Indonesian Agricultural Workforce in the Digital Era

Review of Integrative Business & Economics Research

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ABSTRACT

As an agricultural country, Indonesia must develop farmers amid the digitalization. This study aimed to determine the characteristics of Indonesian farmers in the digital era. This research used microdata from Indonesia in 2020, comprising 22,078 data, and the probit method. The research result found that the majority of Indonesian farmers have not used the Internet for agricultural development to increase agricultural products such as promotion, communication, and transactions. The agricultural workforce is also not even highly educated, having only completed elementary school. This hinders the absorption of digitalization knowledge among farmers due to a lack of understanding of how to use the internet and smartphones. Most farmers are between the ages of 25 and 54 and have a low understanding of digitalization, whereas highly educated young workers are less interested in working in the agricultural sector due to a lack of practical agricultural skills and the stigma associated with low wages. Increasing the practical skills of farmers through formal training, as well as the participation of young workers in agricultural technology innovation and development is very much needed. The government must also meet the demand for internet infrastructure to reach remote villages, which is the primary facility for maximizing internet usage.

Keywords: Employment, Agriculture, Technology, Human Capital.

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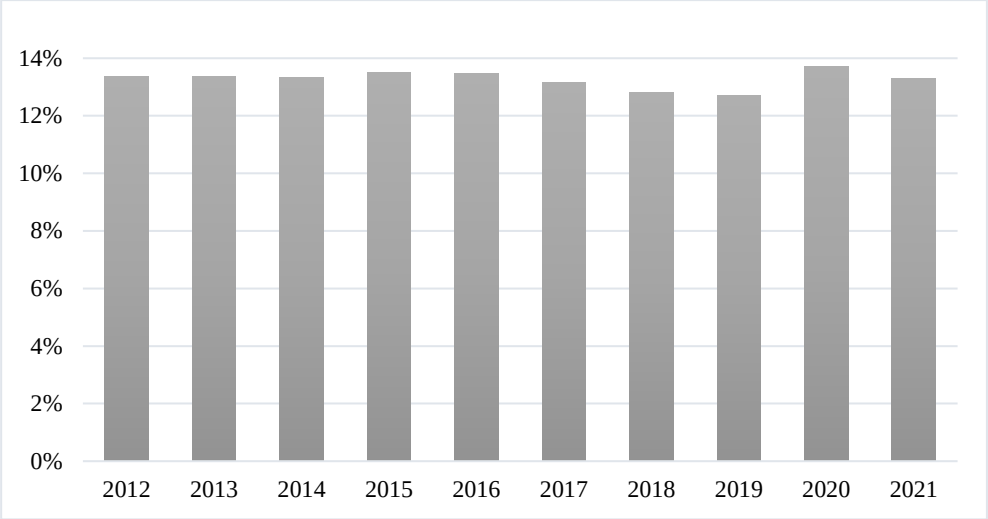
1. INTRODUCTION

Known as a developing country with abundant human resources, Indonesia has received special attention from international organizations in terms of population. According to the 2017 World Population Prospect, Indonesia is the fourth most populous country, and its population growth has a positive influence on the composition of the global population. The demographic bonus projected by the Central Statistics Bureau (BPS) and ongoing since 2010 has made Indonesia's human resources condition abundant and a distinct strength for the national economy. Along with these conditions, the number of elderly population continues to grow. This fact is in line with the health program launched by the government in the health insurance scheme for the entire Indonesian population through the Health Social Security Administration Agency (*BPJS Kesehatan*).

Figure 1. Agriculture's Contribution to Indonesian GDP (%)



Source: Badan Pusat Statistik, 2022

On the other hand, agriculture continues to contribute significantly to Indonesia's national income. Until 2021 the Indonesian agricultural sector still contributes up to 13.28%. This percentage is quite stable as compared to previous years in Indonesia. Even though Indonesia's economic policies have been quite successful in shifting Indonesia's economic foundation from agriculture to industry, this sector remains in great demand among Indonesian workers. Farming skills are considered an inheritance from parents. Land in rural areas that are still extensive is an agricultural asset for Indonesian farmers, who continue to maintain agriculture as one of the sectors engaged in by Indonesian workers.

