultural Transformation

The agricultural sector has an important role in the Indonesian economy as a developing country. Indonesia's economy is very promising, with an annual economic growth rate in the last two decades (2001-2018) of about 5.3%. Compared to other countries economic performance, Indonesia's growth rate (5.37%) was above the average growth of middle-income countries (5.16%), lower-income countries (5.06%), and top middle-income countries (5.21%).⁶ The agricultural sector contributed roughly 12.23% of the total of 17 sectors in 2018, which was higher than the manufacturing sector's 8.43%⁷ and the service

³ Lewis, W.A. (1954). Economic Development with Unlimited Supplies of Labour. *The Manchester School of Economic and Social*, 22: 139-191. <https://la.utexas.edu/users/hcleaver/368/368lewistable.pdf>

⁴ Ranis, G. and Fei, J.C.H. (1961), "A Theory of Economic Development," *American Economic Review*, Vol. 51, 533-565.

⁵ Syrquin, M. (2008). Structural change and development. *International Handbook of Development Economics*, 1: 48-67. https://www.researchgate.net/publication/287237769_Structural_change_and_development

⁶ According to World Bank data from 2011-2018.

⁷ Processing industry; Electricity and Gas Procurement; Water Supply, Waste Management, Waste, and Recycling; Construction.

sector's 4.16%,⁸ according to data from the Central Statistics Agency (BPS). The agricultural sector represented the majority of employment in rural areas and around 28.79% of all employment nationally, far exceeding the averages of the manufacturing (5.52%) and services sectors (4.36%). Agriculture, on the other hand, played a role in distributing economic benefits in rural areas, where economic activity options were more limited than in urban areas. The agricultural sector's share of Indonesia's GDP continued to decrease as the nation experienced transformation. Despite this, a large percentage of rural residents remained in poverty. Farmers also started looking for informal work outside of agriculture at this time, making them the group of people most vulnerable to economic shocks. In this situation, agriculture still plays a strategic role as a safety net for these informal workers. Our experiences during the crisis of 1997–1998 showed that this sector became "home" for workers in urban areas (non-agricultural sector) who lost their jobs due to the impact of the crisis in 1998 (Warr, 1998).⁹

The problem arises when this vulnerability condition overshadows transformed countries with the risk of being trapped in the Middle Income Trap. A 2008 World Bank study found that the choice to subsidize the poor was a very popular choice due to the disparities that occur within developing countries. It had the consequences of limiting fiscal space to sustain transfers large enough to reduce the income gap and continue urban demands for low food prices, as well as reducing public goods for growth and social services in rural areas.¹⁰

The development gap between provinces is one of the serious problems in Indonesia. The unequal conditions make the economic structure vary between provinces. This inequality, according to Rosengard and McPherson, frequently results in measurement bias between the national and sub-national levels. They called it "The Sum Is Greater Than The Parts."¹¹ Referring to the Williamson¹² at the provincial level, the inequality rate in Indonesia was quite high. In 2010 the figure was more than half (0.730).¹³ This figure briefly decreased in 2015 to 0.726 and increased again to 0.747 in 2019. The COVID-19 pandemic slowed the economic growth in various regions, thereby slightly lowering the index to 0.740 in 2020. DKI Jakarta played the biggest role in increasing the Williamson index score compared to other provinces. This index simulation, without taking DKI into account, makes the index value only 0.521 in 2010. The value fell in 2015 to 0.457, then again in 2019 and 2020 to 0.407 and 0.404, respectively. It means that DKI's GRDP per capita left other provinces far behind.

⁸ Trade, Restaurant, and Accommodation Services; Transportation; Warehousing and Communication; Financial institutions; Real Estate; Rental Business and Company Services; and Community, Social, and Individual Services.

⁹ Peter, G. Warr. (2001). Crisis, Poverty and Agriculture in Indonesia. Economic and Finance in Indonesia, Faculty of Economics and Business, University of Indonesia, 49, 197-228.

¹⁰ World Bank (2008), World Development Report 2008: Agriculture for Development, DOI: 10.1596/978-0-8213-7233-3

¹¹ Rosengard, Jay K., and Malcolm F. McPherson. The Sum Is Greater Than The Parts: Doubling Shared Prosperity in Indonesia Through Local and Global Integration. Gramedia Pustaka Utama, 2013.

¹² Aghion, P., & Williamson, J. (1999). Growth, Inequality, and Globalization: Theory, History, and Policy (Raffaele Mattioli Lectures). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511599064

¹³ In this paper, the CV calculation uses the formula:

The structural transformation strategy is already incorporated in Indonesia's Long-Term Development Plan (PJP) for the period 2005–2025. The document emphasized increasing the added value of primary sector activities, particularly mining and agriculture, as part of the industrialization process approach.¹⁴ This strategy also encouraged the economy to increase its competitiveness in the global market, which was pursued by increasing productivity and innovation through the sustained development of human resource capabilities, the creation of technological mastery and application, as well as support for economic stability and the provision of physical and economic infrastructure.¹⁵ In addition, enhancing forward and backward linkages in the value chain between sectors was one strategy to boost the economy's added value. The agricultural sector, as a primary sector, had a strategic role in supporting other related sectors. Meanwhile, the strategy to increase global competitiveness was implemented by improving human resource capabilities, creating mastery and application of technology, supporting economic stability, and providing physical and economic infrastructure.

1.3. Research Problems, Research Objectives, and Research Questions

The Middle Income Trap is a big issue in Indonesia's economic transformation. This trap makes a country fail to enter the category of developed countries because the speed of growth is not enough to deliver an economy at a certain level of income that is beneficial for the welfare of its people and economic productivity.¹⁶ To address this issue and foster more inclusive economic growth, closing the economic gap between the provinces was prioritized.¹⁷ In this context, the agricultural sector could be regarded as a barometer of how far the transformation has come and where it is headed. This paper tried to see the pattern of shifting in the agricultural sector by taking into account the dynamics of socioeconomic indicators at the provincial level. This study also examined the interaction between the agricultural sector and the poverty rate in rural areas. The following questions were addressed in this paper:

- 1) How has the development of agricultural transformation across provinces in Indonesia evolved over the last two decades?
- 2) What is the impact of various socioeconomic indicators on this transformation?
- 3) How has the agricultural sub-sector responded to the dynamics of these socioeconomic factors over the last ten years?

¹⁴ National Development Planning Agency, Vision and Long-Term Development Direction (PJP) 2005 – 2025, Ministry of National Development Planning/Bappenas, Jakarta, 2007 – page 32 (see point 6).

¹⁵ Ibid (see point 3).

¹⁶ Glawe, L., Wagner, H. The Middle-Income Trap: Definitions, Theories, and Countries Concerned –A Literature Survey. *Comp Econ Stud* 58, 507-538 (2016). <https://doi.org/10.1057/s41294-016-0014-0>

¹⁷ See WDR 2008, Briones & Felipe (2013), Kyunghoon et al (2018), dan Dartanto et al (2017).

2. Literature Review

2.1. Theories of Agricultural Transformation

Discussions on structural transformation have lasted for a long time, and there was no one mutually agreed definition of this (Syrquin, 2008). Therefore it was necessary to put the term “transformation” in this paper, and why not use the term “change”? It made the terminology clear, consistent, and easier to read. Some publications have highlighted that "structural transformation" has a broader definition than "structural change," notably Syrquin (2008)¹⁸ and Rahardja & Manurung (2008).¹⁹ Here, "structural change" was described as a persistent change in the composition of economic aggregates over the long term, while "structural transformation" was defined as a structural change accompanied by the dynamics of economic development.²⁰ Measures of "structural change" were often associated with quantitative indicators like economic growth,²¹ whereas "structural transformation" was a qualitative indicator²² that was frequently associated with economic development activities like urbanization, demographic change, and the distribution of household income,²³ including poverty. So, looking at these explanations, this paper chose the term "agricultural transformation" to figure out the structural change that occurs in development from the perspective of the agricultural sector.

Lewis' (1954) theory is one of the most often adopted concepts of structural transformation. Its simple explanation makes this theory useful in many studies in various countries. Over time, this theory received much criticism. Nafziger (2005),²⁴ for example, criticized the absorption of the urban sector from agricultural subsistence workers in one cycle would increase demand for wages in the next cycle. It was because there were not enough workers in the villages to meet the growing demand for labor. It would ultimately disrupt the absorption mechanism of the urban sector in the future. Lewis also pointed out that the urban sector's absorption effect creates a relative reduction in the quantity of food available because farmers in the remaining villages would be increasingly constrained. As a result, there would be an increase in the cost of food products due to the resulting scarcity. The process of profits accumulating through wages was eventually eroded due to worker demands for wage increases. Another criticism also came from Sen (2019)²⁵ about the difficulty of applying Lewis's theory to developing/low-income countries. The findings showed a tendency for urban workers to move from the agricultural sector directly to the service sector. In this case, the service sector primarily had lower yields than the

¹⁸ Syrquin, M. (2008). Structural change and development. *International Handbook of Development Economics*, 1: 48-67. https://www.researchgate.net/publication/287237769_Structural_change_and_development

¹⁹ Rahardja, P & Manurung, M (2008) *Teori Ekonomi Makro: Suatu Pengantar*, Ed. 4. Jakarta: Lembaga Penerbit Fakultas Ekonomi Universitas Indonesia – page 318.

²⁰ See Syrquin (2008).

²¹ See Rahardja & manurung (2008).

²² Ibid – page 318.

²³ See Syrquin (2008).

²⁴ Nafziger, E. (2005). *Economic Development*, Ed. 4. Cambridge: Cambridge University Press. <https://doi.org/10.1017/CBO9780511805615.006>

²⁵ Sen, K. (2019). *Structural Transformation Around the World: Patterns and Drivers*. *Asian Development Review*, 36:2. <https://ssrn.com/abstract=3451537>

manufacturing sector, even though there was a trend for the manufacturing sector to decrease in developing nations.

Until now, various ideas and other perspectives have emerged to classify the economic development position of an economy in the context of structural transformation analysis. These ideas were very helpful in simplifying the study of structural transformation (Kyunghoon et al, 2018). Lin (2018)²⁷ described this structural transformation of the economy as a change in the sectors and technologies. This is indicated by the shift in employment patterns from the agricultural sector to the manufacturing and service sectors, which offer higher salaries. In the context of agricultural development, Briones & Felipe (2013) outlined the four stages of an economy's structural transformation.²⁸ (1) First Stage: here, the productivity of labor in the agricultural sector was experiencing rapid growth; (2) Agricultural Surplus Stage: Agricultural surplus, in the early stages, began to be used to finance the non-agricultural sector; (3) Integration Stage: The agricultural sector was connected with various sectors through infrastructure improvements; (4) Since integration was complete, people have also started to leave agriculture and go to more profitable economic sectors. Agriculture also started to deteriorate in this period.

