Profitability and Labor Productivity in Indonesian Agriculture

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EXECUTIVE SUMMARY

1. **Urbanization and income growth are contributing to significant changes in consumer food demand and expenditures, with aggregate demand for rice levelling off and with increased consumption of animal products, fruits and vegetables, processed foods, and a range of beverages.** This provides Indonesian farmers with significant market opportunities if they can competitively supply these foods or food/feed raw materials. Yet, most attention to farm economics has centered on rice and comparatively little is known about the productivity and profitability of farmers supplying this wider range of commodities. Are the returns to family and hired labor (significantly) higher for these other commodities than for rice despite the predominant attention which the government has given to supporting rice production? If this is the case, then we would expect to see market forces driving considerable shifts in agricultural land uses in the coming years. Yet, if such production systems are not yielding higher returns to farmers, then adjustments in policies and programs may be needed to better facilitate a competitive supply response by Indonesian smallholders to changing patterns of demand.

2. **This study is a first attempt to address this knowledge gap. Given funding and time limitations, it is designed as an exploratory study whose insights may stimulate discussion and demand for further work in this area**. The study aims to inform the discussion on improving productivity and farmer incomes by examining the profitability and labor productivity of different crops and smallholder farming systems**.** The study draws upon existing survey and a supplemental field survey to compare and contrast the labor productivity and overall profitability in smallholder production for a range of staple and higher value food crops, animal production systems and mixed farming systems.

3. **Urbanization and income growth are contributing to significant changes in consumer food demand and expenditures, with aggregate demand for rice levelling off and with increased consumption of animal products, fruits and vegetables, processed foods, and a range of beverages.** This provides Indonesian farmers with significant market opportunities if they can competitively supply these foods or food/feed raw materials. Yet, most attention to farm economics has centered on rice and comparatively little is known about the productivity and profitability of farmers supplying this wider range of commodities. This study is a first attempt to address this knowledge gap. Given funding and time limitations, it is designed as an exploratory study whose insights may stimulate discussion and demand for further work in this area. The study aims to inform the discussion on improving productivity and farmer incomes by examining the profitability and labor productivity of different crops and smallholder farming systems**.** The study draws upon existing survey and a supplemental field survey to compare and contrast the labor productivity and overall profitability in smallholder production for a range of staple and higher value food crops, animal production systems and mixed farming systems.

4. **In the process of economic structural transformation, countries generally experience a significant contraction in the share of employment in primary agriculture as growth rates diverge between agriculture, industry and services, as agricultural production consolidates into somewhat larger and often more mechanized units, and**

as surplus underemployed agricultural labor is absorbed in other segments of the economy. With a lower proportion of the workforce employed in agriculture and with a growing proportion of agricultural workers coming to be involved with higher value segments of primary agriculture (i.e. horticulture and animal production) there is a tendency for wages and productivity levels in agriculture to converge with those in many segments of industry and services.

5. **Middle-income Indonesia has been experiencing a reduction in the share of workers engaged in primary agriculture, although the pace of this reduction is slower than the contraction in primary agriculture's share of national GDP and also slower than observed patterns in many other peer countries in Asia.** For a variety of reasons, other segments of the economy have been slow to absorb surplus agricultural labor, resulting in significant levels of seasonal or other underemployment of people in rural areas. Lack of demographic pressures, small farm sizes, topographical challenges and other factors have contributed to very low rates of mechanization in Indonesian agriculture. In 2017, primary agriculture (including fisheries and forestry) remained by far the largest employer in Indonesia with nearly 36 million people involved.

6. **This study has found very large gaps in labor productivity between primary agriculture and nearly all other segments of the Indonesian economy.** While the estimated growth rate in labor productivity has been quite a bit higher in agriculture than in some other segments of the economy in the period of 2000 to 2017, the size of the productivity gap is such that it will take many decades to fully close this gap based upon the current patterns. The picture for Indonesia is somewhat unusual in that even the segments of agriculture experiencing somewhat higher rates of labor productivity still lag or barely approximate the productivity levels experienced in comparatively lower levels of industry (i.e. construction) and services (i.e. hotel and restaurants).

7. **This study utilized three sources of data to estimate agricultural labor productivity**, namely (i) Sakernas household survey data, (ii) prior surveys of smallholder tree crop producers, and (iii) a small supplemental field survey covering several locations and a range of staple and specialty food crops and animal or mixed farming systems.

8. **The results convey a mixed picture, with some divergence between the Sakernas results and those based upon surveys focused on specific commodities.** The Sakernas surveys point to patterns which are consistent with observations in other Asian countries in which labor productivity for (relatively low unit value) food crops is decidedly lower—by half or more—than is the case for horticulture, animal production, mixed farming systems, and specialized plantation crops. The surveys that focused on individual crops or production systems point to a much more complex pattern. As expected, labor productivity is comparatively higher in poultry and aquaculture production and in some segments of horticulture which have received government attention (i.e. shallot production). However, labor productivity is found to be quite a bit lower in several horticultural crop specialties and in beverage crop production than in rice cultivation. This pattern contrasts sharply with that found in Vietnam, a country which has experienced considerable success both in raising rice productivity and in developing large competitive cash crop industries. There, labor productivity in rice differs among regions depending upon patterns of mechanization and commercialization, yet even in the best

circumstances this labor productivity is no more than one-third that experienced for coffee or horticulture production.

9. **The factors underpinning the observed patterns in Indonesia are not fully clear and require additional work, including through more extensive field surveys which would bring out greater variations among locations due to agro-ecological, farmer organization, rural connectivity and other factors.** Restrictions on competitive imports and various programs of direct support have helped to boost the profitability of rice production in parts of Indonesia, although this profitability remains modest and given very small average farm sizes, inadequate to provide a solid living standard for most producing households. Even among surplus rice growing households an increasing majority of household income is now coming from other (including non-agricultural) sources.

10. **Perhaps more surprising is the moderate to low level of profitability and/or labor productivity associated with most horticultural and beverage crops in Indonesia.** This is alarming as one would expect these higher value commodities to provide for more remunerative employment. Growing demand, both at home and abroad, should be catalyzing farmers to invest further in these crops and to build up the requisite knowledge base to improve product quality. More competitive horticultural and beverage crop industries should then be achieving higher rates of productivity growth and be in a better position to reward both skilled and unskilled labor. This dynamic does not seem to be occurring, at least not on a broad scale.

11. **This is of concern not only for realizing near term goals related to poverty reduction and farm incomes, but also in relation to attracting and retaining entrepreneurial youth to being Indonesia's farmers of the future.** Recent studies and consultative processes have drawn attention to the challenges of productivity, profitability and competitiveness in Indonesian horticulture and beverage crop industries. This study's findings about low labor productivity in these industries calls for a redoubling of efforts to strengthen the provision of core public goods and services to such industries and to better facilitate private investment in production technologies, advisory services, and downstream logistical and marketing services.

12. **There are multiple pathways to raise labor productivity in Indonesian agriculture and all these should be further explored and re-enforced by appropriate government policies and programs.** For example:

    a. One important pathway will be efforts to achieve more economies scale in smallholder production of staple food crops, by facilitating community-based land consolidation, a more active market in agricultural land rentals and sales, and the emergence of a dynamic market for provision of mechanized services covering different components of the crop cycle. Reforms will be needed in land administration and in the enabling environment for mechanized services.

    b. A second important pathway will be to encourage more diversified farming systems to make fuller use of available labor and other resources as well as better mitigate weather, pest and other risks. In place of monocrop systems, higher labor productivity and remuneration may be possible through the introduction of

rotations in lowland rice-based systems (i.e. moving towards rice-vegetable, rice-aquaculture and other rotations) and mixed agro-forestry systems. Single crop advisory services may need to be replaced by technical support emphasizing whole farm management.

c. A third critical pathway is through measures to increase productivity, value addition, and risk management capabilities in higher value crop and animal production systems. This may require interventions to improve biosecurity controls and practices, enable farmers to acquire new knowledge and skills, foster greater rural entrepreneurship, encourage more collective action in agricultural marketing, and strengthen the market and other rural infrastructure to carry perishable and other higher value commodities.

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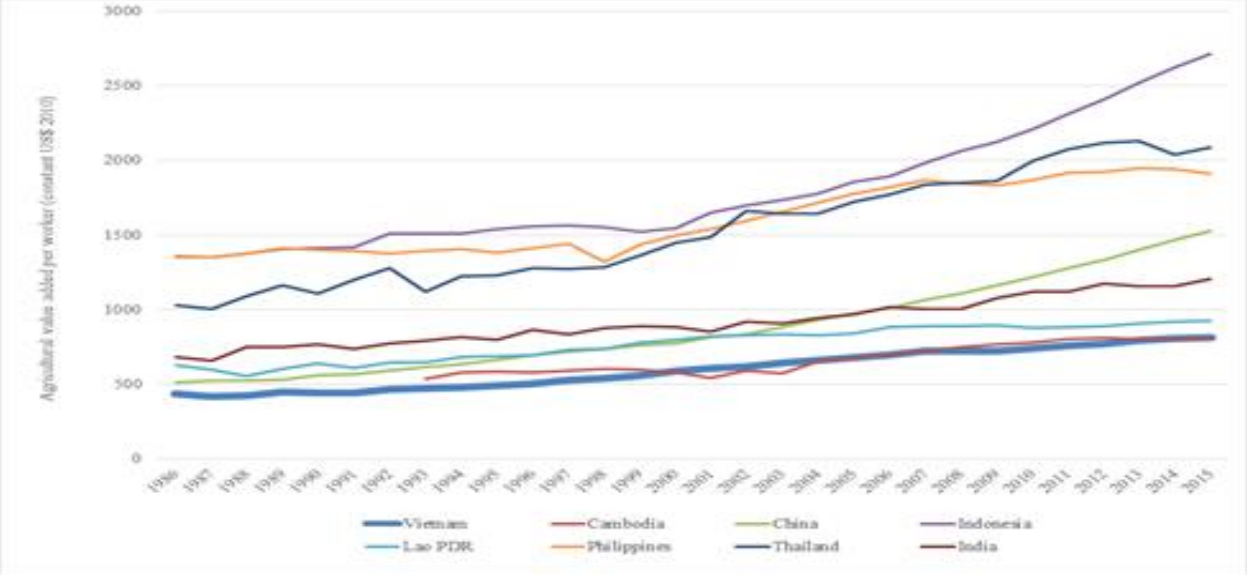
1. INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

13. **Indonesia's agricultural strategy aims to expand national output, especially of 'strategic commodities', while also raising farm incomes. Given constraints on available resources, improvements in productivity are needed to realize these twin goals.** National policies have tended to define productivity in narrow terms, centered on crop yields (i.e. physical output per hectare of land). Investments (i.e. in irrigation facilities) and programs (i.e. input subsidies) have sought to promote higher yields. But, agricultural productivity should be understood and promoted from a broader perspective. Especially when exploring opportunities to improve rural livelihoods and farm incomes it is also critical to consider the status and patterns of agricultural labor productivity and the strategies for increasing this. To date, labor productivity has factored little in national policy considerations.

14. **Earlier analytical work pointed to two very different and potentially conflicting viewpoints on the status and trajectory of agricultural labor productivity in Indonesia**. Based simply upon national aggregates for agricultural GDP and 'persons employed in agriculture', the picture for Indonesia looks highly favorable, at least in comparison with regional peers. This can be seen in Figure 1 below with Indonesia seemingly experiencing an accelerated pace of growth in agricultural labor productivity since the early 2000s. Yet, other comparative analyses paint a less favorable picture. Analysis by Bordey et al. (2016) of the economics of production in Asia's leading 'rice bowls' found West Java farmers to experience comparatively good returns per hectare, yet exceptionally low returns and productivity per unit of labor, with small land sizes and extremely low rates of mechanization being among the main contributing factors (Table 1).

Figure 1: Comparative Trajectories in Agricultural Labor Productivity



15. **How could Indonesia be achieving high rates of overall growth in agricultural labor productivity when labor productivity for its leading crop—accounting for a majority of agricultural land use—is exceptionally low?** Can this be explained by much higher rates of labor productivity for a range of other crops or in other sub-sectors of agriculture such as livestock and aquaculture? What are the policy implications of this? Or, has this divergence been due to a more specific factor? For example, the period of accelerated growth in agricultural labor productivity overlaps quite closely with a major expansion in the planted area of oil palm. It is possible that favorable labor dynamics in that industry have hidden a less favorable pattern elsewhere in Indonesian agriculture? If so, what are the implications of this for future policy and programs?

Table 1: Net Returns Per Hectare and Per Person-Day in Major Asian 'Rice Bowls' (US$)

	Net Returns / Ha	Labor Person-days	**Returns per Person-day**
Thailand (SuphanBuri)	606.4	9.7	**62.52**
Vietnam (Can Tho)	1076.0	21.9	**49.13**
China (Zhejiang)	728.2	34.9	**20.86**
Philippines (Nueva Ecija)	723.5	68.7	**10.53**
Indonesia (West Java)	850.2	96.2	**8.84**
India (Tamil Nadu)	205.5	78.2	**2.63**

Source: Bordey et al (2016)

16. **Urbanization and income growth are contributing to significant changes in consumer food demand and expenditures, with aggregate demand for rice levelling off and with increased consumption of animal products, fruits and vegetables, processed foods, and a range of beverages.** This provides Indonesian farmers with significant market opportunities if they can competitively supply these foods or food/feed raw materials. Yet, most attention to farm economics has centered on rice and comparatively little is known about the productivity and profitability of farmers supplying this wider range of commodities. Are the returns to family and hired labor (significantly) higher for these other commodities than for rice despite the predominant attention which the government has given to supporting rice production? If this is the case, then we would expect to see market forces driving considerable shifts in agricultural land uses in the coming years. Yet, if such production systems are not yielding higher returns to farmers, then adjustments in policies and programs may be needed to better facilitate a competitive supply response by Indonesian smallholders to changing patterns of demand.

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1.2 RECENT ECONOMIC DEVELOPMENTS

18. The growth of Indonesian agriculture in 2017 was 3.81 percent, below overall economic growth of 5.06 percent. Agriculture sector growth has slowed compared to the 1980s when six percent was the norm, with economic growth exceeding seven percent. In terms of structural transformation of the Indonesian economy, the declining share of agricultural sector to the Gross Domestic Product (GDP) from 15.3 percent in 2010 to 13.1 percent in 2017 is also followed by the declining share of agricultural labor from 39 percent in 2010 to 29.7 percent in 2017, as would be expected.