The contribution of the Indonesian agricultural sector to national income which is still quite high is supported by other informal sector labour patterns, such as labour interest in various formal, non-formal agricultural, and non-agricultural sectors and agricultural workers in Indonesia. Agricultural workers continued to dominate the workforce until 2018. From 2011 to 2018, the agricultural workforce increased by an average of 37.60%. Meanwhile, the workforce in the formal non-agricultural sector fluctuated significantly, with an average of 30.25%. The formal sector workforce

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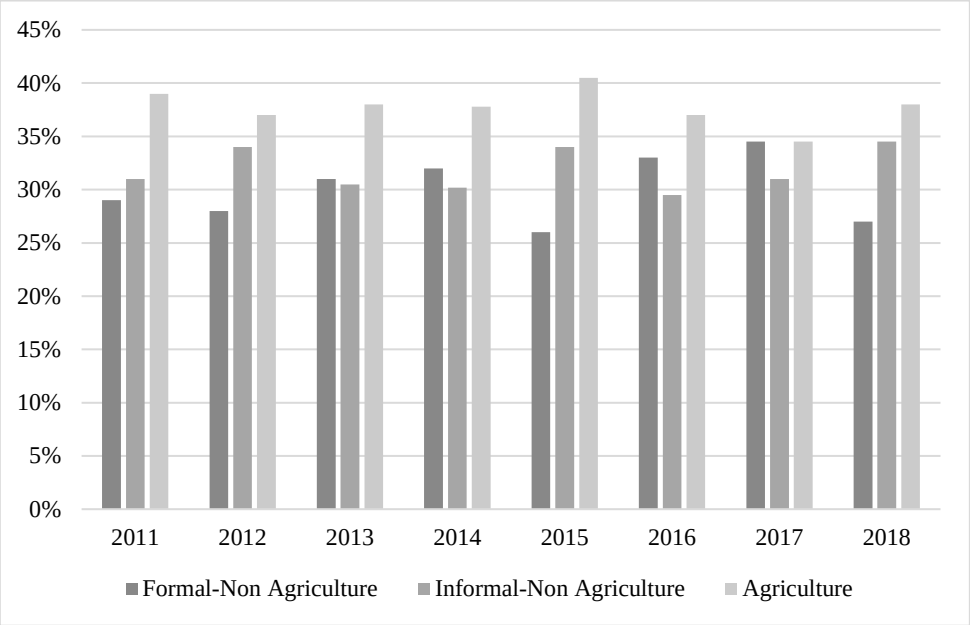
declined significantly in 2015, while the average for non-agricultural informal sector workers remained quite stable at 31.87% (Figure 2). Figure 2 shows that the potential of agriculture in Indonesia still has a high potential for absorbing labour from other employment sectors.

Figure 2: Share of Labor in the Agricultural Sector, and Non-Agricultural and Informal Non-Agricultural Sectors, 2011-2018 (%)



Source: Badan Pusat Statistik, 2018

The growth of the agricultural sector in Indonesia, combined with the absorption of a comprehensive workforce, is regarded as required for further observation. This condition cannot be tolerated due to the inability of the elderly workforce to participate in the process of innovation and higher productivity, which ultimately affects regional economic growth as a whole (Guo *et al*., 2015) The agricultural sector is a crucial sector to all people; thus, if this condition is allowed to continue, it will bear the negative impacts of the aging workforce in this sector.

Increasing agricultural productivity is still extremely doable in this digital and millennial era. Digitization of agriculture is the key to this increase. Artificial intelligence, robotics, and the Internet of Things (IoT) can all increase productivity and improve the quality of life in many ways (Savitri, 2019). The success of agricultural digitization is largely determined by the age and educational level of the workforce working in the sector. The higher the education level and the younger the farmer, the more open they are to adopting technology. Due to the fact that the majority of Indonesian farmers only have a high school education, this presents a particular issue in that country. On the other hand, the massive use of the internet and digital media among the millennial generation has resulted in the low interest of the millennial generation to become farmers (Schwab, 2019). It is acknowledged that the COVID-19 outbreak may increase the amount of internet use and e-commerce to improve the economy in all sectors (Ji & Zhang, 2022).