In line with Lewis's theory (1954), several studies and reports use agriculture as a milestone to measure structural transformation. About 15 years ago, the World Bank launched the 2008 World Development Report²⁹ titled "Agriculture for Development." There were three important questions that this report tried to answer. *First*, what contribution can agriculture make to support the development of an economy? *Second*, what instruments can be effectively applied to support the idea that agriculture can be used as an engine of development? Furthermore, what kind of agenda would support this? These growing concerns exist because the agricultural sector remains regarded as a vital instrument for promoting development strategies and securing the livelihoods of the poor, particularly in developing countries. The research tried to map every nation in the world according to its individual economic structures in an effort to address the problems. It was done by connecting the poverty indicator to the financial contribution of the agricultural sector. These nations were then divided into three groups using data from 1990 to 2005, including: (1) The agriculture-based countries. This category was characterized by the 32% contribution of the agricultural sector to its gross domestic product (GDP). Nearly 70% of the poor in this category live in rural areas, which are mainly found in Sub-Saharan countries; (2) The Transforming Countries. In this group, agriculture was no longer the primary driver of economic expansion. However, the majority of rural areas (up to 82%) remained in pockets of poverty due to the continued dominance of the agricultural sector. Countries that fall into this category were, for example China, India, Morocco, Romania, including Indonesia; Meanwhile, (3) The Urban Countries were countries where economic activity and pockets of poverty were already dominant in urban areas -with agriculture contributing only about

²⁶ Kyunghoon Kim & Andy Sumner & Arief Anshory Yusuf (2018), Is Structural Transformation-led Economic Growth Immiserising or Inclusive? The Case of Indonesia, May 2018 Working Paper No. 2018/11, Arndt-Corden Department of Economics Crawford School of Public Policy ANU College of Asia and the Pacific.

²⁷ <https://bit.ly/3yriyBh>

²⁸ Briones, R and Felipe, J (2013). Agriculture and Structural Transformation in Developing Asia: Review and Outlook, No. 363 August 2013; ADB Economics Working Paper Series.

²⁹ World Bank (2008), World Development Report 2008: Agriculture for Development, DOI: 10.1596/978-0-8213-7233-3

5% of its total growth. The World Bank report³⁰ also listed several possible approaches, including promoting rural agriculture's ability to add value and expanding its non-agricultural economic sector. The agriculture sector continued to serve as the most efficient instrument for household wealth distribution while the transition to secondary and tertiary economic activity continued. A number of alternative policies were implemented, such as creating price incentives, increasing the quality and quantity of investments in public goods, enhancing the quality of the commodity markets, expanding access to financial services, lowering business risk, enhancing the performance of farmer and producer organizations, boosting innovation based on science and technology, and implementing sustainable agricultural practices that improved the environment.

Important roles of agriculture have been an interesting discussion in various scientific works. Johan (2018) saw agriculture plays roles as an instrument in broadly distributing the economy at the macro level, but at the same time, this sector was also able to distribute income to the community at the micro level.³¹ While Briones & Felipe (2013) highlight the magnitude of the determination of the agricultural sector in various countries in Asia, both countries that have entered the advanced economic phase (such as Japan; South Korea; Taipei; and China), countries whose agricultural sector still plays a major role (such as Malaysia, Indonesia, and Thailand), to economies whose agricultural sector had not yet grown to its full potential (Bangladesh, India, Pakistan and the Philippines).³² Yifu Lin (2018)³³ said that the agricultural sector plays at least three central roles in economic transformation, including economic growth, ensuring food safety, and improving the nutritional quality of the community. The three responsibilities listed above highlight the urgency of agricultural modernization. This agricultural modernization aims to advance industrialization through increased worker productivity, increased agricultural surpluses for capital accumulation, and increased exports. In addition, this upgrade would make food affordable in terms of quantity (lower pricing) and quality (fulfilment of nutritional standards). In addition to changing people's purchasing habits for secondary and tertiary items, modernization also increased people's incomes which would also aid in the community's structural transformation process.

2.2. Transformation in Indonesia: An Analytical Framework

There have been numerous studies done on structural transformation in Indonesia. Kyunghoon et al (2018)³⁴ examined the relationship between structural transformation and growth inclusiveness in Indonesia. This paper reviewed many aspects of structural transformation in Indonesia, including changes in value-added, trade, employment, productivity, formal employment, and opportunities for low-educated workers in various economic sectors (Kyunghoon et al. 2018). This study was conducted amid the declining

³⁰ World Bank (2008), World Development Report 2008: Agriculture for Development, DOI: 10.1596/978-0-8213-7233-3, 10

³¹ Swinnen, Johan (2018). *The Political Economy of Agriculture and Food Policies*, Palgrave Macmillan, 1 New York Plaza, New York, NY 10004, U.S.A. ISBN 978-1-137-50102-8. <https://doi.org/10.1057/978-1-137-50102-8>

³² Briones, R & Felipe, J (2013). *Agriculture and Structural Transformation in Developing Asia: Review and Outlook*, No. 363 August 2013; ADB Economics Working Paper Series.

³³ <https://bit.ly/3yriyBh>

³⁴ Kyunghoon Kim & Andy Sumner & Arief Anshory Yusuf (2018), *Is Structural Transformation-led Economic Growth Immiserising or Inclusive? The Case of Indonesia*, May 2018 Working Paper No. 2018/11, Arndt-Corden Department of Economics Crawford School of Public Policy ANU College of Asia and the Pacific

manufacturing sector as a growth driver and replaced by the service sector after the Asian financial crisis. It also affected the decline in productivity and absorption level of employment. The added value of manufacturing remains higher than the value added of the service sector in the last two decades. Various characteristics of the economy at the subnational level in Indonesia made the path to structural transformation more complex.

Dartanto et al³⁵ (2017) linked the structural transformation with the phenomenon of income inequality in society. The results of this study supported those of earlier studies conducted in emerging nations that indicated Indonesia transitioned from the agriculture to the service sectors without first passing through the Manufacturing sector. The results of this study using the Theil L decomposition index, both static and dynamic, show that (i) the root of the increase in inequality in Indonesia was pure (unexplained effect); (ii) mobility of the population from the agricultural sector to the manufacturing and service sectors, from rural to urban areas, and from the informal to the formal sector was a secondary contributor in increasing inequality that occurred; (iii) Increasing levels of education have also contributed in increasing inequality in the last two decades; (iv) However, this inequality had eased slightly with an increase in the income of the population who, however, work in the agricultural sector, the informal sector, in the village, as well as with the quality of non-formal education.

Regarding Structural Change, Fitriani (2005) tried to see the phenomenon of growth convergence at the district/city level in Indonesia during 1993-2003 using the Solow model. In this study, the treatment conditions were classified into absolute and conditional conditions. In this model, the factors of infrastructure, education, and population determined the acceleration of convergence. Meanwhile, Andriansyah et al (2021), in their analysis of structural change indices, found that the pattern of structural transformation generally moves from the agricultural sector to the service sector. In addition, it also found that resource-rich areas and negative Extraordinary Events (KLB) impact the slowness of a region's transformation. This study also discovered that the provinces in Sulawesi experienced the most rapid transformation when compared to others. If this transformation was accompanied by sector-specific growth, it had an impact on long-term regional growth.

3. Data and Method

3.1. Data Sources

Data for this research was obtained from the Central Statistics Agency (BPS) and INDO-DAPOER from the World Bank. The scope of this study was the Indonesian economy at the provincial level. These analyses were classified into descriptive and inferential analyses based on the time sequence. The inferential analysis was performed from 2000–2018, while the descriptive analysis was performed from 2000–2020.³⁶ This inferential analysis was limited until 2018 to rule out the impact of the COVID-19 pandemic, which could interfere

³⁵ Dartanto, T., E. Z. W. Yuan, and Y. Sofiyandi. 2017. Two Decades of Structural Transformation and Dynamics of Income Equality in Indonesia. ADBI Working Paper 783. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/twodecades-structural-transformation-and-dynamics-income-equality-indonesia>

³⁶ The input data in the model includes data in the range of 2002-2018. The 2000 and 2001 data used include the variables converted into lag-1 (*lexpnf_rur_pct*, *lexpnf_urb_pct*, *limpor2gdrp*, *lekspor2gdrp*, *llnicor*) and lag-2 (*ldak_pct*) data.

with the calculations. The North Kalimantan and DKI Jakarta were excluded from the study as they employed panel data to maintain a well-balanced set of data.

In some cases, BPS and INDO-DAPOER had the same indicators but different figures/values. In these cases, the BPS data was prioritized over the INDO-DAPOER data. However, in several cases, INDO-DAPOER data had a longer series than BPS data. In this case, the growth pattern of INDO-DAPOER data was calibrated with indicators from BPS. An example of this was the generation of Gross Regional Domestic Product (GDPR) data.

3.2. Technical Definition of Agricultural Transformation

It was necessary to decide on the technical definition of agricultural transformation that would be used in this research to respond to the first question, which was related to the development pattern of the agricultural sector in Indonesia over the past 20 years that occurred in the provinces of Indonesia. The technical definition was modified slightly from the World Development Report 2008's mapping of countries based on how important agriculture was to their development. The mapping was as follows:

Table 1. Technical Definition of Agricultural Transformation

<p>% Rural Poverty</p> <p>% Agriculture Distribution</p>	<p>The percentage of poverty in rural areas within the province ³⁷ was below the national average.</p> <p>$(\%Pov_rurProv < \%Pov_rurNat)$</p>	<p>The percentage of poverty in rural areas within the province was above the national average. $(\%Pov_rurProv > \%Pov_rurNat)$</p>
<p>The percentage of GRDP in the agricultural sector within the province was above the national average.</p> <p>$(\%AgrProv > \%AgrNat)$</p>	<p>Quadrant 3: Transforming Provinces</p>	<p>Quadrant 1: Agriculture Based Provinces</p>
<p>The percentage of GRDP in the agricultural sector within the province was below the national average.</p> <p>$(\%AgrProv < \%AgrNat)$</p>	<p>Quadrant 4: Urban Provinces</p>	<p>Quadrant 2: Transforming Provinces</p>

Sources: Author's formulation

The quadrant boundaries (cut-off) of each variable (distribution of the agricultural sector and the percentage of rural poverty) were the average values in the first decade (2002-2010). These averages were used as a reference (milestone) to see the transformations formed in the next decade.

These quadrants were analyzed in two steps. The first was general analysis. Provinces were categorized into three groups for this analysis, which included: (a) Provinces

³⁷ Percentage of Rural Poverty = Rural Poor / (Rural Poor + Urban Poor)

based on the agricultural sector, (b) Transforming Provinces, and (c) Urban Provinces. The categories were transitive in the following order:

$$(c) > (b) > (a) \tag{1}$$

At this stage, Quadrants 2 and 3 were included in category (b)/Transforming Provinces. Therefore, the type of data formed on this agricultural transformation variable was ordinal.

The provinces represented in quadrants (2) and (3) were separated into two models in the following stage to examine the characteristics and interactions of each socioeconomic indicator. It was important to know the dynamics that occurred in the transforming province. So:

$$(b2) \neq (b3) \tag{2}$$

3.3. Model Specification & Variables

It was required to define the specifics of the study method that was used in order to respond to the second research question, which focused on the response of agricultural transformation to socioeconomic indicators. This study was performed using a quantitative methodology. The methodology selected to get the appropriate inferential analysis results was affected by the use of ordinal data on the dependent variable (agricultural transformation). The Ordered Logit model was used to analyze the model for this kind of ordinal data using the cumulative distribution function (CDF). Because this study used panel data, the application of CDF to panel data was as follows:

$$p_{ij} = p(y_i = j)$$

$$p(a_{j-1} < y_i^* \leq a_j) = F(a_j - x_i'b - v_i) - F(a_{j-1} - x_i'b - v_i) \tag{3}$$

This probability function describes when observation i would choose alternative j . In the ordered logit, F was the logistic CDF, with the form $F(z) = e^z / (1 + e^z)$.