19. Indonesia has experienced de-industrialization perhaps too early. The share of the manufacturing and mining industries continued to decline from 36 percent in 2010 to 28.7 percent in 2015 and 27.7 percent in 2017. The share of the services sector increased significantly, from 36.3 percent in 1975, to 41 percent in 1995, to 48 percent in 2005, and by 59.2 percent of the total GDP of the economy. Before the economic crisis in 1998, the pace and patterns of structural transformation seemed to follow the normal path when the share of the agricultural sector declined from 30 percent in 1975 to around 23 percent in 1985 and continued to decline to 15.3 percent in 2010 and 13.1 percent in 2017. During this period, the share of the industrial sector increased from 33.5 percent in 1975 to 35 percent in 1985 and continued to rise to 41.8 percent in 1995. However, the share of the industrial sector declined to 38.5 percent in 2005, as a result of the 1998 economic crisis which affected mostly the manufacturing, the financial sector and other service sectors.

20. Meanwhile, agricultural labor was recorded at 62 percent, then declining steadily to 42.5 percent in 1995, decreasing to 39 percent in 2010 and only 29.7 percent in 2017. However, the falling share of agricultural GDP relative to the national economy was much faster compared to the declining share of employment in the agricultural sector. This would suggest that structural transformation in Indonesia did not empower the economy, especially given the de-industrialization process mentioned above. As the services sector is less labor intensive than the agriculture and manufacturing sectors, excess agricultural labor did not go anywhere and remained in agriculture or became disguised unemployment. The strength of the agricultural workforce did not have the flexibility to shift to other sectors. Limited value addition in agricultural products and slow diversification in the agricultural export base are important contributing factors to such imbalanced structural transformation in the Indonesian economy.

21. Even though Indonesia's GDP per capita has increased significantly in the past decade, the increase in agricultural GDP per worker has been slow, mostly because employment creation in non-agricultural sectors has been limited. The structural transformation process has contributed to a modest decline of the poverty rate from to 11.2 percent in March 2015 to 9.8 percent in March of 2018. Nevertheless, the number of poor people in rural areas is still large, about 15.81 million people (13.20 percent), higher than the 10.14 million urban poor people (7.02 percent). The Gini coefficient of the Indonesian economy generally has increased in the past decade or so, from 0.32 in 1998 to 0.38 in 2007, increasing to 0.41 in 2012 and decreasing to 0.39 in 2018 of March. A Gini coefficient at 0.39 means that 40 percent of population receives only 16.86 percent of the GDP, while the top 20 percent of population receive as high as 48.41 percent of the GDP.

This constitutes a serious imbalance that needs to be recognized when designing and implementing social inclusion policies and programs. More importantly, ineffective government policies have contributed to Indonesia's income inequality while poor infrastructure affects the economic access to the production factors.

22. In the staple food sector, the policy to increase the production of rice, maize and soybean (*Pajale Program*) and to stabilize prices has not succeeded to improve the welfare of farmers and the general public. According to the most recent official estimates of rice production (October 2018), using the Area Sample Framework (KSA) method, the total area of 7.10 million hectares of rice fields is a significant reduction compared to 7.75 million hectares in 2013. In the past five years, the conversion of rice fields accounts for more than 600 thousand hectares, or over 120 thousand hectares each year. This conversion of rice fields occurred in spite of Law No. 41/2009 on the Protection of Agricultural Land for Food Production (PLP2B). The Law is supplemented by Government Regulation (PP) No. 1/2011 on Allocation of Land Protection, PP 12/2012 on Incentives of Land Protection, and PP 25/2012 on Information System of Land Protection and PP 30/12 on Financing for Land Protection, and other Ministerial Regulations.

23. The harvested area as measured by the KSA (an agriculture survey that measures area under production) in 2018 is 10.9 million hectares, far lower than 16 million hectares by earlier "eye estimates". The difference of 5.1 million hectares (31.88 percent) is too high to be statistically tolerable, causing biases in any development planning such as fertilizer and seed subsidies, agricultural machinery and equipment etc. The new estimate of rice production by KSA in 2018 is 56.54 million tons of non-husked dry rice (GKG), instead of 83 million ton, which is a correction of 26.46 million tons (31.88 percent). Until September 2018, BPS data showed that rice imports reached 2.02 million ton, a significant increase from 311 thousand tons in 2017. Some rice production centers in Indonesia experienced a serious drought and crop failures due to pests and diseases, the rice import in 2018 might exceed 2.5 million ton, which is much higher than the import after El-Nino year in 2016 of 1.3 million tons.

24. BPS recorded that the retail price of rice in November 2018 was Rp 14,007 per kilogram, an increase of 4.30 percent compared to the price of rice in June 2017. The price of rice has now decreased compared to the price of rice in February 2018 of Rp 14,697 per kilogram, the highest record so far. The high price of rice and other food contributes specifically to the poverty line in Indonesia. The price of food contributes 73.48 to the poverty line in March 2018, an increase from the contribution of 73.35 percent in September 2017. Food commodities that affect the rural poverty line are rice, clove cigarettes, eggs, chicken meat, instant noodles and sugar. Although the number of poor people has dropped to 25.95 million people (9.82 percent) in March 2018, from 26.58 million people (10.12 percent) in September 2017, the number of poor people in rural areas is still large, namely 15.81 million people (13.20 percent), higher than the urban poor 10.14 million people (7.02 percent).

25. Compared to other major rice producing countries in the region, Vietnam, Thailand, India, the Philippines, and China, the cost structure of rice production in Indonesia is the highest. A study by IRRI (2016) suggests that the average production cost of one

kilogram of rice in Indonesia is Rp 4,079, which is nearly 2.5 times the cost in Vietnam (Rp 1,679), nearly 2 times the cost in Thailand (Rp 2,291) and India (2,306), and 1.5 times the cost in the Philippines (Rp 3,224) and China (Rp 3,661). The highest cost components are land rental (Rp 1,719) and labor costs (Rp 1,115) to produce one kilogram of non-husked rice. Low labor productivity in Indonesia has contributed to the low level of competitiveness of the rice farming system and has contributed to poverty incidence in rural areas. Agricultural labor in Indonesia only receives Rp 86,593 per day, which is generally lower than that in the Philippines of Rp 86,752, in Vietnam of Rp 121,308, in Thailand of Rp 181,891 and in China of Rp 208,159, but significantly higher than that in India of Rp 42,492 (IRRI, 2016).

2. LABOR PRODUCTIVITY IN AGRICULTURE

2.1 CASE STUDY: AGRICULTURAL LABOR PRODUCTIVITY IN VIETNAM[1]

26. The number of people working in Vietnam's primary agriculture is large, but it is decreasing over time. In 2000, about 25 million people worked in agriculture, accounting for 65 percent of total labor force. By 2015, agriculture employed some 23.2 million people, representing 46 percent of the workforce. The movement of rural people out of agriculture has largely been a result of rapid economic growth that created many nonfarm jobs.[2] As primary agriculture remains a large employment and income source in many parts of rural Vietnam, improving the remuneration of this work is an important task for policy makers. How to do it is strongly related to labor productivity, which is perceived to be low.

27. When measured in a traditional way, by dividing the sectoral value-added by number of workers, agricultural labor productivity is indeed low—in 2014 it was 2.5 times smaller than the average labor productivity in Vietnam's industry and construction. Yet agricultural labor productivity is not necessarily lower than other sectors when measured on per-hour-worked basis. The recent survey evidence from around the world indicates that on a per-hour-worked basis, rather than simply using national accounts data on the

[1] Based on Vietnam's Future Jobs: Shaping Agriculture to Deliver Jobs. S. Zorya et al (2018) World Bank: Hanoi.

[2] Vietnamese households increasingly rely on nonfarm sources of income. Between 2004 and 2014, the share of rural households relying entirely on nonfarm income and wages increased from 22 percent to 32 percent. At the same time, the share of rural households relying only on income from agriculture declined from 23 percent to 19 percent. About 90 percent of rural households have multiple sources of income.

number of people employed in agriculture, and accounting for differences in human capital, agricultural labor productivity is not intrinsically lower than other sectors – it is often similar.

28. Indeed, for Vietnam the labor productivity of some specialized agricultural households appears to be even higher than that in nonfarm sectors where skill requirements are comparable to that in primary agriculture (Table 2). The value of the unadjusted agricultural labor productivity in 2014 was VND 28.6 million per worker; yet the per-hour-worked adjusted annual productivity is estimated to be almost as twice as large at VND 53.7 million per worker. Some productivity gap with manufacturing and construction remains, but it narrowed from more than 200 percent when using national accounts annual data to only 20 percent for construction and 30 percent for manufacturing and transport and warehousing when using per-hour-worked data.[3]

Table 2: Comparison of annual and per-hour-work adjusted labor productivity, 2014

	Annual labor productivity (GDP/worker) (VND)	**Per-hour-work adjusted annual productivity (VND)**
Agriculture	28,600,000	53,710,000
Crops		*51,000,000*
Livestock		*57,000,000*
Agricultural services		*76,000,000*
Fisheries		*68,750,000*
Forestry		*39,250,000*
Manufacturing and processing industry	70,000,000	
Construction	60,700,000	
Transport and warehousing	73,200,000	

29. Labor productivity varies significantly by commodity, pointing to the ability of different jobs to provide differentiated income. This analysis suggests that large gains can be achieved from changes in land use, e.g. by moving land from less labor productive to more labor productive commodities. Importantly for employment discussions, is also the fact that the commodities with higher labor productivity in Vietnam also tend to be more labor intensive, allowing the full use of sector resources for job and income generation.

[3] In addition, the labor productivity in agricultural services, provided by cooperatives and other farmer organizations, was found to be higher than that in nonfarm sectors, and the labor productivity in fisheries was higher than that in construction, a common off-farm employment alternative to farmers.

Table 3: Labor input and productivity from the field data by commodity, 2016-2017

	Labor input, days/ha	Labor productivity, '000 VND/day
Paddy [*VHLSS 2014]*	46-150 [*278*]	174-276 [*94*]
Maize	165-170 [*n/a*]	95-110 [*n/a*]
Cassava	185-220 [*n/a*]	118-135 [*n/a*]
Oranges	350-415 [*300*]	600-1,000 [*297*]
Mango	200-300 [*182*]	500-900 [*484*]
Dragon fruit	700 [*n/a*]	550-650 [*n/a*]
Pepper	360-500 [*329*]	520-1,830 [*511*]
Coffee	115-130 [*287*]	500-700 [*411*]
Pork	500-1,500 [*n/a*]	320-950 [*157*]
Shrimp	240-335 [*261*]	1,700-3,300 [*403*]
Fish	212 [*373*]	280-980 [*329*]

Sources: IPSARD's estimate using field data collected in 2016-2017; Maize and cassava from Keyser et al. (2013)
Figures in parentheses are the estimates based on VHLSS 2014

30. This analysis illustrates that labor productivity in primary agriculture is generally higher than often perceived in Vietnam. This is most evident when one looks beyond paddy production or production of other low value feed commodities. The latter have dragged down the aggregated estimate of labor productivity in the entire sector, and this is especially the case when statistics do not take account of the part-time and highly seasonal nature of paddy production—especially in the Mekong Delta, which has accounted for a large majority of Vietnam's rice production expansion since 2000. When adjusting labor input by per-hour-worked efforts and differentiating by commodities, some of which are more labor intensive and higher value than others, a brighter picture arises for agricultural labor productivity. Significant economic and "better job" gains can still be achieved in Vietnam's primary agriculture going forward by facilitating the shift of labor from less to more productive activities, often requiring a shift of farmland from paddy and maize to other crops. This would be consistent with the government efforts to promote high-tech agriculture and would be similarly consistent with a broad employment agenda.

2.2 LABOR PRODUCTIVITY IN INDONESIA

31. Agriculture has played an important role in the Indonesia national economy, even though its share of the country's gross domestic product (GDP) has declined as the economy has grown. The decline in the share of GDP in agriculture occurs due to both push and pull-factors. Push factors can have negative effects on poverty, where agriculture cannot accommodate the growing labor force, so that resources move out from the agricultural sector to more rapidly growing sectors in the economy. Pull factors are at play where nonagricultural sectors offer more attractive employment opportunities, primarily because of differences in factor endowments and capital accumulation.

32. Structural transformation in the Indonesian economy has not occurred smoothly, especially over the past decade. The share of the agricultural sector has declined from 30 percent in 1975 to around 23 percent in 1985 and continues to decline to 15.3 percent in 2010 and 13.1 percent in 2017 (Table 4). The share of the industrial sector has increased from 33 5 percent in 1975 to 35 percent in 1985 and continued to rise to 41.8 percent in 1995. The share of the industrial sector declined to 38.5 percent in 2005, as a result of the 1998 economic crisis which affects mostly manufacturing sectors in Indonesia and financial and other service sectors.

Table 4: Roles of Agriculture in the Indonesian Economy, 1975-2017

	1975	1985	1995	2005	2010	2015	2017
1. Share of GDP (%)							
▪ Agriculture	30.2	22.9	17.1	13.4	15.3	13.5	13.1
▪ Industry (manufacture etc.)	33.5	35.3	41.8	38.5	36.0	28.6	27.7
▪ Services	36.3	42.8	41.1	48.1	48.7	57.9	59.2
2. Share of Employment (%)							
▪ Agriculture	62.0	56.0	46.0	42.5	39.0	32.9	29.7
▪ Industry (manufacture etc.)	6.0	9.0	12.8	13.0	14.5	13.3	14.5
▪ Services	32.0	35.0	43.2	44.5	47.5	53.8	55.8

Source: The share is calculated from BPS data, various issues.

33. The literature on the roles of agriculture in economic development and productivity gap between agriculture and non-agriculture during the structural transformation can be traced back to the seminal works by Johnston and Mellor (1961), Mellor (1995), Timmer (1988) and my most recent works by Christiaensen *et al*. (2011), Dorward (2013), Imai *et al.* (2016), Imai *et al.* (2017) and Mellor (2017). Initially, agriculture has made a net contribution to the capital required for overhead investment and expansion of secondary industry. The rising net cash income of the farm population will be important as a stimulus for an expansion of the non-farm sector. The relationship between agriculture and non-agriculture developed from the facts that modernization of agriculture would require the use of chemical fertilizers, pesticides, machine services, processed seeds or fuels, which would promote non-agricultural production. Increase in agricultural income will lead to increased demand for non-agricultural products, and vice versa. Finally, decrease in food prices as a result of agricultural growth will result in better food security and overall poverty reduction in both rural and urban areas, while the reduction in food price would lower the real product wage in non-agriculture, thereby raising profitability and investment in that sector (Christiaensen, *et al*. 2011).

34. The performance of labor productivity in Indonesia is generally increasing in all sectors, measured in terms of added value per worker (Rp/worker) (Table 5). The data show that the overall labor productivity on Indonesian workers were Rp 66.4 million in 2011, increased to 72.8 million in 2014 and 78.7 million per worker in 2017. The labor productivity in agriculture also increased significantly in the last decade, from Rp 25.4 million per worker to Rp 30 million and to 35 million per worker. However, the level of labor productivity in agriculture is relatively lower than that of other sectors, as the total added value in non-agricultural sectors is generally higher. There has been a tendency of

sectoral gap between labor productivity in agriculture and non-agriculture, such as suggested by Imai *et al*. (2018).

