The Superior Strategies to Establish Indonesia Digital Agriculture by 2030

Ani Apriani[1]; Ardy Kusuma Nugraha[2]; Afifah Fitriani[3]; Herlina Duma[4]; and Yayan Sudaryana[5]

Universitas Pamulang, Tangerang Selatan, Indonesia

Email: [a]aapriani294@gmail.com; [b] ardykusumanugraha@gmail.com; [c]afifahfitriani90@gmail.com; [d]herlinaduma19@gmail.com; [d]dosen00497@unpam.ac.id

Abstract: The biggest problem in agricultural development lies in human resources. As the results of the 2018 Agricultural Census, the majority of farmers are in the 45-54 year range, which is 28%, while the number of young farmers aged less than 25 years is only 1%. Many experts agree that attracting the younger generation to want to farm is through efforts to improve the welfare of farmers. Digital transformation in agriculture is an effort to improve farmers' welfare. The focus of digitization is not only on the upstream part of cultivation (on-farm) but also must be integrated with the downstream part of marketing or off-farm. Digital literacy is an important part of the adoption of digital agriculture. Institutions that play an important role in the development of digital agriculture, namely, the Ministry of Agriculture, the Ministry of Communication and Information, the Ministry of Trade, Research Institutes and Universities and the Private Sector. If theprogress in the fields of technology and science, especially with the implementation of digital agriculture accompanied by government policy support, continues, then based on the projection results, the contribution of the agricultural sector in 2030 will reach 1.662 trillion Rupiah.

Keywords: Strategy, *digital agriculture, Indonesia, 2030*

INTRODUCTION

The Covid-19 pandemic that has hit the world has resulted in an economic downturn in Indonesia of 2.07% in 2020 [1]. When various sectors experienced a decline, there was one sector that experienced positive growth in the economic sector namely, the agricultural sector which experienced positive growth of 2.15 percent (y on y) with a prediction of 3.30% to 4.27% in 2021 [2].

The growth of the agricultural sector is not proportional to the increase in the exchange rate of farmers, which is slower than the increase in the exchange rate of workers in other sectors. The farmer's exchange rate in March 2021 is 103, meaning that the condition of farmers is heavy when buying non-agricultural/industrial goods [3]. The exchange situation

is crawling slowly,which is to be the cause of the slow regeneration of farmers. Workers who are engaged in the agricultural sector, especially the cultivation of agricultural crops/plantations, consisting of older people. Thus, affected their poor productivity is not good and adaptation to technological develpments are slower than younger farmers.

Agricultural development is carried out through optimal management of all resources, both natural resources or human resources, technology, and institutions. But until now the biggest problem of agricultural development is in human resources. The agricultural sector is one of the sectors with a fairly large national labor absorption rate of 25.19%, but the demographic structure has changed in which older farmers (more than 55 years) are more than young farmers [4]. As in the 2018 Agricultural Census, the majority of farmers are in the 45-54 year range, which is 7,813,407 or 28%, while the number of young farmers under 25 years is only 273,839 or 1% [5].

The lack of interest of the younger generation in agriculture is an old phenomenon, nowadays the younger generation tends to choose to work in the non-agricultural sector. Narrow land ownership and low use of technology make Indonesian agriculture dominated by traditional agriculture which is less profitable. In addition, the possibility of crop failure, natural disasters, and price fluctuations puts the agricultural sector at a high risk of loss. The combination of low income and high risk of loss makes the younger generation more attracted to the industrial/service sector which tends to have higher and relatively stable incomes. This makes the agricultural sector the sector of the last choice compared to other occupations. Therefore, it is necessary to develop a strategy for developing an Agricultural Management Information System through Digital Agriculture to attract the younger generation to agriculture.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Digital Agriculture

Agriculture is defined as the effective integration of Information and Communication Technology (ICT) in the agricultural sector so as to realize sustainable agriculture, providing accurate agricultural information, which enables farmers to make informed decisions to increase productivity [6]. Digital agriculture is understood as the application of information and communication technology (ICT) through relevant devices, networks, services and applications with a primary focus on agriculture, can help agricultural stakeholders to make the best decisions and use the available resources in the most productive and efficient way. sustainable. Thus, it can increase the productivity of cultivation (on-farm) through increasing technical and allocative efficiency, post-harvest profitability (off-farm), and environmental sustainability [7].

