Disruption of information technology and farming empowerment strategies in Indonesia

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Abstract. Disruption is a major change or critical point that occurs in the world today, which covers almost all aspects of life. It is characterized by the use of information technology. Indonesia is an agricultural country, in which around 25.89% of the population or 34,577,831 people worked in agriculture in 2019. Generally, the agricultural system in Indonesia is still conventional and not connected and integrated yet with information technology. The research aims to identify the conditions of ownership and the level of accessibility of farmers to agricultural information technology. Another aim is to get a strategy for empowering farmers to improve accessibility to information technology. This study used a literature research method and a quantitative approach. This research was carried out by a descriptive statistic. The results show that 62.41% of Indonesian population had used cell phones, but only 16.15% of the population worked in agriculture. Some farmers empowerment strategies were carried out with three approaches, namely through optimizing the role of millennial youth farmers and increasing the ratio of smartphone ownership by the farmer through credit schemes. Finally, increasing applications in the smartphone for agriculture item.

1. Introduction
In Indonesia, agriculture and fishery is a key sector which becomes the main source of community livelihood. In 2018, 25.89 % of the population or 34,577,831 people worked in the sector [1]. This condition shows that agriculture is still a mainstay of economic income for Indonesian people. On the other hand, there is a change in the life pattern of the world community, including in Indonesia, characterized by the stronger use of Information Technology (IT) in various fields. The use of IT raises a new atmosphere which is one of the drivers and characteristics of disruption. The term disruption was introduced as a theory by Clayton Christensen in 2007. Disruption is a major change or super innovation that occurs mainly in the field of business. It is different from the way or pattern that generally occurs before, both in terms of doing business and in the way of thinking and management patterns [2]. The business pattern that generally occurs now is property economy, while in the disruption era, it is sharing economy. Kasali [2] and Kasali [3] describes that in the sharing economy, users do not have to be owners of economic goods and the owners can share their property with other users, for example, the emergence of online motorcycle taxi business.
In general, the agricultural communities in Indonesia still face many limitations. Besides, farmers still run subsistence farming. Subsistence farming is a farming system where the main goal of farmers is to fulfil their needs and their families [4]. In their view, agriculture is a means to meet individual needs, so that crop productivity is not optimal. This definition shows that subsistence agriculture has not been oriented to market needs (market-oriented). Waters [5] states that subsistence farming is different from commercial farming, which is oriented to market demand and development of farming. However, some farmers in Indonesia are business oriented or run a farming business with entrepreneurship approach. However, the number is still limited. One of Indonesia’s 2045 targets is the independent and sustainable food security system, maintained self-sufficiency in protein and carbohydrates, and increased farmers’ welfare and agricultural commodity value added [6]. As one of the member countries of the ASEAN Economic Community (AEC), Indonesia needs to understand the consequences of the AEC. Kifli [7] stated that one of the important impacts of the implementation of the AEC for agriculture in the border regions is the need to increase competitiveness through community empowerment, especially agricultural extension workers. With the occurrence of disruption in all aspects of life at this time, including agriculture, then this problem must be resolved through a thorough study to answer the phenomenon that is happening.

Concerning the condition, a study is needed to identify and produce a description of the ownership and the level of accessibility of farmers to agricultural information technology that supports their agricultural businesses. The results of this study can be used as a strategy for empowering farmers and improving access to information technology so that farmers can be connected and supported optimally in meeting their needs and find ways how the government plays a role in supporting farmers and agricultural empowerment.

The use of cellular phones has been studied by some researchers, for example Karetsos [8] in Athens, Chhachhar [9] in Malaysia, Singh [10] and Oladejo [11] in India. Another research by Kefela [12] in Afrika, Asingwire [13] in Uganda, Costopoulou [14] and Anjum [15] in Asia, Chhachhar [16] and Karubanga [17] in developing countries. The studies revealed that several information facilities can be accessed by agricultural actors in their respective countries. However, the results of these studies are still limited to second-generation cellular telephone facilities (2G) which only used audio and text (voice and short message service); they had not reached the level of accessibility in supporting the business of users, especially farmers. Data from the 2018 Central Statistics Agency [18] shows that 62.41% of the Indonesian population own and use cellular phones. Further, 53.61% of the rural population owned and used cellular phones. Kifli [19] in their study revealed that 96.36% of tomato farmers in Pangalengan, West Java, owned and used cell phones, but 98.18% of the farmers still use 2G cellular phones and only 1.82 % used a smartphone phone.

The result of this research put a position between the condition, the potential, and agriculture development strategies, especially in rural areas, with disruption of 4th-Generation (4G) of information technology. The novelty value of this research is some policy and technical strategies that can be applied in agriculture development in Indonesia by used technology information.