Table 5: Labor Productivity in Indonesia 2011-17 ('000 Rp at Constant Price 2010) and index

Sector	2011	2012	2013	2014	2015	2016	2017
1. Agriculture, Livestock, Forestry	25,425	26,254	27,617	28,970	31,031	32,053	34,987
2. Mining and Quarrying	522,355	482,040	555,497	553,659	582,488	526,989	562,352
3. Manufactures	108,359	105,193	113,961	118,706	124,505	127,050	119,774
4. Electricity, Gas, Clean Water	237,832	251,622	251,948	236,080	218,189	214,689	152,770
5. Construction	109,107	106,290	121,700	113,545	107,109	115,943	121,412
6. Trade, Hotel, and Restaurant	53,215	52,899	54,028	55,723	55,523	55,333	54,795
7. Transportation, Communication	107,345	117,234	126,526	137,332	149,272	147,520	154,834
8. Finance, Rental, and Services	224,692	228,680	230,871	234,046	229,320	231,849	233,240
9. Other Services	45,769	45,469	45,225	46,459	50,745	48,947	49,651
Total Sector	**66,495**	**67,199**	**70,532**	**72,856**	**75,767**	**76,828**	**78,748**
Index of labor productivity							
1. Agriculture, Livestock, Forestry	100	103	109	114	122	126	138
2. Mining and Quarrying	2,054	1,896	2,185	2,178	2,291	2,073	2,212
3. Manufactures	426	414	448	467	490	500	471
4. Electricity, Gas, Clean Water	935	990	991	929	858	844	601
5. Construction	429	418	479	447	421	456	478
6. Trade, Hotel, and Restaurant	209	208	212	219	218	218	216
7. Transportation, Communication	422	461	498	540	587	580	609
8. Finance, Rental, and Services	884	899	908	921	902	912	917
9. Other Services	180	179	178	183	200	193	195
Total Sector	**262**	**264**	**277**	**287**	**298**	**302**	**310**

Source: Calculated from BPS, GDP at 2010 Constant Price and Sakernas Series (various years)

35. Using the data of Asian countries, Imai *et al* (2018) examine the pattern of (1) the convergence of labor productivity between agricultural and non-agricultural sectors and (2) the convergence of agricultural or non-agricultural productivity across different countries. The studies find that the agricultural labor productivity growth has promoted the non-agricultural productivity growth. The sectoral gap has widened, while the between-country disparity of sectoral labor productivity has reduced.

36. However, the growth performance of labor productivity is somewhat different from the magnitude or the value of labor productivity. The growth performance of each sector has experienced some fluctuations, but the average growth level of labor productivity in agriculture is 6.09 percent per year, the second largest, after that of transportation and communication sector of 8.91 percent per year (Table 6). Sectors that have experienced negative growth performance, although the added value is quite large, also experienced negative growth in labor productivity.

Table 6: Growth of Labor Productivity in Indonesia 2011-2017 (percent per year)

Sector	2011	2012	2013	2014	2015	2016	2017	Average
1. Agriculture, Livestock, Forestry	9.73	3.26	5.19	4.90	7.12	3.29	9.15	6.09
2. Mining and Quarrying	-11.18	-7.72	15.24	-0.33	5.21	-9.53	6.71	-0.23
3. Manufactures	0.90	-2.92	8.33	4.16	4.89	2.04	-5.73	1.67
4. Electricity, Gas, Clean Water	4.58	5.80	0.13	-6.30	-7.58	-1.60	-28.84	-4.83
5. Construction	-5.29	-2.58	14.50	-6.70	-5.67	8.25	4.72	1.03
6. Trade, Hotel, and Restaurant	10.19	-0.59	2.14	3.14	-0.36	-0.34	-0.97	1.88
7. Transportation, Communication	24.24	9.21	7.93	8.54	8.69	-1.17	4.96	8.91
8. Finance, Rental, and Services	-27.90	1.77	0.96	1.38	-2.02	1.10	0.60	-3.44
9. Other Services	6.70	-0.65	-0.54	2.73	9.22	-3.54	1.44	2.19
Total Sector	**7.27**	**1.06**	**4.96**	**3.29**	**4.00**	**1.40**	**2.50**	**3.50**

Source: Calculated from BPS, GDP at 2010 Constant Price and Sakernas Series (various years)

37. Empirical estimates on productivity growth using the concept of total factor productivity (TFP) and decomposition of the sources of economic growth have been conducted by Fuglie (2004, 2010, and 2012) and some others (see Arifin, 2015). The studies suggest that in the period of 1961-2006, Indonesia achieved an annual growth rate in agricultural production of 3.6%. About half of this growth can be attributed to an expansion of conventional inputs (land, labor, capital and intermediate inputs) and the rest to improvement in total factor productivity. Productivity growth accelerated during the "Green Revolution" period when modern varieties of food crops were widely disseminated but stagnated during the 1990s. Productivity growth resumed in the early 2000s following the recovery from the Asian Financial Crisis and liberalization of policies toward agriculture.

38. Commodity diversification, allocating more agricultural resources to the production of higher-valued commodities as well as crops that make fuller use of farm labor, has been an important source of TFP growth in recent years. The private sector rather than the state appears to be the driving force behind the reemergence of growth in the sector. Higher levels of schooling amongst the farm population account for about 10% of the growth in labor productivity. Continued improvement in the quality of labor can offset the projected decline in the size of the farm labor force. Commodity diversification was probably as important a source of agricultural productivity growth as technological change. Farmers increased productivity by moving to more intensive production systems involving perennial tree crops, horticulture, animals and aquaculture. However, the gains from diversification were preceded by an impressive improvement in productivity of rice and other food staples. Having secured food security first may well have been a prerequisite for small-holder farmers to be willing to allocate more resources to producing non-staple commodities for the market (Fuglie, 2010).

39. The Indonesian economy has been dominated by rice production, although the agriculture sector has become increasingly diversified, with perennials, horticultural crops, livestock, and aquaculture growing in relative importance over time. Indonesia has become a significant global supplier of tropical vegetable oil, rubber, cocoa, coffee, fish, and shrimp. Although the country continues to rely on imports for a significant share of its

cereal grain needs for food and feed, it maintains a positive agricultural trade balance overall. Resource expansion and productivity improvement have been important sources of growth in Indonesian agriculture. Agricultural land continues to expand in the sparsely populated regions of the country where area planted to perennial crops, oil palm especially, has undergone rapid expansion in recent decades, with serious environmental consequences. These regions include the islands of Sumatra, Kalimantan, Sulawesi, and Papua. Both smallholder farms and large estate companies are heavily involved in the perennial-crop sector. Large estate companies, with access to capital and technology, often dominate the early stages of perennial crop development, but over time, smallholders have entered these sub-sectors. Presently, smallholders dominate the production of rubber, coffee, cocoa, and coconut and are gaining market share in oil palm.

40. Rice farming is barely profitable, according to a recent survey on rice farm cost structures conducted by BPS in 2017, covering a sample of 165.9 thousand farm households. Farm profit from lowland paddy is Rp 4.7 million in 2017 per season. For upland paddy this is Rp 2.4 million per season (Hermanto, 2018). The revenue to cost ratio (R/C ratio) for lowland paddy is 1.32 and for upland paddy is 1.28, implying that the rice farming system in Indonesia does not contribute much towards a decent living standard for farm households. The benefit revenue to cost ratio (B/C ratio) for lowland paddy is 0.34 and for upland paddy is 0.28, implying that the profit generated from rice farming activities is too low to allow the farmers to invest in a more productive and profitable crop production system (the literature generally suggests a bench mark of 1.5 for R/C ratio and 1.25 for B/C ratio).

41. The economic performance of farm households of rice paddy using a large sample is comparable to the results of a farm household survey of 403 paddy farmers along the Lower Sekampung Watershed in the Province of Lampung in 2017. The profitability of rice farming system is positive, but very low, which prevents the paddy farmers to have a decent living, and possibly very prone to fall below poverty line. The R/C ratio of rice farmers in the District of Central Lampung is 2.19 during rainy season and decrease to 1.07 during dry season. The R/C ratio of rice farmers in the District of East Lampung is 1.73 during rainy season and 1.11 during the dry season. The B/C ratios of rice farming systems in all two districts in study sites of Lower Sekampung Watershed are a way below 1.00, implying that the farming system is not able to generate an adequate economic profitability for the farm households (Arifin *et al.*, 2018). The major problems in rice farming system along the Lower Sekampung Watershed is the lack of water supply and other availability issues of irrigation water as the problems of operation and maintenance (O&M), both physical and social-economic issues of irrigation infrastructures, as well as heavy sedimentation of irrigation infrastructures along the main canals as well as secondary and tertiary canals. In addition, added value of secondary and other food crops and could be significantly higher than the economic returns on rice farming activities.

42. The average land holding size of rice farmers in Indonesia is less than 0.5 hectares, leaving many in relative poverty and with limited options to diversify and become a more profitable enterprise. Government efforts to implement land reforms, including land registration and certification, and land distribution to landless farmers may contribute to

enhanced access to land. However, a holistic approach of empowerment is required that would improve the farmers' access to markets, information, technology, and finance.

3. METHODS AND FRAMEWORK

3.1 LITERATURE AND DATA

43. The study combines desk analysis, literature studies, field surveys and in-depth interviews with relevant resource persons from the government, private sector, academia, farmers associations, stakeholder groups and community organizations. A small field survey was conducted in four relevant food crop production areas.

44. A desk analysis was carried out to review the available literature and relevant previous studies on the economics of agricultural labor productivity, both in the context of macroeconomics and structural transformation, and in a microeconomic context using data from the national labor survey (Sakernas). The review also covered economic policy on food and agriculture, labor policy, and other relevant policies in the local and regional context.

45. The study included a field survey among smallholders farmers in four relevant provinces, namely North Sumatra, East Nusa Tenggara, Central Java and West Java. These provinces were purposively selected based on the characteristics of the regions and crop production performance of food commodities covered in the study. Samples were selected based on recommendation by local officials of the Ministry of Agriculture in the districts and/or provinces. Using non-probability sampling, 20-30 households were included in the sample in each district:

    a. North Sumatera: Rice in the districts of Deli Serdang and Serdang Bedagai, and orange, cabbage, tomatoes in the districts of Karo.

    b. East Nusa Tenggara: Maize in the districts of Timor Tengah and Kupang, Poultry in the districts of Kupang and Kupang City.

    c. Central Java: Soybean and maize in the district of Grobogan, and shallot and garlic in the district of Brebes.

    d. West Java: Mixed farming and aquaculture fresh water in the district of Garut and mixed farming and poultry in the district of Tasikmalaya.

3.2 METHODS OF ANALYSIS

46. The methods of analysis of both primary and secondary data collected for the study can be summarized as follows:

FARM ECONOMICS ANALYSIS

47. Farm economic analysis was employed in the study, by calculating (a) the production costs of each crop by multiplying the total use of farm inputs and their prices, (b) revenue of farming system by multiplying the estimated output and farm gate price, and (c) estimated income by subtracting the total revenue from the total costs. Therefore, the concept of (d) revenue-cost ratio (R/C ratio) could be easily calculated by dividing the total revenue from total costs, while (e) benefit-cost ratio (B/C) could also calculated by dividing the total income from total costs. Here is the brief explanation of the farm economics and cost.

    a) Production Cost (C). This is the total costs of using all inputs for farm production or simply written as follows:

    $$C = \sum Xi.\ rXi$$

    where C is production cost (in Rupiah), Xi the i-th production input and rXi the i-th input price.

    b) Revenue (R). This is the total revenue generated from selling the production or the current value of production or output of farming activities, simply written as follows:

    $$R = Q \times P$$

    where R is total revenue (in Rupiah), Q is total production output and P is the farm-gate price.

    c) Farm Income (π). Farm income is calculated by subtracting total revenue from total cost.

    $$\pi = TR - TC$$

    where Y is income, TR is total revenue and TC is total costs, where all is Rupiah.

    d) Revenue-Cost Ratio (R/C Ratio). This is usually defined by simply comparing the total revenue from total costs, or simply written as follows:

    $$R/C\ ratio = TR/TC$$

    e) Benefit-Cost Ratio (R/C Ratio). This is usually defined by simply comparing the estimated income from total costs, or simply written as follows:

    $$B/C\ ratio = \pi/TC$$

48. The profitability of crop production and/or farming systems can be assessed based on the R/C ratio and B/C ratio of each crop and/or farming system. Further profitability analysis of each crop production can differentiate the use of subsidized inputs (mostly fertilizer and seed) from the inputs purchased at the market price.

PRODUCTIVITY ANALYSIS

49. We performed productivity analysis in a macro context based on published data from the Central Agency of Statistics (BPS) and other sources, and in a micro context using the data collected from the field surveys in four provinces as well as previously collected data by the researchers. Labor productivity in agriculture here is simply defined as "value added per worker". In the micro context, we employed a more detailed calculation of "value added per working hour" from each farming system.

50. We also referred to the findings from Fuglie (2010, 2015) to discuss the Total Factor Productivity (TFP) of Indonesian agriculture.

PROFIT FUNCTION ANALYSIS

51. This is a standard profit function analysis where the input use and input price are important determinants of farm income, such as in the following equation.

$$Y_i = \alpha + X_i'\beta + Z_i'\gamma + e_i$$

where Y_i represents farm incomes, X_i' is a vector of internal households' variables such as: household size, farm land size, and level of education, Z_i' denotes a vector of policy variables such as price supports, subsidies and social assistance for agricultural households.

52. Profit function in Cobb-Douglas model is usually expressed in the production output and farm-gate price, which is normalized by a certain price, which is usually written as follows:

$$\ln \pi^* = \ln A^* + \sum_{j=1}^{m} \alpha i \ln qj^* + \sum_{j=1}^{n} \beta j \ln Zj$$

Where:

π^* = Normalized profit or farm income by the farm-gate price
A = Intercept
αi = Coefficient of input price, also normalized by farm-gate price
βj = Coefficient of fixed input
qj = Price of variable inputs, also normalized by farm-gate price
Z j = Fixed input

POLICY ANALYSIS

53. Consequences for the relationship between profitability and labor productivity are examined and simulated under some conditions, such as changes in prices of outputs and/or inputs, and changes in other sensitive and non-sensitive factors.

