Torun International Studies

2022, No. 1 (15), pp. 25–45

Published online June, 2022

DOI: http://dx.doi.org/10.12775/TIS.2022.002

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THE CHALLENGES TO DEVELOPING SMART AGRICULTURAL VILLAGE IN THE INDUSTRIAL REVOLUTION 4.0 – THE CASE OF INDONESIA

ABSTRACT

Nowadays, rural depopulation is one of the biggest problems in developed and developing countries, especially due to the COVID-19 pandemic. This pandemic impacts various sectors, especially the economic sector. However, the development of the 4.0 Industrial Revolution forced all sectors, including agriculture, to adapt and take advantage of internet-based digital technology by developing smart agriculture. Therefore, the objective of this study is to analyze the development of smart agriculture in rural areas. This study uses a systematic

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literature review with a TAA approach with secondary data collected from Scopus databases. The downloaded documents will be further analyzed using VOSviewer software to find the clustering. After the coding process by first-order categories, second layer theme, and aggregate dimension, this research found several theoretical concepts about the "Smart Village". The definition of the 'smart village' concept is a combination of smart agriculture and industry 4.0 technology utilized by rural MSMEs to use the information and communication technology integrated into public services and economic activities. There are still many obstacles encountered in the application of 'smart villages,' such as the lack of youth participation and the low quality of human resources in the agricultural sector, limited internet network coverage, and the lack of optimal capital support. This research will contribute to the systematic literature review method by purposing filtering criteria of TAA to shade the light of the lack of data accuracy in several leading databases of scholarly impacts. This research also gives a clear direction for further research regarding industry 4.0 and Indonesia's smart agriculture concept application.

Keywords: Agriculture, industry 4.0, micro small and medium-sized enterprises (MSMEs), rural development, TAA filtering criteria, systematic literature review

INTRODUCTION

The world is currently shocked by the global pandemic of COVID-19. This pandemic impacts various sectors, especially the economic sector (Ibn-Mohammed et al., 2021). One of the macroeconomic indicators, GDP, experienced a drastic decline in 2020 due to government restrictions (Albert et al., 2020; Malliet et al., 2020). In 2021, the economy began to recover again, marked by increases in GDP (Zhang et al., 2020). In the same year, it is expected that there will be a decrease in COVID-19 cases along with mass vaccination (Kantner & Koprucki, 2020). However, the number of COVID-19 cases keeps increasing along with the mutations in new COVID variants that were more easily transmissible and more lethal (Alkhatib et al., 2022; Monajjemi et al., 2022).

Therefore, a strategy to utilize the technology is needed to reduce direct contact without slowing the economic growth. This issue is the reason for the importance of using industry 4.0 technology (Cugno et al., 2022; Pingali & Korem, 2021). An innovative economic development model from rural areas is needed to boost the economic development by utilizing local resources such as agriculture. One of the concepts related to industry 4.0 technology is the concept of smart agriculture (Arvanitis & Symeonaki, 2020).

However, it is not an easy job to apply this concept. The problem to promote this concept is the disparity between the city and the village (Szanyi-Gyenes, 2019). The disparity between cities and villages can be seen by the rapid rate of urbanization in recent years. At present, the rate of urbanization in villages is 1.2 percent annually (Detik.com., 2019). The development gap between cities and villages cannot be separated from the impact of the unequal distribution of demographics and economic capacity (Pérez-delHoyo & Mora, 2019), also in the availability of adequate infrastructure (Brahimi & Bensaid, 2019), including disparities in information and communication technologies (Nieto & Brosei, 2019). According to the Ministry of Communication and Information (2021), around 40 percent of the total villages in Indonesia do not have access to information and communication technologies (ICT). The

data also shows that 73.4% are still categorized as underdeveloped villages, 19.1% are developing, and only 7.43% of all villages in Indonesia are developed. Now, agriculture in Indonesia has to face a new challenge of Industry 4.0 that presents a significant threat to conventional business processes while at the same time offering unique opportunities for MSMEs. Innovations in Industry 4.0 will increase the production process's complexity at the micro and macro levels (Chen, 2020; Xiang & Worthington, 2017; Zhou et al., 2020).

