BIDANG KAJIAN
MICROECONOMICS DASHBOARD
FAKULTAS EKONOMIKA DAN BISNIS
UNIVERSITAS GADJAH MADA

Kajian
Vol. 14
2025

Agricultural Economics:

The Moderation of Indonesia's Agricultural Sector: Why Productivity and Growth Are Slowing Down?

Bidang Kajian Microeconomics Dashboard, Fakultas Ekonomika dan Bisnis, Universitas Gadjah Mada;
December 2025

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Executive Summary

- The agricultural sector in Indonesia remains a vital source of employment and food security but is growing to be typified by stagnation in productivity. Despite the improvement in agricultural value added per worker over time, the growth has been low and has been persistently lower than industry and services.
- One major factor behind this stagnation is the aging structure of the agricultural workforce. A growing share of agricultural workers is above prime working age, while younger generations are steadily leaving the sector. This demographic shift limits labor productivity and slows the adoption of modern technologies and practices.
- Land fragmentation and insecure tenure represent another critical bottleneck. Most agricultural holdings operate on small and fragmented plots, often without formal land ownership. These conditions increase production costs, reduce scale efficiency, restrict access to credit, and discourage long-term investment in productivity-enhancing inputs.
- There is still a significant share of agricultural holdings who are still in subsistence and semi-subsistence farming where farmers produce goods that are mostly consumed in the family or they are not sold in the market. The low productivity and land underutilization is reinforced by this type of production, which restricts income production, capital accumulation, and reinvestment.
- Despite policy efforts to expand access to fertilizers, irrigation, and digital technologies, technology adoption remains uneven. The small area of irrigation covered, the lack of uniformity in the use of inputs, and partial diffusion of modern tools are the reasons why the overall agricultural sector of Indonesia is not changing and slow down the process of agricultural transformation.

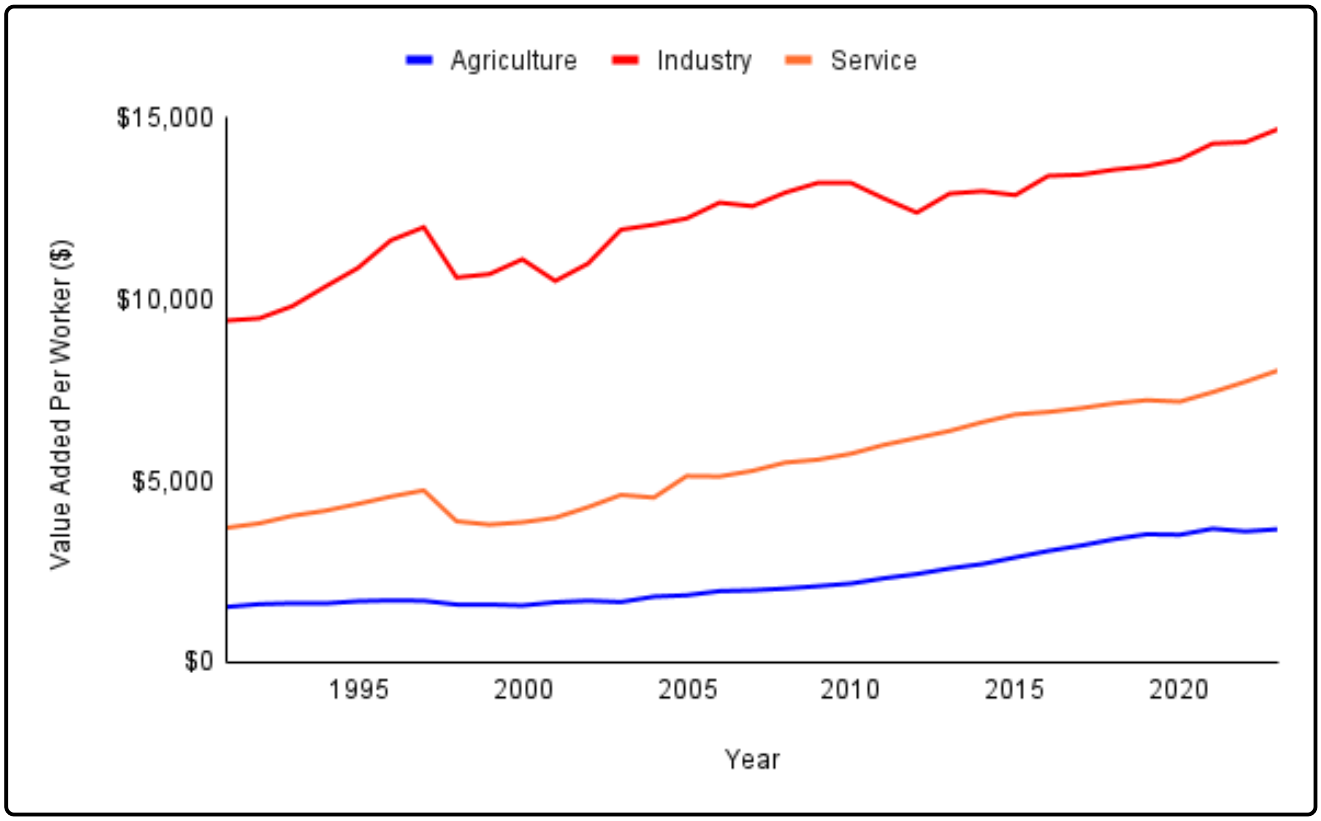
Introduction

Historically, agriculture plays a pivotal role in the economic development of Indonesia. Agriculture not just acts as the source of growth, but also the anchor of labor employment especially in the rural areas of Indonesia (Afriyanti et al., 2023). In macroeconomic perspective, national agriculture development in Indonesia also plays an indisputable role as the main economic stabilizer within the context of global food insecurity and volatility (Siregar et al., 2024). Although the agricultural sector shows an astonishing achievement in explaining the historical economic development in Indonesia, the current condition of the agricultural sector shows the clockwise.