In terms of increasing agricultural productivity, the use of digital approaches can increase the generation, dissemination and absorption of technical knowledge and good practices; measurable application of water, fertilizer, feed and other inputs in relation to certain types of plants, soil, climate and animal species; more effective use of physical capital, including tractors, machinery and equipment, in agriculture; improved decision-making and farmer mitigation through the provision of more accurate, timely, and location-specific weather, agronomic and livestock data; and better alignment of production decisions with broader market conditions, trading opportunities and storage options.

Degeneration of Human Resources in the Agricultural Sector in Indonesia

Degeneration is defined as the decline or decline of a generation, which means that the new generation is less than the previous generation [8]. Farmer degeneration is a decline in regeneration that occurs among farming families [9]. The trend of degeneration of human resources in the agricultural sector is caused by the income of farmers being less promising and based on social status that is still considered low, this condition results in a decrease in the interest of youth to enter the agricultural sector [10].

As of the results of the 2018 Agricultural Census, the majority of farmers are in the 45-54 year range, namely 7,813,407 or 28%, while the number of young farmers aged less than

25 years is only 273,839 or 1%. The distribution of the number of farmers by age group is shown in the following diagram:
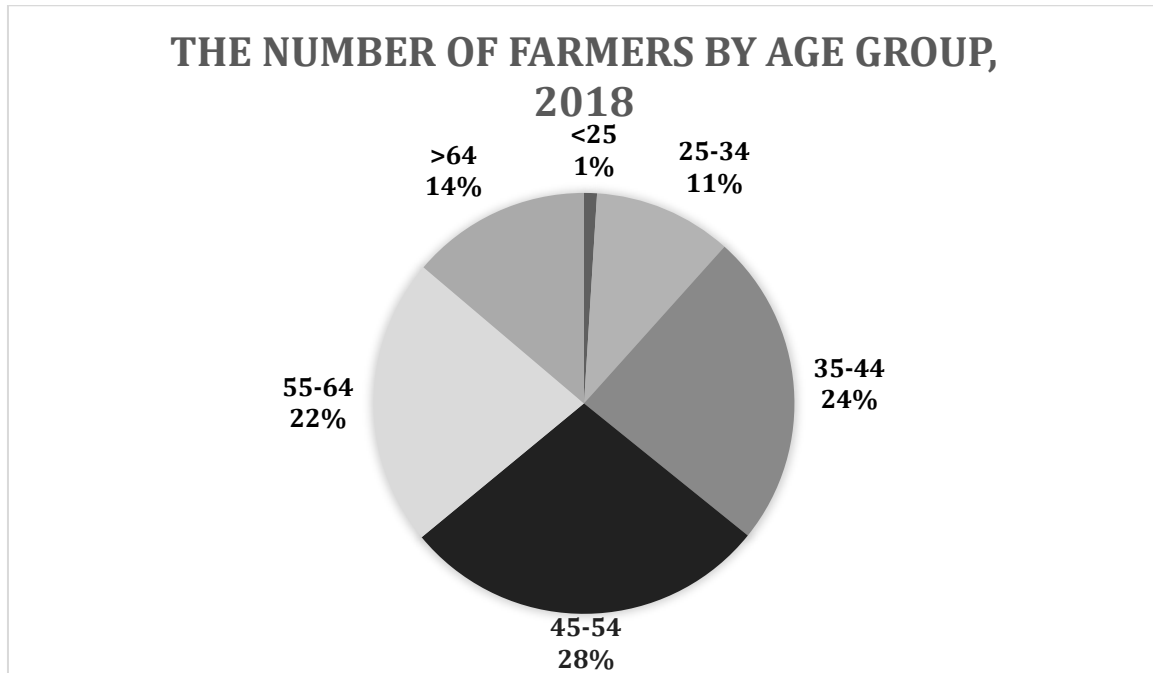
Figure 1. Diagram of the Number of Farmers by Age Group [5].