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The low number of people in Indonesia who are interested in farming and the country's lack of use of digital media and the internet in agricultural activities make agriculture in the country seem stuck and unchanging enough, as evidenced by the marketing and techniques used by agricultural actors. Nonetheless, due to the poor educational attainment of Indonesian farmers, there are still few large-scale innovations implemented by farmers. Based on this explanation, it is important to understand the characteristics of Indonesian farmers in the digital era by analyzing data on Indonesian workers from the Central Bureau of Statistics (BPS) in the 2020 National Labor Force Survey (SAKERNAS).

2. LITERATURE REVIEW

Qualified human resources are one of the main assets in economic growth. Digitalization is a process based on digitization, adding interconnections that enlarge the space involved in the innovation process and cause social and institutional changes (Rolandi *et al*., 2021) Using digital technology has helped agricultural managers to increase efficiency, and yields, and reduce losses (Nasirahmadi & Hensel, 2022).
According to Chergui *et al*. (2020) a digital farming approach can provide farmers with useful information on the following subjects: (1) use of fertilizers, chemicals, seeds, and irrigation management strategies, (2) environmental protection, (3) pest control, climate, and crop monitoring management solutions, and (4) market tensions and business conditions. However, materials production systems are complex, and dynamic, and require sophisticated management. The digitization approach is expected to provide more monitoring, data analysis, and optimization capabilities, as well as further decision support.

According to Rotz (2019), agricultural automation significantly improves the lives of farmers and workers who can take advantage of digital technology to create new jobs. Nevertheless, a branched labour market radically increases social asymmetry (Rotz *et al*., 2019). As a result, if farmers make the most of digitalization, their income will increase greatly; however, farmers who are unable to operate digital tools will not receive a high income, and inequality will occur. Low-skilled workers are at risk of becoming dependent on robots and other automation tools. However, if this automation is run simultaneously, the fulfilment of SDGs will be disrupted since it consumes too much electricity to run the automation (Laamarti *et al*., 2020).

The key to the development of agricultural digitization is education. Only educated and competent producers can understand and appreciate that the introduction of new technologies can result in savings, analytical systems that can help better management decisions and the purchase of equipment that can improve the quality of all output (Geels, 2002).

3. METHOD

This research is quantitative as data used are in the form of numbers and analyzed using statistical methods (Sugiyono, 2010). The results of the analysis are then turned into a description of a process of identifying facts and interpreting them appropriately. In general, this study aims to analyze the success of the workforce in the agricultural sector in the digital era.

The 2020 National Labor Force Survey (SAKERNAS 2020) results served as the research's data source. SAKERNAS is a household-based survey that the Indonesian Central

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Bureau of Statistics (BPS) conducts regularly to collect data about Indonesian employment. The data was chosen in this study because it contains a comprehensive source of the characteristics of Indonesian employment data in the form of a cross-section, making the data suitable for use as the main source in this study. In addition, the data for 2020 represents the most recent valid publication. The research population is the entire workforce in Indonesia with a total of 793,202, while the sample in this study is Indonesian farmers with a total of 22,078 (Badan Pusat Statistik, 2020). The data analysis method used was probit binary regression analysis which aims to find out the characteristics of Indonesian farmers. This probit model is used to analyze data with qualitative variables that reflect the choice between two alternative answers to determine the probability of the elderly engaging in the agricultural sector which is expressed in the dummy variable using attributes 1 and 0. The basic formula for this probit model is as follows:

$$\mathbf{Yi = \beta 0 + \beta 1 Xi}$$

where: Yi = dependent variable

β0 = Constant

βi = coefficient of variable Xi

Xi = Independent variable

The following is the elaboration form of the probit model in this study:

$$\mathbf{Y = \beta 0 + \beta 1\ X1 + \beta 2 X2 + \beta 3\ X3 + \beta 4\ X4 + \beta 5\ X5 + \beta 6\ X6 + \beta 7\ X7 + \beta 8\ X8 + \beta 9\ X9 + \beta 10\ X10 + \beta 11\ X11 + \beta 12\ X12 + \beta 13\ X13 + \beta 14\ X14 + \beta 15\ X15 + \beta 16\ X16 + \beta 17\ X17 + \beta 18\ X18 + e}$$

where:

Y = Probability of labour entering agriculture

X1 = internet (1 = use internet, 0 = don't)

X2 = marital status (1= married, 0= other)

X3 = promotion (1 = use internet for promotion), 0 = no)

X4 = communication (1= use internet for communication, 0=no)

X5 = transactions (1 = use internet for transactions, 0 = no)