Recent studies from Arifin et al. (2019) found that there is a massive labor productivity gap between workers in agriculture and other sectors in Indonesia. Statistics from the World Bank (2025) also found a similar problem, where the average labor productivity of the agriculture sector is always increasing over time (see **Graph 1**), but the slope (growth) and the value of the average value-added per worker was significantly lower than other sectors. Moreover, Statistics Indonesia (called *Badan Pusat Statistik* or BPS) categorized the majority of Indonesian agricultural producers as small scale farmers who generate equal or below IDR 26.60 million per year and cultivate equal or below 1.02 hectares in the year of 2023.

In line with the Lewis dual-sector theory (Lewis, 2016), agricultural labor productivity is not expected to surpass that of other sectors, as the fixed supply of land implies diminishing productivity when labor absorption increases. This structural characteristic positions agriculture as a sector with inherent productivity constraints relative to industry and services. Nevertheless, Schultz (1964) argues that agricultural transformation is feasible through technological advancement and institutional development. This notion is supported by empirical evidence from Llewellyn (2018), who finds that within the context of the Green Revolution in Mexico, Asia, and Africa, agricultural yields and overall performance improved significantly. The findings indicate that even when labor input remains constant, productivity gains can be achieved through alternative channels such as technological innovation and improved agricultural practices.

Graph 1. Value-added Per Worker (USD) by Sector in Indonesia (1991-2023)



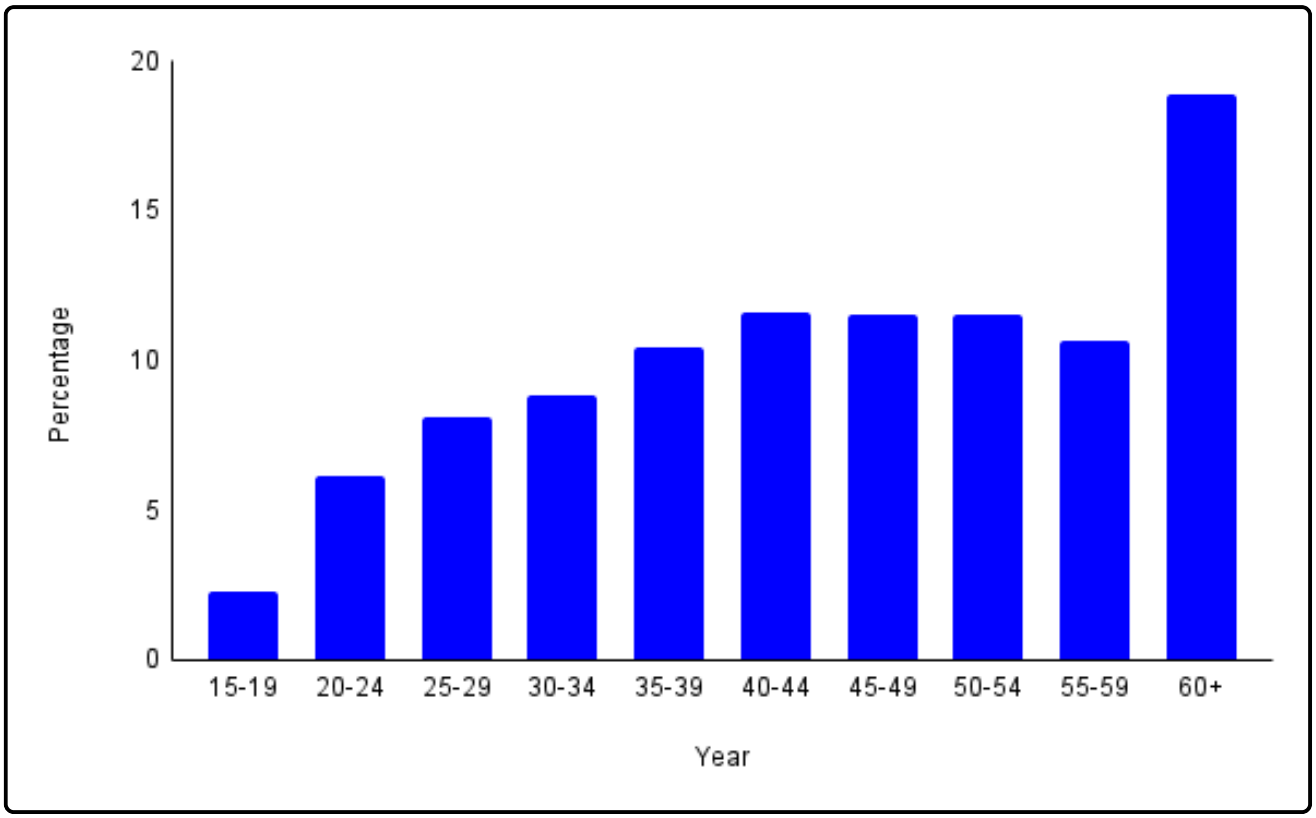
Source: World Bank (2025a; 2025b; 2025c), processed by author.

This edition of Microeconomics Dashboard research article follows the framework developed by Mellor (2017), where the study develops a framework that identifies several key bases for agricultural development. Firstly, it is argued that the problem of agricultural development is the underutilization of labor, where weak incentives, high risk, and stagnant modernization are shown as the main core problems, rather than the technical inefficiency of farmers. Secondly, the study suggests that land productivity is also an affecting factor. Mellor (2017) found that the fragmented land ownership, land tenure uncertainty, and yield variability affect the land productivity. Based on this framework, this Microeconomics Dashboard article tries to identify the problems of the Indonesian agricultural sector and explain the mechanism behind it.

PROBLEM 1: AGEING AGRICULTURAL WORKERS

The aging of agricultural workers is the first problem identified within the agricultural sector in Indonesia. **Graph 2** shows that in 2024, around 52.5% of the agricultural casual workers are older than 45 years old, with almost 20% of them are elderly (older than 60 years old) (BPS, 2024c). Meanwhile, only 45% of the farmers are actually at their peak of working ages. These results imply that there might be a low tendency of younger people to work in this sector, while the older generation remains working beyond their retirement age due to the absence of a formal retirement age in this sector. These numbers also emphasize that the Indonesian agriculture sector currently depends on the older generation to fill in their employment.

Graph 2. Percentage of Casual Workers[1] in Agriculture by Age Group in Indonesia, 2024



Source: Sumber: BPS (2024c), processed by author.