The factors that influence the degeneration of farmers are the lack of parental socialization to continue farming, less prestigious farming jobs, high economic uncertainty and the risk of crop failure, education and changes in the orientation of the younger generation to the world of work.[9]. Agricultural productivity can be influenced by the level of interest of potential human resources in the agricultural sector rather than the industrial sector. The transfer of potential agricultural resources to the industrial sector can hamper agricultural productivity, because it is highly expected that reliable human resources in the agricultural sector will be able to become a driving force for advanced agricultural development [11].

Structural changes in the agricultural workforce are caused by the poor image of the agricultural sector and changes in the concept of the younger generation in line with the modernization process. The agricultural sector is not the main choice of the younger generation. Factors causing structural changes in the workforce and the reluctance of the younger generation are internal factors such as small land area, low education, insufficient economic benefits, and limited opportunities for young farmers to obtain financial support services (capital), while external factors are family support. And the community environment [12].

Factors that affect the low interest in the agricultural sector, namely the perspective or way of life of youth, are now changing according to the development of postmodern society as it is today. For rural youth, they think that the agricultural sector has lost its appeal. In addition to the unpromising agricultural sector, these youths have been reluctant because they are influenced by the new culture that is developing in the current digital era [13]. The impact of agricultural degeneration is reduced food productivity. High population growth every year will increase national food needs. If this increase in food demand is not accompanied by an increase in agricultural productivity, it is not impossible that a food crisis will occur. This imbalance in the short term can still be overcome by imports, but in the long term it will be a very risky problem if you rely on other countries to meet your food needs.

METHODS

The research methodology used in this study is a literature study or library research containing theories relevant to research problems. As Nadzir (1988) says that literature study is a data collection technique by conducting a study on books, notes, literature, and reports related to the problem being studied. [14].

The data and information obtained during the literature review were then processed using descriptive analysis methods. Sanusi (2016) said that descriptive analysis focuses on a structured description of the facts or clues obtained during the research [15].

The aspects that will be analyzed are the integration of digital agriculture (on farm-off farm), SWOT analysis of digital agriculture, digital literacy and adoption of digital agriculture, the role and function of institutions related to digital agriculture and the projection of agricultural GDP growth in 2030.

RESULTS AND DISCUSSION

Integration of Digital Agriculture (*On Farm-Off Farm*)

The phenomenon of human resource degeneration in the agricultural sector is basically caused by the low level of farmer welfare. The heavy work of farmers and the low income of farmers cause agriculture to no longer be 'prestigious' in the eyes of the younger generation. Many experts agree that attracting the younger generation to want to farm is through efforts to improve the welfare of farmers. Farmers as producers of the first product should no longer receive the least profit compared to middle parties such as middlemen and wholesalers in the market. Therefore, digital transformation in agriculture is an effort to increase productivity and profitability which ultimately improves the welfare of farmers. The focus of digitization is not only on the part of cultivation (on farm) but also must be integrated with the part of marketing (off farm). The digital agriculture integration scheme which is as follows:
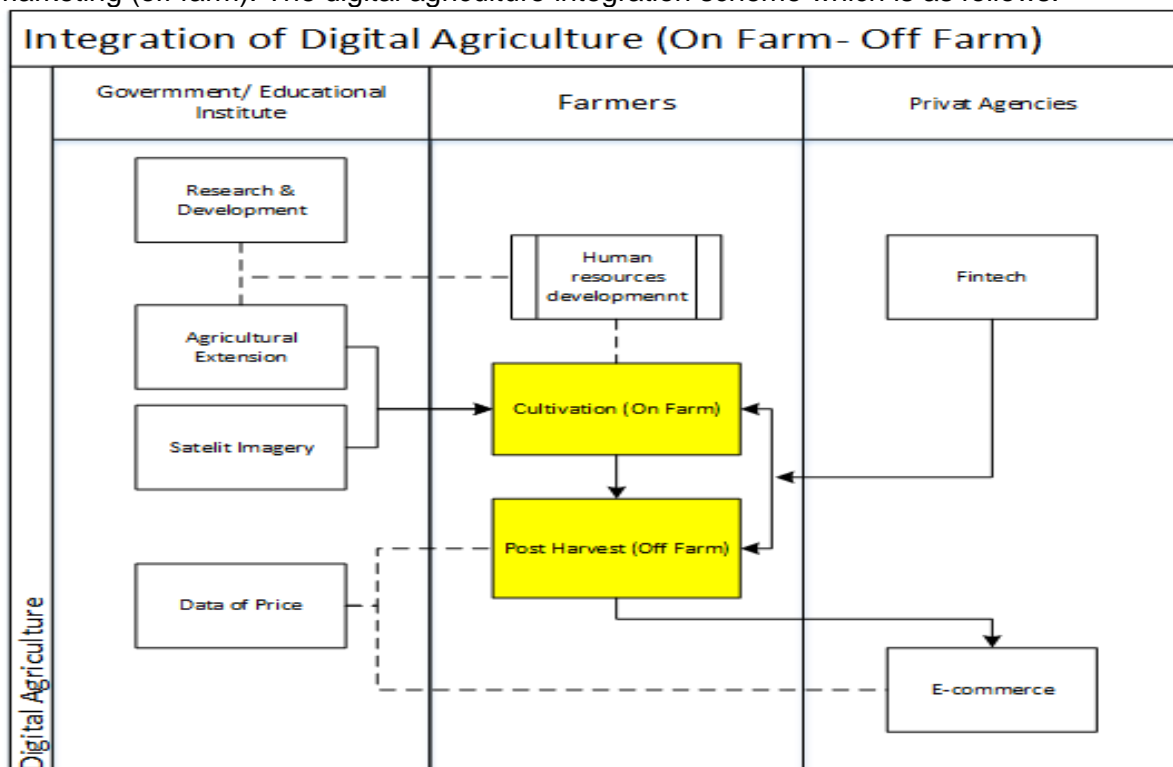