X6 = under elementary school education level of farmers

X7 = Elementary School education level of farmers

X8 = Junior High School education level of farmers

X9 = Senior High School education level of farmers

X10 = Vocational High School education level of farmers

X11 = Diploma Degree education level of farmers

X12 = Bachelor Degree education level of farmers

X13 = Farmer aged 15-24 years

X14 = Farmer aged 25-34 years

X15 = Farmer aged 35-44 years

X16 = Farmer aged 45-54 years

X17 = Farmer aged 55-64 years

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X18 = Farmer aged >65 years

4. RESULT AND DISCUSSION

The importance of the agricultural sector in economic development lies in several ways, including providing an ever-increasing food surplus to an increasing population, increasing demand for industrial products which affects expanding the secondary and tertiary sectors, and generating additional income and foreign exchange for imports of capital goods needed for development. These can be done by consistently exporting agricultural products, increasing village income to support government mobilization, and improving the welfare of rural people (Jhingan, 2000). The role of agricultural sector plays such an important part in human life that it is still the major sector responsible for providing the country with safe food stocks.

Based on data from Indonesian Agricultural Indicators (Badan Pusat Statistik, 2021), the production index of the agricultural sector by subsector from 2016-2020 is as follows:

Table 1. Production Index of the Agricultural Sector by Sub-Sector 2016-2020 (2010=100)

Sub Categories	2016	2017	2018	2019	2020
Crops	113.10	119.84	95.30	94.42	91.95
Horticulture	122.62	113.33	95.18	112.43	119.26
Plantation	121.83	124.91	143.45	151.92	155.53
Farm	135.07	139.19	272.78	275.63	280.08
Fishery	162.46	193.84	198.55	196.01	-
Forestry	69.86	83.86	95.66	96.47	-
Agriculture	125.51	122.56	150.11	162.43	167.55

Source: Badan Pusat Statistik, 2021

In general, over the last five years, the total agricultural production index in Indonesia has increased significantly, from 125.51 in 2016 to 167.55 in 2020, representing a 42.04-point rise. Plantations, livestock, fishing, and forestry were the subcategories with increased production indexes. Meanwhile, horticulture production has increased during the last 3 years, from 2018 to 2020, has increased, but it remains lower than in 2016. Another sub-category that experienced a significant decline is food crops. Even though there was a rise in 2017, the trend continued to decline. In 2016, the horticultural production index was 122.62 and dropped to 91.95 in 2020. This means that agricultural production has decreased by 30.67 points.

Based on these facts, Indonesia's dream of self-sufficiency in food and the certainty of the existence of food stocks are fading, as evidenced by a significant fall in the food crop production index from period to period, including rice, corn, green beans, peanuts and soybeans (Badan Pusat Statistik, 2021). Of course, this issue can be solved by increasing the number of farmers to match the rise in population. As the population

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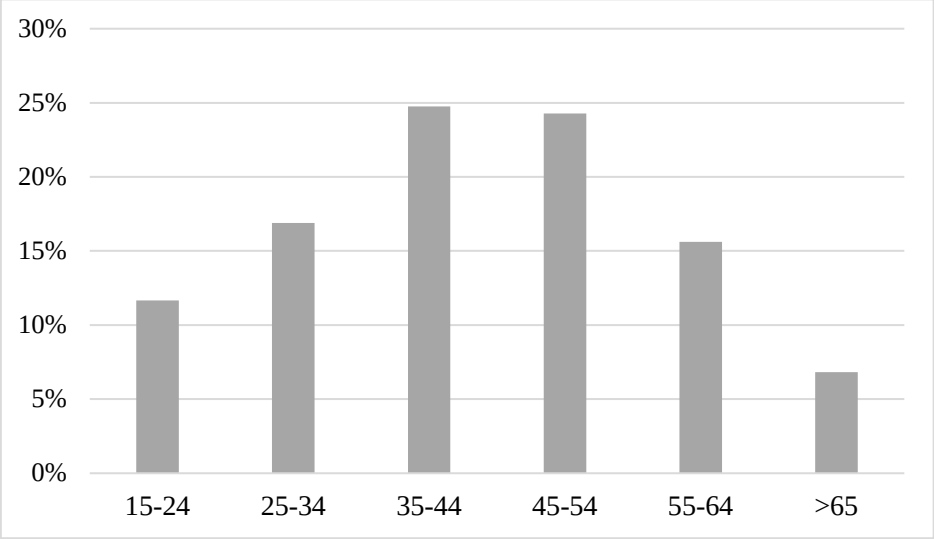
grows, so does the demand for food crop products to meet market needs (Ross & Hansson, 2018)