2. Methods
This study used a literature research method. Research data were obtained from reliable sources, such as scientific journals, books, reports, legal official documents of government and private institutions, both at the regional and national levels in Indonesia. This study used a quantitative approach. Data were analyzed, processed, translated, and described descriptively.

3. Results and discussion
Some results of the research show that most farmers in the research setting research have not used smartphones. At the national level, the data show that smartphone ownership and the use are increasing in the public, including communities whose main livelihood is agriculture. In 2017, the number of internet users in Indonesia reached 143,200,000 people [20]. Based on this number, livelihoods in agriculture are 20.95% or around 30,000,040 people. Then, the number of people who access the internet
via smartphone is 85.25% (25,575,341 people) or in other words, the community groups who make a living in agriculture using smartphones are 9.76% of the Indonesian population in 2017. Most of the groups are farmers, and some agricultural entrepreneurs and agricultural traders.

Table 1. Diversity of cellular phone use and internet access in Indonesia in 2018.

| Number | Category | Description                                      | Quantity | Per cent |
|--------|----------|--------------------------------------------------|----------|----------|
| 1.     | Strength of Cellular Telephone Signals in rural areas*: | a. Strong Signal (village units)                    | 55,575   | 66.21    |
|        |          | b. Weak Signal (village units)                    | 21,597   | 25.73    |
|        |          | c. There is no signal (village units)             | 6,759    | 8.06     |
| 2.     | Households that have cell phones in rural areas*): |                                                   |          |          |
| 3.     | Media used in accessing the internet in rural areas, through*: | a. Desktop/ PC                                      | 18.71    |          |
|        |          | b. Laptop                                          | 18.46    |          |
|        |          | c. Cellular phone                                   | 91.35    |          |
|        |          | d. Other/ smart TV                                  | 0.51     |          |
| 4.     | The purpose of accessing information in rural areas*: | a. Get information                                 | 61.30    |          |
|        |          | b. Doing task                                      | 36.54    |          |
|        |          | c. Make use of e-mail                               | 17.09    |          |
|        |          | d. Using social media                               | 79.33    |          |
|        |          | e. buying and selling online                        | 7.53     |          |
|        |          | f. Entertainment                                     | 44.20    |          |
|        |          | g. Get financial facilities                         | 1.94     |          |
|        |          | h. Others                                           | 10.02    |          |
| 5.     | Penetration of internet**: | a. Landowner farmer                                 | 33.50    |          |
|        |          | b. Farm labor                                       | 25.70    |          |

Source: *1 Central Statistics Agency [1].
**1 APJII [21].

The current national agricultural development policy is still directed and focused on farmers because they are the main actors of agriculture and the largest community group in Indonesian society. Some potentials, especially in existing information technology, can be used for developing farmers' accessibility in developing their farming through the use of information technology, especially through cellular telephones. Some of these potentials are rural areas in Indonesia that have been reached by cellular signals, with a large part of the region (66.21%) getting a strong signal and only a small portion (8.06%) of the area does not receive cellular signals (Table 1). These conditions provide a high opportunity for farmers, traders and agricultural entrepreneurs in rural and urban areas to be able to communicate well anywhere through cellular networks. Another phenomenon shows that most of the internet users use their devices to access social media (79.33%) and obtain information (61.30%), and only 7.53% used for buying and selling online (Table 1). This indicates that internet use by the community is carried out for activities that are consumptive and not productive, because of the low use of the internet for online business activities. However, this condition can direct and encourage the community, especially the actors of farming to carry out productive activities in the use of the internet, to obtain economic benefits from internet access activities. Positive and productive economic activities can be done by utilizing and developing several applications on smartphones. The applications generally use an information system that is available in smartphones with the operation that is easy, concise, fast and cheap or free. Some agricultural applications that can be accessed through smartphones are currently
Generally free, but the number of applications is still limited compared to other applications. These applications are constantly undergoing updating, making the applications efficient and effective for users, both farmers, sellers of agricultural facilities, agricultural entrepreneurs, traders or other agricultural actors. In the agricultural field, there are at least 6 types of applications recorded (Table 2).