This research aims to present a comprehensive literature review of Industry 4.0 and the role of MSMEs in rural agriculture for developing countries such as Indonesia. Therefore, this research will provide the impact of Industry 4.0 technologies on creating a new strategy of smart village concept. This research will cover several discussions; the first is the systematic literature review methodology (SLR) with the theory, content, and method approach (Paul & Criado, 2020). Based on coding and analyzing the data collected from systematic reviewing, this research provides aggregate themes in the coding structure and will be further explained in **Section 1.** The following section will discuss how far Industry 4.0 and the role of MSMEs in rural agriculture for developing countries. **Section 3** will discuss the Industry 4.0 technology development in the Indonesian Agriculture Sector.

1. METHODOLOGY

To ensure rigor, objectivity, and transparency in the research process, this research adopts an SLR approach to obtain replicable and valid results for evaluating and interpreting all available published research studies to a precise question or topic of interest (Ali & Usman, 2018; Weißer et al., 2020). The SLR process started with defining its conceptual boundaries captured by our research question (Siegel et al., 2019).

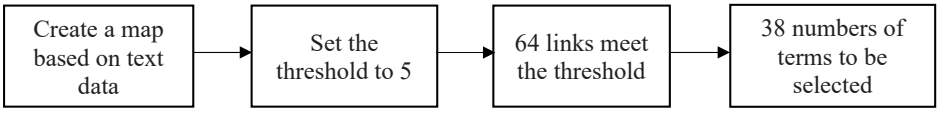
The SLR method is often used to find a new concept and provide direction for further research. SLR documents are mainly downloaded from reputable databases such as Scopus and Web of Science (Hossain et al., 2022; Mengist et al., 2020). Most SLR studies utilize software installed on the operational computer system or web-based software such as Covidence, Rayyan, EPPI-Reviewer, CADIMA, etc. (Person et al., 2021). However, most of the software is not free. In addition, due to the competition between publishers, the filtering system on databases webpage must be carefully observed and re-filtered manually (Aghaei Chadegani et al., 2013; Hindawi, 2009; Kiduk & Meho, 2006; Vieira & Gomes, 2009). For this reason, this research purpose the new filtering concept of Title and Abstract Alignment (TAA).

TAA is quite similar to the theory, concept, and method (TCM) purpose by Paul et al. (2017). Their research purpose is for further research direction regarding the TCM concept. Therefore in 2020, Paul & Criado further discuss how the TCM concept related to the hybrid review (Paul & Criado, 2020). In contrast, TAA is about the filtering criteria based on the title and abstract only and as the last filtering criteria after the general criteria provided by the databases such as document type, subject area, etc. Subsequently, there is an argument about the lack of data accuracy in several leading databases of scholarly impacts, such as Scopus and Web of Science (Nees Jan van Eck & Waltman, 2019; Perianes-Rodriguez et al., 2016). Therefore, the researchers should know the filtered result provided and then use the TAA approach as manual filtering. The researchers need a subscription to access the databases of scholarly impact such as Scopus and Web of Science, and it is not free. Even when the researchers have access to the databases, not all the documents can be downloaded because it

needs another subscription to the journal or publisher, which is not free. While TCM needs those downloaded documents, TAA does not require the document to be downloaded. TAA will contribute to the researchers who need .ris format, .bib format, etc., only to conduct text or bibliography analysis using computer software such as VOSviewer. However, many researchers still do not realize the importance of this concept. Therefore, this research uses the TAA approach to generate a conceptual, theoretical framework for using technology 4.0 in developing smart agriculture villages in Indonesia.