In the era of digitalization in the Industrial Revolution 4.0, stakeholders in the agricultural sector must be able to prepare and adapt to these changes. One of them is the ability of farmers to access the internet. Based on the sample used in this study of 22,078 workers, only 792 (3.58%) farmers use the Internet, while the other 96.41% do not (Badan Pusat Statistik, 2021).

Comparing Indonesian farmers' use of the internet for transactions, communication, and promotion to that of other sectors, it is still relatively low. Farmers continue to apply inadequate digitalization in their agricultural processes, particularly in the marketing sector, meaning that it is still heavily underutilized. Indonesian agriculture still tends to be conventional in the field of marketing, making the price of agricultural products also depend on market prices because of the intense competition (Badan Pusat Statistik, 2021).

On the other hand, the age of farmers determines how the use of the internet and digitalization can be optimally adopted by farmers in Indonesia. It is evident that the age of farmers can influence whether or not they use digital technologies.

Figure 3. Age Distribution of Indonesian Farmers



Source: Badan Pusat Statistik, 2021

The age distribution of Indonesian farmers is quite diverse. Up to 11.66% of Indonesian farmers are between the ages of 15 and 24 years and 16.89% are between 25 and 34 years. Most farmers aged 35 to 44 years reached 24.75%, followed by farmers aged 45 to 54 years with a total of 24.27%. The remaining 15.61% are farmers aged 55 to 64 years and 6.83% are elderly farmers or over 65 years. This age distribution shows that the largest age range for Indonesian farmers is 35-54 years. This age is not too old to start using the internet and other digital devices. However, it must be supported by good education and knowledge in adequate use of the internet.

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Table 2. Probability of Indonesian Farmers Using Digital Technology

Y: 1= Agriculture labor 0 = no	Coefficient	Sig
Using Internet	-0.013102	0.869
Promotion	-0.5344348	0.000
Communication	-0.0311191	0.000
Transaction	-0.4807022	0.000
Married	0.3932298	0.000
Under Elementary School	1.226201	0.000
Elementary School	1.173991	0.000
Junior High School	0.8895792	0.000
Senior High School	0.6378981	0.000
Vocational High School	0.5630684	0.000
Diploma Degree	0.1118463	0.436
Bachelor Degree	-0.0865732	0.533
Age 15-24	0.077983	0.017
Age 25-34	0.3839762	0.000
Age 35-44	0.3857982	0.000
Age 45-54	0.3848713	0.000
Age 55-64	0.2716971	0.000
Age >65	-0.33536	0.198
Constanta	-3.339849	0.000

Source: Badan Pusat Statistik, 2021.

Based on the results of the probit regression output, the dependent variable is 1 = agricultural labour and 0 = non-agricultural labour, internet use for farmers is -0.013102 and is not significant at α = 5% (0.869 > 0.05). This demonstrates that while a small percentage of farm labourers use the internet and digitization, some do. The use of the internet and digitization among farmers is limited because Indonesian farmers continue to rely on conventional methods to solve agricultural problems such as marketing and obtaining superior seeds. The limited use of the internet has forced the marketing and growth of agricultural products in Indonesia to stagnate year after year. As the global economy shifts towards a digital world, the availability of reliable internet infrastructure reaching villages is also critical to support the role of farmers in digital development. In addition to adopting technology, the government must be able to encourage promotion and support the spread of internet use (Schwab, 2019). Positive farmer digitization efforts will emerge if the infrastructure is adequate, evenly distributed, and widely accessible to farmers at a low cost. Digitalization and automation are dependent on the availability of the internet infrastructure itself.