4. RESULTS AND DISCUSSION

4.1 INTRODUCTION

54. Results of data analyses are presented, both at macro level using the data from the Agency of Central Statistics (BPS) on standardized method of Gross Domestic Product (GDP) accounting and on employment composition and changes from the series of National Labor Survey (Sakernas). Even though BPS has now published the GDP details of 17 sectors in the economy, we are using the old classification of 9 sectors as of the GDP in 2000, simply for the consistency purposes. As mentioned briefly in previous chapter, the structural transformation of the Indonesian economy has not occurred in the last two decades (Table 7). The declining share of agricultural sector in the national GDP from 16.6 percent in 2000 to 13.2 percent in 2017 has been also associated with the declining share of agricultural employment in total employment of the country from 45.3 percent to 29.7 percent in the same period. However, the GDP share of manufacturing sector during the same period has not increased, but surprisingly declined from 23.9 percent to 22.1 percent. The phenomena of deindustrialization in the early 2000s have affected the performance of labor productivity in the country. The employment contribution of manufacturing sector to the total employment in Indonesia has increased from 13 percent in 2000 to 14.5 percent in 2017. This should imply that increasing number of labor force in manufacturing has not been translated into higher contribution to the national GDP. In other words, there have been serious issues of declining labor productivity in Indonesia, especially in manufacturing sectors, and most probably in other economic sectors. The details of increasing labor productivity in the Indonesian economy will be explained in the following sub-sections.

Table 7: The Share of Sectoral GDP and Employment to the Indonesian Economy

Sectors	PDB Contribution (%)			Employment Contribution (%)		
	2000	2010	2017	2000	2010	2017
1. Agriculture, Livestock, and Forestry	16.62	14.31	13.19	45.28	38.35	29.68
2. Mining and Quarrying	15.73	10.74	8.18	0.50	1.16	1.15
3. Manufactures	23.87	22.63	22.07	12.96	12.78	14.51
4. Electricity, Gas, and Clean Water	0.89	1.17	1.15	0.08	0.22	0.59
5. Construction	7.82	9.38	10.37	3.89	5.17	6.72
6. Trade, Hotel, and Restaurant	15.40	16.82	16.89	20.58	20.79	24.28
7. Transportation and Communication	3.65	7.50	9.56	5.07	5.19	4.86
8. Finance, Rental, and Services	6.86	8.03	9.04	0.98	1.61	3.05
9. Other Services	9.15	9.41	9.55	10.66	14.75	15.15
Total	100.00	100.00	100.00	100.00	100.00	100.00

Source: Calculated from Sakernas 2000, 2010 and 2017.

4.2 INCREASING LABOR PRODUCTIVITY

55. The average wage rate in the agricultural sector in 2017 was Rp 1.9 million per month, the lowest in the economy, in contrast with the wage rate in mining and quarrying sector which was Rp 4.4 million per month, the highest in the economy. The wage rate in manufacturing sector has increased from Rp 1.2 million per worker per month in 2000 to Rp 2.5 million per worker per month in 2017. In general, wage rates have nearly doubled, which would be driven by the level of economic development and inflation during the last 17 years.

Table 8: Average Wage Rate by Sector in 2000, 2010 and 2017 (Rp/worker/month)

Sectors	2000	2010	2017
1. Agriculture, Livestock, Forestry	241,724	945,728	1,936,813
2. Mining and Quarrying	699,669	2,387,778	4,374,756
3. Manufacturing	408,509	1,176,612	2,544,264
4. Electricity, Gas, Clean Water	660,115	1,757,994	3,886,441
5. Construction	431,692	1,302,241	2,370,966
6. Trade, Hotel, and Restaurant	418,565	1,067,812	2,142,618
7. Transportation, Communication	532,124	1,438,353	3,005,767
8. Finance, Rental, and Services	732,330	1,957,823	3,722,759
9. Other Services	567,638	1,688,410	3,052,498

Source: Calculated from Sakernas 2000, 2010 and 2017

56. In general, labor productivity in Indonesia has experienced a significant increase during the period of 2000 to 2017. We calculate labor productivity using the added value of the sectoral GDP divided by the number of workers in each sector, using current prices and constant 2010 prices, presented in Table 9 below. For further analysis and comparison, 2010 constant prices are used. Overall, labor productivity in Indonesia has increased from Rp 45.5 million in 2000 to Rp 78.8 million in 2017. The "usual tradable sectors" such as agriculture and manufacturing have experienced a significant increase in labor productivity. Labor productivity in agriculture has increased from a very low Rp 16.7 million in 2000 to Rp 35.0 million, and that in manufacturing sector has increased from Rp 83.9 million in 2000 to Rp 119.8 million in 2017. However, a decrease in labor productivity occurred in the mining and quarrying sector, in electricity, gas and clean water, and in finance, rental and services. Despite the growth trajectory, labor productivity in agriculture remains the lowest of all sectors in absolute terms (Figure 2).

Table 9: Labor Productivity by Sector both in Current and Constant Price of 2010

Sectors	Productivity (Constant Price in 2010, Rp million)			Productivity (Current Price, Rp million)		
	2000	2010	2017	2000	2010	2017
1. Agriculture, Livestock, Forestry	16.72	23.04	34.99	5.33	23.04	49.71
2. Mining and Quarrying	1,423.79	572.44	562.35	371.06	572.44	741.78
3. Manufacturing	83.91	109.43	119.77	33.12	109.43	156.02
4. Electricity, Gas, and Clean Water	516.17	334.93	152.77	118.84	334.93	239.97
5. Construction	91.50	112.09	121.41	21.90	112.09	173.27
6. Trade, Hotel, and Restaurant	34.08	49.98	54.79	12.14	49.98	73.35
7. Transportation Communication	32.84	89.24	154.83	14.28	89.24	212.65
8. Finance, Rental and Services	317.86	308.73	233.24	130.82	308.73	321.95
9. Other Services	39.11	39.40	49.65	13.55	39.40	72.69
Total	**45.54**	**61.77**	**78.75**	**15.47**	**61.77**	**107.95**

Source: Processed from Sakernas 2000, 2010 and 2017.

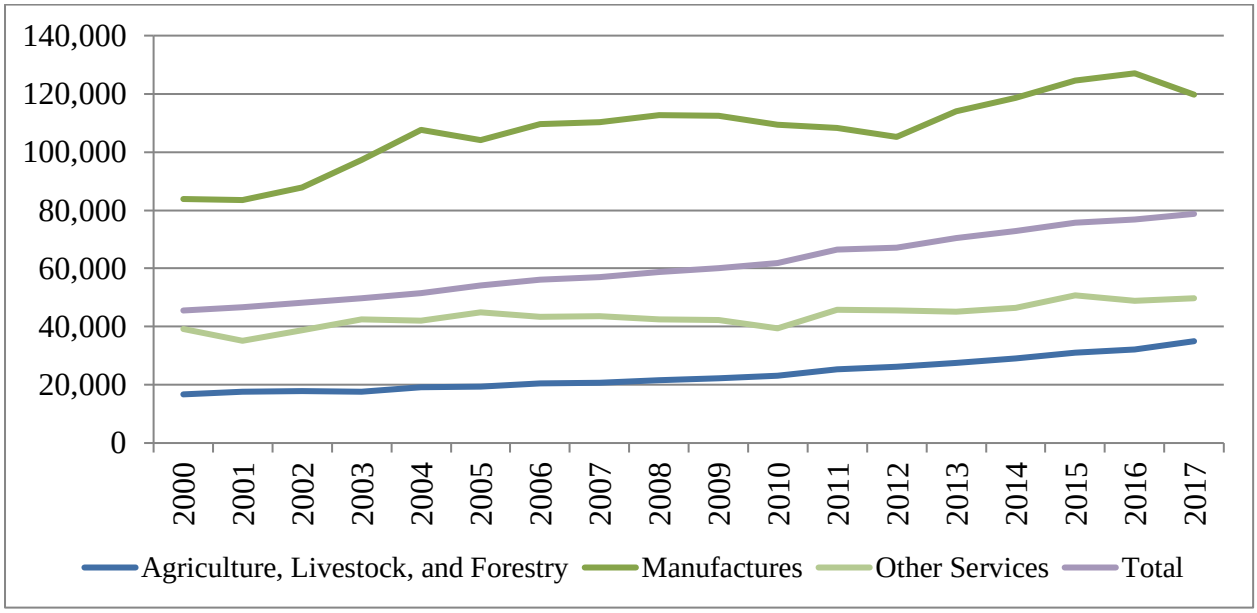
57. The growth rate of agricultural labor productivity was relatively high. At 4.5 percent per year in the 2000-2017 period, it exceeded the growth rate of labor productivity of manufacturing (2.2 percent), construction, finance and rental services (-1.0 percent) and other services (1.6 percent). This performance is largely due to the positive growth in output and value added of agricultural sector combined with negative growth of employment in agriculture (Table 10).

Table 10: Rate of Growth of Agricultural Productivity in the period of 2000-2017 (%)

Sectors	Labor Productivity Growth (% in Constant Price)		
	2000-2009	2010-2017	2000-2017
1. Agriculture, Livestock, Forestry	3.30	5.82	4.49
2. Mining and Quarrying	-5.00	-0.44	-2.85
3. Manufactures	3.41	0.89	2.22
4. Electricity, Gas, Clean Water	-0.86	-8.38	-4.40
5. Construction	1.91	1.85	1.88
6. Trade, Hotel, and Restaurant	3.84	1.94	2.95
7. Transportation, Communication	9.26	10.24	9.72
8. Finance, Rental, and Services	1.83	-4.14	-0.98
9. Other Services	1.09	2.23	1.63
Total	**3.13**	**3.46**	**3.29**

Source: Calculated from Sakernas 2000-2017.

Figure 2: Labor productivity in agriculture and other sectors, 2000-2017



Source: Calculated from Sakernas 2000-2017.

4.3 DECLINING EMPLOYMENT IN AGRICULTURE

58. Structural transformation in the Indonesian economy is characterized, among other things, by a declining share of employment in agricultural sector. Total employment in agriculture was 40.7 million (45.3 percent of total employment) in 2000 and declining to 35.9 million (29.7 percent of total employment) in Indonesia (Table 11). All other sectors from mining, manufacture, electricity, trade and other services experienced a significant increase in employment.

Table 11: Sectoral Shifting of Employment, 2000, 2010 and 2017

Sectors	Employment (thousand)		
	2000	2010	2017
1. Agriculture, Livestock, and Forestry	40,677	41,495	35,925
2. Mining and Quarrying	452	1,255	1,387
3. Manufactures	11,642	13,824	17,559
4. Electricity, Gas, and Clean Water	71	234	717
5. Construction	3,497	5,593	8,137
6. Trade, Hotel, and Restaurant	18,489	22,492	29,382
7. Transportation and Communication	4,554	5,619	5,883
8. Finance, Rental, and Services	883	1,739	3,694
9. Other Services	9,574	15,956	18,340
Total	**89,838**	**108,208**	**121,022**

Source: Calculated from Sakernas 2000, 2010 and 2017.

59. Breaking down the period of employment decline and economic growth between 2000 and 2017, the analysis reveals some important dynamics. First, the decline rate of employment in agriculture was recorded at -1.8 percent per year in the period 2010-2017, which was much faster from the rate of -0.7 percent per year in the period of 2000-2017. If such a declining employment in agriculture is dominated by a *push-factor*, where the rural labor and other people involved in agriculture are forced to seek employment in the city, low-wage pay in the manufacturing sector, informal sectors and others, the structural transformation does not contribute much to the development process. However, if such a declining employment in agriculture is dominated by a *pull-factor*, the labor force previously involved in agriculture or residing in rural area have moved to manufacturing sector and other service sectors in urban area because of their higher skill and better education. Such a structural transformation contributes to agricultural development or economic development in general.

60. The growth of employment in the manufacturing sector showed a positive rate of 4.10 in the period of 2010-2017, which was significantly higher than the employment growth of the sector in the period 2000-2017. Other sectors of the economy have experienced positive growth rates of employment, except transportation and communication sector in the period of 2010-2017, which was associated with the output performance of the sector. Employment growth in electricity, gas, and clean water has recorded the highest growth rate of 17.8 percent in the period of 2000-2017 (Table 12). Overall, the growth rate of employment in the Indonesian economy was 1.8 percent in the period of 2000-2017, which is consistent with increasing number of labor force in all sectors.

Table 12: Growth of Employment by Sector, 2000-2017 (%)

Sectors	Growth of Employment by Sector (%)		
	2000-2009	2010-2017	2000-2017
1. Agriculture, Livestock, and Forestry	0.31	-1.79	-0.68
2. Mining and Quarrying	16.30	2.75	9.92
3. Manufactures	1.17	4.10	2.55
4. Electricity, Gas, and Clean Water	18.58	16.85	17.76
5. Construction	5.29	5.32	5.31
6. Trade, Hotel, and Restaurant	2.08	3.72	2.85
7. Transportation and Communication	3.40	-0.32	1.65
8. Finance, Rental, and Services	7.01	12.78	9.72
9. Other Services	4.53	3.62	4.11
Total	**1.74**	**1.82**	**1.78**

Source: Calculated from Sakernas 2000-2017.