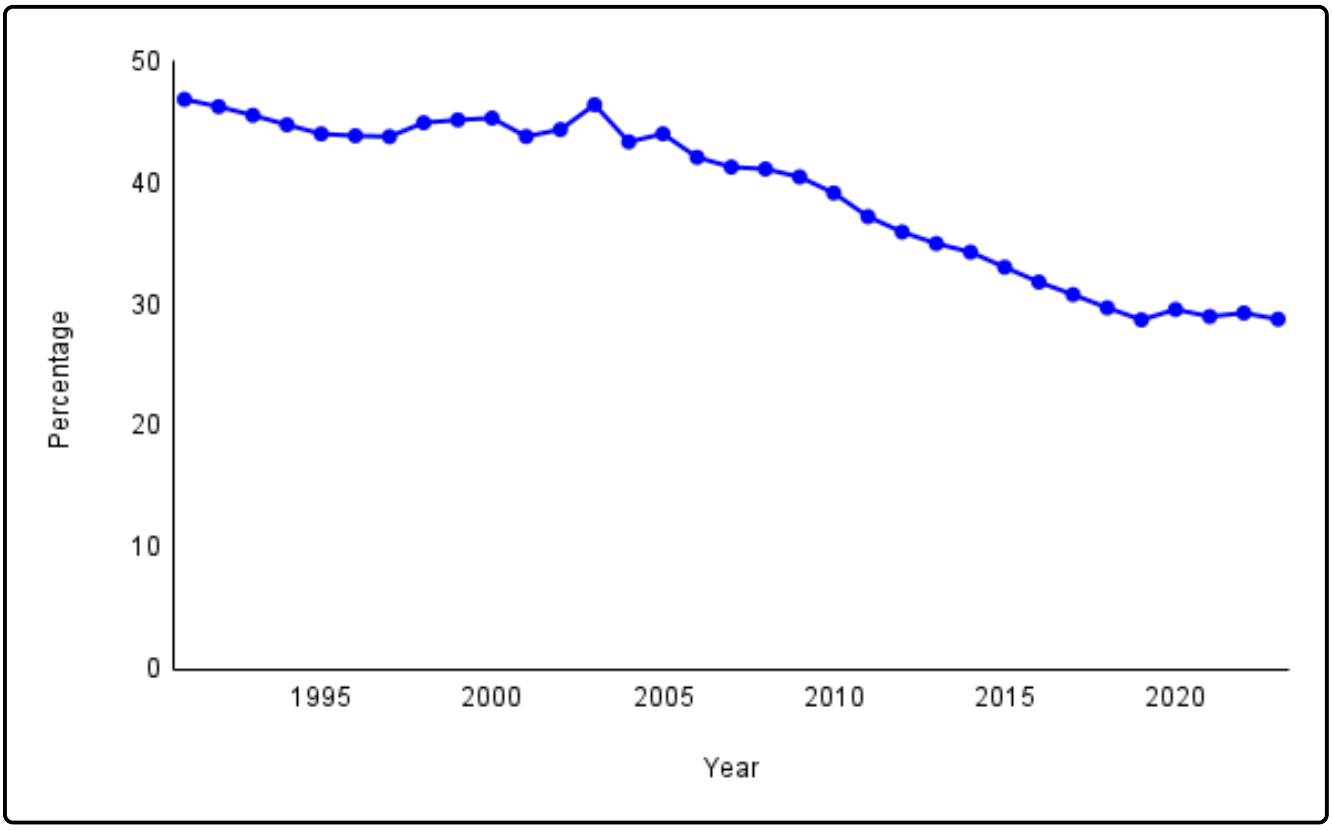
There are several problems with the agricultural sector aging workers in common literature. A study in China shows that aging workers in agriculture lower the total factor productivity by slowing down the technological adoption and disturbing the resource allocation (Tong et al., 2024). Moreover, aging workers are prone to health risks, increasing attrition and absenteeism, which result in lower productivity (O'Meara, 2019). These challenges underscore the urgency for policy intervention to prevent demographic aging from becoming a structural constraint on agricultural modernization and productivity growth.

Moreover, the agricultural sector has experienced a gradual decline in labor participation. **Graph 3** shows a decline in the share of agricultural workers in Indonesia. In the early 1990s, nearly 50% of the Indonesian labor force was employed in agriculture. By 2023, this figure had fallen to just above 30%, indicating a persistent downward trend in agricultural employment. One of the most common explanations for this shift is rapid industrialization and urbanization, which have drawn younger workers away from the agricultural sector (Ngadi et al., 2023).

When viewed alongside **Graph 2**, this trend raises concerns about future labor productivity in agriculture, particularly if the inflow of young workers is insufficient to replace the aging workforce. Ngadi et al. (2023) find that younger generations are significantly less likely to work in agriculture. They argue that urban job opportunities offer higher wages and greater employment flexibility, making them more attractive to young workers. In addition, younger individuals tend to have higher levels of education, which allows them to earn higher returns outside the agricultural sector. Similarly, FAO (2021) reports that millennials are generally reluctant to engage in agriculture, partly due to the high risks associated with agricultural activities.

[1] A casual worker in agriculture is someone who works for another person/employer/institution on a temporary basis (more than one employer in the last period) in an agricultural business, whether a home-based business or a non-home-based business, for remuneration, receiving wages or compensation, either in cash or in kind, and either on a daily or piecework basis. Agricultural businesses include: food crop farming, plantations, forestry, livestock, fisheries, and hunting, including agricultural services (BPS, 2024b).