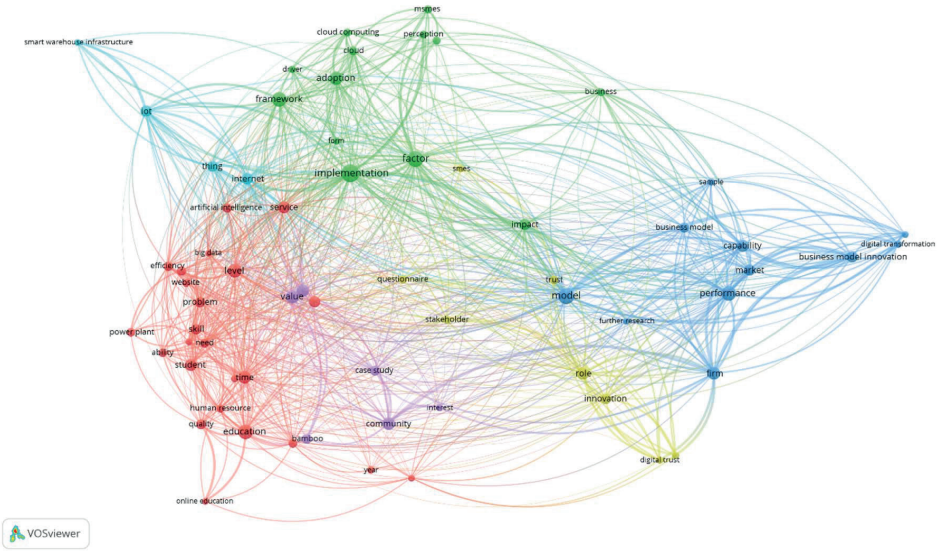
The SLR with the TAA filtering criteria started with finding documents on reputable databases; this research case is Scopus databases. The concept of smart agriculture villages in Indonesia is not found in the Scopus databases because this concept is still new. There have been no previous studies that have used smart agriculture as a keyword in their research. Furthermore, this study examined supporting technology for smart agriculture villages in Indonesia and found 101 documents in Scopus related to "Industry 4.0" as a keyword and "Indonesia" mentioned in the abstract. All the documents are downloaded using the Ris file type and analyzed using VOSviewer. The whole process of VOSviewer is summarized in figure 1 below.

Figure 1. VOSviewer Analysis Steps



The result from the co-occurrence analysis with full counting method by VOSviewer, as shown in figure 2 below:

Figure 2. Mapping based on the text data by VOSviewer



From figure 2, this research generated several clustering as follow:

1. Internet of things (light blue color)
2. Implementation diver MSMEs (green color)
3. Skill requirement of Human Resources (red color)
4. Innovation (yellow color)
5. Digital transformation business model (blue color)

Subsequently, this research use TAA filtering criteria to emphasize the coding analysis. This research defined the filtering process as summarized in Table 1 below:

Table 1. Document Filtering

Filtering Criteria	Number of Scopus Documents
Keyword search : "Industry 4.0" and "Indonesia"	101
Document type : article and conference paper	99
Subject area : – Business, Management, and Accounting – Social Science – Economics, econometrics, and Finance	35
Title and Abstract Alignment (TAA)	31

Based on coding and analyzing the data collected from systematic reviewing of the industry 4.0 and Indonesia literature, this research provides insights into smart agriculture development in Indonesia. Following the order of aggregate themes in the coding, the relevant findings of this research are described in the next section.

2. INDUSTRY 4.0

Industrial revolution 4.0 is both a hope and a challenge to MSMEs in the agricultural sector in the future (Moeuf et al., 2018). This hope arises when the 4.0 industrial revolution can increase agricultural productivity effectively and efficiently in terms of time and cost with the advancement of existing technology (Nagy et al., 2018). On the other hand, the lack of skilled experts in agriculture and technology has become the main problem. Rural agricultural MSMEs must adapt to follow the technological advancements (Zambon et al., 2019) to support the Indonesian Government's roadmap "Making Indonesia 4.0" (Hidayatno et al., 2019; Kearney, 2018).

Industrial revolution 4.0 has fundamentally changed human life and work and brought sustainability as the main priority. Unlike any previous industrial revolution, the 4th generation industrial revolution has a broader scale, scope, and complexity (Sommer, 2015). The advances in new technologies that integrate the physical, digital, and biological worlds have influenced all disciplines, economies, industries, and governments (Vasin et al., 2018). It becomes a very fundamental challenge in most developing countries that still use conventional agricultural technology, especially in the rural areas (Aklin et al., 2018). Industrial technology 4.0 brings significant changes, especially in innovation and agricultural sustainability,

which is the critical success factor in creating value of big data and analytics technology, cloud computing, and the internet of things (Arvanitis & Symeonaki, 2020; Zambon et al., 2019). Areas experiencing breakthrough technological advances include artificial intelligence robots, nanotechnology, biotechnology, quantum computer technology, blockchains (such as bitcoin), internet-based technology, and 3D printers (Khalid & Naumova, n.d.; Klius et al., 2020; Low et al., n.d.; Natarajan & Kumar, 2017; Romanovs, 2017). Industrial revolution 4.0 is the fourth phase of the history of the industrial revolution, which began in the 18th century (Sommer, 2015).