61. Labor productivity varies considerably between agricultural subsectors. We use two measurements of labor productivity, first in terms of added value (GDP) per workers and second, in terms of added value (GDP) per adjusted full-time worker. Overall agricultural labor productivity in 2010 was Rp 23 million added value per worker and Rp 29.7 added values per full-time adjusted worker. These numbers were far lower than the labor productivity in non-agricultural sector, amounting of Rp 85.9 million (Table 13). The

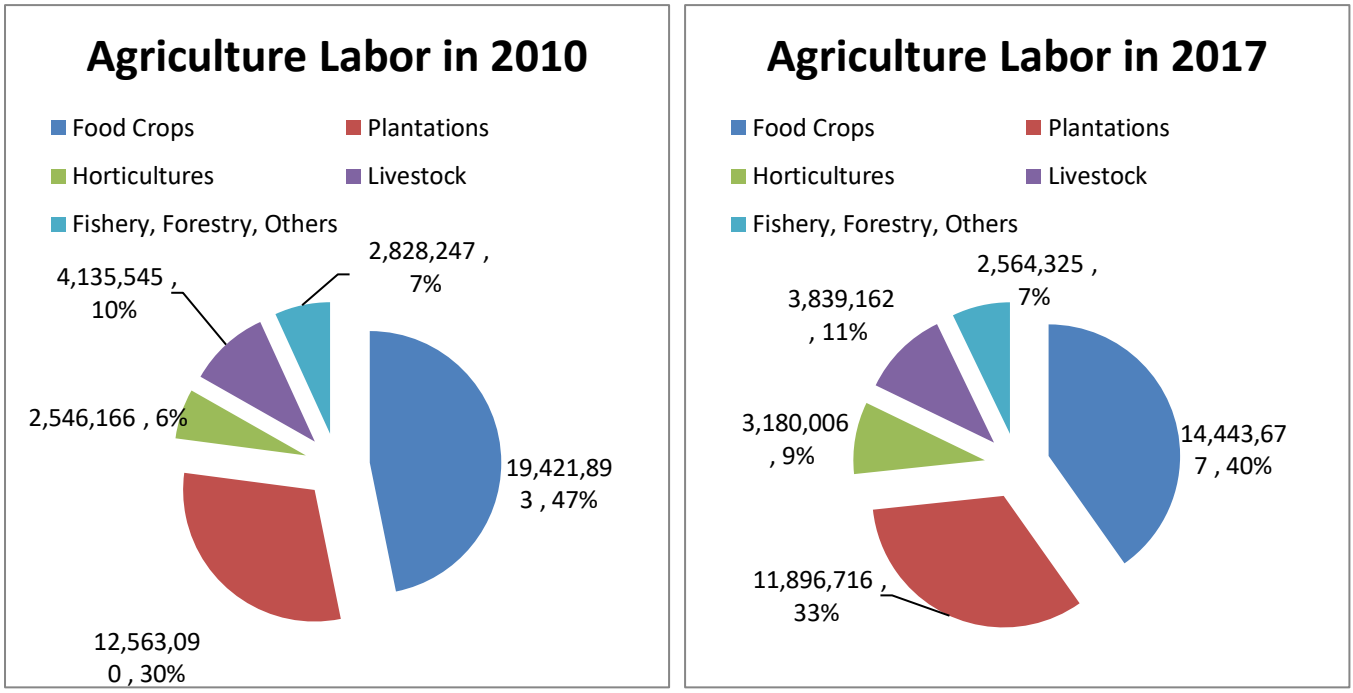
lowest agricultural productivity in agriculture is on food crop sub-sector, gaining only Rp 13 million per worker or Rp 17.8 million per full-time adjusted worker; while the highest agricultural productivity was forestry, generating added value of Rp 99.4 million per worker and Rp 109.2 million per full-time adjusted worker. Some agriculture labor has shifted from the food crops subsector to plantations and horticulture, and to a lesser extent livestock (Figure 3).

Table 13: Agricultural Labor Productivity (Regular, Per full-time Adjusted) in 2010

Sectors	Annual Labour Productivity, (GDP/ Number of Workers) Rp	Annual Full-time Adjusted Productivity (Rp) [1)]	Productivity Per day (sakernas) Rp	Productivity per day (full-time) Rp
Agriculture	**23,041,838**	**29,685,241**	**88,622**	**114,174**
Food Crops	13,043,353	17,139,241	50,167	65,920
Plantations	21,348,832	27,004,099	82,111	103,862
Horticultures	43,357,464	54,158,943	166,759	208,304
Livestock	26,211,757	41,050,815	100,814	157,888
Mix Farming and Agricultural Services	38,225,952	45,185,927	147,023	173,792
Forestry	99,425,947	109,211,133	382,407	420,043
Fishing	76,579,962	72,776,389	294,538	279,909
Non Agricultural	**85,853,957**	**75,117,651**	**330,208**	**288,914**
Mining and Quarrying	572,441,632	503,483,598	2,201,699	1,936,475
Manufactures	109,428,048	98,226,410	420,877	377,794
Electricity, Gas, and Clean Water	334,932,285	300,800,224	1,288,201	1,156,924
Construction	112,089,566	94,958,317	431,114	365,224
Trade, Hotel, and Restaurant	49,982,074	41,151,487	192,239	158,275
Transportation and Communication	89,236,792	71,971,591	343,218	276,814
Finance, Rental, and Services	308,727,578	276,242,298	1,187,414	1,062,470
Other Services	39,401,769	38,503,840	151,545	148,092
Total	**61,767,098**	**61,625,472**	**237,566**	**237,021**

Source: Calculated from Sakernas 2010, August round.

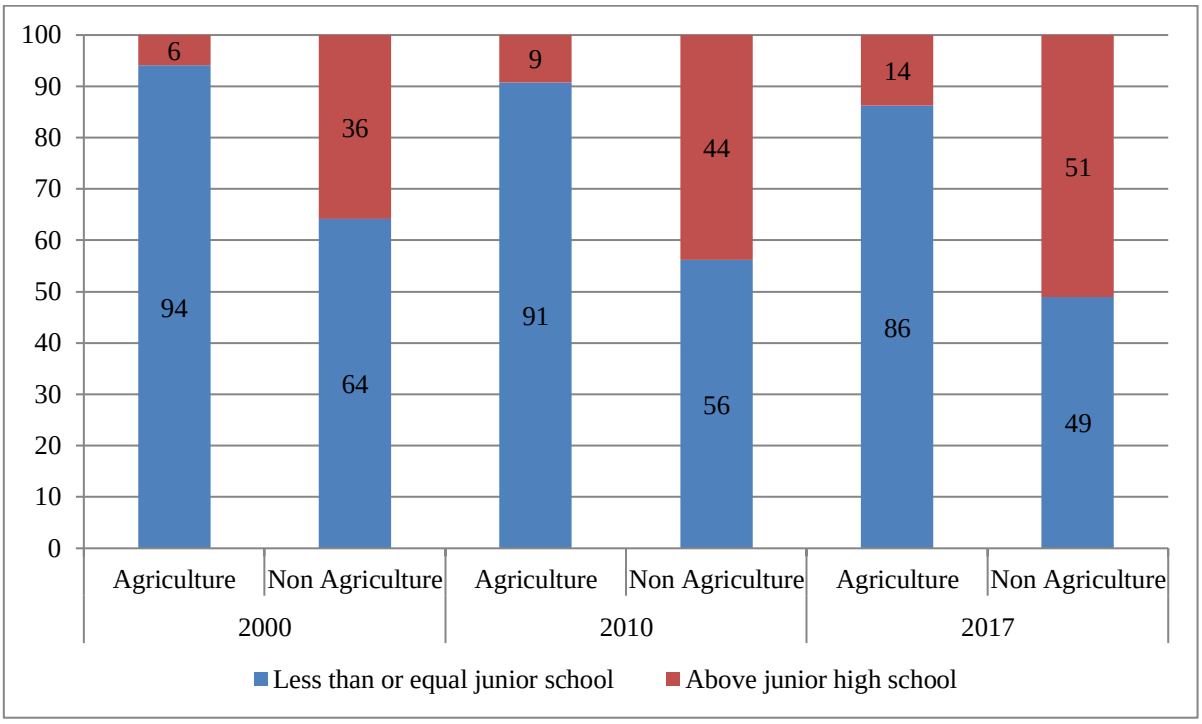
Figure 3: Number of agricultural workers (and share in agriculture sector) by subsector



Source: Processed from SAKERNAS (2017)

62. **The level of education among the agriculture labor force is low**. In 2000, 94 percent of the labor force in agriculture had an educational attainment of junior high school or lower, while the remainder of the labor force was educated above the level of junior high school (Figure 4). In that same year, 63 percent of non-agriculture workers were educated at junior high school or lower. While the proportion of post junior high school educated agricultural workers increased by 2017 to 14%, the education gap between agriculture and non-agriculture widened, with 51% of the non-agricultural work force being educated above junior high. However, this may be partly explained by the ageing farmer population.

Figure 4: Sectoral Employment by Educational Attainment (%)



Source: Calculated from Susenas 2000, 2010 and 2017

4.4 SOURCE OF GROWTH IN INDONESIAN AGRICULTURE

63. The growth in Indonesian agricultural Total Factor Productivity (TFP) has been lower than growth in either land or labor productivity. Table 14 provides a summary of findings on productivity measures for the agricultural economy of Indonesia as a whole over the past five decades and for the entire 1961-2015 period. The first two columns of results show average annual growth rates of total agricultural outputs and inputs and the remaining columns indicate growth rates in three measures of productivity: changes in TFP, labor productivity and land productivity. The average growth rate of Indonesia's agricultural output steadily increased since 1960 through 1990 from 3.06% to 4.54% but then fell during 1991-2000 to 2.37%. The growth started to pick up during 2001-2015 at double the rate compared to the previous period. Until 1990, the source of output growth was being primarily input-driven. Nonetheless, from 1991 onward the source of agricultural growth became productivity-driven. Annual growth in total inputs fell from 2.4% in the 1960, to between 1.62% and 1.69% in the 1990s and 2000s. Productivity thus compensated the declining growth in input to keep output growth from falling. The fact that growth in agricultural TFP has been lower than growth in either land or labor productivity indicates an intensification of capital and material inputs in agriculture, which eventually stimulate labor and land productivity but less so TFP. Agricultural TFP experienced the falling during 1961-2000 before rising remarkably since 2001 from

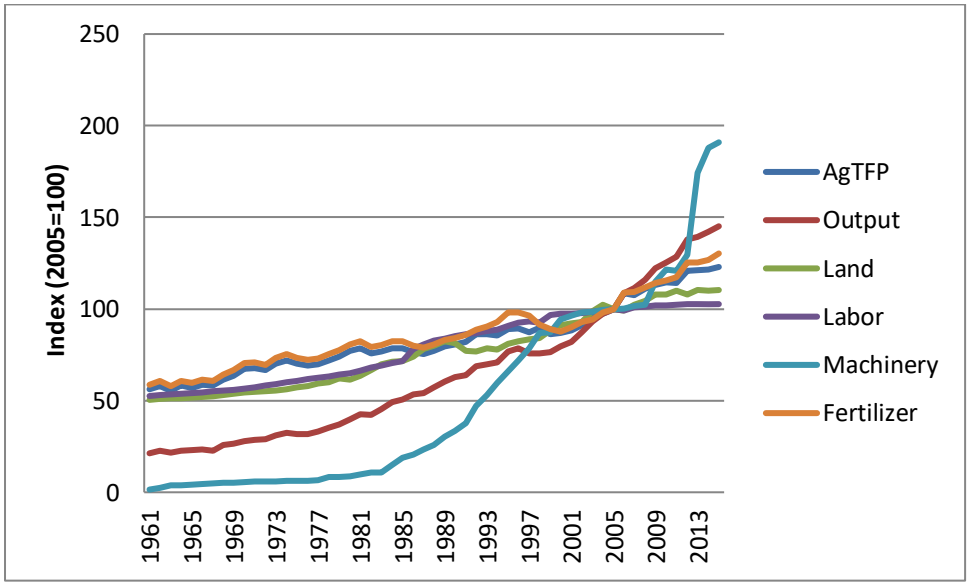
0.75% to 2.32%. This reflects the fact that during this period Indonesian agriculture used its factors of production more efficiently compared to the preceding decade.

Table 14: Productivity Indicators for Indonesia's Agriculture (average annual growth rate in percent)

Period	Gross Output	Total Input	Total factor productivity	Output/worker	Output/hectare of land
1961-1970	3.06	1.02	2.04	2.43	2.38
1971-1980	3.52	2.16	1.37	2.19	2.40
1981-1990	4.54	4.12	0.42	1.88	1.79
1991-2000	2.37	1.62	0.75	1.12	1.36
2001-2015	4.01	1.69	2.32	3.76	2.81
1961-2015	*3.556*	*2.10*	*1.45*	*2.41*	*2.20*

Source: Author's calculation from Fuglie (2015)

Figure 5: Indonesia Agriculture Productivity Index



Source: Derived from Fuglie (2015)

64. Among agricultural inputs, the importance of machinery/mechanization shows a significant rise since 1960 (Figure 5 and Table 15). Fertilizer demonstrates low average annual growth rates during 1980s and 1990s, followed by a slight upward trend which can be attributed to the fertilizer subsidy provided by the government. As for labor, the average growth rate significantly diminished from 2.74% in 1980s to 0.35% in 2000s. This confirms the findings of a study by Malian et al. (2004) and *Badan Penyuluhan dan Pengembangan Sumberdaya Manusia Pertanian* (Susilowati, 2014), that labor force in rural area has been declining during the last two decades.

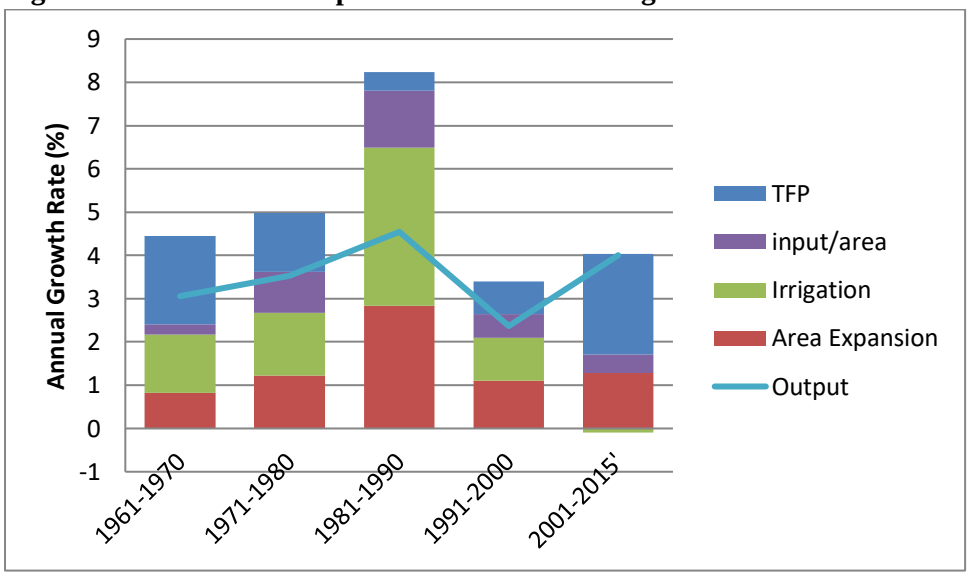
Table 15: Indonesia's agricultural productivity average annual growth rate in percent

Period	Output	TFP	Land	Labor	Fertilizer	Machinery
1961-1970	3.06	2.04	0.83	0.79	2.04	15.00
1971-1980	3.52	1.37	1.22	1.41	1.37	4.33
1981-1990	4.54	0.42	2.84	2.74	0.42	13.43
1991-2000	2.37	0.75	1.10	1.31	0.40	10.34
2001-2015	4.00	2.32	1.29	0.35	2.64	4.69

Source: Author's calculation from Fuglie (2015)

65. To identify what accounts for better TFP results during the period 2001-2015, we need to decompose the growth of agriculture as depicted in Figure 6 below. Growth of agriculture output is composed of total input use and total factor productivity. Total input use can be distinguished further into input intensification (total input/land area of agriculture) and area expansion (including quality change). To incorporate the quality change into the land calculation, Fuglie (2015) assigns land weights to three types of land (irrigated=2.9933, rainfed cropland=1 and pasture=0.0566) creating "rainfed cropland equivalents".