Graph 3. Employment in Agriculture (% of Total Employment) in Indonesia



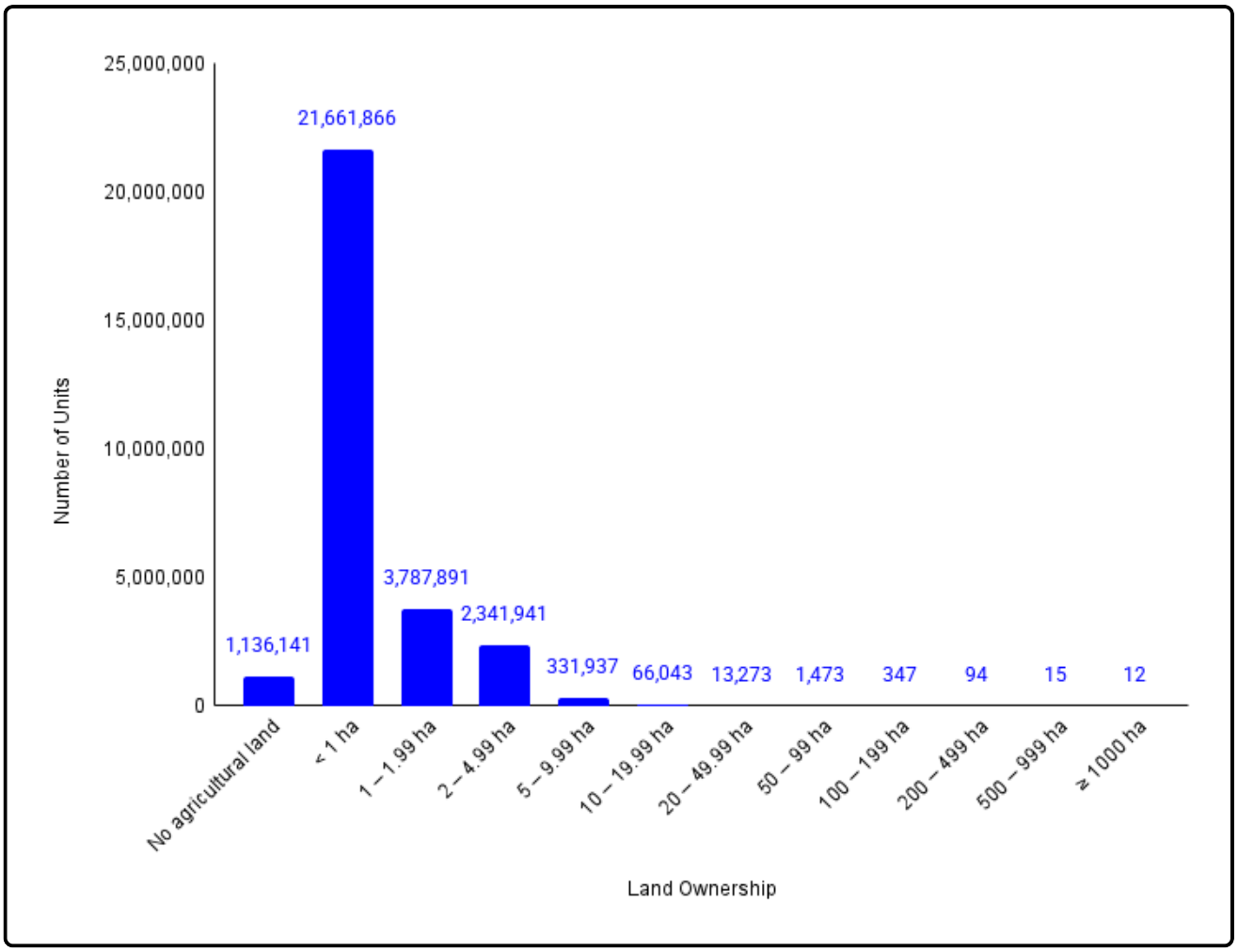
Source: World Bank (2025d), processed by author.

Taken together, these findings suggest that Indonesia needs to adopt policy measures to address the demographic imbalance within its agricultural labor force. This requires improving the sector's attractiveness to younger workers while simultaneously easing productivity constraints faced by older farmers. Policy efforts should focus on creating clearer income prospects, reducing production risks, and strengthening institutional support so that agriculture is no longer perceived as a transitional sector by the younger generation. Without such adjustments, the continued aging of agricultural workers combined with declining labor inflows risks entrenching low productivity and slowing the pace of agricultural modernization in Indonesia.

PROBLEM 2: LAND FRAGMENTATION AND LAND TENURE

In Indonesia, the main problem of land ownership is land fragmentation. A recent census by Statistics Indonesia (BPS) in 2024 found that more than 24 million individual agricultural holdings in Indonesia operate on less than 2 hectares (see **Graph 4**). Meanwhile, Article 8 of Government Regulation in Lieu of Law (also known as *Peraturan Pemerintah Pengganti Undang-undang* or Perpu) No. 56/1960 establishes a minimum agricultural landholding of 2 hectares per farming household, while Article 9 prohibits land transfers that would result in landholdings below this threshold. This indicates that although regulatory efforts exist to restrict land fragmentation, they have remained ineffective in practice.

Graph 4. Number of Agricultural Land Area Held by the Individual Agricultural Holding[2] in Indonesia



Source: BPS (2024a), processed by author.

Furthermore, small and fragmented landholdings generate multiple structural constraints on agricultural performance. Land fragmentation increases the distance between plots, raises transportation and management costs, and reduces labour efficiency, particularly when parcels are spatially dispersed (Blarel et al., 1992; Niroula & Thapa, 2005; Mellor, 2017). In addition, fragmented and small plots limit the economic feasibility of mechanization and irrigation investments, thereby constraining capital intensification and technological adoption (Rahman & Rahman, 2009). As summarized by Aslam and Fazal (2025), a large body of empirical evidence across developing countries shows that land fragmentation consistently reduces agricultural productivity, profitability, and technical efficiency by increasing input costs and weakening scale economies.