Figure 2. Integration Service of Digital Agriculture (On Farm- Off Farm)

The main service functions integrated digital farm which is as follows:
1. Agricultural Extension (On-Farm)
   Extension agriculture has an important role in terms of increasing farmers' knowledge of cultivation products and techniques. However, public extension services are still lacking in terms of reach and capacity. Therefore, through application and technology support, extension services can be provided up to the village level through various access points (mobile, web, community center, etc.) facilitated by the Agricultural Extension Coordinating Board at various levels.
2. Satellite Imagery (On-Farm)
   Satellite imagery can improve agriculture through irrigation water management, weather forecasting, yield forecasting and natural disaster prevention so that food security can be maintained. Production cost efficiency by monitoring soil organic content and water evapotranspiration. Pest & disease control management via drone
3. Financial services (On-Farm to Off-Farm)
   Improve access to financial data to rural areas (access additional information about potential clients) and increase insurance products and agricultural investments. time and energy efficiency due to digital payment systems.
4. E-commerce (Off-Farm)
   Connecting producers and consumers directly so that suppliers are more responsive to market needs. These services can increase prices at the producer level because they cut the market chain.

The functions of supporting services are as follows:
1. Research and Development
   Research and development on cultivation techniques plays an important role in technological developments, especially regarding the creation of new innovations. Therefore, data on research and development is very useful for developing cultivation techniques and developing agricultural human resources.
2. Data of Price
   Policies to maintain food price stability are very important to avoid the risk of price fluctuations that are detrimental to farmers. Therefore, data on prices from the relevant government is needed.

Digital Literacy and Adoption of Digital Agriculture

Digital literacy is the main obstacle to providing digital agricultural extension and services to rural communities, especially farmers. Whereas the use of digital technology for digital consulting services will facilitate farmers' access to increase knowledge. One of the main factors for the low level of digital literacy is that the majority of farmers are currently elementary school graduates and are elderly.

Agricultural digital literacy itself is defined as the knowledge and ability of farmers in utilizing digital agricultural media such as communication tools, internet networks and so on. Low agricultural digital literacy results in low absorption of agricultural digital technology which in turn can hamper agricultural productivity and profitability.