Figure 6: Resource Decomposition of Indonesian Agriculture Growth



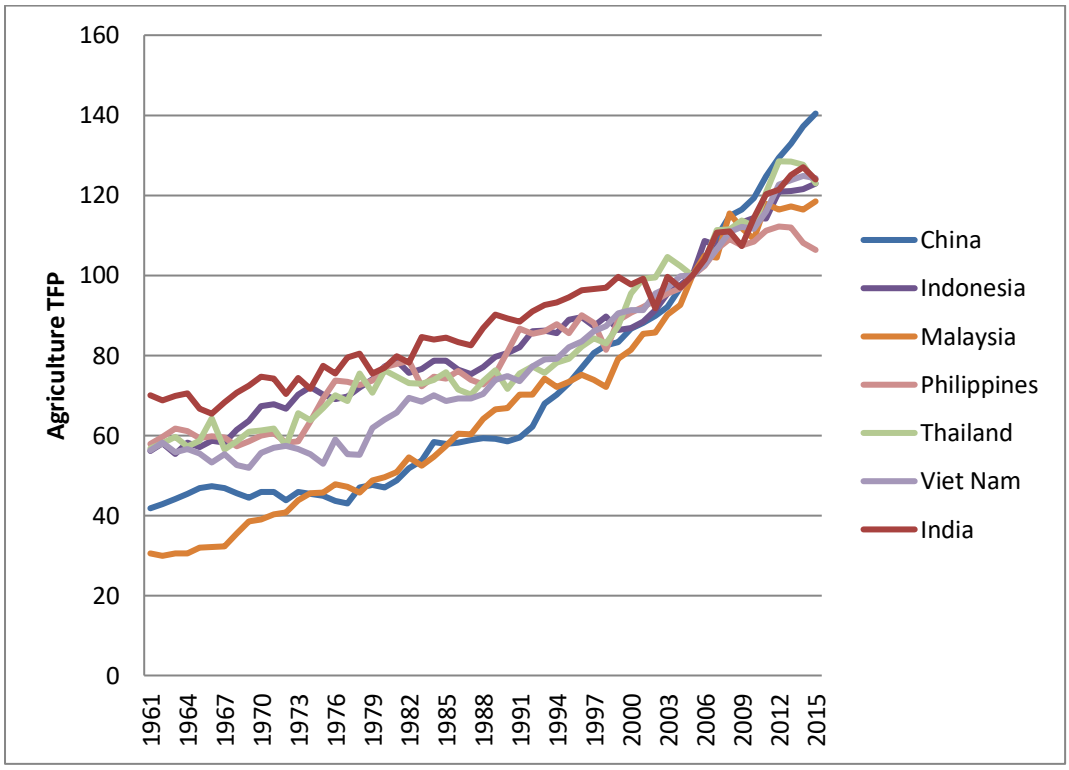
Source: Fuglie[4] (2014)

[4] Fuglie, K. 2014. Total Factor Productivity in Agriculture: Taking Water into Account. International Workshop on "Going beyond agricultural water productivity". World Bank. Washington DC. December 8-9, 2014.

66. Resource decomposition of agricultural growth shows that TFP became the major source of agricultural growth in Indonesia in the last decade. Area expansion is the second driver in agricultural output growth. Based on the land-weight assignment by Fuglie, rainfed cropland dominates the agriculture land, however the growth in the past few years has stagnated.

67. China's and Malaysia's agriculture TFP grew more rapidly than other countries in the region, including Indonesia (Figure 7 and Table 16). Except Malaysia, all of these countries experienced a downfall of TFP growth rate during 1980s, but China demonstrated its productivity performance by rising at double digit growth rates. It implies that China's output growth became increasingly driven by the improvement of immaterial values such as technology change, knowledge and skills compared to peer Asian countries. China is also known as one of the largest agricultural producers (China has by far the largest agricultural sector in the world, accounting for 24% of gross agricultural output in 2013 according to FAO). Philippines, Thailand and India exhibit a slightly decrease in TFP growth rate in the past decade.

Figure 7: Agricultural total factor productivity of some Asian countries



Source: Derived from Fuglie (2015)

Table 16: Agricultural total factor productivity average annual growth rate of selected Asian countries (percent)

Period	China	Indonesia	Malaysia	Philippines	Thailand	Viet Nam	India
1961-1970	1.03	**2.04**	2.75	0.39	0.87	-0.12	0.71
1971-1980	0.24	**1.37**	2.41	2.51	2.18	1.40	0.30
1981-1990	2.20	**0.42**	2.98	0.49	-0.62	1.71	1.48
1991-2000	3.93	**0.75**	1.98	1.14	2.86	2.00	0.92
2001-2015	3.22	**2.32**	2.50	1.13	1.69	2.06	1.59

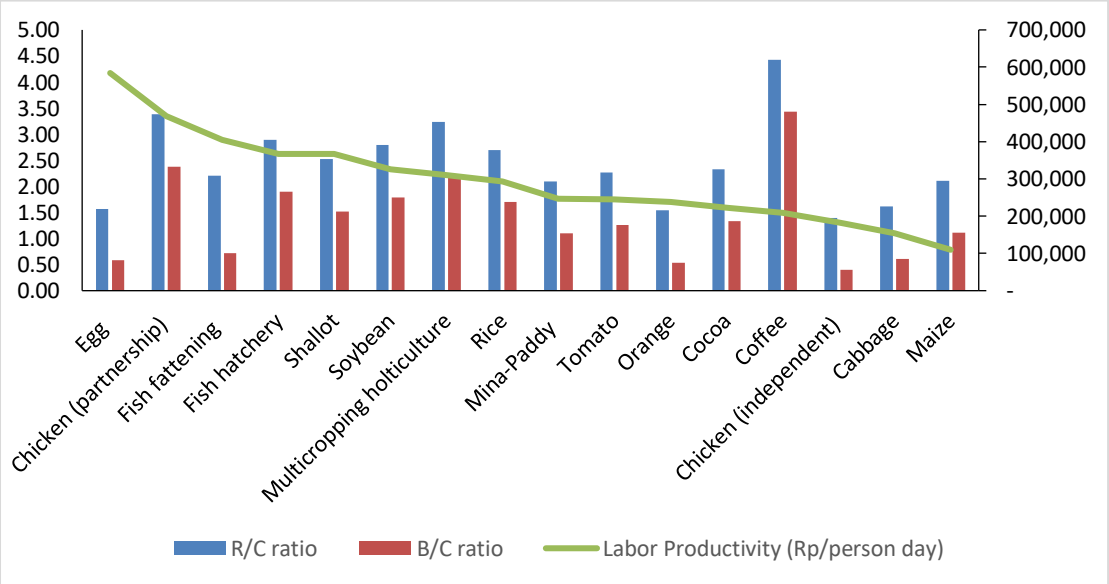
Source: Author's calculation from Fuglie (2015)

4.5 FARM PROFITABILITY AND LABOR PRODUCTIVITY

68. Agricultural labor productivity is critical for the welfare of the rural population and for long term economic growth and structural change. The analysis presented below is based on data collected during a small survey aims to provide an improved understanding of farm and crop level profitability and productivity and broaden the discussion beyond physical yield as a measure of productivity.

69. Farm profitability and labor productivity is analyzed using R/C ratio and B/C ratio, whilst the labor productivity of each commodity is defined as value added of the studied commodities (excluding cost of labor) divided by the total person-days employed in a year. Figure 8 summarizes the R/C ratio, B/C ratio and labor productivity of the 16 commodities that were studied, using survey data from four provinces, except coffee and cocoa. All data presented have been annualized. Data on coffee and cocoa were obtained from previous studies. Given the small sample size and the non-probability sampling method, the sample is not representative of the population.

Figure 8: Profitability and Labor Productivity of Selected Commodities



Source: Processed from field-survey data and secondary data

70. Labor productivity does not necessarily converge with the level of profitability of each commodity. Coffee, for instance, although it exhibits relatively high profitability, its labor productivity is not as high as expected. From the perspective of profitability, three commodities appear to stand out: broilers (partnership model), coffee, and multi-cropping horticulture farming system.

FOOD CROPS: RICE, MAIZE, AND SOYBEAN

71. In general, production of food crops generates profitability, as shown by the R/C ratio being greater than 2.0 and B/C ratio greater than 1.0 for rice, maize, and soybean. The average land productivity (yield) of rice in the study sites in North Sumatra is 5.1 ton/ha, about similar to the national average of 5.2 ton/ha. The land productivity of maize in East Nusa Tenggara is 2.24 ton/ha, which is much lower than the national average of 4.5 ton/ha. Maize farmers in Nusa Tenggara do not use certified seeds and rarely apply chemical fertilizer due to the remoteness of the study sites and limited access of poor maize farmers. Land productivity of soybean in Central Java is 2.31 ton/ha, far higher than the national average of 1.5 ton/ha. The sample sites of Grobogan District and the vicinity are the soybean production centers of the Province, where government programs such as high-yielding seed, farmers' empowerment for good agricultural practices (GAP) etc. are frequently allocated to the soybean farmers.[5]

72. Smallholder farmers in Indonesia use less than one hectare for food crop production. Survey respondents reported land holding sizes for rice, maize, and soybean of 0.58 hectare, 0.79 hectare, 0.75 hectare respectively. This number is consistent with the national farmers' panel survey (Patanas). Rice yields in North Sumatera are 5,000 to 5,750 Kg/Ha. The farm-gate price of rice received by farmers ranges from Rp 4,500 to Rp 5,000 per kilogram and total revenue received by farmers is about Rp 24.1 million. The total cost of rice production in the study was reported at Rp 9.3 million, mostly for labor costs and land rental, so that the estimated profit or farm income is Rp 14.8 million. The ratio between revenue and costs of rice production results in R/C ratio of 2.7, which means that every Rp 1 of input will produce an output of Rp 2.7. This shows that rice farming in North Sumatra is worth cultivating or providing financial benefits. The estimated profit of 14.8 million per hectare is much higher than the recent estimates of farm cost structure (SOUT) by BPS, suggesting the profit of Rp 4.95 million per hectare.

[5] The government has allocated Rp 15 trillion for the "Special Efforts to Increase the Production of Rice, Maize and Soybean" (*Upsus Pajale*), with the goal to achieve self-sufficiency in these commodities. This includes providing subsidies for fertilizer, seeds, tractors, and other activities to empower smallholder farmers, even involving military personnel in rural areas (*Babinsa*) in addition to the regular agricultural extension agents.

Table 17: Profitability of Food Crops (Rice, Maize, and Soybean) –per hectare basis

Commodities	Land Size (Ha)	Production (ton/ha)	Revenue (Rp)	Total Cost (Rp)	Profit (Rp)	Value Added (Rp)	Labor (HOK)	R/C ratio	B/C ratio	Labor Productivity (Rp/person day)
Rice Research area: North Sumatera Respondent: 29	0.58	5.10	24,148,121	9,350,487	14,797,634	21,102,430	93	2.7	1.7	293,838
Maize Research area: East Nusa Tenggara Respondent: 42	0.79	2.25	10,268,254	5,439,003	4,829,250	7,767,010	78	2.11	1.11	109,775
Soybean Research area: Central Java Respondent: 24	0.75	2.31	15,915,711	6,178,428	9,737,283	14,183,900	51	2.79	1.79	325,744

Source: Calculated from field-survey data

73. The profitability of maize farming in Nusa Tenggara Timur (NTT) is Rp 4.8 million, calculated from the total revenue of Rp 10.3 after a deduction of Rp 5.4 million, producing an R/C ratio of 2.11 and a B/C ratio of 1.11. The total cost of maize production in the survey sites is low mostly because local farmers in NTT do not use an intensive system, only applying low levels of fertilizer, pesticides, and limited modern varieties of seed. Maize yields of 2.25 ton per hectare fall within the range of Patanas data of 2.2 – 3.0 ton/ha. The profitability of soybean farming in Central Java was Rp 9.7 million hectares, which is generating an R/C ratio of 2.8 and a B/C ratio of 1.8. The B/C ratio implies that for every Rupiah spent for input will generate profit of Rp 1.8 from soybean farming.

74. Comparing these three major food crops, total labor allocation in soybean farming is the lowest, only 51 person-working days, compared to that in maize farming of 78 person-working days (HOK), and that in rice farming of 93 person-working days (HOK). These differences have contributed to labor productivity results for each crop, where labor productivity in soybean is the highest, followed by rice and maize. The labor productivity value of soybean is Rp 325.755 per person per day, while maize and rice have a value of labor productivity Rp 109,775 and Rp 293,838, respectively. The value of labor productivity of Rp 325,744 indicates that every labor force involved in soybean farming system has contributed to the value-added of Rp 325,744 of the soybean farming.

CASH CROPS: COFFEE AND COCOA

75. The profitability of cash crops is generally higher than food crops, although the farming system is generally not intensive. Coffee and cocoa are two of the ten main Indonesian export commodities, according to the Indonesian Ministry of Trade. As important export commodities, the production of both commodities is important to Indonesia's trade

balance while at the same time increasing the welfare of coffee and cocoa farmers. Based on survey results, the average land ownership of coffee in Lampung Province is 1.43 hectare, generating yields of around 523 kg/ha (Table 18). Profitability of coffee farming takes into account all real costs, including labor costs both family labor and hired labor, a total of Rp 6.6 million per hectare per season. The values for the R/C and B/C ratios are 4.43 and 3.43 respectively, implying that coffee farming is profitable and contributing not only to the household economy, but also the regional economy of the province.

Table 18: Profitability of Cash Crops (Coffee and Cocoa) –per hectare basis

Commodities	Land Size (Ha)	Production (ton/ha)	Revenue (Rp)	Total Cost (Rp)	Profit (Rp)	Value Added (Rp)	Labor (HOK)	R/C ratio	B/C ratio	Labor Productivity (Rp/person day)
Coffee Research area: Lampung Respondent: 390	1.43	522.92	8,721,395	2,081,392	6,640,003	7,961,672	42	4.43	3.43	209,070
Cocoa Research area: West Sulawesi Respondent: 47	0.97	714.65	11,973,680	5,535,843	6,437,836	10,469,736	89	2.33	1.33	222,477

Source: Calculated from Nuryartono *et al* (2017) and Arifin *et al* (2016)

76. The performance of cocoa farming in the study sites of West Sulawesi is higher than coffee in Lampung, despite the smaller land holding size of the farm households. The cocoa yield at the farm level was 715 kg/ha (Table 18), generating revenues of Rp 12 million. The production costs incurred (including labor costs in the family) of Rp 5.5 million, therefore the profit of cocoa farming practices was Rp 6.4 million. The values of R/C ratio and B/C ratio were 2.33 and 1.33 respectively, implying that cocoa farming is profitable and generating labor productivity of Rp 222,477, which is higher than that of coffee of Rp 175,222.