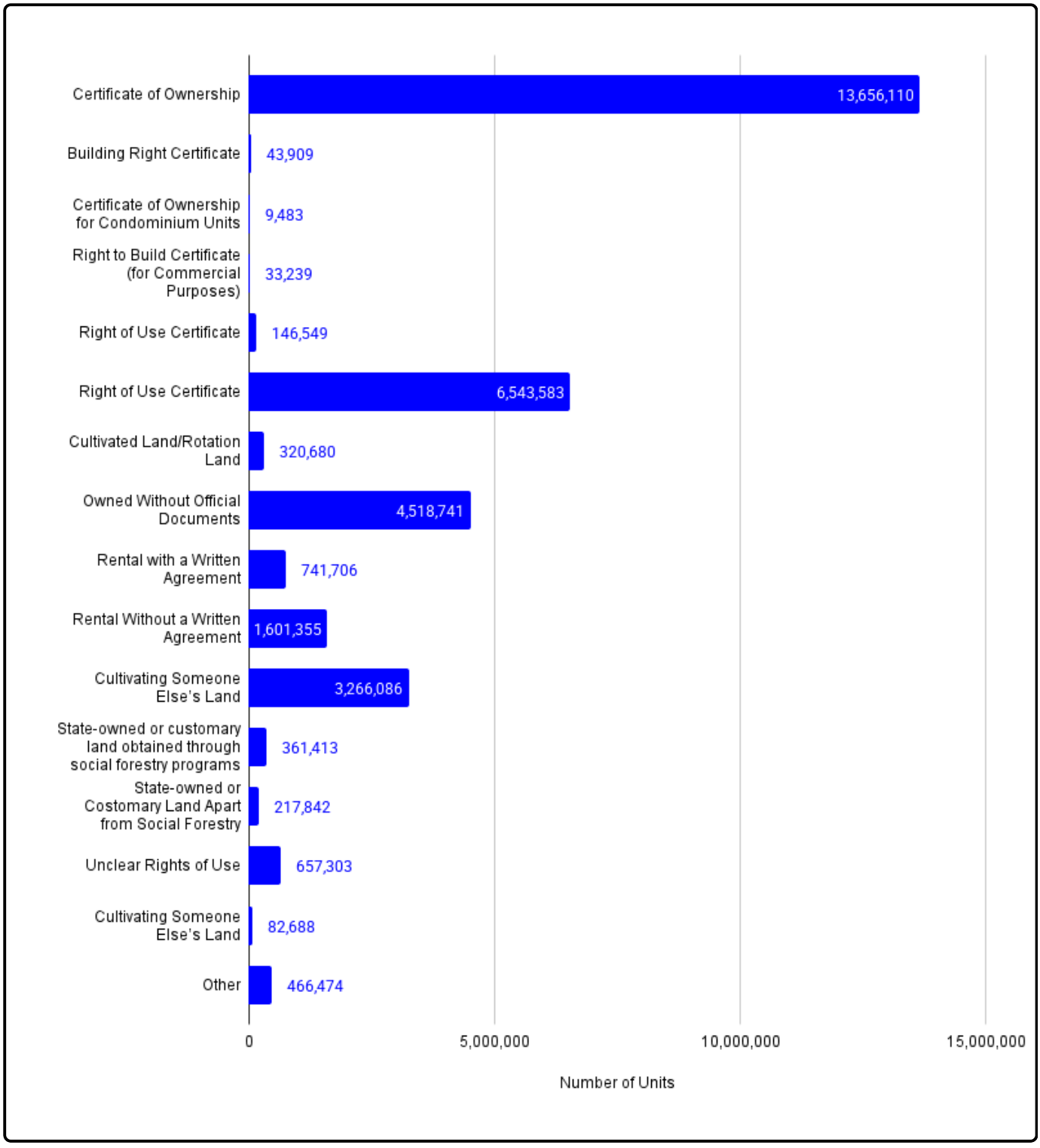
Several studies were conducted to understand the root cause of this problem. Umyati et al. (2022) found that most of the agricultural land gathered in Indonesia is in the form of inheritance. This inheritance pattern implies that agricultural land is divided among heirs, leading to smaller landholdings across generations. Similar patterns of land fragmentation are also observed in several African countries (see Mwendwa et al., 2024; Shabu et al., 2020), where customary inheritance practices lead to repeated subdivision of agricultural land among descendants, thereby reducing average farm size over time. In Asia, Niroula and Thapa (2005) conducted a similar study and found that inheritance laws lacking progressive tax on inherited land are the cause of fragmented land. Moreover, it is common for the second generation farmers to sell their inherited land which signified the agricultural land fragmentation (Al-Tulaibawi, 2024). Lastly, the law inefficiency on consolidating the scattered land can also be the cause of the low attempt for the land consolidation as proposed by Abubakari et al. (2016). Hence, land fragmentation is a problem that is complex but could be resolved if there is some kind of institutional push to reform the problem.

[2] Individual Agricultural Holding refers to an agricultural holding managed by one person who bears technical, juridical, and economic responsibility for the holding. This person may carry out all responsibilities directly or delegate day-to-day management tasks to a manager, without establishing a legal entity. Agricultural holdings include activities in the food crop, horticultural crop, estate crop, livestock, fisheries, and forestry subsectors.

Beyond land fragmentation, **Graph 4** also shows that a significant share of individual agricultural holdings in Indonesia do not own agricultural land. This pattern is further supported by data in **Graph 5**, which indicates that more than 4.5 million agricultural holdings operate without official land documentation or rely on informal rental arrangements lacking legal contracts. Moreover, nearly half a million agricultural holdings cultivate land under unclear or disputed rights of use, exposing them to potential legal conflicts in the event of future disputes. These conditions suggest that agricultural holdings in Indonesia not only operate on small and fragmented plots but also face insecure land tenure, which may weaken their incentives and capacity to enhance productivity. In the absence of secure tenure, land cannot function as an economic buffer during production shocks, further increasing farmers' vulnerability.

Insecure land tenure creates several structural constraints for agricultural activities. Unclear or informal land rights reduce incentives to invest in land-augmenting technologies, long-term soil improvements, and productivity-enhancing inputs, as farmers cannot be certain that they will capture future returns from such investments (Lawry et al., 2017). The lack of formal documentation also restricts access to credit, since land cannot be pledged as collateral in formal financial markets. This limits farmers' ability to smooth income, manage risk, and scale up production (Ncube, 2018; Dabessa & Han, 2025). In addition, tenure insecurity increases exposure to legal disputes and eviction risks, heightening uncertainty and discouraging efficient land use (Richardson, 2017).