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Additionally, farmers have not fully utilized the internet as a means of promotion. It is proven by the coefficient value at -0.5344348 which is significant at α=5% (0.000 <0.05). It can be said that farmers have not carried out digital promotional activities for agricultural products, thus marketing remains conventional, such as in markets and collector shops. Another activity that uses the internet is communication, with a significant coefficient of -0.0311191 at α=5% (0.000 <0.05). In general, farmers have used smartphones to communicate. However, not all farmers engage in intense communication as a means of business, marketing or enhancing production. It is known beforehand that technology opens up economic opportunities for the people of any country. Farmers who struggle to read can now be taught directly how to increase productivity through videos (Rolandi *et al*., 2021). Furthermore, the use of the internet for buying and selling transactions is also still low with a significant value of -0.4807022 at α=5% (0.000 <0.05). Additionally, farmers have not fully embraced digital transactions and have not even done so to meet transactional needs.

Based on the results of the probit regression for the education variable, the highest coefficient value is shown by agricultural labour under elementary school and elementary school of 1.226201, which is significant at α=5% (0.000 <0.05). This means that the majority of Indonesian farmers are low-educated labour resources. Many studies have indicated that advances in the application of technology must be supported by adequate understanding. Faskhutdinova (2020) argues that the development of digital literacy education and skills is immediately enhanced through the training of highly qualified personnel for the digital economy and the development of educational programs for the dissemination of digital competencies (Faskhutdinova *et al*., 2020). Developed countries are successfully modernizing their economies, developing innovative technologies at an accelerated pace, dominated by artificial intelligence, automation, and digital platforms. According to experts, by 2021, digital technology will account for 25% of the global economy, facilitating the smooth operation of nations, corporations, and societies (Faskhutdinova *et al*., 2020).

Given the fast aging information, the education system must adapt to changing environmental needs and shift the focus of educational programs away from the development of exclusive topic knowledge and toward the development of personal and meta-subject competencies, which will be increasingly required (Kumar, 2016). Increasing the competence of farmers through training and personal development is carried out to improve the overall digital literacy skills of farmers so that the skills acquired by farmers can grow simultaneously. Apart from formal education, digital innovation can be carried out through banking institutions, government agencies in the business world, and practices from academics. Knowledge about consumer satisfaction also needs to be improved, for example, ideas and suggestions for product development, improving service quality, campaigns on digital platforms, and consumer feedback(Purbasari *et al*., 2023).

In addition to schooling, the age distribution of farmers is another noteworthy aspect. The most dominant Indonesian farmers are in the age range of 25 to 54 years, with a coefficient value of 0.38. The age distribution of Indonesian farmers can be classified as quite good, but the use of technology is limited to farmers who are quite young by developing digitalization, technology and superior seeds that are more focused on supporting adequate agricultural technology. The digitization movement focuses on a young workforce that is familiar with the internet and cutting-edge agriculture technologies. Unfortunately, young workers with agricultural graduates rarely engage in agricultural work. They are more interested in theory than in

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agriculture and lack any real agricultural abilities. Nevertheless, many agronomists do not make adjustments more practically by changing the methods they use to increase the productivity of agricultural products. The methods that can be adopted are preparing young specialists for work through master programs from selected higher education institutions in the country, including basic higher education institutions for staff training for companies in the sector; training of young specialists in new fields; direction of personnel for retraining in the country's leading higher educational institutions with an orientation towards acquiring knowledge in the field of management that will make it possible to use the high scientific potential of training in solving the most pressing problems of industrial development (Faskhutdinova *et al.*, 2020).

5. CONCLUSION

The characteristics of the Indonesian agricultural workforce in this digital era are the low use of the internet to increase the productivity of agricultural products and marketing activities, such as promotions, transactions, and communications. This shows that Indonesian farmers have not fully implemented digitalization to increase the productivity of agricultural products. Furthermore, the majority of Indonesian farmers have low education; they either never went to school or only graduated from elementary school. This is quite disruptive to the absorption of the use of technology and digitization in the farming process to the development of agricultural products due to the lack of knowledge of farmers in the use of technology. When it comes to age, Indonesian farmers are between the ages of 25 and 54 years, and at this age, they still face constraints in using digital technology due to the lack of expertise with digital applications. Millennials who contribute to the development of Indonesian agriculture are urgently needed. Agricultural graduates who have received a proper education should be able to contribute to the revival of Indonesian agriculture. The things needed to revive Indonesian agriculture are practical training for farmers in technology and digitalization, an increase in the number of young farmers skilled in innovation, the development of agricultural products, and the provision of internet infrastructure in rural areas as the primary means of accessibility in the digital era.

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