A recent literature review on Industry 4.0 with a particular emphasis on MSMEs found a lack of empirically-based research on the application of its technology (E. Müller & Hopf, 2017). There are several studies related to precision agriculture, decision support systems, irrigation, etc. (Bonfante et al., 2019; Ferrández-Pastor et al., 2016; Zhai et al., 2020), which tend to be applied to large-scale companies only with significant assets and capital because SMEs have fewer resources and experience in managing new technologies (Blili & Raymond, 1993; Chang et al., 2012; Zach et al., 2014). Further research regarding lessons learned from industrialized small farms but not specific to the small agricultural industry was conducted by Liu (2020). A systematic literature review regarding the role of the internet of things in agriculture has also been presented by Farooq et al. (2020). Still, it has not yet concerned directly small businesses in agriculture. However, the contributions of these studies are input for the development of Industry 4.0 in agriculture.

In several countries, the Industry 4.0 concept has been applied under different terminologies such as Smart Factories, Industrial Internet of Things (Dlodlo & Kalezhi, 2015; Natarajan & Kumar, 2017), the Cloud, Social Network (Molano et al., 2018) Smart Industry, or Advanced Manufacturing (J. M. Müller et al., 2018). Although the terminology is different, the idea shares the same goal of increasing the industrial competitiveness of each country to face of a very dynamic global market. This condition stems from the rapid development of the utilization of digital technology in various fields (Sung, 2018).

In the digitalization era of the industrial revolution 4.0, MSMEs in the agricultural sector must prepare themselves and adapt to changes to respond to future challenges and turn threats into opportunities (HAJI, 2021; Hrivnák et al., 2021; Kusumawati et al., 2021; Lioutas et al., 2021; PENG et al., 2021; Zambon et al., 2019). Agricultural MSME activities are expected to efficiently and effectively increase productivity significantly and be competitive (Rovena Tahiti & Besa Shahini, 2010; Szanyi-Gyenes, 2019).

The concept of agriculture developed at this time is the concept of intelligent agriculture, or so-called smart farming or precision agriculture, which purpose is to increase productivity and competitiveness of agricultural products in general (Mondal & Basu, 2009; Skobelev et al., 2019). This concept refers to the application of information and communication technologies (ICT) in agriculture, which aims to optimize the form of increased yield (in quality and quantity) and efficient use of resources by using sensor devices to obtain data from agricultural land accurately and in real-time (Dutta et al., 2021).

The essential thing that needs to be done to implement industry 4.0 in agriculture is internet-based rural development because most of Indonesia's agricultural sectors are rural (Kindangen et al., 2019; Paruntu & Tumiwa, 2016). The digitalization of rural areas is expected to develop the potential of villages, marketing (e-commerce), and acceleration of access and public services connected through wireless networks. Further, the internet is the

most critical factor in enhancing e-commerce (Barroso et al., 2019; Drew, 2003; Li et al., 2018; Ulas, 2019). The most significant determinants of SMEs' e-commerce practices are marketing and promotions, website and digital platform, operational management, products, entrepreneur profile, and market (Barroso et al., 2019). Thus, the next section will discuss the development of the industry 4.0 Revolution in agriculture in small businesses in rural areas in Indonesia.