One of the indicators for accelerating the adoption of agricultural technology is by increasing the number of young people working in the agricultural sector. However, until now the interest of the younger generation in agriculture is still low. Whereas the total internet users in Indonesia who are in the age range of 16-64 years are 98.3% [16]. This young generation of internet users actually has the opportunity to become early adopters of agricultural digital technology. If the number of young people working in the agricultural sector increases, the adoption of technology in the agricultural sector will expand. The stages of adoption of digital agriculture are as follows:
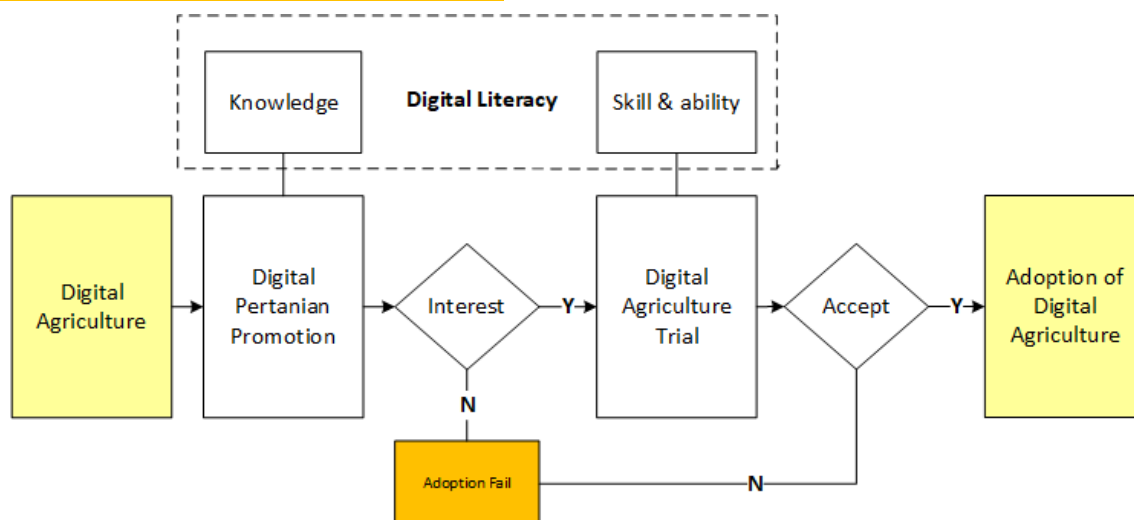
Figure 3. flow of step adoption of digital agriculture

The process of adopting digital agriculture starts with the introduction and provision of detailed information about digital agriculture, so that the target realizes the benefits of digital agriculture. Then when the target starts to take interest, the target will try to implement digital agriculture, in this stage the abilities and skills are obtained so that the target will evaluate whether to accept digital agriculture or not. If accepted then the target will continue to use and adoption of digital agriculture occurs. Meanwhile, if the target does not accept, then the adoption stage fails.

Digital Agriculture SWOT Analysis

The development of digital agriculture requires some changes in strategies and programs needed by importance, change and development of this strategy can be seen by a power analysis strengths, weaknesses, opportunities and threats or abbreviated as SWOT. For more details, it can be seen from the following table:

Strengths (Strengths)	1. Access to internet network facilities and the development of very advanced e-commerce technology 2. amount of land that can be used by farmers both traditionally and in modern agriculture (by utilizing gadgets, robot construction, and artificial intelligence) 3. Adoption of digital agricultural development science (in all countries) is increasingly accessible and can be applied 4. Can connect directly between producers and consumers so that suppliers are more responsive to market needs
Weaknesses	1. Not all farmers want to learn Digital agriculture due to limitations (stuttering technology, and there are still many who think traditionally both in managing and marketing their products) 2. Lack of socialization and support from related institutions that go directly to farmers, especially in this area regarding digital agriculture The 3. number of young farmers is less than 1% so the process adoption of agriculture digital will tend to slow 4. need for improvements in infrastructure for implementing Internet of thing (IOT) all of the area in Indonesia
Opportunities (Opportunities)	1. Opportunities grabbed networking new 2. Opportunities gain market Virtual

	3. Opportunities increase human capital
	4. Opportunities Strengthening Social Capital internally and expand the capacity of social capital of an external
threat (Threats) The	1. Number of competitors who sell similar products so they must provide more services in order to survive.
	2. There will be hackers who target online businesses such as data theft and even the theft of money from transactions.
	3. Consumer loyalty is reduced where consumers with low loyalty will tend to move places to buy.