Following these assumptions, the model specifications were described linearly as follows:

$$y_i = X_{it}b + v_i + e_{it} \tag{4}$$

Note that y_i was the dependent variable indicating the number of possible outcomes (in this case: $a_1 = 1$ (Agriculture-based Province), $a_2 = 2$ ("Transforming Province"), and $a_3 = 3$ (Urban Province)). Meanwhile, v_i was the identification of the panel coefficient, and e_{it} was a logistically distributed error with zero average and variance of $\pi/3$ (Stata, 2019).³⁸

We also could use the Multinomial Logit/Probit Model as an alternative model for this study. However, this paper did not choose this model due to efficiency considerations because it required additional efforts to translate the transitive information of the estimation

³⁸ StataCorp (2019), Stata Longitudinal-Data/Panel-Data Reference Manual Release 16, see page 338 (StataCorp. 2019. Stata: Release 16. Statistical Software. College Station, TX: StataCorp LLC.)

results on the independent variables. This variable was denoted by *transform_3*, representing the agricultural transformation classification variable defined above (see Technical Definition section 2.2). This variable has three ordinal values, denoted by the notations 1 for a rural province, 2 for a province in transition, and 3 for an urban province. These three stages were the result of justification to prevent enlargement of the assumption parameter (to be more than three), which would risk the models (William, 2019).³⁹ This variable was the dependent variable in the model (y_i).

This paper also explored the "transforming provinces" (b) in more detail. These two quadrants (quadrant-2 and quadrant-3) were analyzed using the logit-panel model by making the outcome in binary form. The new dependent variable was labeled *transform_2*. This variable was a sub-classification of the *transform_3* variable for outcome 2 (Transforming Provinces). The outcome of this binary variable follows: 0 was quadrant-2 (high proportion of rural poverty and low distribution of the agricultural sector), and 1 was quadrant-3 (low proportion of rural poverty and distribution of the agricultural sector was still high).

In order to address the third research question, the analysis then explored the effects that socioeconomic variables had on the performance of the agricultural sub-sector over the past ten years. This estimation identified the most important elements that could help or hinder efforts to promote agriculture. This analysis also explored several perspectives on the transformation of agriculture that had occurred in various provinces in Indonesia. Some of these points of view cover dominant variables in each province, such as the economic, social, and infrastructure. The following covariates (X) were incorporated into the model:

- **Social**

- A variable that showed the percentage of population expenditure per capita per month for these two types of commodities was necessary to determine the level of public consumption based on the food and non-food goods. However, this paper also compares expenditure between urban and rural households. So there would be four variables that showed the proportion of consumption based on the area of residence of the population and the type of consumption goods.

These variables include:

$$\text{expnf_*_pct} = \frac{\text{Urban (or rural)nonfood expenditure}}{(\text{Urban food expenditure} + \text{Rural food expenditure} + \text{Urban nonfood expenditure} + \text{Rural food expenditure})}$$

The variable of public consumption used in this model was **lexpnf_urb_pct** (Share (%) of non-food expenditure per month for urban households at the lag-1 year); and **lexpnf_rur_pct** (percentage (%) of non-food expenditure per month for rural households at the lag-1 year).

³⁹ Williams, R. (2019), Ordered Logit Models – Basic & Intermediate Topics, University of Notre Dame, <https://www3.nd.edu/~rwilliam/>, (Last revised February 9, 2021)

- **Urbanization:** the proportion of the urban population divided by the total population in the province. This value showed the share of the urban population in a province.
- **s4_ipm_01:** number of morbidity (illness) of the population of a province in a year, in the natural logarithm form (\ln).
- **s4_ipm_03:** the average number of years of schooling for people over 25 years old, in \ln .
- **Economy**
 - **limpor2gdrp:** proportion of imports to GRDP at lag-1 year.
 - **lekspor2gdrp:** proportion of exports to GRDP at lag-1 year.
 - **infl_def_krsna2008:** growth of GRDP deflator (%).
 - **manufperc:** the ratio between the GRDP (constant price 2010) of the Miscellaneous Manufacturing sector to the workers in the respective sector.
 - **jasaperc:** the ratio between the GRDP (constant price 2010) of the Miscellaneous Service sector to the workers in the respective sector.
- **Infrastructure**
 - **Inicor:** Incremental Capital Output Ratio (ICOR) in \ln at the lag-1 year.
 - **dspesisir_pct:** percentage of the number of coastal villages from the whole villages in the province.
 - **ldak_pct:** the ratio between Special Allocation Fund (DAK) and the total revenue of APBD, at lag-2 years.
 - **lspencap_pct:** the ratio between Direct Expenditure for Capital Expenditure (BM) and total Expenditure.

Similar to the previous model specifications, Transforming Provinces would be analyzed further using the Logit model (panel). However, previously the Transforming Provinces were separated first between those included in Quadrant 2 (denoted by 0) and Quadrant 3 (1). These two models were technically compiled with the help of STATA 16 software using the *ologit* & *xtologit* commands for the first model (Ordered Logit) and *xtlogit* for the additional models (Logit).

The estimated coefficients in logistical modeling could not be interpreted as the direct magnitude of interactions between the response variables and their covariates. This is because the coefficients have been converted into log-odds form. As a result, these coefficients must first be calibrated into a more practical form. A feature in STATA 16 allows us to do this by converting the log odds into a probability form.

4. Results and Discussion

4.1. Two Decades of Structural Transformation in Indonesia

In the last two decades, there has been a decline in the average contribution of the agricultural sector and the percentage of the rural poor compared to urban areas in all provinces. The average annual percentage of GRDP in the agricultural sector across all provinces was around 22.7% in the early years (2002–2010), but it decreased to 20.1% in the following ten years (2011–2018). Meanwhile, in terms of the total poverty rate, the trend fell from 70.4% to 68.2% per year in the same period.

The decline in the contribution of the agricultural sector per province mainly occurred in Eastern Indonesia Areas (KTI)⁴⁰ by -2.2%. Especially in Nusa Tenggara (-6.9%), Sulawesi Island (-5.7%), and Maluku Island (-3%). The lowest rate of decline occurred in Sumatra Island -0.6% and Java-Bali fell around -1.3%. Growth in the service sector was a major factor in the drastic drop in KTI's agricultural sector (Table 2). The average increase in the service sector in the last decade compared to the previous in all regions reached 5.5%. In non-Papuan locations, the increase in the manufacturing sector tended to be negative (-0.4%) on average. Manufacturing saw a surge of about 9.1% in the Papua anomaly, particularly in West Papua. It was related to the commencement of exploration of the Tangguh block for the Liquefied Natural Gas (LNG) processing industry. The performance of the regional manufacturing sector and even the economy of West Papua as a whole⁴¹ had been significantly impacted by the Tangguh Block, raising concerns about the viability of sustainable economic management in this area.

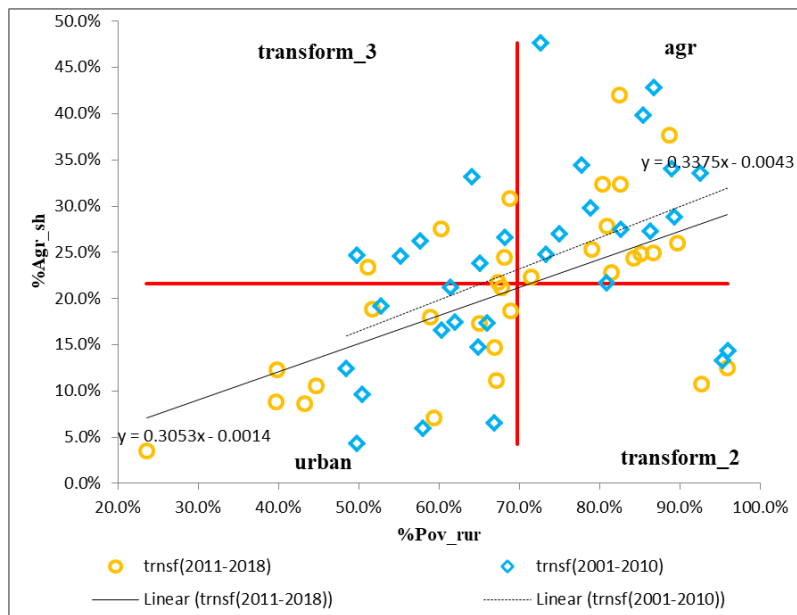


Figure 1. Plot of Percentage of Rural Poverty (%) to Distribution of GRDP in the Agriculture Sector per Province (%)

Sources: BPS & INDO-DAPOER (author's calculation)

The information above completes the picture of the employment structure in the agricultural sector. Although it was still the main job of the rural workers, the agricultural sector continued to experience a decline in the interest of Indonesian workers from year to year. In the early 2000s, workers in this sector were still the majority (43.78% in 2001), but the trend declined to 28.79% in 2018. Farmers' jobs started to be displaced by jobs in the service sector, particularly informal services (47.97%) and manufacturing jobs (22.06%). The trend of job shifting over the past 20 years had two key characteristics: First, presuming the

⁴⁰ Includes: Nusa Tenggara, Kalimantan Island, Sulawesi Island, Maluku Island, and Papua Island.

⁴¹ Bank Indonesia, 2019. Kajian Ekonomi dan Keuangan Regional Provinsi Papua Barat - Februari 2019. Page 22

non-agricultural sectors could provide a higher added value than the agricultural sectors, and the transition from agriculture to non-agriculture first appeared to be favorable. However, if we explore deeply, the sectoral shift was not carried out gradually.⁴² It immediately leaped from the agricultural sector to the service sector. It could be a signal of a structural problem within. If we compared the sector productivity data per worker, the gap between the service sector and its original sector (agriculture) was not very large. The GDP of the service sector was IDR 80.36 million per capita in 2018,⁴³ they were compared to IDR 47.80 million per capita for the agricultural sector. On the other hand, the manufacturing sector outperformed other sectors in the same year, with a productivity per capita of Rp. 165.91 million. Second, the structure of the service sector had a problem of income inequality among its workers. Some types of work in the service sector promise high rewards. However, this sector had a problem with the highest degree of inequality compared to the manufacturing and agricultural sectors. SUSENAS 2018 data showed that the standard deviation between workers' expenditures in the service sector reached Rp. 1,284,423, the manufacturing and agricultural sectors were only Rp 952,356 and Rp 570,843, respectively.

Table 2. The Difference in Average GRDP Contribution of the Non-Agricultural Sector 2011-2018 with 2002-2010

Islands	Manufacturing	Services	Mining
Sumatera	0.8%	4.3%	-4.6%
Jawa-bali	-1.1%	2.3%	0.0%
Nusra	1.6%	9.7%	-4.4%
Kalimantan	-4.9%	5.2%	2.2%
Sulawesi	0.6%	3.5%	1.6%
Maluku	0.8%	4.2%	-1.4%
Papua	12.1%	9.1%	-19.1%

Sources: BPS & INDO-DAPOER (author's calculation)

In the context of rural economies, the phenomenon of peasant migration to cities in search of jobs could be used to highlight inequality within that service sector.⁴⁴ Examples are farmers who look for work in the city while waiting for the harvest season or villagers who leave their hometowns because they no longer have land in the village. Because of this, structural adjustments in economic sectors were unable to produce the expected sustainable income growth.