HORTICULTURE: ORANGE, TOMATO, CABBAGE, SHALLOT

77. Field survey data indicate that the average land size for the production of horticultural commodities such as oranges, tomatoes, cabbage, and shallots is 1.12 Ha; 0.26 Ha; 0.64 Ha; and 0.23 Ha respectively. Orange yields reach 7.5 tons/ha. Tomato yields are 18.2 tons/ha, which is consistent with the data released by the MoA (which reaches around 20 tons/ha). Cabbage yields are 4.2 tons/ha and shallot yields are 9.3 tons/ha, consistent with the data released by the MoA (9.31 tons/ha). The average price at the farm level for Oranges is around IDR 6,600 / kg, Tomato at IDR 5,400 / kg, Cabbage at IDR 2,400 / kg and Shallot at IDR 11,400 / kg. So, the profit per/ha/season of orange farming is IDR 15 million, tomatoes are IDR 52.6 million, cabbage is IDR 4.2 million, and Shallot is IDR 53.3 million.

Table 19: Profitability of Horticulture (Orange, Tomato, Cabbage, Shallot) –per hectare

Commodities	Land Size (Ha)	Production (ton/ha)	Revenue (Rp)	Total Cost (Rp)	Profit (Rp)	Value Added (Rp)	Labor (HOK)	R/C ratio	B/C ratio	Labor Productivity (Rp/person day)
Orange Research area: North Sumatera Respondent: 10	1.12	7.60	50,333,333	35,264,555	15,068,778	28,272,153	150	1.54	0.54	238,817
Tomato Research area: North Sumatera Respondent: 10	0.26	18.29	99,533,185	46,918,060	52,615,125	80,447,089	353	2.26	1.26	244,897
Cabbage Research area: North Sumatera Respondent: 7	0.64	4.27	10,438,776	6,241,529	4,197,246	7,900,058	53	1.61	0.61	153,954
Shallot Research area: Central Java Respondent: 26	0.23	9.30	106,289,327	53,001,985	53,287,341	69,493,750	269	2.52	1.52	366,229

Source: Calculated from field-survey data

78. R/C ratio analysis shows that all commodities have ratios greater than one. Shallots have the highest R/C ratio of 2.52, tomato and cabbage have R/C ratio of 2.26 and 1.61. Oranges have the lowest R/C ratio among the commodities analyzed, namely 1.54. Labor productivity for shallot production is relatively high with IDR 366,229. This can be partly explained by relatively low labor requirements. Labor productivity for tomato, oranges and cabbage are IDR 244,897/ day/person, IDR238,817/day/person, and IDR 153,954/day/person respectively.

POULTRY: CHICKEN/BROILERS AND EGGS

79. An interesting result from data and analysis of poultry, where chicken from partnership farmers has very high profitability compared to chicken and egg from independent farmers. Based on the survey results, the R/C ratio of chicken farming under a partnership arrangement is 3.38 while independent chicken farming has an R/C ratio of 1.4. The biggest cost for poultry farming is the cost of feed. Under a broiler partnership model, farmers do not pay any feed costs since it is provided by the partner companies who are the off-takers, while independent farmers spend themselves on the feed costs. These results are consistent with the farming of laying hens for eggs where the R/C ratio is not much different from that of independent broiler farming, which is 1.57.

Table 20: Profitability of Poultry (Chicken and Egg) –per m3 volume

Commodities	Volume (m)	Production/100m (ton/ha)	Revenue/100m (Rp)	Total Cost/100m (Rp)	Profit (Rp)	Value Added (Rp)	Labor (HOK)	R/C ratio	B/C ratio	Labor Productivity (Rp/person day)
Chicken (independent) Research area: Kupang (NTT) Respondent: 6	120	1,825	33,216,666.7	22,158,666.7	11,058,000	14,408,000	67	1.4	0.4	183,554
Chicken (partnership) Research area: Kupang (NTT) Respondent: 14	220	3,550	63,892,714.3	19,322,857.1	44,569,857	50,362,714	118	3.38	2.38	467,975
Egg Research area: Tasikmalaya (West Java) Respondent: 7	720	12,384	263,185,071	203,455,386	59,729,685	66,906,953	126	1.57	0.59	584,320

Source: Calculated from field-survey data

80. Labor productivity for broiler partnership farming reaches IDR 467.975 / day / person with the production of 3,550 Kg of chicken/farming cycle or about 2 months. The productivity of independent chicken farmers is about IDR 183,554 / day / person and produces 1,825 kg of chicken. Compared to broilers, egg production achieves a higher labor productivity of IDR 584,320 / day / person. This is due to the relatively high volume and value of eggs produced, reaching 12,384 kg in 2 months with a selling price of around Rp 20,000 - Rp 23,000 / kg.

AQUACULTURE (FATTENING AND HATCHERY)

81. The survey results show that profitability of a fish hatchery is higher than fish farming (fattening). The R/C of a fish hatchery is 2.89 with an average revenue of IDR 18.7 million / season and average total cost of IDR 7 million / season so the average value of profit reaches IDR 11 million / season. Fish farming achieves an R/C ratio of 2.21 with an average revenue of IDR 5.6 million / season and an average total cost of IDR 2 million / season.

Table 21: Profitability of Aquaculture (Fresh water: Fattening and Hatchery) –per m3

Commodities	Volume (m)	Production/100 m	Revenue/100m (Rp)	Total Cost/100m (Rp)	Profit	Value Added	Total HOK	R/C ratio	B/C ratio	Labor Productivity (Rp/person day)
Fish fattening Research area: West Java Respondent: 15	2,338.2	721.77	5,645,011	2,054,391	3,590,620	3,951,594	7	2.21	0.72	405,591
Fish hatchery Research area: West Java Respondent: 14	1,435.7	692.67	18,756,046	7,097,232	11,658,814	12,967,032	36	2.89	1.9	366,468

Source: Calculated from field-survey data

82. The results for labor productivity show that fish farming has a slightly higher labor productivity at IDR 405,591 / day / person compared to IDR 366,468 for the fish hatchery. The amount of labor on fish farming is 7 mandays/harvest cycle mainly for feeding and other maintenance. Labor requirements for a fish hatchery are more demanding, especially during spawning or mating sires. In one harvest cycle the fish hatchery requires an average of 36 person days.

MIXED FARMING: MINA-PADDY, HORTICULTURE

83. Mina-paddy is a farming system that combines rice and fish in one cultivated land area. Survey results show that the average land ownership for mina-paddy is 1.6 ha. The average revenue is IDR 59 million/season with the average cost of IDR 32.5 million/season. The R/C ratio for mina-paddy farming is 2.1, i.e. it appears financially profitable. Labor productivity of mina-paddy is IDR 247,546 / day / person.

Table 22: Profitability of Mixed Farming (Mina-Paddy and Horticulture) –per hectare

Commodities	Land Size (Ha)	Production (ton/ha)	Revenue (Rp)	Total Cost (Rp)	Profit (Rp)	Value Added (Rp)	Labor (HOK)	R/C ratio	B/C ratio	Labor Productivity (Rp/person day)
Mina-Paddy Research area: West Java Respondent: 8	1.632	9,027	58,902,435	32,568,285	26,334,150	49,067,156	234	2.1	1.1	247,546
Multicropping holticulture Potato, Chili, Cabbage Research area: West Java Respondent:	1.09	10,052	57,697,299	18,333,883	39,363,416	48,880,478	168	3.23	2.23	309,922

Source: Calculated from field-survey data

84. In the multi-cropping farming system that was included in the survey, a number of crops are produced, mainly horticulture crops. Based on the survey data, the average land ownership is 1.09 ha. Farmers receive an average revenue of IDR 57.6 million/season with profit of around IDR 39.3 million/season. A multi-cropping system is more profitable than monoculture, as confirmed by the R/C ratio of 3.23 and a labor productivity of IDR 309.922 / day / person. The production inputs such as fertilizers, chemicals, and labor are used simultaneously for various types of plants, which enhances efficiency.

5. CONCLUSIONS

85. In the process of economic structural transformation, countries generally experience a significant contraction in the share of employment in primary agriculture as growth rates diverge between agriculture, industry and services, as agricultural production consolidates into somewhat larger and often more mechanized units, and as surplus underemployed agricultural labor is absorbed in other segments of the economy. With a lower proportion of the workforce employed in agriculture and with a growing proportion of agricultural workers coming to be involved with higher value segments of primary agriculture (i.e. horticulture and animal production) there is a tendency for wages and productivity levels in agriculture to converge with those in many segments of industry and services.

86. Middle-income Indonesia has been experiencing a reduction in the share of workers engaged in primary agriculture, although the pace of this reduction is slower than the contraction in primary agriculture's share of national GDP and also slower than observed patterns in many other peer countries in Asia. For a variety of reasons, other segments of the economy have been slow to absorb surplus agricultural labor, resulting in significant levels of seasonal or other underemployment of people in rural areas. Lack of demographic pressures, small farm sizes, topographical challenges and other factors have contributed to very low rates of mechanization in Indonesian agriculture. In 2017, primary agriculture (including fisheries and forestry) remained by far the largest employer in Indonesia with nearly 36 million people involved.

87. This study has found very large gaps in labor productivity between primary agriculture and nearly all other segments of the Indonesian economy. While the estimated growth rate in labor productivity has been quite a bit higher in agriculture than in some other segments of the economy in the period of 2000 to 2017, the size of the productivity gap is such that it will take many decades to fully close this gap based upon the current patterns. The picture for Indonesia is somewhat unusual in that even the segments of agriculture experiencing somewhat higher rates of labor productivity still lag or barely approximate the productivity levels experienced in comparatively lower levels of industry (i.e. construction) and services (i.e. hotel and restaurants).

88. This study utilized three sources of data to estimate agricultural labor productivity, namely (i) Sakernas household survey data, (ii) prior surveys of smallholder tree crop

producers, and (iii) a small supplemental field survey covering several locations and a range of staple and specialty food crops and animal or mixed farming systems. The results convey a mixed picture, with some divergence between the Sakernas results and those based upon surveys focused on specific commodities.

89. The Sakernas surveys point to patterns which are consistent with observations in other Asian countries in which labor productivity for (relatively low unit value) food crops is decidedly lower—by half or more—than is the case for horticulture, animal production, mixed farming systems, and specialized plantation crops. The surveys focused on individual crops or production systems point to a much more complex pattern. As expected, labor productivity is comparatively higher in poultry and aquaculture production and in some segments of horticulture which have received government attention (i.e. shallot production). However, labor productivity is found to be quite a bit lower in several horticultural crop specialties and in beverage crop production than in rice cultivation. This pattern contrasts sharply with that found in Vietnam, a country which has experienced considerable success both in raising rice productivity and in developing large competitive cash crop industries. There, labor productivity in rice differs among regions depending upon patterns of mechanization and commercialization, yet even in the best circumstances this labor productivity is no more than one-third that experienced for coffee or horticulture production.

90. The factors underpinning the observed patterns in Indonesia are not fully clear and require additional work, including through more extensive field surveys which would bring out greater variations among locations due to agro-ecological, farmer organization, rural connectivity and other factors. Restrictions on competitive imports and various programs of direct support have helped to boost the profitability of rice production in parts of Indonesia, although this profitability remains modest and given very small average farm sizes, inadequate to provide a solid living standard for most producing households. Even among surplus rice growing households an increasing majority of household income is now coming from other (including non-agricultural) sources.

91. Perhaps more surprising is the moderate to low level of profitability and/or labor productivity associated with most horticultural and beverage crops in Indonesia. This is alarming as one would expect these higher value commodities to provide for more remunerative employment. Growing demand, both at home and abroad, should be catalyzing farmers to invest further in these crops and to build up the requisite knowledge base to improve product quality. More competitive horticultural and beverage crop industries should then be achieving higher rates of productivity growth and be in a better position to reward both skilled and unskilled labor. This dynamic does not seem to be occurring, at least not on a broad scale.

92. This is of concern not only for realizing near term goals related to poverty reduction and farm incomes, but also in relation to attracting and retaining entrepreneurial youth to being Indonesia's farmers of the future. Recent studies and consultative processes have drawn attention to the challenges of productivity, profitability and competitiveness in Indonesian horticulture and beverage crop industries. This study's findings about low labor productivity in these industries calls for a redoubling of efforts to strengthen the provision of core public goods and services to such industries and to better facilitate

private investment in production technologies, advisory services, and downstream logistical and marketing services.

93. There are multiple pathways to raise labor productivity in Indonesian agriculture and all these should be further explored and re-enforced by appropriate government policies and programs. For example:

- One important pathway will be efforts to achieve more economies scale in smallholder production of staple food crops, by facilitating community-based land consolidation, a more active market in agricultural land rentals and sales, and the emergence of a dynamic market for provision of mechanized services covering different components of the crop cycle. Reforms will be needed in land administration and in the enabling environment for mechanized services.
- A second important pathway will be to encourage more diversified farming systems to make fuller use of available labor and other resources as well as better mitigate weather, pest and other risks. In place of monocrop systems, higher labor productivity and remuneration may be possible through the introduction of rotations in lowland rice-based systems (i.e. moving towards rice-vegetable, rice-aquaculture and other rotations) and mixed agro-forestry systems. Single crop advisory services may need to be replaced by technical support emphasizing whole farm management.
- A third critical pathway is through measures to increase productivity, value addition, and risk management capabilities in higher value crop and animal production systems. This may require interventions to improve biosecurity controls and practices, enable farmers to acquire new knowledge and skills, foster greater rural entrepreneurship, encourage more collective action in agricultural marketing, and strengthen the market and other rural infrastructure to carry perishable and other higher value commodities.

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ANNEX 1. STRUCTURAL TRANSFORMATION OF THE INDONESIAN ECONOMY

94. In his recent works, Timmer (2010) suggests that agricultural growth gives most households access to the food in their fields and markets, resulting in their improved food security and poverty. The structural transformation and the long-run dynamic evolution of the rice-based systems in Southeast Asia have contributed to the linkages between agriculture and non-agriculture and rural development as well. Empirical studies by Imai *et al* (2016) suggest that agricultural growth has reduced poverty – both headcount ratios and poverty gaps – although not the case for non-agricultural growth. What matters most is the role of *overall* agricultural sector in promoting overall economic growth and reducing poverty. The interactions between agricultural and non-agricultural sectors matter as they promote sectoral growth and reduce poverty and inequality in the long-run. In particular, the transformation of agricultural sector through changing cropping patterns with declining shares of grains and rising shares of non-grains such as fruits, vegetables, dairy products, and meet would promote interaction between agricultural sector and non-agricultural sectors and help reduce poverty. Government policies that facilitate these processes for agricultural transformation would be important for reduction of poverty and inequality in the long run.