From the SWOT analysis, the potential for the development of digital agriculture is very good, especially in the next ten years. This can be seen by the *Strengths* that are owned and can be used to improve the *Weaknesses* that exist by evaluating and implementing programs that have been planned and implemented. Received support from various stakeholders. In addition, there are many opportunities (Opportunities) that will be obtained if this Digital Agriculture develops, especially in networking and dominates the market virtually (more *modern*). However, we must also pay attention to the *Threats* that will arise from this very dynamic digital agricultural development because in addition to making it easier to access and sell products (so that the competition will be very tight), on the other hand, security against the world. *Cyber is* also a top priority in this is so that there is no crime caused by / *Cybercrime.*

Roles and Functions of Institutions Related to the Development of Digital Agriculture
Development, provision and use of digital agricultural technology is basically a private sector activity, but there is an important role for the government in policy making and public action to create the right supporting conditions for example, adequate investment incentives, infrastructure and complementary capacity to avoid market failures. The role, function and authority of institutions in the development of digital agriculture are as follows:
1. Ministry of Agriculture
   The role of the Ministry of Agriculture is very important in the development of digital agriculture because the ministry is the main institution that must promote digital agriculture to be adopted by farmers. beside other roles namely, improving agricultural infrastructure, development of agricultural extension, strengthen farmers 'incentives and improving farmers' access to agricultural inputs (seeds, fertilizers and alsintan)
2. Ministry of Communication and Information
   The Communication and Information Ministry was instrumental in the provision of technology infrastructure and information and equitable access to the network especially for rural areas. Equitable Information Technology infrastructure can increase the adoption of digital agriculture at the farmer level.
3. Ministry of Trade
   The role of the Ministry of Trade in the development of digital agriculture is to provide information on relevant agricultural markets, starting from collecting, processing and disseminating information on food prices at the retail level, especially consumer prices. Apart from monitoring, the Ministry of Trade also plays a role in controlling prices.
4. Research Institutes and Universities
   Research Institutes and Universities play an important role in contributing the results of agricultural research and innovation which will later be useful in increasing agricultural productivity and post-harvest profitability.
5. Private Institutions Private
   Institutions play an important role in the development of digital agricultural startups, ranging from farmer community applications, agricultural investment services to agricultural digital markets which are very helpful in breaking the market chain of

agricultural products. For example, there are already several agricultural startups in Indonesia including: farmer consulting services (eFishery, KARSA, NeuraFarm); mechanized platforms (Sentragro, AgroDrone); digital marketplaces (TaniHub, Chilibeli, Kedasayur); search platforms (HARA, Koltiva) and agricultural investment services (Crowde, iGrow, Tanijoy)

Agricultural Sector GDP Growth Projection in 2030

When viewed from the development of the agricultural sector from 2016 to 2020, the contribution to Indonesia's Gross Domestic Product experienced an average growth of 3.4% in the last 5 years [17]. The data can be seen in the table below:

Table 1. GDP of the agricultural sector 2016-2020

Year	Food Plants	Horticultural Plants	Plantation Crops	Total
2016	425.186	187.403	428.783	1.041.371
2017	438.890	197.326	471.466	1.107.682
2018	449.732	218.713	489.186	1.157.631
2019	446.870	238.831	517.508	1.203.208
2020*	805.956	269.165	113.805	1.188.925
Total	2.566.632	1.111.437	2.020.747	5.698.816

Notes : Number in billion
Source : BPS(processed by Pusdatin)

However, it is not impossible that in 2030 the agricultural sector in Indonesia can grow even larger with various advances in technology and science, especially with the application of digital agriculture. Companied by government policy support. If calculated by calculation, the agricultural sector in Indonesia in 2030 will be able to contribute 1.662 trillion Rupiah to Gross Domestic Product, which in detail can be seen in the following table:

Table 2. Projected GDP Growth until 2030

| Predicted Figures Assumptions Until The End of 2030				
Year	Food Plants	Horticultural Plants	Plantation Crops	Total
2021	833.412	278.335	117.682	1.229.429
2022	861.805	287.817	121.691	1.271.313
2023	891.164	297.622	125.836	1.314.623
2024	921.524	307.762	130.123	1.359.409
2025	952.918	318.246	134.556	1.405.721
2026	985.382	329.088	139.140	1.453.611
2027	1.018.952	340.299	143.881	1.503.132
2028	1.053.665	351.893	148.782	1.554.340
2029	1.089.561	363.881	153.851	1.607.293
2030	1.126.679	376.277	159.092	1.662.049
Total	9.735.063	3.251.221	1.374.635	14.360.920
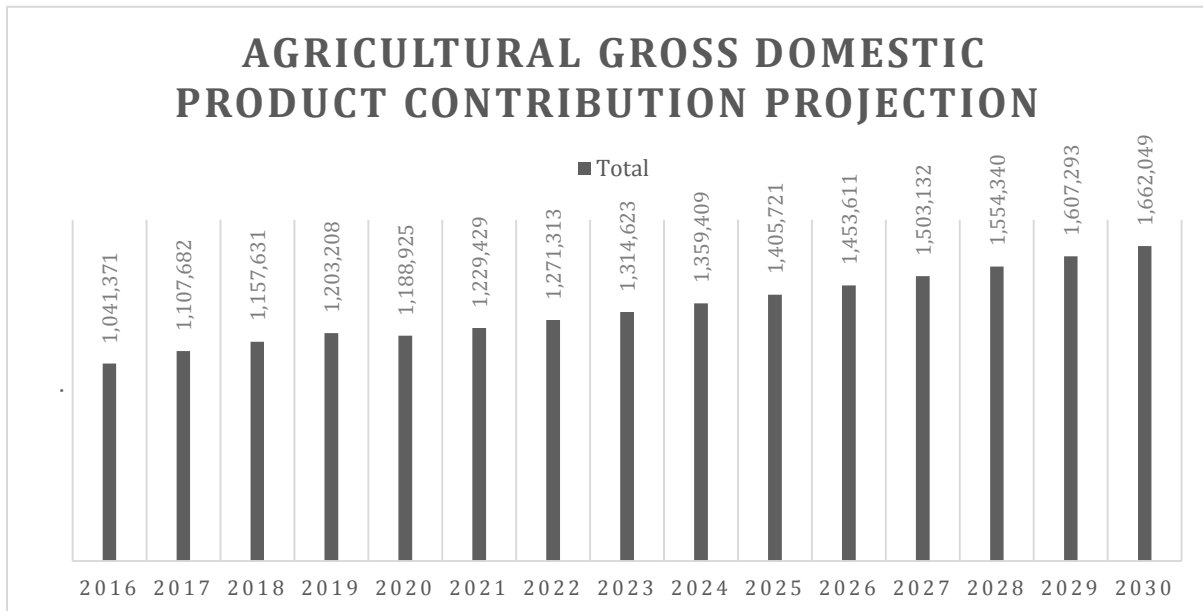
Figure 4. Agricultural Gross Domestic Product Contribution Projection

CONCLUSIONS

The phenomenon of human resource degeneration in Indonesia's agricultural sector is basically caused by the low level of farmer welfare. Digital transformation in agriculture is an effort to increase productivity, profitability, equity and environmental sustainability which ultimately improves farmers' welfare. Thus, the focus of digitization is not only on the upstream part of the cultivation (on farm) but must also be integrated with the downstream part of marketing or off farm. In addition, digital literacy is an important part of the adoption of digital agriculture. In order to accelerate the realization of digital agriculture in Indonesia, the role of the Ministry of Agriculture, the Ministry of Communication and Information, the Ministry of Trade, Research Institutes and Universities and the Private Sector is in accordance with their respective functions and authorities. Finally, if progress in the field of technology and science, especially with the application of digital agriculture accompanied by government policy support, continues, then based on the projection results, the contribution of the agricultural sector in 2030 will reach 1.662 trillion Rupiah.