⁴² Starting from the agricultural sector to manufacturing and then to the service sector.

⁴³ This statistic was calculated by dividing the agricultural sector's GDP in the relevant year by the number of workers within this sector. In the manufacturing and service sectors, the same calculation was applied.

⁴⁴ Because there were no options.

Table 3. Average Category of Agricultural Transformation per Province 2002-2010 and 2011-2018

Code-prov	ProvName	Categories (2002-2010)	Categories (2011-2018)	Code-prov	ProvName	Categories (2002-2010)	Categories (2011-2018)
11	ACEH	Agr	Agr	52	W. NUSA TENGGARA	Transform_b	Urban
12	N. SUMATERA	Transform_b	Transform_b	53	E. NUSA TENGGARA	Agr	Agr
13	W. SUMATERA	Transform_b	Transform_b	61	W. KALIMANTAN	Agr	Agr
14	RIAU	Transform_b	Urban	62	CTRL. KALIMANTAN	Agr	Agr
15	JAMBI	Transform_b	Transform_b	63	S. KALIMANTAN	Urban	Urban
16	S. SUMATERA	Urban	Urban	64	E. KALIMANTAN	Urban	Urban
17	BENGKULU	Transform_b	Transform_b	71	N. SULAWESI	Agr	Transform_b
18	LAMPUNG	Agr	Agr	72	CTRL. SULAWESI	Agr	Agr
19	BANGKA BELITUNG ISL	Urban	Urban	73	S. SULAWESI	Agr	Agr
21	RIAU ISL	Urban	Urban	74	N. E. SULAWESI	Agr	Agr
32	W. JAWA	Urban	Urban	75	GORONTALO	Agr	Agr
33	CTRL. JAWA	Urban	Urban	76	W. SULAWESI	Agr	Agr
34	DI YOGYAKARTA	Urban	Urban	81	MALUKU	Agr	Agr
35	E. JAWA	Urban	Urban	82	N. MALUKU	Agr	Agr
36	BANTEN	Urban	Urban	91	W. PAPUA	Transform_a	Transform_a
51	BALI	Urban	Urban	94	PAPUA	Transform_a	Transform_a

Sources: BPS & INDO-DAPOER (author's calculation)

The changes in the agricultural transformation map within Indonesian provinces did not align with the shift in agricultural contribution to the economy and the percentage of rural poverty. According to the criteria of agricultural transformation mentioned above, the number of provinces categorized as agriculture-based provinces (a) in the first decade was 13 (40.6%), while it dropped to 12 (37.5%)⁴⁵ in the second decade. However, the number of Transforming Provinces (b) had decreased to 7 provinces (21.9%) from 8 (25%) in the previous decade. In the same decade, the urban category (c) increased by two provinces,⁴⁶ from 11 (34.4%) to 13 (40.6%). Within The Transforming Provinces (b) in Quadrant 2, there was no change in the last two decades (Table 3).

These dynamic situations were associated with several socioeconomic factors. The variables that were used to estimate the logistics model are summarized as follows:

⁴⁵ Maluku Province moved from the Agriculture-Based (a) category to the Transforming Province category (b).

⁴⁶ Riau and NTB provinces have shifted from the category of transforming provinces (b) to the category of urban provinces (c).

Table 4. The Average of Covariates in Agricultural Transformation Model 2002-2018⁴⁷

Mean	2002-2010	2011-2018	2002-2018
manufpercap	4.567 (0.7776627)	4.733 (0.7723987)	4.635 (0.7855277)
jasapercap	3.914 (0.2833728)	4.116 (0.2447749)	3.995 (0.2908648)
infl_def_krsna2008	-2.545 (0.5752344)	-3.118 (0.7692906)	-2.772 (0.7168948)
limpor2gdrp	0.452 (0.2629856)	0.516 (0.2361408)	0.483 (0.2522925)
lekspor2gdrp	0.471 (0.2739677)	0.495 (0.2978749)	0.482 (0.2856369)
expnf_urb_pct	0.329 (0.1116019)	0.327 (0.0321372)	0.328 (0.083164)
lexpnf_rur_pct	0.151 (0.055108)	0.164 (0.0228549)	0.157 (0.0431375)
urbanisation	0.377 (0.1272454)	0.420 (0.1564108)	0.396 (0.142644)
s4_ipm_01	3.382 (0.2344747)	3.310 (0.2035526)	3.340 (0.224852)
s4_ipm_03	2.048 (0.103944)	2.142 (0.0966538)	2.093 (0.1100751)
llnicor	1.392 (0.9412323)	1.713 (0.6925374)	1.566 (0.8309086)
ldak_pct	0.043 (0.0445035)	0.075 (0.0475867)	0.059 (0.048714)
lspencap_pct	0.280 (0.1027681)	0.234 (0.0596197)	0.257 (0.0869816)
dspesisir_pct	0.218 (0.2170497)	0.236 (0.2320474)	0.225 (0.2236035)

Sources: BPS & INDO-DAPOER (author's calculation)

The Pearson test revealed that the covariates with the highest linear correlations to the response variable (transform_3) were urbanization (correlation coefficient=0.744), exports (lekspor2gdrp=0.429), the sum of the Special Allocation Fund (ldak_pct=- 0.322), the number of coastal villages (dspesisir_pct=- 0.306), and manufacturing sector productivity per capita (manufpercap=0.273). On the other hand, there was a low correlation between the average number of school years (s4_ipm_03=0.06), the morbidity rate (s4_ipm_01=0.03), the ICOR (llnicor=0.031), the inflation (infl_def_krsna2008=0.044), and the variable non-food spending of urban households (lexpnf_urb_pct=0.007).

Import (limpor2gdrp) and export (lekspor2gdrp) variables showed the largest aggregate correlation. West Java, Kep. Riau, Bengkulu, Yogyakarta, West Sumatra, South Kalimantan, Gorontalo, Bali, West Papua, and West Kalimantan had the highest correlation value at the province level. At the same time, the lowest occurred in Papua Province: Maluku, South Sumatra, Lampung, Aceh, Jambi, West Nusa Tenggara, East Kalimantan, East Nusa Tenggara, and West Sulawesi. These correlations, however, did not create the specific

⁴⁷ The number in brackets is the standard deviation.

patterns of the agricultural transformation status of most of the provinces. More than half (56.25 percent, or 18 provinces) of the 32 provinces⁴⁸ experienced an increase in the average value of the Pearson correlation index between the value of exports and imports in the last decade compared to the previous decade. This growth was regarded as the integration of local business strategies into international trade activities. This strategy was also associated with the flow of urbanization that occurred from time to time, where the correlation index of the urbanization to the export and the import activities was respectively 0.515 and 0.248.

The correlation between urbanization and exports has increased over the past two decades from 0.389 to 0.578. Meanwhile, urbanization with imports also increased from -0.050 to 0.426. The pattern of non-food consumption of the urban dwellers (lexpnf_urb_pct) to the village (lexpnf_rur_pct) also had a fairly high correlation (0.572). However, this correlation was much changed from the previous decade (0.722) to -0.218 in the last decade. This fact confirms the assumption that economic progress sometimes contributes to the increasing complexity of urban population consumption patterns. Another relationship that stood out occurred between the GRDP of the Manufacturing sector per capita and the Service sector per capita (0.503). However, this relationship has also declined slightly in the last decade.

Table 5. Pearson Correlation Index for Structural Transformation of Variables Covariate 2002-2018

2002-2018	transfo rm_3	expnf_ urb_pc t	lexpnf_ rur_p ct	urbani sation	limpor 2gdrp	lekspo r2gdrp	llnicor	infl_de f_krsn a2008	s4_ip m_01	s4_ip m_03	dspesir ir_pct	ldak_p ct	lspenc ap_pct	manuf percap
lexpnf_urb_pct	0.007													
lexpnf_rur_pct	0.213	0.572												
urbanisation	0.744	0.015	0.192											
limpor2gdrp	0.148	-0.024	-0.042	0.248										
lekspor2gdrp	0.429	-0.061	0.036	0.515	0.667									
llnicor	0.031	-0.006	0.010	0.070	0.132	0.103								
infl_def_krsna2008	0.044	0.014	-0.044	0.085	0.056	0.052	-0.017							
s4_ipm_01	0.030	-0.126	-0.069	0.010	-0.088	-0.179	-0.081	0.081						
s4_ipm_03	0.060	-0.097	0.060	0.324	0.234	0.300	0.177	0.032	-0.215					
dspesir_pct	-0.306	-0.006	-0.016	-0.079	0.305	0.118	-0.028	-0.030	-0.095	0.255				
ldak_pct	-0.332	-0.149	-0.051	-0.285	0.023	-0.237	0.082	-0.081	0.068	0.212	0.241			
lspencap_pct	-0.133	-0.048	-0.083	-0.230	-0.094	0.122	0.105	-0.002	-0.199	-0.029	0.045	0.008		
manufpercap	0.273	-0.063	-0.040	0.227	-0.059	0.489	0.151	-0.031	-0.433	0.278	-0.145	-0.214	0.421	
jasapercap	0.110	0.001	-0.089	0.123	0.116	0.335	0.176	-0.002	-0.308	0.293	0.056	0.156	0.131	0.503

Sources: BPS & INDO-DAPOER (author's calculation)

4.2. The Impact of Social Economic Variables in Shaping Agricultural Transformation

This paper also examined the relationship between the dependent variable of agricultural transformation, which was ordinal, to a series of socioeconomic variables as the independent variables. Agricultural transformation Variables here were categorical and ordered variables, which assumed the stages of development of an area. This model used the cumulative distribution function (CDF) because it was part of the logistic analysis. Since this

⁴⁸ North Kalimantan and DKI Jakarta were excluded from the analysis.

analysis used panel data, the CDF was also calibrated into a panel function.⁴⁹ Table 6 displays the outcomes of modeling the Agricultural transformation variable and its variables.⁵⁰ Because the estimated magnitude was in the form of a log-odds ratio (see Table 6), it first had to be calibrated using the cut-off coefficient (/cut1; and/cut2) to obtain the marginal likelihood for each unit change (see Table 7). The "_margins" command feature of STATA 16 was applied for the calibration.

The modeling outcomes shown in table 6 provide several details. Most of the Macroeconomic variables had a significant impact on the transformation of agriculture. According to Lewis (1954), improving the productivity of the secondary (manufacturing) and tertiary (services) sectors is considered a pull factor for agricultural transformation in each province. In every one million rupiahs per capita, increasing the productivity of the manufacturing sector would increase the likelihood of transformation of provinces based on Agriculture (Agr) into Transforming (Transform) and Urban (Urban) categories by 9.7%, as well as transforming provinces with Transforming category (Transform) into Urban (Urban) by 19.6%. Meanwhile, an increase in the service sector would likely transform agriculture-based provinces into Transforming (Transform) and Urban (Urban) categories by around 28.9% and also encourage the transformation of provinces that were currently Transforming (Transform) into Urban (Urban) provinces by 6.5%.