**Table 2.** Some internet applications in the field of agriculture on smartphones in Indonesia.

| Number | Application Name | Description of the contents |
|--------|------------------|------------------------------|
| 1.     | Petani, Tanam, Katam Terpadu, iTani, Tani Link, Kampus Tani, MyAgri | Technical information, interactive exchange, agricultural counselling on agriculture commodities, variety selection, weather information, fertilizer dosage. |
| 2.     | Panel Harga Pangan BKP, Pantau Harga Mobile, TaniHub | Information on food prices of agriculture commodities in some regions. |
| 4.     | Limakilo, eTani | Marketplace, buy and sell on-line agricultural commodities. |
| 5.     | Mata Daun, Rice Doctor, Pakar Padi, Dokter Tani | Determining of fertilization dosage, and identification and controlling of plant diseases. |
| 6.     | Smart Feed, Feed Calculator | Determining for mixing of livestock feed from some local feed sources. |

Source: Personal processed data, 2020.

Several applications in the agricultural sector are available (Table 2). The applications can generally be divided into two types, namely interactive and passive applications. In interactive applications, users actively communicate in two directions, between application makers and other users; whereas in passive applications, users cannot interact directly with the application maker. Interactive applications are generally applications that require a direct response from other users, such as buying and selling online, online services, while passive applications are generally informative by using a database that has been provided by the application maker. The current agricultural applications have beneficial contents, especially for farmers, starting from the upstream aspects of farming such as Katam Terpadu, iTani, Petani; then for cultivation aspects, such as Mata Daun, Rice Doctor, Pakar Padi and Tanam, as well as in downstream or marketing aspects, such as Panel Harga, Pantau Harga, limakilo, TaniHub and eTani.

The applications presented in Table 2 use a small capacity in operation about 1.00 – 20.00 MB for each application. Also, these applications can be downloaded for free and installed on smartphones. Some of these applications will help farmers in providing information, interaction and buying and selling. However, these applications must be further developed, improved and updated so that they can adapt to the needs of users, especially farmers.

The percentage of people whose livelihoods are in the agriculture sector (farmers, agricultural traders, agricultural entrepreneurs) who have accessed the internet via smartphones was 9.76% from the Indonesian population in 2017. This means that people who work as farmers are less than 9.76%. So, the percentage is still in the small category compared to the number of farmers in Indonesia today. Data of the Central Statistics Agency [22] shows that people working in the general agriculture sector were 35,923,886 people. So, the number of farmers in 2017 was 13.71% of the total population of Indonesia; there were around 4.0% - 5.0% of farmers or around 11,785,090 farmers who have not been able to access the internet through smartphones. The large number of farmers who have not yet connected to the internet network becomes a challenge, especially when there is a disruption in the economic sector, including in agriculture. The disruption is an inevitable global phenomenon. This condition is increasingly challenged when linked to free trade of the ASEAN Economic Community. This condition is a challenge for agricultural actors and policymakers to design strategies for farmers so that farmers can play an active role as subjects in disruption circles and not only act as objects or consumers of disruption. Thus, farmers can survive and develop with their farming.

In the disruption era, there is a need for a strategy in reacting, among others by paying attention to and implementing RPV, as well as the existence of bridging generations [3]. RPV is the values of Resources allocation (R), Business Process (P) and Value (V). Resources allocation is the right allocation of resources (natural, human, technological), while the business process is addressed by
preparing and making new and different business processes from existing ones, and values are positive values in attitude that can be used as a focus or characteristic and stand out in carrying out the business or business. Another important thing is bridging generations, which is to prepare people or groups of people who can take over the relay from the previous generation, then do business engineering in their way according to the times.

The strategy of empowering human resources is done through increasing farmers' access to the internet network; they were previously not connected to the internet network. Then, gradually the smartphone ownership ratio increased. The results of the study show that 66.50% farmers are not connected to the internet network via smartphones. Increasing the smartphone ownership ratio needs to be done with several stimuli or subsidy patterns from the government for farmers or farmer groups by self-procurement through credit schemes from farm cooperatives. Smartphone ownership is important at this time because through smartphones, farmers can find information needed in agriculture. Smartphones are now easy to obtain. Besides, the operational costs are also still affordable. The internet quota offered by almost all cellular operators is relatively inexpensive. Data from the Statistic Agency [18] show that the average expenditure of each household in rural areas in Indonesia in 2018 reached Rp 97.986 per month or around 2.81% of the total household expenditure per month. Expenditures are generally used to purchase internet quota.