3. THE DEVELOPMENT OF INDUSTRIAL REVOLUTION 4.0 IN THE INDONESIAN AGRICULTURE SECTOR

In industrial revolution 4.0, various social, economic, educational, political, and other activities are always associated with automatic machines integrated with the internet network (M. Z. Hasan et al., 2021; Purnomo et al., 2021; Vasin et al., 2018). To support the industrial revolution 4.0 in the agricultural sector, the Indonesian Ministry of Agriculture, through the Agency for Agricultural Research and Development (in Indonesian language, it is abbreviated as *Balitangtan*), began to invest in developing technologies such as cloud computing, mobile internet, and artificial intelligence (Indonesian Ministry of Agriculture, 2022). All of them will be combined into agricultural machine technology in the form of tractors capable of operating without machinists, drone aircraft for nutrient detection, and robot grafting. All the data regarding agricultural machine technology in Indonesia is available on https://www.litbang.pertanian.go.id/.

The Ministry has also introduced various applications to help agricultural MSMEs, such as the Rice Plant Monitoring System (in Indonesian language, it is abbreviated as *Simotandi*), which uses high-resolution satellite imagery to be able to read standing crops of rice plants, the Planting Calendar application, which determines planting time, fertilizer recommendations and use of plant varieties. Another application is *Si Mantap*, utilized by PT. Jasindo in the context of backing up agricultural insurance and assisting the insurance company in detecting the risk of drought and flooding, even plant-disturbing organisms. Other applications also such as ekosis.id, jualansayur.com, etc. All these technologies aim to develop modern agricultural practices that have been carried out, including irrigation, land management, use of fertilizers and pesticides, processing, and marketing.

4. SMART VILLAGE CONCEPT

Smart village is a concept program that implements government service systems, community services, and community empowerment based on information technology. The smart village concept is quite similar to the smart city (Trencher, 2019). The program aims to develop village potential, marketing, and accelerate access in the agricultural region (Aggarwal et al., 2018). In a 'smart village' public services will be digitalized by connecting via a wireless network. In the economic context, a 'smart village' can be used as a catalyst to improve the financial performance of the village itself and the economic empowerment of rural communities (Paruntu & Tumiwa, 2016; Tumiwa & Tuegeh, 2019). The 'smart village' system can be utilized in the agricultural sector to digitalize every agricultural MSME in rural areas.

Until now, the exitance of several smart villages has resulted from a collaboration between the regional government and the central government (Shaw & Bennett, 1999). In the 'smart village,' the local government submitted a proposal to the Ministry of Communication and Information, which provides internet services (Kang & Xiong, 2021). In the development of smart villages, innovation in clean energy is needed. One example of pure energy that has been developed in Indonesia is bioethanol from cassava (Dinata & Kartawiria, 2021). Another example is the development of organic rice in the Simpatik Gapoktan, Manonjaya District, Tasikmalaya Regency (Hidayanti, 2020). Through the application of technology and information in smart villages, productivity is expected to increase following the success stories of other villages in the use of the internet integrated with Wireless Sensor Network (WSN) technology (Hidayat et al., 2020); for example, the Majasari village in Indramayu Regency, West Java Province. Due to the internet, the farmers in the village have improved organic farming and animal husbandry. The Majasari Village implements feed processing technology from agricultural waste to supply animal feed. Livestock waste is then used as a fertilizer on agricultural land. The Majasari Village, since a few years ago, has switched to organic farming (Indonesian Ministry of Communication and Information, 2021). With the internet, agricultural and livestock products from Majasari village can be marketed throughout the country, increasing the village's incomes. This makes the Majasari village successful in reducing the poverty rate by 8.24 percent. The region itself was ranked the best village in 2016. Another example of smart villages is Putang Village, Indramayu Regency. This village is a digital fishing village that implements NB-IoT (Narrowband Internet of Things) on an automatic fish feeder tool from e-fishery to feed fish efficiently and speed up the fish harvest cycle (Indonesian Ministry of Communication and Information, 2021). This technology also makes it easier for rural MSMEs to analyze fish cultures, quality, and real-time water conditions (Aziiza & Susanto, 2020).

Smart village will make rural MSMEs to market their agricultural products easily (Annosi et al., 2019; Naldi et al., 2015). They will have the opportunity to significantly increase their income by carrying the sustainability concept (Anderson et al., 2017; Arvanitis & Symeonaki, 2020; Hrivnák et al., 2021) and cutting the marketing channel (Cox, 2002; Kuhlmann & Brodersen, 2001; Schipmann & Qaim, 2011). The process of selling agricultural products has become more accessible with various applications. One example is the "*Pak Tani* Digital" application, which can be used through an android application or the website (Suwanan et al., 2021). The application develops excellent features that are very useful for farmers. The main part set is free ads. Thus, farmers can market their agricultural products online and reach a broader range of consumers.