Table 6. Indonesian Agricultural Transformation Ordered Logit Regression 2002-2018

No	Agricultural Transformation Categ. (transform_3)	Pooled (2002- 2018)	Random Effect (Robust) ⁵¹		
			(2002- 2018)	(2002- 2010)	(2010- 2018)
Economy					
1	GRDP ratio of Manufacturers sector to its workers (manufpercap)	0.963*** (0.3286196)	1.168 (0.978401)	1.988 (1.446383)	16.310 (11.25161)
2	GRDP ratio of the Services sector to its workers (jasapercap)	1.269* (0.6751453)	4.045** (1.826104)	3.421 (2.912481)	-7.787 (15.0225)
3	Deflator growth (infl_def_krsna2008)	-0.74*** (0.2607416)	-0.626 (0.418369)	-0.905 (1.585407)	13.797 (26.99581)
4	Percentage of imports to GDRP lag-1 (limpor2gdrp)	3.396*** (0.8150767)	2.700 (1.643079)	13.525*** (4.805828)	11.105 (26.8943)
5	Percentage of exports to GDRP lag-1 (lekspor2gdrp)	1.001 (0.9879997)	1.538 (2.456605)	2.452 (4.583795)	-35.494 (38.17436)

⁴⁹ StataCorp. (2019), Stata Longitudinal-Data/Panel-Data Reference Manual Release 16, see page 338 (StataCorp. 2019. Stata: Release 16. Statistical Software. College Station, TX: StataCorp LLC.)

⁵⁰ The Pooled Effect and the Random Effect Models were used in the analysis of the Ordered Logit Model discussed above. These two approaches are used to determine the estimators who have had the largest impact on agricultural transformation over the last 20 years. As a result, data from each method can be used simultaneously or interchangeably. In the conventional RE model without robustness, the results of the LR2 significance test comparing the two models suggested that the RE model had lower variance than the standard model (Pooled). (See Table 6, row 22).

⁵¹ Robust is a feature in STATA to select the maximum variance estimator to be used in the model based on the score of the equation at a certain level and its covariance matrix (STATA 16 Manuals).

No	Agricultural Transformation Categ. (transform_3)	Pooled (2002- 2018)	Random Effect (Robust) ⁵¹		
			(2002- 2018)	(2002- 2010)	(2010- 2018)
Social					
6	Percentage of urban non-food expenditure lag-1 (lexpnf_urb_pct)	-0.842 (2.407906)	-6.872* (3.464124)	13.482 (15.34241)	-36.225 (35.98685)
7	percentage of rural non-food expenditure lag-1 (lexpnf_rur_pct)	9.034* (4.843767)	20.203*** (4.533783)	19.760 (19.42558)	94.562* (55.13867)
8	The ratio of city population to the total population (urbanization)	25.061*** (2.088979)	22.260** (10.65045)	53.169*** (11.45679)	297.563* (96.13681)
9	ln of Morbidity Rate (s4_ipm_01)	0.716 (0.7554912)	0.054 (1.345237)	2.152 (3.062585)	1.913 (15.83647)
10	ln of Average Length of School Rate (s4_ipm_03)	-6.658*** (1.149855)	-3.234 (4.927691)	-12.011* (6.61164)	-90.391 (106.6864)
Infrastructure					
11	ln of ICOR lag-1 (llnicor)	-0.163 (0.1355511)	-0.284** (0.123367)	-0.378 (0.265015)	-2.504 (2.478555)
12	The ratio of Special Allocation Fund (DAK) to total Revenue of APBD lag-2 (ldak_pct)	-0.634 (3.508817)	5.480 (6.204729)	6.656 (7.37414)	23.671 (26.52608)
13	The ratio of Capital expenditures to Total expenditures (lspencap_pct)	-2.172 (2.361119)	-2.508 (6.674816)	6.495 (9.988024)	-1.090 (23.73752)
14	Percentages of villages coastal from total villages (dspesisir_pct)	-3.569*** (0.8528296)	-8.707** (3.491913)	12.099*** (4.017916)	-3.522 (9.446938)
15	/cut1	7.695 (5.128489)	21.412 (13.74108)	35.581 (24.51059)	-47.297 (65.41919)
16	/cut2	10.593 (5.142428)	26.651 (13.97265)	41.532 (24.67544)	-9.355 (79.81481)
17	/sigma2_u		16.375 (11.8085)	12.066 (5.287915)	746.823 (860.094)
18	Log pseudolikelihood ⁵²	-219.76834	162.17914	-84.85465	48.585836
19	Wald chi2(14)	228.13***	139.38***	81.1***	391.78***
20	Number of obs	429	429	238	191
21	Number of groups		32	32	31
22	LR Test in Normal RE		Sig. 1%	Sig. 1%	Sig. 1%

Notes: * significance. 10%; ** 5%; ***1%. The brackets () indicate the standard error

Sources: BPS & INDO-DAPOER (author's calculation)

⁵² The fit model was only successful up to the 29th iteration due to incomplete iteration processes.

Table 7. Marginal Effect Model Ordered Logit Indonesian Agricultural Transformation Year 2002-2018

No	Agricultural Transformation Categ. (transform_3)	Mean	Agr	Transforming	Urban
Economy					
1	GRDP ratio of Manufacturers sector to its workers (manufpercap)	4.667	-0.083 (0.0739886)	-0.019 (0.0386588)	0.102 (0.078407)
2	GRDP ratio of the Services sector to its workers (jasapercap)	4.039	-0.289 (0.1355252)	-0.065 (0.1420251)	0.354 (0.1678233)
3	Deflator growth (infl_def_krsna2008)	0.074	0.045 (0.0320295)	0.010 (0.0230624)	-0.055 (0.0406764)
4	Percentage of imports to GDRP lag-1 (limpor2gdrp)	0.480	-0.193 (0.1175855)	-0.043 (0.0988946)	0.236 (0.154184)
5	Percentage of exports to GDRP lag-1 (lekspor2gdrp)	0.465	-0.110 (0.1845164)	-0.025 (0.0610186)	0.134 (0.216604)
Social					
6	Percentage of urban non-food expenditure lag-1 (lexpnf_urb_pct)	0.331	0.491 (0.2850707)	0.110 (0.2357595)	-0.601 (0.3186522)
7	percentage of rural non-food expenditure lag-1 (lexpnf_rur_pct)	0.160	-1.443 (0.6019597)	-0.324 (0.6745962)	1.767 (0.5680383)
8	The ratio of city population to the total population (urbanization)	0.406	-1.590 (0.846948)	-0.357 (0.8005767)	1.946 (1.101739)
9	ln of Morbidity Rate (s4_ipm_01)	3.358	-0.004 (0.0956355)	-0.001 (0.0222092)	0.005 (0.1177765)
10	ln of Average Length of School Rate (s4_ipm_03)	2.101	0.231 (0.355517)	0.052 (0.1343011)	-0.283 (0.4317753)
Infrastructure					
11	ln of ICOR lag-1 (llnicor)	1.570	0.020 (0.0102016)	0.005 (0.0100587)	-0.025 (0.0128591)
12	The ratio of Special Allocation Fund (DAK) to total Revenue of APBD lag-2 (ldak_pct)	0.062	-0.391 (0.4686471)	-0.088 (0.1945512)	0.479 (0.5328063)
13	The ratio of Capital expenditures to Total expenditures (lspencap_pct)	0.252	0.179 (0.487881)	0.040 (0.128046)	-0.219 (0.5837507)
14	Percentages of villages coastal from total villages (dspesisir_pct)	0.231	0.622 (0.2711042)	0.140 (0.3024404)	-0.761 (0.3246811)
15	Marginal effect Prediction		0.245 (0.0799414)	0.453 (0.1056715)	0.302 (0.0823313)

Notes: * significance. 10%; ** 5%; ***1%. The brackets () indicate the standard error

Sources: BPS & INDO-DAPOER (author's calculation)

The secondary and tertiary sectors mentioned above require investment support in capital goods and raw materials to enable a proper production process. The national investment rate in 2015 was IDR 3926.2 trillion, or 34.1% of the GRDP, for various capital goods (PMTB) and raw materials (inventory). Imports accounted for 46.32% of that total investment.⁵³ It was relevant to the estimation results above, which show a positive and significant relationship from this import activity. For example, a 1% increase in imports (from GRDP) has the potential to elevate an agriculture-based province to the transforming and urban category by 34.1%. An increase at the same level also has the potential to push the province, which is currently in the transforming category, into the urban category by 37.4%. Unfortunately, the important role of international trade was not accompanied by an improvement in export performance. At the same time, the correlation between these two (imports and exports) was very high compared to the correlation between variables that occurs in other variables. This/it meant that the revenue, which came from exports, was represented by the import capacity at the time. Improving export capacity had to be able to increase domestic income in order to support the agricultural and structural transformation processes.

The secondary and tertiary sectors above, which represent sectors in urban areas, could also be considered a reflection of the potential income and consumption of urban people at the household level. As noted from BPS data, the average annual household consumption in the last decade (2011–2018) represents about 55% of GRDP by expenditure. According to the 2015 BPS data, from a total of Rp 6490 trillion, most of this consumption was spent on food and beverage needs (around 21.65%), followed by transportation and communication needs (23.4%), household furniture needs (7.37%), and the remaining amount (25.08%) being spent on clothing, health care, and other needs. This description also provides an overview of the agricultural sector's role in the consumption sector. The assumption was that the agricultural sector (38.4%) supplied all demands for food and beverages and that non-food consumption products made up the remaining 61.6%.

The estimation results also confirm that non-food consumption had an effect on slowing down the agricultural transformation process. This condition was suspected to be the result of a structural imbalance in the economy, as explained by Baumol's Law of Disease Costs (Chai, 2018). The law explained the interpretation bias in the shifting consumption of manufactured goods and services due to changes in their relative prices due to innovation disruption. This point of view differs from Engel's Law in seeing the shift in consumer preferences, seen through their food and non-food expenditure curves, as income increases. According to Baumol (1967), quoted by Chai (2018),⁵⁴ the "disease" began when disparities widened as a result of technological advances in both the manufacturing and service sectors. Although both are developing, innovation in the manufacturing sector moves faster than in the service sector. This eventually has an impact on the differences in the level of production efficiency of each sector, where the manufacturing sector could perform production costs efficiently and vice versa for the service sector (Chai, 2018). This inequality condition would provide a paradoxical picture of people's consumption activities. It is well known that the

⁵³ 2015 Exchange rate: IDR 13795 / US\$ obtained from Statista.

⁵⁴ Andreas Chai (2018), "Household consumption patterns and the sectoral composition of growing economies: A review of the interlinkages," Discussion Papers in Economics economics:201802, Griffith University, Department of Accounting, Finance, and Economics. Page 21

consumption habits of urban and rural households differ in terms of both food and non-food products. Urban dwellers tended to consume secondary and even tertiary (non-manufacturing) non-food commodities, whereas rural dwellers tended to do the opposite. However, as Baumol noted, when a 'disease' strikes, it is possible to observe bias in the city's population's consumption pattern. Because there is a possibility that one of the parties, both on the producer and consumer sides, will bear the consequences of the cost inefficiencies that are formed. The falls in the relative price of the manufacturing sector to services would transmit the weakening pull of the manufacturing sector in the agricultural transformation process. Especially when the degree of substitution between these two sectors (manufacturing and services) was low.