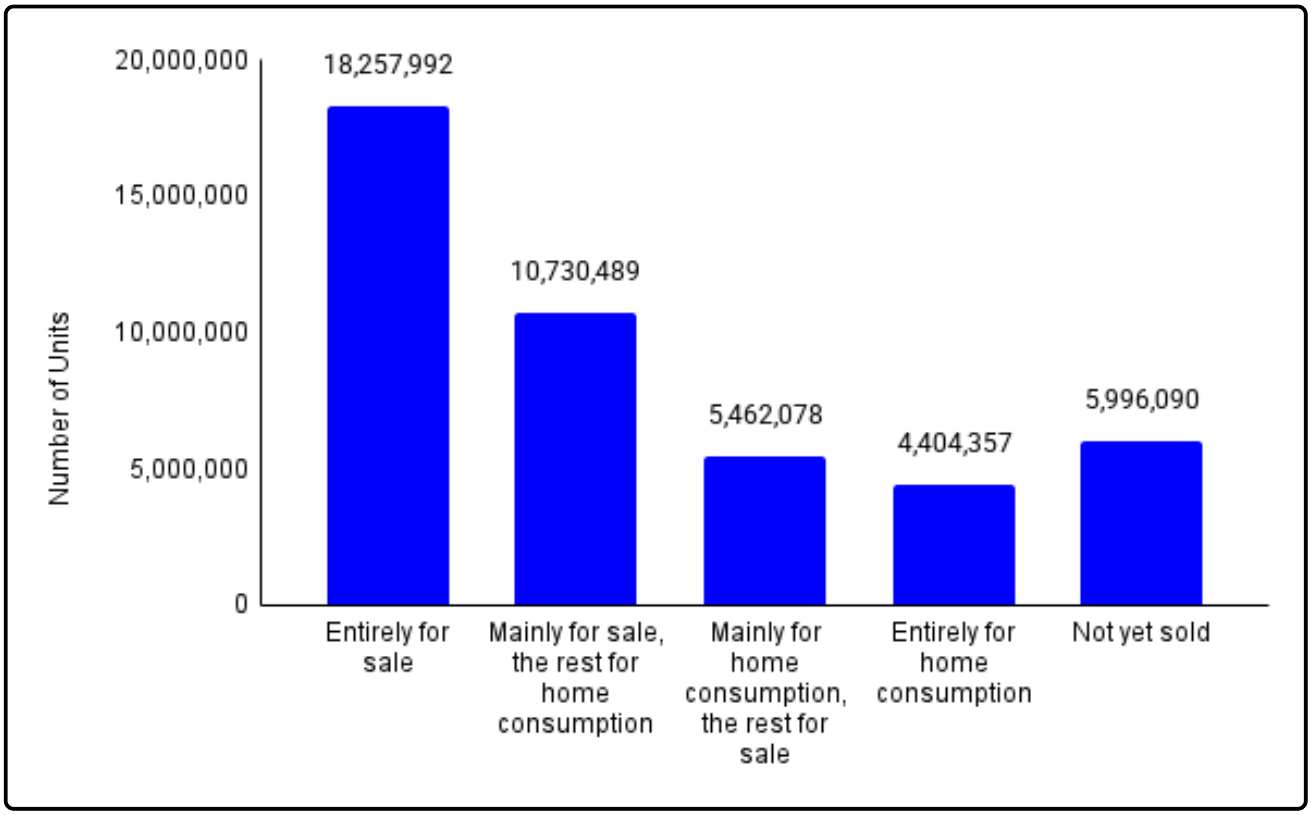
Graph 5. Number of Individual Agricultural Holding by Land Tenure in Indonesia, 2023



Source: BPS (2024a), processed by author.

Turning to the utilization of agricultural production, the data indicate a different way in how farm output is allocated. The majority of individual agricultural holdings sell their output either entirely or predominantly, with only a small portion retained for household consumption. However, there remain approximately 5.4 million agricultural holdings whose production is largely consumed within the household, with only a limited share sold to the market (see **Graph 6**). In addition, around 4.4 million holdings engage in farming activities that are fully subsistence-oriented, where output is consumed entirely and not commercialized at all.

Graph 6. Number of Individual Agricultural Holding by Utilization of Agricultural Production (unit), 2023



Source: BPS (2024a), processed by author.

This pattern raises important concerns for agricultural productivity and rural welfare. When a large share of agricultural output is retained for self-consumption, land generates limited market value-added and weak income flows, constraining farmers' ability to accumulate capital, reinvest in productivity-enhancing inputs, and adopt improved technologies. Empirical evidence from Indonesia shows that farmers who remain in subsistence or semi-subsistence systems experience lower welfare outcomes compared to those who transition toward commercial and intensive farming, largely due to limited access to credit, technology, and markets (Mariyono, 2019). From a broader development perspective, subsistence farming restricts surplus generation and reduces the contribution of agriculture in income growth and poverty reduction (de Janvry & Sadoulet, 2002).

From this analysis, it is found that land use in Indonesia remains substantially underutilized. Despite its archipelagic geography and abundant land resources, Indonesia has not yet managed to optimize land utilization effectively. Instead, the findings suggest that a large share of agricultural land is operated below its productive potential. A significant number of individual agricultural holdings do not possess secure land ownership, while land fragmentation further increases management and transaction costs, reducing operational efficiency.