With rural digitalization, it is possible to run agriculture-based applications that require a high internet speed. Indonesian *Balitangtan* launched a cloud computing technology with mobile internets, such as UPJA smart mobile, an android application used for land cultivation, rice planting services, rice harvesting, rice milling, and grain selling services (Aditiawan et al., 2019). The other mechanization technological innovations launched by *Balitbangtan* are smart irrigation, smart greenhouses, telescoping boom sprayers, mobile dryers, Jarwo Riding Transplants, rice seed growers, and drip lines irrigation installers, all aiming to increase rural MSMEs incomes and improve community welfare (Connor et al., 2021; Husnain et al., 2016).

There would be a structural transformation from the agricultural sector to the industrial one, which would increase the per capita income and deliver people from agriculture to an economy that relies on increasing industrial-based value-added accelerated production with digital technology. This is the main reason lies the importance of rural digitalization of MSME that can benefit from the application of Industry 4.0 (Anderson et al., 2017; Natarajan & Kumar, 2017). However, the utilization of this concept is still limited due to some fundamental small business problems, which are a challenge in applying the idea of the smart village to agriculture (Blili & Raymond, 1993; Masood & Sonntag, 2020; Nagy et al., 2018; Ruslianti & Mulyaningrum, 2020; Sommer, 2015). Therefore, based on previous studies, this research conclude the definition of smart village in Indonesia which is the combination of smart agriculture and industry 4.0 technology utilized by rural MSMEs to use the information and communication technology integrated into public services and economic activities.

5. CHALLENGES TO THE IMPLEMENTATION OF THE RURAL DIGITAL AGRICULTURAL VILLAGE

To prepare rural agricultural MSMEs to enter industrial revolution 4.0 it is important to reduce the digital disparity between cities and villages by using the concept of 'smart villages' (Lioutas et al., 2021; Malik et al., 2022). However, based on previous research that has been discussed in the previous section, the challenges faced by MSMEs in utilizing the use of industry 4.0 technology in the agricultural sector in rural areas can be categorized as follows:

5.1. INEQUALITY IN DISTRIBUTION AND CONSUMPTION OF AGRICULTURAL PRODUCTS

The distribution and consumption of farm products among regions are uneven and sometimes not enough on a local scale (Ilbery & Kneafsey, 1999). Even the need for agricultural products, such as corn and soybeans, is still partly dependent on imports to meet domestic demand (N. Hasan et al., 2015). Indonesia's population has a disparity between city and village in distribution and development. The land is not cultivated in a rural area, while the strategic location in an urban area is overpriced. Small farmer land ownership is still low due to the higher land price. Most farmers who do not have enough capital can only cultivate other people's land. Another problem is converting agricultural land into non-agricultural, reaching 150–200 thousand hectares in 2019 (Prayitno et al., 2021).

It is essential to pay attention to the sustainable management of natural resources to continuously increase agricultural productivity and gain a sustainable competitive advantage (Irina Purcarea, 2008; Pardo et al., 2020; Patalas-Maliszewska & Hochmeister, 2011; Raharjo, 2019). Thus, the challenge of agricultural development with the implementation of Industry 4.0 is to maintain harmony between economic, social, and environmental aspects (Deegan, 2002; Elkington, 1998).

5.2. LACK OF YOUTH PARTICIPATION AND LOW QUALITY OF HUMAN RESOURCES IN THE AGRICULTURE SECTOR

The number of young agricultural entrepreneurs and the poor quality of human resources (HR) working in the agricultural sector is a problem in rural areas (Gibson & Olivia, 2010; Rigg, 2006).