For rural dwellers, a "disease" in urban areas could also have a negative impact. As is known, the agricultural sector played a vital role as a supplier of raw materials, especially for the manufacturing sector. This complementary attribute made the manufacturing sector a determinant of welfare distribution through the agricultural sector for rural dwellers. As a result, problems in the manufacturing sector will have an impact on the welfare of rural households as the disparity between rural and urban areas increases. It could be related to the estimation that we had done. According to the model's estimation, a 1% increase in the proportion of non-food spending by urban households to the total per capita consumption of the province's population would limit the growth of provinces with an agriculture-based status by a possible 49.1% and possibly trap them in the 11% category of transformation. The weakening condition of the economy became important, especially in the early decades (2002-2010). Because, theoretically, the early dominance of the urban sector would have made it harder for regions with an agriculture-based economy to reach the cut-off of every transformation category.

However, this disease did not occur in rural areas. Consumption of non-food goods had a positive and significant correlation with agricultural transformation. If using Baumol's assumptions above, the consumption level of rural dwellers was lower than that of cities, and the absolute dominant pattern of food consumption compared to non-food made the relative price bias of service products to consumption (manufacturing) products less affected. To access these secondary and tertiary products, the villagers had to look for income outside the agricultural sector, which had higher added value and was good for supporting the transformation process. As an illustration, every 1% increase in the share of non-food expenditures by villagers from the total per capita consumption of the province's population would likely encourage the transformation of an agriculture-based province into an advanced province (the Transforming and Urban category) by around 144%. Meanwhile, for a transforming province, every 1% increase in consumption would encourage the change to become a province with an urban category of 32.4%.

The competitiveness of the agricultural sector was low, while the necessities of life were increasing, making villagers forced to leave their jobs to get a more stable life. The inhabitants' quest for a more lucrative life led them to switch from agriculture in the village to the non-agricultural sector in urban areas. This argument is confirmed by the finding that there is a positive correlation between agricultural transformation variables and increased urbanization. An increase of 1% in the urban population compared to the total population in the province would likely encourage the transformation of the Agriculture-based provinces into the Transforming or the Urban provinces by around 252%, while Transforming provinces would be pushed into Urban provinces by 276.4%. The issue was that these

peasants lacked the necessary skills to work in the urban sectors. As a result, they were dragged into informal businesses in urban and non-agricultural rural areas, where the additional value was still limited. This is common among farmers who work in the city on a seasonal basis, such as street vendors and casual workers, while waiting for the harvest.

Long-term efforts are made to enhance the livelihoods of these farmer households by improving their education. Long-term efforts are made to enhance the livelihoods of these farmer households by improving their education. This is because firms in the manufacturing and service sectors usually offer higher salaries but require a certain level of educational certification. This ultimately had a positive and significant impact on the transformation of agriculture itself. The illustration was that every 3-year increase in the average length of schooling would increase the probability of transforming an agriculture-based province into a more developed province by 66.9%. Meanwhile, the probability of transforming the province into an urban province was 73.4%.

At this point the transformation of agriculture experienced a transition period. The farmers had begun to leave agricultural activities because they were no longer considered competitive. At the same time, the secondary and tertiary sectors also began to increase. Unfortunately, the growth of the tertiary sector occurred primarily in informal jobs. People's consumption patterns were also starting to show characteristics of urban society. This was shown by the increase in demand for non-food goods. Infrastructure was a very important factor in driving growth at a higher level, but it tends to be neglected. These conditions were evaluated based on the positive correlation between the increase in the ICOR score and the transformation of the province from the Agriculture-based category to the Transforming category and the Urban category.⁵⁵ The results of the estimation above showed that every 3-point reduction in the ICOR score increased the transformation possibility of an Agriculture-Based province into a more advanced province by 2%. Meanwhile, a decrease in the same amount, increased the transformation possibility of the Transforming category into an Urban category by 0.5%.

The estimation results above show that agricultural transformation was occurring amid these inefficiencies. Improving investment quality plays a significant role in accelerating the transformation of the agricultural sector. The increasing efficiency of domestic investment would expand the opportunities for the growth of various businesses with high-added value. Investment constraints lead to the loss of inclusive growth potential and a widening gap. One thing that needed to be improved was infrastructure, especially related to logistics such as ports. Indonesia, as a maritime country, had the potential to connect between islands as well as between countries. This connection would increase the economic benefits of the province concerned and the area around it. The negative correlation between the number of coastal villages in a province and the trend of agricultural transformation indicates the isolation of the coastal area from the surrounding area. So that the improvement of logistics infrastructure increases the opportunities for the connectivity of the coastal area to carry out trade activities between islands and even countries.

⁵⁵ As is well known, ICOR is an indicator of the productivity efficiency of an economy. So when the ICOR value gets bigger it indicates inefficient economic activity. This indicator could be used to guide efforts in transforming the agricultural sector.

4.3. Social Economic Patterns on Transforming Provinces: a Case

As explained above, we would explore more detail about the condition of the Transforming province. In this paper, the category consisted of two types: The first type was a province with a relatively low contribution from the agricultural sector in its economy, but the poverty rate in rural areas was still higher than in urban areas. Provinces included in this type were Papua and West Papua. Compared to the previous decade (2010–2020), the two provinces' rankings remained unchanged (2011–2018). The second type (transforming province) was a province where the agriculture sector's contribution was still rather large but where the rural poverty rate tended to be lower. The third quadrant was mostly dominated by provinces spread across Sumatra and Sulawesi islands. Provinces that entered this sector in the past ten years included North Sumatra, West Sumatra, Jambi, Bengkulu, and North Sulawesi. The average agricultural transformation in two decades in various regions generally occurs in relation to this type of Quadrant 3. Riau and West Nusa Tenggara Provinces were examples of the Transforming category in Quadrant 3, which were promoted to the Urban category.

Meanwhile, North Sulawesi Province became Quadrant 3 a decade ago, the status of an Agriculture-based Province. Table 8 displays the estimation findings for the two categories of provinces. In general, the quality of the model was good in terms of the validity of using panel data to validate the model. The LR test on the logit (rho) model of provinces in both quadrants from 2002 to 2018 shows that panel data was significantly better for modeling purposes than pooled data (without panels).

The estimation findings revealed three variables that significantly distinguished the provinces in quadrants 2 and 3 from each other. The first is the productivity level of the service sector per capita. This variable had a significantly negative correlation with transformation status. For every one million rupiahs per capita, increasing the productivity of the service sector would increase the likelihood of the transformation of provinces in the third quadrant⁵⁶ into the second quadrant⁵⁷ by 118%. The high number of villages in the coastal area also has a significant role in driving the transformation of provinces in the third quadrant into the second quadrant, with a probability increase of up to 243% for every 1% of coastal villages in the province. This indicates how vulnerable coastal villages are to becoming poverty centers in their regions. In West Papua's case, where the extractive sector's contribution to the economy was extremely dominant, it was possible to figure out this province's likelihood of falling into the second quadrant. One of the highlights of this region was the duality between economic growth and the socioeconomic development of its people. The low competitiveness there is mainly due to low access to higher levels of education.

The urbanization variable had a positive and significant correlation with the tendency of the transformation status to form between the two quadrants. A 1% increase in the composition of the city population compared to the total population in each province would increase the probability of forming a province with characteristics in quadrant three by 355%. Urbanization has a positive impact on driving the structural transformation process

⁵⁶ The provinces in the third quadrant still have a high agricultural sector contribution to the economy, but rural poverty rates are already low.

⁵⁷ The provinces in the second quadrant have a low agricultural sector contribution to the economy but high rural poverty rates.

in each province. However, socioeconomic development, especially in health, education, and consumption standards, needs to be considered so that transformation can have a good and sustainable impact.

Table 8. Provincial Logit Regression was Transforming, in Quadrant 2 and Quadrant 3, 2002-2018, using Random Effects Model

No	Transforming Provinces Categ. (Quadrants 2 & 3)	Pooled (2002-2018)	
		Log-Odds Coef.	Marginal Effects
Economy			
1	GRDP ratio of Manufacturers sector to its workers (manufpercap)	-2.955 (5.456963)	-0.107 (0.3863136)
2	GRDP ratio of the Services sector to its workers (jasapercap)	-32.592*** (12.76532)	-1.179
3	Deflator growth (infl_def_krsna2008)	-35.594 (32.93216)	-1.288 (2.889211)
4	Percentage of imports to GDRP lag-1 (limpor2gdrp)	23.685 (20.34466)	0.857 (1.894399)
5	Percentage of exports to GDRP lag-1 (lekspor2gdrp)	-22.018 (18.57165)	-0.797 (1.989568)
Social			
6	Percentage of urban non-food expenditure lag-1 (lexpnf_urb_pct)	38.645 (24.54487)	1.398 (3.152692)
7	percentage of rural non-food expenditure lag-1 (lexpnf_rur_pct)	-71.104 (49.02947)	-2.572 (5.679002)
8	The ratio of city population to total population (urbanization)	98.021*** (41.51678)	3.546 (8.233884)
9	ln of Morbidity Rate (s4_ipm_01)	6.904 (14.70737)	0.250 (0.7581391)
10	ln of Average Length of School Rate (s4_ipm_03)	38.379 (28.22789)	1.388 (3.553336)
Infrastructure			
11	ln of ICOR lag-1 (llnicor)	1.636 (1.574172)	0.059 (0.1519306)
12	The ratio of Special Allocation Fund (DAK) to total Revenue of APBD lag-2 (ldak_pct)	39.965 (59.23271)	1.446 (3.370332)
13	The ratio of Capital expenditures to Total expenditures (lspencap_pct)	21.745 (24.47276)	0.787 (2.21857)
14	Percentages of villages coastal from total villages (dspesisir_pct)	-67.29*** (29.73775)	-2.434 (5.64039)
15	_cons	7.790 (71.14808)	
16	/lnsig2u	4.821 (0.8978261)	
17	sigma_u	11.142 (5.001869)	
18	rho	0.974 (0.0225794)	

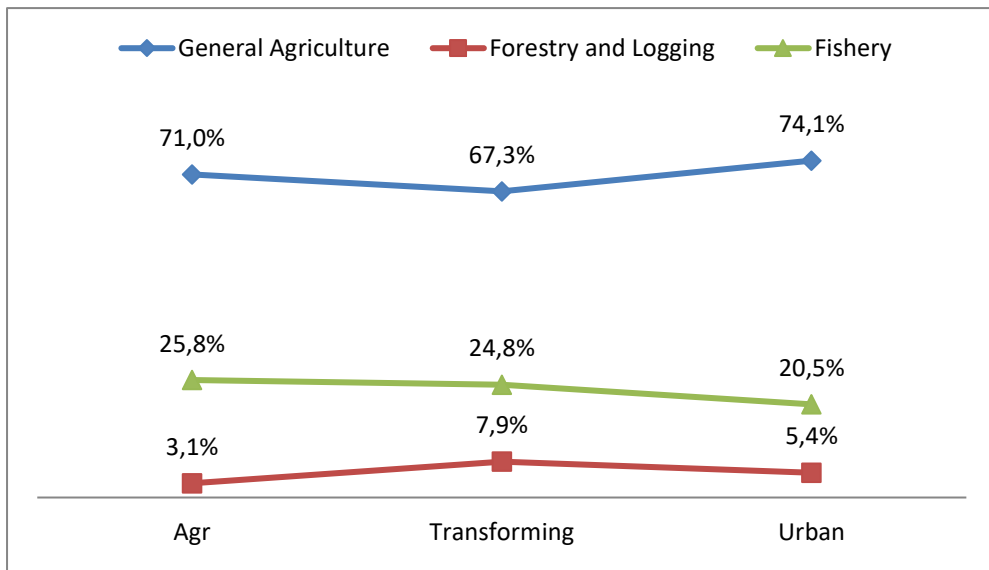
Notes: LR test of rho=0: chibar2(01) = 20.39 Prob >= chibar2 = 0.000; Number of obs: 110; Number of groups: 18

Sources: BPS & INDO-DAPOER (auth. calculation)

4.4. The Impact of Social Economic Variables on Agricultural Sub-Sectors Performances

The agricultural sector had an important position in the rural economy. This is the primary source of employment in rural areas as well as the core of various economic activities. Therefore, the development of this sector is vital in order to improve rural livelihoods and poverty alleviation efforts. It strengthened the development foundation in the ongoing agricultural transformation process. Each province had a unique structure for its sub-sectors based on the type of reform it had experienced. Compared to agriculture-based and urban provinces, the general agriculture sub-sector in the transitioning provinces tended to make up a smaller part of the relevant province's entire agricultural sector. Compared to Agriculture-based and Urban provinces, the general agriculture sub-sector in the transforming provinces tended to make up a smaller part of the respective province's entire agricultural sector. Nonetheless, the Transforming Provinces lead in the forestry and logging sub-sector over the other categories. Meanwhile, the highest fisheries sector was found in the Agriculture-based provinces, while the lowest was in the Urban provinces.