95. Achieving rapid agricultural growth and rural poverty reduction in developing countries, including Indonesia, is very different to current practice in high-income countries. The feasible rate of change is far higher because of the potential for catch-up growth. All the essential institutional structures and investments are in full operation in high-income countries with built-in mechanisms for adjustment to changing conditions. Therefore, building and adapting to changing circumstances the critical set of institutions and making large investments for agricultural growth. That is to be done largely in the public or quasi-public sector and in the context of acute scarcity of financial and trained personnel resources. That requires explicit national vision, strategy, and planning and priorities or sequencing of efforts. The private sector implements the changes to achieve growth and poverty reduction targets. A government's task is to incentivize them, facilitate them, spur them on, and fill the gaps. As in high-income countries, the small commercial farmer requires a substantial set of public institutions (Mellor, 2017).

96. Kim *et al.* (2014) express concern about issues of a decelerating agricultural society and labor productivity improvement during agricultural transformation due to mostly the following limitation in the agriculture and rural sector: (1) lack of economies of scale in traditional agriculture, (2) inefficient farming practices, (3) immature agricultural markets, and (4) institutional conditions. Each will be explained briefly below.

97. *First*, traditional agriculture cannot achieve economies of scale because it is based on smallholder and family farms. The inability to take advantages of economies of scale in production is an important structural problem that hinders growth of traditional agriculture. The behavior of smallholder farmers might be rational, but the optimal economies of scale might not be able to lift up the livelihood due to some institutional characteristics such as risk aversions, no capital accumulation for investment, inadequate access to investment and agricultural technology, incomplete capital market, etc. Transforming such a traditional agriculture would increase the capacity of smallholder

farmers, access to innovation and technological change, supportive public policies to improve access to financial institution for capital formation.

98. *Second*, inefficient farming practices might experience low level of growth because of low productivity from lack of modern technologies. Modern agriculture might also be inferior to other industries, so that the the transition from an agricultural to an industrial economy moves the society to a more developed state. Therefore, a significant improvement in agricultural productivity is necessary to contribute to the development economic process. The neo-classical theory of economic development suggests that the movement of productive resources to industry promotes economic growth. In this case, economic growth is achieved by transferring the input factor from a simple reproduction sector to an expansive-reproduction sector (Johnston and Mellor (1961), Mellor (1995) and Mellor (2017). However, Matsuyama (1991) and Hayami (2001) argues that low productivity in agriculture may promote industrialization of an economy because relatively low income encourages labor to move into higher productive manufacturing. There might a situation where high productivity in agriculture hinders the development of manufacturing, because the surplus of agriculture production may trap people in choosing a career in agriculture. A self-fulfilling expectation of future job opportunities can play a key role in the economy's adjustment processes.

99. *Third*, smallholder farmers usually have difficulties in responding quickly to changes in market conditions so that the supply is therefore inelastic in product or price dimensions. The basic Engel's law suggests that income elasticity of agricultural products, mostly food products, is generally less than that of industrial products. Even, the relative importance of agricultural production decreases as the economy grows due to the characteristics of income elasticity explained above. Therefore, the improvement rate of agricultural technology contributes much more to the economic growth than to the improvement rate of agricultural technology.

100. *Fourth*, the performance of structural transformation is generally affected by the levels of agricultural productivity, which comprehensively also reflect the taxation, regulation, property rights, institutions, and natural environments of each country. Gollin *et al.* (2002) suggests that low agricultural productivity can substantially delay industrialization. Improvements in agricultural productivity can hasten the start of industrialization and, hence, have large effects on a country's relative income. In the short run, such changes will have a larger impact than comparable increases in nonagricultural productivity. Although in the long run, it is productivity in the nonagricultural sector that determines a country's position relative to the leader or other countries. As the productivity of non-agriculture is higher than that of agriculture, the capability of the agriculture sector to release resources to non-agricultural sectors eventually contributes to economic development. Therefore, agricultural development should be investigated not only within the sector but also in the context of the general economy (Mundlak, 2000). Policies, particularly those regarding government expenditure and trade, affect the productivity and human capital resource accumulation in agriculture. When those policies become unfavorable for the modern agricultural sector, large amounts of capital and labor migrate from the agricultural sector to other sectors. This migration is affected by changes in input factor availability and technology as the economic growth progressed.

ANNEX 2. SIMULATION OF GOVERNMENT INTERVENTION

101. Simulation analysis is conducted to understand how much impact of government interventions on agricultural profitability and productivity in Indonesia. Technically, this is a short-term simulation effect since the data used is at one point of time.

Removing Fertilizer Subsidies

Table 23: Removing Fertilizer Subsidies on Food Crops, Horticulture, Mixed Farming

Commodities	Baseline			Simulation			Change (percent)		
	R/C ratio	B/C ratio	Labor Productivity (Rp/person day)	R/C ratio	B/C ratio	Labor Productivity (Rp/person day)	R/C ratio	B/C ratio	Labor Productivity (Rp/person day)
Food crops (Rice, Maize, and Soybean)									
Rice	2.70	1.70	293,838	2.41	1.41	276,774	-10.74	-17.06	-5.81
Maize	2.11	1.11	109,775	1.75	0.75	91,789	-17.06	-32.43	-16.38
Soybean	2.79	1.79	325,744	2.41	1.41	305,874	-13.62	-21.23	-6.10
Horticulture (Orange, Tomato, Cabbage, Shallot)									
Orange	1.54	0.54	238,817	1.50	0.50	231,518	-2.60	-7.41	-3.06
Tomato	2.26	1.26	244,897	2.24	1.24	243,630	-0.88	-1.59	-0.52
Cabbage	1.61	0.61	153,954	1.58	0.58	151,619	-1.86	-4.92	-1.52
Shallot	2.52	1.52	366,229	2.44	1.44	359,844	-3.17	-5.26	-1.74
Mixed farming (Mina-Paddy and Horticulture)									
Mina-Paddy	2.10	1.10	247,546	1.90	0.90	237,191	-9.52	-18.18	-4.18
Multicropping holticulture Potato, Chili, Cabbage	3.23	2.23	309,922	3.14	2.14	307,287	-2.79	-4.04	-0.85

Source: Calculated from field-survey data

102. The biggest impacts occurs in food crop commodities (Rice, Maize, and Soybeans). While the impact on other crops such as horticultural commodities is smaller compared to the food crops. It can be explained since subsidized fertilizer mostly used for food crops. The simulation on mixed farming (mina-paddy and multi-cropping) are consistent with the results of food crops farming simulation where the impact on mina-paddy is greater than multi-cropping of horticultural commodities. Therefore, it can be conclude that the government policy so far has only focused on food crops such as rice, maize and soybeans.

Removing Subsidies for Soybean Seed

Table 24: Removing Subsidies for Soybean Seed

Commodity	Baseline			Simulation			Change (percent)		
	R/C ratio	B/C ratio	Labor Productivity (Rp/person day)	R/C ratio	B/C ratio	Labor Productivity (Rp/person day)	R/C ratio	B/C ratio	Labor Productivity
Soybean	2.79	1.79	325,744	2.60	1.60	317,483	-6.81	-10.61	-2.54

Source: Calculated from field-survey data

103. The Grobogan district government provides subsidized soybean seeds for farmers to increase the soybean production in the district. This simulation explains that the revokes the subsidized soybean seed policy will have major impacts on reducing the profitability and productivity of labor in soybean farming.

Simulation of Government Policy on Agricultural Outputs

Table 25: Removing Price Support on Rice

Commodity	Baseline			Simulation			Change (percent)		
	R/C ratio	B/C ratio	Labor Productivity (Rp/person day)	R/C ratio	B/C ratio	Labor Productivity (Rp/person day)	R/C ratio	B/C ratio	Labor Productivity
Rice	2.70	1.70	293,838	2.12	1.12	216,953	-21.48	-34.12	-26.17

Source: Calculated from field-survey data

104. If the government implements purchase price policy on rice grain, it will have an impact on reducing profitability and productivity in the rice farming. So far, the the farm level prices for the rice is relatively safe. The purchase price policy is not applied to horticultural commodities (such as oranges, tomatoes and cabbage) and the analysis found that profitability and productivity of the farmers will be very dependent on the selling prices, therefore this intervention will not have any impacts to other commodities.

ANNEX 3. DETERMINANTS OF PROFITABILITY AND FARMER INCOMES

Determinants of Profitability

105. The relationship between profitability and labor productivity in this study was carried out by conducting a simple regression with profitability as the dependent variable and labor productivity as an independent variable. The equation of model as below:

$$LnProfitablity_i = \alpha + LnLaborProductivity_i\beta + e_i$$

The regression results show that labor productivity is significant to the profitability of farmers. Coefficient values show the value of elasticity of profitability to changes in labor productivity.

Table 26: Regression Analysis of Determinant of Profitability of Farming Systems

Sector	Coefficient	T stat (P Value)	Obs	R-Squared
All Crops	0.457	15.20 (0.000)	228	0.299
Food Crops	0.383	10.04 (0.000)	95	0.515
Horticulture	0.551	9.60 (0.000)	51	0.646
Aquaculture	0.404	4.10 (0.000)	29	0.360
Poultry	0.662	3.59 (0.001)	27	0.314
Mixed Farming	0.720	8.81 (0.000)	26	0.754

Source: field survey data are processed

106. The regression result for "all crops" yields a coefficient of 0.457, meaning that if labor productivity increases by 1 percent, the profitability of farmers will increase by 0.457 percent, *ceteris paribus*. The lowest elasticity value is produced by food crops with a coefficient of 0.383. While the highest elasticity value is produced by mixed farming with a coefficient of 0.72.

Determinants of Farmers' Income

107. Factors that influence farmers' income in this study were carried out by regression. a standard linear econometric model of farmers' incomes can be applied. econometric model for analyze farmers' income can be modeled as follows:

$$Y_i = \alpha + X_i'\beta + Z_i'\gamma + e_i$$

where: Y_i represents farmers' income, X_i' is a vector of main variable of input such as: labor cost, agriculture input cost, and farm land size. Z_i' denotes control variables of household such as Age, education level, household size, and farmers' experience.

Table 27: Regression Analysis of Determinant of Farmers' Income

Independent Variables	Dependent Variable : ln_Income			
	Model 1 (all crops)	Model 2 (without poultry and aquaculture)	Model 3 (poultry and aquaculture)	Model 4 (Mixed Farming)
Ln_laborcost	0.601***	0.567***	0.816***	0.622***
Ln_agriinputcost	0.423***	0.420***	0.293***	0.473**
Land_size		0.164**	0.079	0.191
Age	0.012	-0.046	0.002	-0.182
Education	0.092**	0.003	0.130	0.150
Experience		0.003	0.063	0.006
Hhsize	0.055***	0.040*	0.036	0.141
Constanta	0.859**	1.514**	0.010	-0.735
Adj R-Squared	0.870	0.889	0.887	0.835

Source: field survey data are processed

Noted: *significant at α = 10%, ** significant at α = 5%, *** significant at α = 1%.

108. Based on the regression results of model 1 (all crops), significant factors affecting farmers' income are labor costs, agricultural input costs, education level, and household size. Model 2 in this analysis excludes aquaculture and poultry. Variable that significantly influence farmers' income are labor cost, agricultural input costs, farm land size, and household size. Results from model 3 (poultry and aquaculture) and model 4 (mixed farming) suggest that farmer income influenced by labor cost and the cost of agricultural inputs.

109. In addition to the above model, alternative models can be constructed to examine the effect of farming type on farmer income. Based on the results, it can be concluded that food crops cultivation will have a significant negative effect on farmer income. In contrast, horticulture, poultry, and mixed farming have a significantly positive effect on farmer income. As a control variable, land ownership, education, and household size have a positive effect on farmer income. And in general, the age variable of the farmer and farming experience does not have a significant effect on farmer income, except in horticulture farming where the age of the farmer has a negative effect on farmer income.

Table 28: Regression Analysis of Determinant of Farmers' Income

Independent Variables	Dependent Variable : ln_income				
	Model 1 Food crops	**Model 2 Horticulture**	**Model 3 poultry**	**Model 4 Aquaculture**	**Model 5 Mixed Farming**
D_FoodCrops	-1.850***	-	-	-	-
D_Horticulture	-	0.967***	-	-	-
D_Poultry	-	-	1.932***	-	-
D_Aquaculture	-	-	-	-0.130	-
D_Mixedfarming	-	-	-	-	1.031***
Land size	1.005***	0.909***	0.996***	0.785***	0.576***
Age	-0.010	0.006	-0.011	0.003	0.003
Education	0.042*	0.085***	0.030	0.068**	0.062**
Experience	0.007	-0.018*	0.001	-0.015	-0.011
Hhsize	0.103**	0.067	0.001	0.058	0.087
Constanta	16.712***	13.315***	16.425***	15.896***	15.689***
Adj R-Squared	0.431	0.176	0.241	0.107	0.146

Source: field survey data are processed

Note: *significant at α = 10%, ** significant at α = 5%, *** significant at α = 1%.

Profit Function Analysis

110. A profit function analysis is carried out to determine the effect of input prices on farmers' income in Indonesia. To analyze these relationships we use a simple regression and the Cobb-Douglas profit function model.

Table 29: Regression Analysis of Profit Function

Independent Variables	Dependent Variable : ln_profit					
	Model 1 (all crops)	Model 2 (Food crops)	Model 3 (Horticulture)	Model 4 (Poultry)	Model 5 (Aquaculture)	Model 6 (Mixed Farming)
ln_inputprice	-0.238***	-0.467	-0.014	0.029	0.462**	0.121
ln_laborprice	0.872***	1.117***	0.216	4.286***	1.044***	0.267
Land	0.784***	1.061***	1.076	1.662**	1.150*	1.056***
Constant	4.884***	3.466***	6.713***	4.760***	5.029***	6.358***
Adj R-Squared	0.255	0.310	0.142	0.739	0.747	0.727

Noted: *significant at α = 10%, ** significant at α = 5%, *** significant at α = 1%.

111. There are 6 different models for analyzing all crops, including poultry and aquaculture. In general, prices of agricultural inputs, labor wages, and land ownership have a significant effect on farmers' profits. The price of agricultural inputs has a negative influence on farmers' profits. Labor wages have a positive influence on farmers' profits, indicating positive labor productivity of hired labor. Based on the previous analysis, an

increase in productivity will have a positive effect on farmer profitability. Land ownership as a fixed input also has a positive influence on farmers' profits, where the addition of land will increase production capacity and profits.

112. The results of the analysis on the agricultural sector of food crops and poultry, farmers' profits are positively influenced by labor wages, and land ownership. There is no variable in the horticulture sector that has a significant effect on farmer profits. In the aquaculture sector, all variables have a positive effect on farmer profits. And in the mixed farming sector, only land ownership influences farmers' profits.