Figure 3. Distribution of Agricultural Sector Workers by Education Level

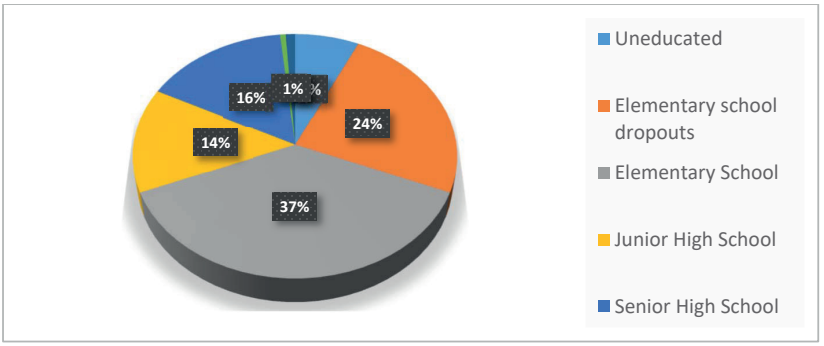
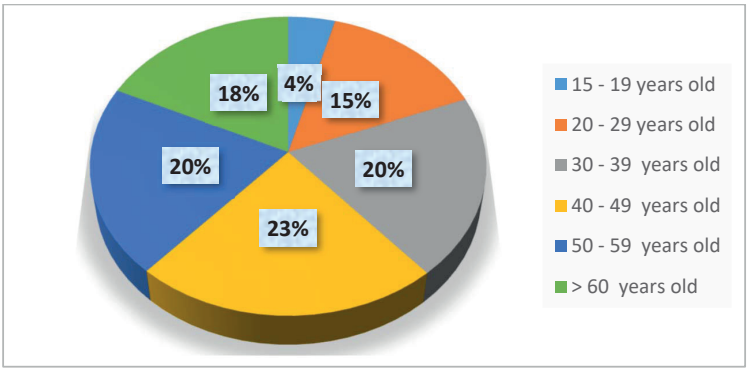


Figure 3 shows the number of workers in the agricultural sector according to their level of education. The number of workers with elementary school education is 37.53 percent, and 24.23 percent did not graduate from elementary school, which is typical for workers in the agricultural sector. While the minority group in the agricultural sector labor force distribution with a percentage of 0.63 percent and 1.02 percent are people with a diploma and a bachelor's degree, respectively.

The Industry 4.0 concept requires continuous innovation and education that depend on people's skills and organizational culture (Mohelska & Sokolova, 2018). Many Indonesian farmers are millennials, but they are not technologically educated. After all, they became farmers because they dropped out of school, withdrawing from elementary, junior high, or high schools. Most farmers are over 40 years old, and more than 70 percent of farmers in Indonesia attained only elementary or even lower levels of education. Such a low level of formal education means that knowledge in agricultural processing is poorly developed and outdated. Farmers merely cultivate agriculture without creating the latest innovations to increase quality and quantity by using the technology offered by Industry 4.0.

According to statistics on employment in the agriculture sector, human resources working in the agricultural industry are dominated by the age group of 60-year-olds and over (17.9 percent). In contrast, the involvement of young people in agriculture is still shallow. The lack of interest of young people in agriculture is dictated by the fact that the agriculture sector is considered a less promising area of high-risk and low prestige in the community. Meanwhile, the participation of young people is very much needed in the industrial Revolution 4.0 (Kang & Xiong, 2021; Kurt, 2019; Puspita et al., 2021; Sahar et al., n.d.; Suharno et al., 2020). Old and low-educated farmers, who still dominate this sector, are afraid to adapt and adopt the changes in technology.

Figure 4. Distribution of Agricultural Sector Workers by Age



The rural community still holds strong to the conventional way that might be an obstacle to entering something new from outside (Malihah & Setiyorini, 2019), such as the internet. The existence of harmful online content poses another challenge in the project of smart villages. Therefore, human resources and rural communities need training, assistance, and digital skills. At present, there is assistance available from ICT volunteers for smart villages (Natarajan & Kumar, 2017; Tuegeh et al., 2021). Still, their number is limited. Thus, the involvement of other parties in digital assistance and developing literacy is needed (Anderson et al., 2017; Tuegeh et al., 2021).