Figure 2. Average Annual Distribution of Agriculture Sub-sector to Total Production of Agricultural Sector 2010-2018



Sources: BPS (auth. calculation)

To illustrate the factors that affected agricultural development in Indonesia, Table 9 presents the estimation findings of the distribution of the agricultural sub-sector against various socioeconomic parameters at the provincial level. It shows the use of panel data had a more significant effect on the model than pooled data. This significant effect occurred in all three sub-sectors.⁵⁸ The Hausman test suggests that the performance of fixed effect estimation is significantly better compared to random effect estimation. That means,

⁵⁸ General Agriculture, Forestry & Logging, and Fisheries.

applying the Fixed Effect here is better than using Pooled Average Means. This is confirmed by the significance of the Breusch-Pagan test for the estimation of the three sub-sectors.

Table 9 also shows that these subsectors are significantly related to macroeconomic activities. Those three subsectors also show a positive and significant response to the productivity of the services sector per capita. As an illustration, in every one million rupiahs per capita, the productivity growth of this sector would increase the share of the General Agriculture sub-sector in the economy by 0.0003%. Fisheries and the Forestry and Logging sectors had lower economic shares, with 0.00001% and 0.00002%, respectively.

Although the value was small, the increase in the price factor had a positive and significant correlation with the increase in the share of the sub-sector, especially in the General Agriculture sub-sector; and the Forestry & Logging sub-sector. An increase of 1% in the price of production and consumption factors affected an increase of 0.0001% and 0.000004%, respectively.

Global trade had a strong influence on the Forestry, Logging, and Fisheries sub-sector performances. The economy's proportion of the Forestry & Logging sub-sector grew by 0.00003% with a 1% increase in imports, and the share of the Fisheries sub-sector climbed by 0.00004%. The opposite condition occurs in export activities. The Forestry and Logging sub-sector's share was predicted to fall by -0.00003 percent for every 1% increase in the export component of GDP. Meanwhile, the Fisheries sub-sector would experience the same reduction, accounting for up to -0.0005% of the economy.

Factors from social groups and infrastructure do not have much influence on the agricultural sub-sectors, except for some variables that only affect the General Agriculture sub-sector. Such as non-food consumption of urban dwellers, the morbidity rate, and the share of Capital Expenditure Expenditure to total expenditure by the Government. Meanwhile, in the Forestry & Logging sub-sector, the variable that had a significant impact was only the percentage of coastal villages compared to the total number of villages in each province. It was also known, from Table 9, that those infrastructure support variables for macroeconomic, social, and agricultural growth were closely related. Meanwhile, inequality and poor development quality are widely regarded as the root causes of agricultural transformation failure.

Table 9. Agricultural Subsector Regression Against Socioeconomic Variables at the Provincial Level in Indonesia 2010-2018 In General, Using Fixed Effects Model

Fixed-Effect		General Agriculture	Forest & Logging	Fishery
Economy				
1	GRDP ratio of Manufacturers sector to its workers (manufpercap)	-0.000048 5.E-05	0.000000 2.E-06	-0.000005 5.E-06
2	GRDP ratio of the Services sector to its workers (jasapercap)	0.0003*** 7.E-05	0.00001*** 3.E-06	0.00002*** 7.E-06
3	Deflator growth (infl_def_krsna2008)	0.0001*** 2.E-05	0.000004*** 7.E-07	0.000007 2.E-06

Fixed-Effect		General Agriculture	Forest & Logging	Fishery
4	Percentage of imports to GDRP lag-1 (limpor2gdrp)	0.000463 1.E-04	0.00003*** 6.E-06	0.00004*** 1.E-05
5	Percentage of exports to GDRP lag-1 (lekspor2gdrp)	-0.000280 1.E-04	-0.00003*** 7.E-06	- 0.00005*** 2.E-05
Social				
6	Percentage of urban non-food expenditure lag-1 (lexpnf_urb_pct)	0.0009*** 3.E-04	0.000021 2.E-05	0.000050 3.E-05
7	percentage of rural non-food expenditure lag-1 (lexpnf_rur_pct)	-0.000162 5.E-04	-0.000016 2.E-05	-0.000050 5.E-05
8	The ratio of the city population to the total population (urbanization)	0.000015 3.E-04	-0.000005 1.E-05	0.000014 3.E-05
9	ln of Morbidity Rate (s4_ipm_01)	- 0.00013*** 6.E-05	-0.000003 3.E-06	-0.000004 7.E-06
10	ln of Average Length of School Rate (s4_ipm_03)	-0.000075 3.E-04	-0.000014 1.E-05	-0.000018 3.E-05
Infrastructure				
11	ln of ICOR lag-1 (llnicor)	-0.000005 9.E-06	-0.000001 4.E-07	0.000000 9.E-07
12	The ratio of Special Allocation Fund (DAK) to total Revenue of APBD lag-2 (ldak_pct)	0.000024 2.E-04	0.000003 9.E-06	-0.000010 2.E-05
13	The ratio of Capital expenditures to Total expenditures (lspencap_pct)	0.00036* 2.E-04	0.000003 9.E-06	0.000022 2.E-05
14	Percentages of villages coastal from total villages (dspesisir_pct)	0.000320 4.E-04	0.00004** 2.E-05	0.000057 4.E-05
15	_cons	-0.000635 6.E-04	-0.000011 3.E-05	0.000004 6.E-05
Obs		266	266	266
sigma_u		0.0001983	0.00001825	0.00002514
sigma_e		0.00009016	4.14E-06	9.13E-06

Fixed-Effect	General Agriculture	Forest & Logging	Fishery
rho	0.82870154	0.9509623	0.88344521
F test that all $u_i=0$: F(31, 220)	7.42***	29.04***	34.61***
Hausman (Chi2(14))	43.04***	34.59***	21.19*
Breusch Pagan (RE Model) (Chibar2(14))	92.4***	409.05***	536.44***

Notes: * significance. 10%; ** 5%; ***1%. The brackets () indicate the standard error

Sources: BPS & INDO-DAPOER (auth. calculation)

Table 10. Agricultural Subsector Regression Against Socioeconomic Factors at the Provincial Level in Indonesia in 2002-2018 Based on Agricultural Transformation Categories, using Fixed Effects Model

No	Agriculture Sub-Sectors	Agricultural-base	Transformation	Urban
Agriculture				
1	(jasapercap)	0.013%	0.012%	0.049%
2	(infl_def_krsna2008)	0.010%	-0.009%	0.010%
3	(lexpnf_urb_pct)	0.030%	0.014%	0.161%
4	(s4_ipm_01)	-0.007%	0.003%	-0.046%
5	(lspencap_pct)	-0.008%	0.000%	0.115%
Forestry				
1	(jasapercap)	0.002%	0.000%	0.002%
2	(infl_def_krsna2008)	0.002%	-0.001%	0.000%
3	(limpor2gdrp)	0.001%	0.003%	0.005%
4	(lekspor2gdrp)	0.000%	-0.003%	-0.004%
5	(dspesisir_pct)	0.008%	0.003%	-0.018%
Fishery				
1	(jasapercap)	0.002%	0.000%	0.002%
2	(limpor2gdrp)	0.001%	0.003%	0.005%
3	(lekspor2gdrp)	0.000%	-0.003%	-0.004%

Sources: BPS & INDO-DAPOER (auth. calculation)

The dynamics of socioeconomic variables have various impacts in each province according to their transformation category. Table 10 suggests that the agricultural sub-sectors in the urban province are more sensitive to changes in these socioeconomic variables than provinces in other categories. These different responses need to be addressed with different policy interventions. The consequence is that agricultural development in each province needs to pay attention to specific aspects of transformation. Agricultural

development efforts have basically benefited from the large domestic consumption market. The different potential of biodiversity in each province as a tropical rainforest area also increases the opportunity to develop alternative commodities to compete in international markets. In addition, the large number of young people is an investment opportunity for the long term.

5. Conclusions and Recommendations

Inequality is a serious problem faced by Indonesia. The decline in the contribution of the agricultural sector to the economy in the last two decades cannot be directly interpreted as a positive agricultural transformation.⁵⁹ On the contrary, it could be an indication of a forthcoming economic stagnation. Indonesia has had a better economic condition compared to other middle-income countries in the last ten years. However, the Indonesian economy continues to be overshadowed by the Middle Income Trap (MIT). Therefore, studying inequality issues in the structural transformation process in Indonesia is very critical.

The following were some of the research questions: (1) How has the agricultural sector in the Indonesian provinces changed over the past two decades? (2) What was the widespread impact of several socioeconomic variables on the transformation of agriculture? (3) How has the agricultural sub-sector responded to the dynamics of these socioeconomic factors over the last decade? The provinces of Indonesia were the focus of this study, and the analysis period started from the years 2001 until 2018. In this study, the agriculture sector was regarded as a milestone in evaluating changes in the economic structure. Meanwhile, the service and manufacturing sectors represent the modern sectors. Efforts to simplify the sectors in the economy into two parts have advantages and disadvantages. The advantage is that complex economic sectors can be easily analyzed and explained, while the disadvantage is the limited information captured regarding the dynamics of the service and manufacturing sectors. To overcome this issue, data from these two sectors was combined to generate a regressor that represented per capita productivity.

In this study, agricultural transformation variables are arranged based on the interaction between the agricultural sector and poverty levels in rural areas. The results of this interaction were classified into three categories: Province Based Agriculture (Agr), Transforming Province (Transforming), and Urban Province. These three outcomes were considered transitive, so the data formed was an ordinal panel. These outcomes would be analyzed using the Panel Ordered Logit method to see the response to the dynamics of certain socioeconomic variables. The category of Provinces in transformation was a combination of provinces with two different characteristics of the interaction of the contribution of the agricultural sector in the economy to rural poverty rates, which would be analyzed further using the Logit Panel model. Meanwhile, to see the impact of socioeconomic variables on agricultural development, panel regression analysis was carried out on the agricultural subsector in the last ten years, which included the General Agriculture sector, Forestry and timber sector, and the Fisheries sector.

⁵⁹ This means economic conditions with high added value, as expressed by various theories.