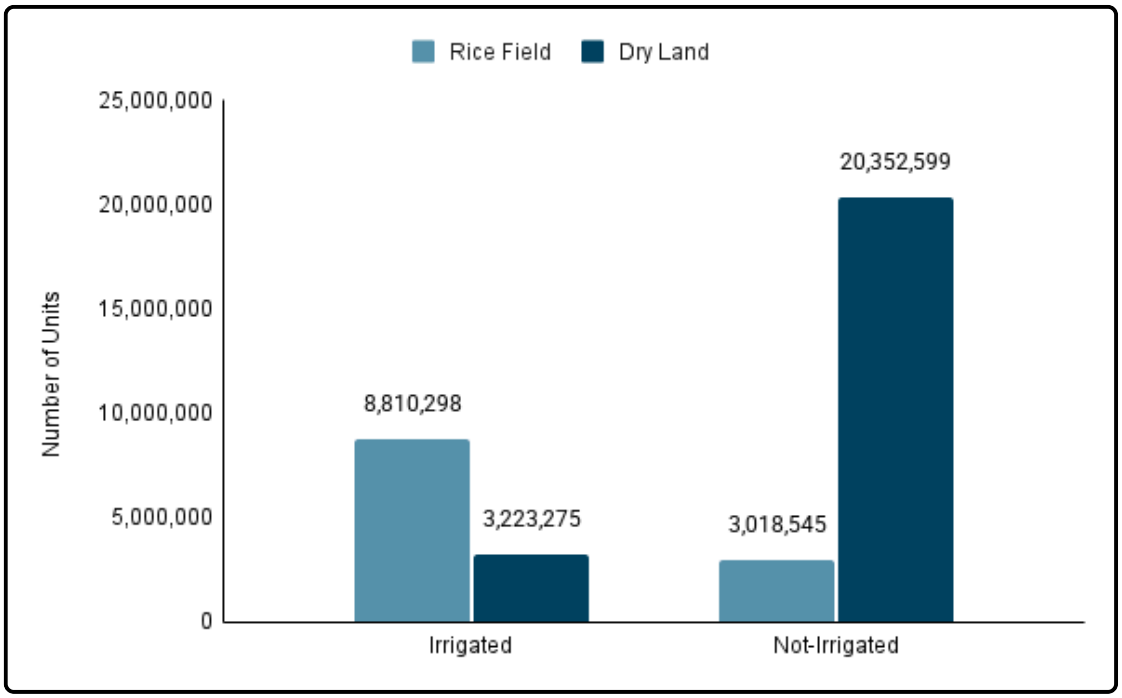
In addition, **Graph 6** shows that nearly five million agricultural holdings engage in farming primarily for household consumption, with little or no market participation. This subsistence-oriented land use limits income generation and prevents agricultural holdings from accumulating assets that could be reinvested in productivity-enhancing technologies (Achmad et al., 2022). As a result, agricultural activities remain stagnant, reinforcing low productivity and constraining the broader transformation of Indonesia's agricultural sector (Otsuka, 2021).

PROBLEM 3: LOW TECHNOLOGY ADOPTION AND MECHANIZATION

Another problem with the Indonesian agriculture sector is the low mechanization and technological adaptation. Agricultural mechanization itself refers to the application of engine- or motor-powered equipment to replace or supplement human labor in farm production systems. By transferring energy from mechanical sources to agricultural operations, mechanization reduces the physical burden of farm work, addresses labor shortages, improves productivity, and can help mitigate risks associated with climate variability (Rahman et al., 2021).

One of the key constraints to agricultural mechanization in Indonesia is the limited extent of irrigated land. **Graph 7** shows that while irrigated rice fields cover approximately 8.8 million units of rice land, around 3.0 million units remain non-irrigated. The disparity is even more pronounced in dry land agriculture, where non-irrigated units reach more than 20.3 million, far exceeding the 3.2 million irrigated units. This indicates that the majority of agricultural land units in Indonesia, particularly dry land, operates under rain-fed conditions. While dry land agriculture does not inherently require irrigation, its strong dependence on rainfall increases water stress, yield instability, and limits productivity gains unless supported by effective water management and irrigation technologies (Apriyana et al., 2025).

Graph 7. Number of Individual Agricultural Holding by Irrigation Use on Rice Fields and Dry-land, 2023

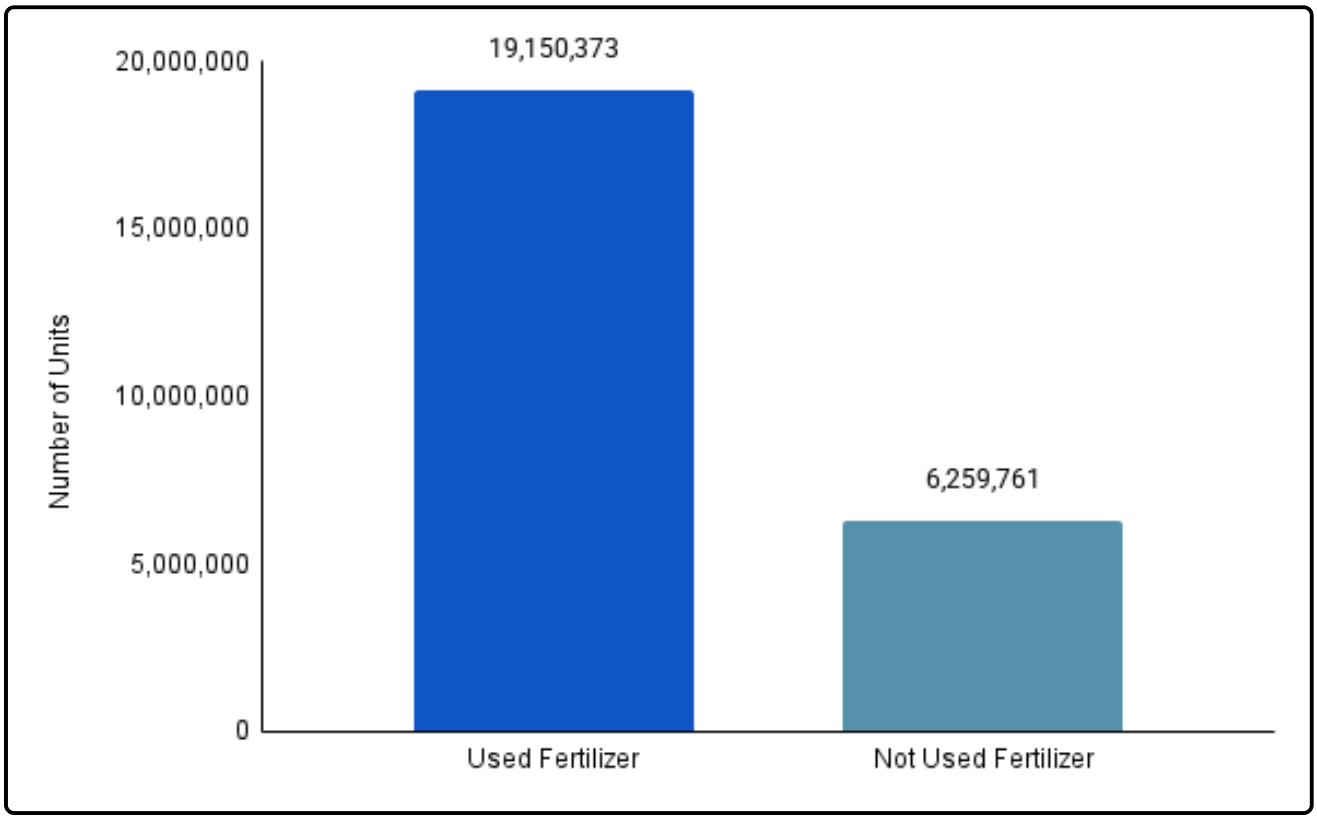


Source: BPS (2024a), processed by author.