5.3. LIMITED INTERNET NETWORK COVERAGE

The use of digital internet access is an integral part of supporting Industry 4.0 (Kagermann, 2015). However, the limited access to the internet will be a challenge in implementing Industry 4.0 in the agricultural sector. According to the data, not all regions of Indonesia have access to the internet, especially in rural areas. The Indonesian Government issues a "Nawacita Jokowi" program from the suburb by strengthening rural areas and villages to eliminate/reduce the existing disparities between villages and cities (Nuryitmawan, 2021). One of the programs is Palapa Ring, which aims to develop a fiber optic cable network and is expected to create networks covering rural areas. So far, the entire region has not been reached, and there are still 150 thousand points that cannot be reached via optical networks (Kumparan, 2019). Meanwhile, the rural areas covered by the 3G network account for only 73.02 percent of the total of 83,218 villages, and in the case of 4G coverage – only 55.05 percent (Detik.com., 2019). On the other hand, according to the results of a survey conducted by the Indonesian Association of Internet Service Providers in 2017, internet use in rural areas alone is only 48.25 percent. Rural agricultural MSMEs, which are the leading players in the sector, account for only 13.45 percent of those that use the Internet. Most are located in the western regions of Indonesia. The background to the reluctance to use the internet is the infrastructure and high internet access costs in rural areas. Not yet resolved the current internet connection problem, now agriculture in Indonesia has to deal with the latest generation in 5G internet connections. However, the Government has treated this problem as one of priorities included in the roadmap of Industry 4.0 and tourism connectivity (Hutajulu et al., 2020).

5.4. LACK OF CAPITAL SUPPORT

Industry 4.0 certainly requires sophisticated technological equipment that demands considerable capital. Financial access and foreign direct investment play a vital role in MSMEs in each country, especially for the developing ones (Czemiel-Grzybowska & Skowronek-Mielczarek, 2017; Wardhani & Haryanto, 2020). Many capital institutions offer various credit schemes, but in reality, only certain groups of companies have access to them, and MSMEs have difficulty obtaining them (Hartungi, 2007). The problem of rural MSMEs in accessing capital stems from the fact that rural agricultural income is small and does not have adequate collateral. Various credit programs developed for farming businesses are still far from expected because a bank will not grant credit if a company does not have sufficient collateral. The use of the internet through financial technology (fintech), which is supposed to help and facilitate access to capital (because the requirements of fintech are not as tricky as banking), in fact, still does not favor the rural MSMEs (Disemadi, 2021). The reason is that interest from fintech is still too high and reaches 30 percent.

6. CONCLUSION, LIMITATION, RECOMMENDATION, AND FURTHER RESEARCH DIRECTION

In implementing Industry 4.0 in the agricultural sector, the 'smart village' is a concept that can be applied as a model to improve the capacity of rural MSMEs in the face of industrial revolution 4.0. The definition of the 'smart village' concept is the combination of smart agriculture and industry 4.0 technology utilized by rural MSMEs to use the information and communication technology integrated into public services and economic activities. Indeed, there are still some obstacles, including the imbalance between the distribution and consumption of agricultural products, the lack of participation of the younger generation and the still existing lack of high-quality human resources, limited infrastructure and internet networks, and capital problems that need to be addressed together.

To implement Industry 4.0 in Indonesia, especially in the agricultural sector, the Indonesian Government focuses on the development of technology and the challenges by improving the quality of human resources. Currently, there are many more old farmers than young ones in the agriculture sector. The Government must embrace and encourage the young generation to actively engage in the agricultural industry. Then, to improve skills and abilities, educational and training institutions should be developed, and it is mandatory to enhance vocational education as well. It can be expected that improving vocational education through reorganizing the curriculum and learning methods will contribute to connecting the world of education with the world of work and market needs and increasing the interest of young people in agriculture. Regarding limited internet access in rural areas, internet networks in rural areas need to be accelerated and leveled by the Government. Finally, financial institutions (banks and non-banks) should be encouraged to enter the agricultural sector with a scheme that does not burden MSMEs.

This research scope is limited to a developing country, and covers Indonesian agriculture. The literature examined in the article is limited to Scopus databases only. Thus, the definition of smart agriculture is limited to the Indonesian agriculture based on the Scopus databases.

For the further research direction, it is necessary to add more archives from other leading databases of scholarly impact. There are more villages in the developed countries to be investigated in order to get wider perspectives on the smart village framework and definition.

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