The empowerment of other human resources in the context of supporting farmers’ businesses is by making young farmers agents or communicators that connect farmers who have not been able to access the internet with internet networks. Youth farmers are teenagers, especially those who make a living in farming. Young farmers are children of farmers or agricultural scholars who have the desire to develop agriculture in rural areas or children of farmers who have become scholars. Youth, in general, are the main movers in a community group. Agricultural youth are human resources that have the potential to become a driver in the village. So, efforts are needed to encourage agricultural scholars to return to their villages to become "millennial youth farmers", namely young farmers who are connected and able to utilize the internet network, so that they can develop the area in a different and advanced way according to the era, namely by utilizing information technology to develop agriculture. The program that involves millennial youth farmers is village-based and integrated with village government programs found in the Ministry of Village, Development of Disadvantaged and Transmigration (Kementerian Desa PDTT) programs, such as the Rural Areas Superior Program (Prukades), Village Information Systems, Potential Systems Village by utilizing the Village Fund. Millennial farming youth can also be "village facilitators", as a companion to programs from the Ministry of Desa PDTT.

| Human Resources |
|-----------------|
| • Millennial farm youth as the village companion |
| • Technical guidance on the use of the internet for farmers |
| • Survey through digital useful and superior village products |

| Information Technology Resources |
|----------------------------------|
| • Increased ratio of smartphone ownership by farmers |
| • Increase applications on smartphones in agriculture items |

| Institutional / Organizational Resources |
|----------------------------------------|
| • Integration of digital development in the Village Ministry's village program, |
| • Integration of digital stalls into Village Integrated Posts |

**Table 3.** Matrix of farmer empowerment strategy through information technology in Indonesia.

| Empowerment Strategy | Supporter |
|----------------------|-----------|
| Human Resources      | 1         |
| Information Technology Resources | 2, 3 |
| Institutional / Organizational Resources | 4, 5 |

Description:  
1) Village Government (millennial youth, the village companion)  
2) Regency / City Government  
3) Provincial Government  
4) Central Government/ministry  
5) Creator / Developer application
Some strategies for empowering farmers through human empowerment, technology and institutions with the Information Technology approach are presented in table 3. Empowerment should not be carried out by only one party but it should be carried out by many parties in an integrated manner because cooperation is needed in planning and financing. Empowerment of human resources can be done by optimizing the role of village facilitators as agents of the programs of the Ministry of Village, Development of Disadvantaged Areas, and Transmigration of the Republic of Indonesia, as well as becoming millennial youth farmers in the utilization of Information Technology. The millennial agricultural youth can be professional and commercial agents between farmers maximizing the internet network access from upstream aspects, such as seeding, land resources, production processes, cultivation, then downstream aspects such as post-production and marketing manually and digitally.

Furthermore, after farmers have a smartphone, it is necessary to have technical guidance in utilizing the internet network via a smartphone. The technical guidance can be carried out in 1 to 2 days so that the farmers can make good use of the smartphone. After technical guidance is done, other important things to do are field and digital surveys or studies by exploring the resources of production facilities, cultivation, processed products and marketing of potential agricultural commodities and seeded in the village. Empowerment through technological resources (Table 3) is done by increasing the ratio of smartphone ownership to farmers; one of which is through a credit system provided by village cooperatives (Bumdes) integrated so that payments do not become a burden for farmers. Empowerment through institutional or organizational resources is carried out by integrating digital development programs with village programs from the Ministry of Village (Kemendes PDTT). Another method of empowerment, namely the utilization of existing village buildings/posts, can be realized in the form of digital kiosks operated by millennial youth farmers. Another technological empowerment is to increase applications on smartphones that cover agriculture from upstream to downstream (from seed supply, soil analysis to digital marketing). Based on several strategies, the government must support the existing strategies, starting from the village government, district government to the provincial government (Table 3). This support can be done directly through the provision of financing or subsidies; it can also be done indirectly (stimulus), through the provision of facilities, facilities, infrastructure. Then, regulations are made to support agricultural actors, both government regulations, so that the government shows its responsibility to the people.

4. Conclusion
From the total population of Indonesia, 62.41% owned and used cellular phones, but only 9.76% of that percentage work in agriculture. Smartphones are mostly used to obtain information; only 7.54% of smartphone users use it for buying and selling online, and only 1.94% used to get financial facilities. In this era of disruption of information technology, three approaches are needed as a strategy for empowering farmers, namely empowering human resources, information technology resources and institutional or organizational resources. Empowerment of human resources is carried out by optimizing the role of millennial youth farmers; empowering information technology resources can be done by increasing the ratio of smartphone ownership by farmers through a credit scheme, and by increasing applications on smartphones for agriculture items, starting from upstream to downstream activities. Then, institutional or organizational empowerment can be carried out by applying the pattern of integration of digital development in rural areas with village programs, as well as the integration of digital kiosks with village posts. For regional and national governments, the three strategies can be realized in the form of direct support through subsidies or information technology assistance and indirect support (stimulus, facilities, and regulations) to farmers, thereby increasing farmers' capacity to develop farming business.

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