The agricultural transformation map between Indonesian provinces did not change in response to adjustments in the agricultural contribution variable or the percentage of rural poverty in the regional scope. The classification results show that 13 provinces (40.6%) were categorized as agriculture-based provinces (a) in the first decade. In comparison, in the next decade, the number only decreased by one province to 12 provinces (37.5%). However, the number of Transforming Provinces (b) has decreased to 7 provinces (21.9%) from 8 (25%) in the previous decade. Meanwhile, the Urban category (c) increased by two provinces from 11 (34.4%) to 13 provinces (40.6%) in the same decade.

Macroeconomic factors, such as imports and productivity increases in the secondary (manufacturing) and tertiary (services) sectors, had a considerable impact on the transformation of agriculture. In this case, urban consumption at the household level represented the productivity of the manufacturing and service sectors. Unfortunately, economic performance has not demonstrated proper utilization of these economic benefits so far. Although the link between exports and imports was high, which indicates a balanced trade strategy, the trade balance deficit poses a challenge to increasing the competitiveness of local products against foreign products. The low competitiveness of the local economy was shown by the increasing value of ICOR, especially in the last decade. Unfortunately, this economic inefficiency was accompanied by increasingly limited fiscal space for the productive sector, especially concerning Capital Expenditures (BM) for regional development. For rural dwellers, the lack of business opportunities in rural areas stimulated them to carry out urbanization. The long-term effort to enhance urbanites' competitiveness is to improve their educational level.

The estimation results pointed to a problem with Baumol's Cost Disease, where non-food consumption slows down the agricultural transformation process. However, the 'disease' conditions did not occur in rural areas. Consumption of non-food goods had a positive and significant correlation with agricultural transformation. At this point, this agricultural transformation was taking place prematurely. The farmers had begun to leave agricultural activities because they were no longer considered competitive. At the same time, the secondary and tertiary sectors also began to increase. Unfortunately, the growth of the tertiary sector occurred primarily in informal jobs. People's consumption patterns were also starting to show characteristics of urban society. This was shown by the increase in demand for non-food goods. Infrastructure was a very important factor in driving growth at a higher level, but it tends to be neglected.

In the case of the Transforming Provinces, the estimation results also show that every 1% increase in coastal villages will increase the probability of being included in Quadrant 2 by 243%. Meanwhile, the urbanization variable has a positive and significant correlation in both quadrants. The educational component plays a critical role in weakening competitiveness and increasing inequality during the transformational process. This is the reason for the rise of informal workers, especially those in the service sector.

The estimation results to determine the driving factors for agricultural development indicate that the interaction of these sub-sectors on macroeconomic activities was quite strong. Factors from social groups and infrastructure did not have much influence on the agricultural sub-sectors, except for some variables that only affected the General Agriculture sub-sector. Meanwhile, in the Forestry & Logging sub-sector, the variable that had a significant impact was only the percentage of coastal villages compared to the total number of villages in each province. The estimation results found that infrastructure, social, and

macroeconomic support variables were closely related to agricultural development efforts. In the meantime, it was also widely recognized that development inequality was the crucial problem affecting agricultural development and the effectiveness of its transformation process.

Strengthening appropriate infrastructure on target was one of the answers to solving the blockage in the development flow. Indonesia's status as a maritime country makes transportation in favor of the smooth flow of goods was the key to stimulating agricultural development, which was in slow-transforming pockets such as Eastern Indonesia. This group has the opportunity to supply household consumption needs as well as raw material needs for producers in other regions that already have industrial production facilities.

References

- Aghion, P., & Williamson, J. (1999). *Growth, Inequality, and Globalization: Theory, History, and Policy* (Raffaele Mattioli Lectures). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511599064
- Alessandria, G., R. C. Johnson, and K.-M. Yi (2021): "Perspectives on Trade and Structural Transformation," NBER Working Papers 28720. DOI 10.3386/w28720
- Andreas Chai, 2018. "Household consumption patterns and the sectoral composition of growing economies: A review of the interlinkages," Discussion Papers in Economics economics:201802, Griffith University, Department of Accounting, Finance and Economics. Page 21
- Andriansyah Andriansyah, Asep Nurwanda & Bakhtiar Rifai (2021) Structural Change and Regional Economic Growth in Indonesia, Bulletin of Indonesian Economic Studies, DOI:10.1080/00074918.2021.1914320
- Anugrah, I (2019) "Menelaah Persoalan dan Gerakan Agraria: Masihkah Relevan?" pengantar dalam Scott, James C (2019) "Moral Ekonomi Petani: Pergolakan dan Subsistensi di Asia Tenggara". Depok: Pustaka LP3ES, 2019
- Badan Perencanaan Pembangunan Nasional, Visi dan Arah Pembangunan Jangka Panjang (PJP) Tahun 2005 – 2025, Kementerian PPN/Bappenas, Jakarta, 2007 - hal 36 (lihat poin 8)
- Bank Indonesia, 2019. Kajian Ekonomi dan Keuangan Regional Provinsi Papua Barat - Februari 2019. Page 22
- Bill Vorley, Paolo Cravero, Paule Moustier, Tuong Lan Dinh and Delphine Marie-Vivien (2015). Food Consumption, Urbanisation and Rural Transformations, IIED: Regional Workshop Report. Hanoi, 1-2 October 2015, Final draft 10/12/2015
- Bottini, N., Miguel Coelho, & Jennifer Kao (2013). "Infrastructure and Growth: Launch Version", The London School of Economics and Political Science (LSE) Growth Commission Report
- Briones, R and Felipe, J (2013). Agriculture and Structural Transformation in Developing Asia: Review and Outlook, No. 363 August 2013; ADB Economics Working Paper Series

- Chan, C., Forwood, D., H. Roper, and C. Sayers (2009) 'Public Infrastructure Financing: An International Perspective', Productivity Commission Staff Working Paper.
- Dartanto, T., E. Z. W. Yuan, and Y. Sofiyandi. 2017. Two Decades of Structural Transformation and Dynamics of Income Equality in Indonesia. ADBI Working Paper 783. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/twodecades-structural-transformation-and-dynamics-income-equality-indonesia>
- Falianty, T.A (2019). Teori Ekonomi Makro dan Penerapannya di Indonesia, Ed. 1 –Cet.1 Depok: Rajawali Pers, 2019 (hal 123)
- Fitriani. F., (2005) "Sub National Growth Performance in Indonesia Economic Crisis, Deentralization, and Convergence". A Master Thesis of Economic and Politics: Albert Ludwig Universitat Freiburg, Germany.
- Glawe, L., Wagner, H. The Middle-Income Trap: Definitions, Theories and Countries Concerned –A Literature Survey. *Comp Econ Stud* 58, 507-538 (2016). <https://doi.org/10.1057/s41294-016-0014-0>
- Kyunghoon Kim & Andy Sumner & Arief Anshory Yusuf (2018), Is Structural Transformation-led Economic Growth Immiserising or Inclusive? The Case of Indonesia, May 2018 Working Paper No. 2018/11, Arndt-Corden Department of Economics Crawford School of Public Policy ANU College of Asia and the Pacific
- Lewis, Arthur. 1954. "Economic Development with Unlimited Supplies of Labour." *The Manchester School* 22 (2): 139–91.
- Mohammad Arsjad Anwar, Soekarno Wirokartono, Kiki Verico, Vid Adrison, Dendi Ramdani, Jahen Fachrul Rezki, I Kadek Dian Sutrisna Artha, Riatu Mariatul Qibthiyah, Abdul Malik, Diaz Erlangga (2015) Transformasi Struktural dan Perangkap Pendapatan Menengah: Menelaah Proses Pembangunan di Indonesia Menuju 2030, Bappenas-LPEM FEBUI <https://bit.ly/3wDEI7g> (hal 10)
- Nafziger, E. (2005). *Economic Development* (4th ed.). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511805615
- Rahardja, P & Manurung, M (2008) Teori Ekonomi Makro: Suatu Pengantar, Ed. 4. Jakarta: Lembaga Penerbit Fakultas Ekonomi Universitas Indonesia - hal 318
- Ranis, G. and Fei, J.C.H. (1961), "A Theory of Economic Development," *American Economic Review*, Vol. 51, pp. 533-565.
- Rostow, W. W. (1960). "Politics and The Stages of Growth". Cambridge University Press: New York.
- Peter G. Warr, 2001. "Crisis, Poverty and Agriculture in Indonesia," *Economic and Finance in Indonesia*, Faculty of Economics and Business, University of Indonesia, vol. 49, pages 197-228, June
- Sari, N.A (2016). Analisis Pola Konsumsi Pangan Daerah Perkotaan Dan Pedesaan Serta Keterkaitannya Dengan Karakteristik Sosial Ekonomi Di Provinsi Kalimantan Timur, *JEMI Vol 16/No 2/Desember/2016*

- Sen, Kunal, Structural Transformation around the World: Patterns and Drivers (September 10, 2019). *Asian Development Review* 36:2, Available at SSRN: <https://ssrn.com/abstract=3451537>
- Setyanto, A (2015). ICOR Sektor Pertanian Sebagai Basis Arah Investasi Dalam Pembangunan Pertanian Berbasis Kabupaten/Kota Di Indonesia, Analisis Kebijakan Pertanian. Volume 13 Nomor 1, Juni 2015: 75-108
- StataCorp. 2019. *Stata Longitudinal-Data/Panel-Data Reference Manual Release 16*, see page 338 (StataCorp. 2019. *Stata: Release 16. Statistical Software*. College Station, TX: StataCorp LLC.)
- Stewart, J. (2010) 'The UK National Infrastructure Plan 2010', European Investment Bank Papers: Public and Private Financing of Infrastructure.
- Sumarto. S & Indunil De Silva (2015), "Child Malnutrition in Indonesia: Can Education, Sanitation and Healthcare Augment the Role of Income?". TNP2K Working Paper 31-2015: Jakarta
- Swastika, D.K.S (tanpa tahun) .Reformasi Paradigma Urbanisasi: Strategi Percepatan Pengentasan kemiskinan di Perdesaan.
- Swinnen, Johan (2018). *The Political Economy of Agriculture and Food Policies*, Palgrave Macmillan, 1 New York Plaza, New York, NY 10004, U.S.A. ISBN 978-1-137-50102-8. <https://doi.org/10.1057/978-1-137-50102-8>
- Syrquin, Moshe. (2008). Structural change and development. *International Handbook of Development Economics*, Volumes 1 & 2. 48-67. https://www.researchgate.net/publication/287237769_Structural_change_and_development
- UNHabitat (2016), *Structural Transformation In Developing Countries: Cross Regional Analysis*, HS/018/16E. <https://bit.ly/38QJJKV>
- United Nations, (no year) "Evaluation of Infrastructural Interventions for Rural Poverty Alleviation", Transport, Communications and Tourism Division Economic and Social Commission for Asia and the Pacific. Bangkok: Thailand
- United Nations, (No year) "The Wye Group Handbook: Statistics On Rural Development And Agricultural Household Income"
- Williams, Richard (2019). *Ordered Logit Models – Basic & Intermediate Topics*, University of Notre Dame, <https://www3.nd.edu/~rwilliam/>, (Last revised February 9, 2021)
- World Bank (2008), *World Development Report 2008: Agriculture for Development*, DOI: 10.1596/978-0-8213-7233-3