Previous studies have shown that irrigation provides a positive impact on agriculture. Wang et al. (2021) found that irrigation increases the yield probability higher compared with rainfed production. Irrigation could also reduce the year to year yield variability among different years (Kukal & Irmak, 2020). From the literature, it is empirically supported that irrigation will improve crop yields and stability for farmers. Such accomplishment is important, especially for farmers, when they face shock and uncertainty among their crops. And if the income is stable, farmers tend to invest more in other sectors which possibly increase the farmer's productivity (Abokyi et al., 2020).

Another important characteristic of Indonesian agriculture is the uneven use of productivity-enhancing inputs such as fertilizer. **Graph 8** shows that in 2023, approximately 19.2 million individual agricultural holdings reported using fertilizer, while a considerable number, with around 6.3 million holdings, did not use fertilizer at all. This indicates that a significant share of individual agricultural holdings in Indonesia still operate without basic chemical or organic inputs to support soil fertility and crop growth. Given the absence of fertilizer use, these holdings are likely to exhibit lower productivity compared to those that use fertilizer.

Graph 8. Number of Individual Agricultural Holdings by Fertilizer Usage, 2023

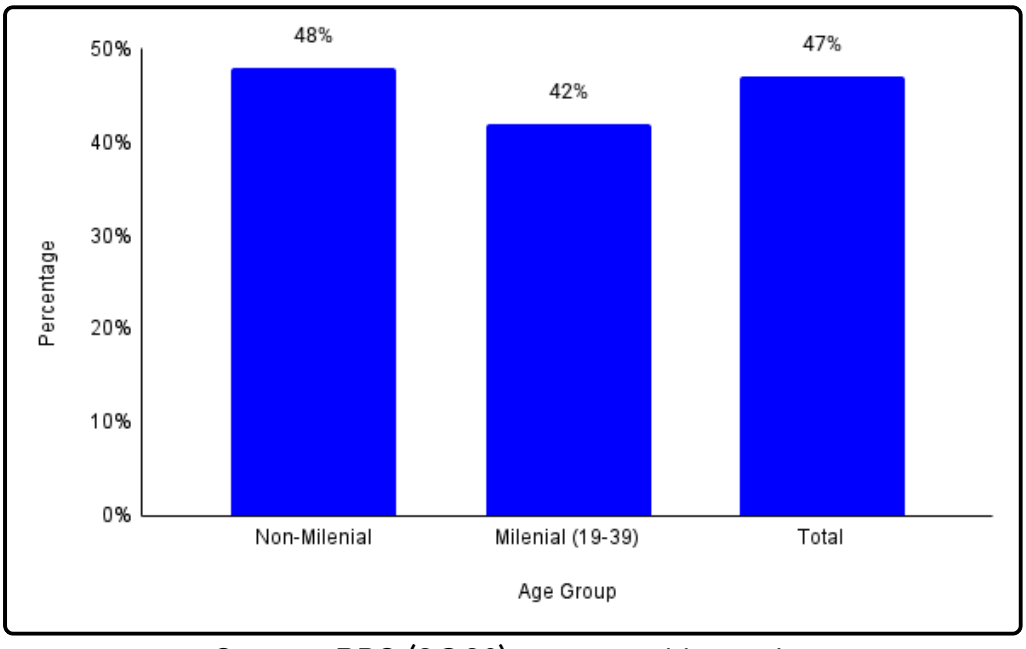


Source: BPS (2024a), processed by author.

To address the uneven use of fertilizer among agricultural holdings, the Indonesian government has implemented several policy initiatives aimed at improving farmers' access to agricultural inputs. One of the main policy instruments is the subsidized fertilizer program, which aims to lower input costs for smallholder farmers and support agricultural production. The program is implemented through fertilizer quota allocations based on farmer registration systems (called *Sistem Elektronik Rencana Definitif Kebutuhan Kelompok* or e-RDKK) and relies heavily on state-owned enterprises, particularly PT Pupuk Indonesia, for fertilizer production and distribution (Firdausi et al., 2025). Despite this effort, **Graph 8** suggests that more than 6.2 million individual agricultural holdings still run their agricultural production without any fertilizer and there still a lot room for improvement for this area.

In terms of digital technology adoption, it is found that there is an increasing trend of digital technology adoption among farmers in Indonesia (see **Graph 9**). BPS (2023) defines digital technology as the use of the internet, smartphones, information technology, drones, and artificial intelligence for agricultural activities. This trend represents a notable achievement, as it indicates growing awareness and willingness among farmers to integrate digital tools into agricultural practices. Moreover, existing literature suggests that the adoption of digital technology in agriculture can lead to improvements in productivity, input efficiency, and market access, by facilitating better access to information, reducing transaction costs, and supporting more precise farm management decisions (Abiri et al., 2023; Balyan et al., 2024).

Graph 9. Percentage of Farmers Utilizing Digital and Modern Technology in Indonesia, 2023



Source: BPS (2023), processed by author.

CONCLUSION

Based on this article, it is clear that no single constraint exists that influences low labor productivity in Indonesian agriculture. The issue is quite a mix of demographic, structural and technological factors. The working population in the agricultural sector is aging, and the young are no longer participating in the sector. Meanwhile, land fragmentation, insecure tenure and subsistence based production skew land productivity and discourages investment. Low mechanization, inadequate irrigation regions, and mismatched application of fertilizers are further structural problems that contribute to such problems. The facts show that agricultural output in Indonesia requires a comprehensive transformation strategy, which will address labor relations, land institutions, and the availability of modern inputs and technologies simultaneously. Without these coordinated reforms, agriculture will have remained a low productivity survival sector that will undermine its historical role as an economic growth stabilizer, food security, and poverty reduction instruments in Indonesia.

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