ACKNOWLEDGEMENT

REFERENCE

Arviant, EY, Masyhuri, Waluyati, LR, & Darwanto, DH (2019). *Overview of the Crisis of Young Farmers in Indonesia.* Journal of Socio-Economic and Agricultural Policy, 168-180.

BPS. (2018). *Results of the 2018 Inter-Census Agricultural Survey (SUTAS).* Central Statistics Agency : Jakarta

BPS. (2020). Indonesia's Gross Domestic Product Quarter 2016-2020. BPS RI : Jakarta

Harras, H., Sugiarti, E., & Wahyudi, W. (2020). Kajian Manajemen Sumber Daya Manusia Untuk Mahasiswa.

Lubis, D., (2010). *Utilization of information and communication technology supports sustainable agricultural development.* IPB: Proceedings of theSeminar

Ministry of Republic of Indonesia. (2021). BPS, Agriculture Grows Positively 2.15 Percent YonY in the Third Quarter. Taken July 2021 from the Ministry of Agriculture's website: https://www.pertanian.go.id/home/?show=news&act=view&id=4561

Murdayanti, Maulida. (2021). *Increasing Interest of Young Farmers in the Agricultural Sector.* Journal of Agricultural Sector Human Resources, in various perspectives: UMM Malang

Nadzir. (1988). *Research methods.* Jakarta: Ghalia Indonesia

Raya, AB and S. (2010). *Public opinion on the image of local food commodities.* Journal of Agricultural Sciences: Gajah Mada University 6(2), 116–141.

Sakuntala, Anggita Ayunda. (2021). *Bachelor of Agriculture: The Young Generation And The Threat Of The Crisis Of Agricultural Human Resources.* Journal of Human Resources in the Agricultural Sector, in various perspectives: UMM Malang

Sanusi, Anwar. (2016). *Business Research Methodology.* Jakarta : Salemba Empat

Saparyati, Dwi Isnaini. (2008). *Study of the Role of Education on Agricultural Development in Demak Regency.* Diponegoro University: Thesis

Sulistyowati, T. (2019). *DEGENERATION OF RICE FARMERS IN TANJUNGSARI VILLAGE.* Semarang: Thesis : State University of Semarang.

Sunardi, N., & Lesmana, R. (2020). Konsep Icepower (Wiramadu) sebagai Solusi Wirausaha menuju Desa Sejahtra Mandiri (DMS) pada Masa Pandemi Covid-19. *JIMF (Jurnal Ilmiah Manajemen Forkamma),* *4*(1).

Lesmana, R., Sutarman, A., & Sunardi, N. Building A Customer Loyalty Through Service Quality Mediated by Customer Satisfaction. *American Journal of Humanities and Social Sciences Research (AJHSSR*), 5(3), 38-45

Lesmana, R., Sunardi, N., & Kartono. The Effect of Financing and Online Marketing on MSMEs Income Increasing at Intermoda Modern Market BSD City Tangerang Selatan. *American Journal of Humanities and Social Sciences Research (AJHSSR*), 5(7), 25-34

World Bank. (2020). *Indonesia Agro-Value Chain Assessment* : Issues and Options in Promoting Digital Agriculture

Riyanto, GP (2021, February 23). The number of Indonesian internet users in 2021 reaches 202 million. Retrieved from Kompas.com: https://tekno.kompas.com/read/2021/02/23/16100057/sum-user-internet-indonesia-2021-tembus-202-juta.

BPS (2021). Farmer's Exchange Rate (NTP) in March 2021 was 103.29, up 0.18 percent. Picked September 2021 BPS: https://www.bps.go.id/pressrelease/2021/04/01/1786/value-tukar-petani--ntp--maret-2021-sebesar-103-29-or-naik -0-18-percent.html.

KBBI. What is the meaning of the word. Taken October 2021 KBBI : https://www.kbbi.co.id/arti-kata/degeneration

BPS. (2021). Indonesia's Economy in 2020 Down by 2.07 Percent (c-to-c). picked September 2021 from BPS: https://www.bps.go.id/pressrelease/2021/02/05/1811/ekonomi-indonesia-2020-terurun-sebesar-2-07-persen--c-to-c -.html