Central Java smallholders: transformation and persistence through ICT development

M I H Wijaya¹, H B Wijaya², B N Priambudi¹ and N M Ariani¹

¹Diploma of Urban and Regional Planning, PSDKU, Diponegoro University
²Department of Urban and Regional Planning, Faculty of Engineering, Diponegoro University

indrahadiwijaya@lecturer.undip.ac.id

Abstract. Information communication and technology development nowadays becomes an issue in developing countries, especially Indonesia. The use of information and communication technologies (ICT) that became spearheading in the digital era is still not able to meet the needs of peoples in rural areas. This happens when there is lack of digital infrastructure between urban areas and rural areas, where ICT development is still concentrated in urban areas (city area). Agriculture has been being an important main activity in rural areas which are not yet optimized due to the digital divide. One of the drivers of the lack of digital infrastructure in rural development of the market needs to be seen from the ICT, infrastructures, and capacity of smallholders. The smallholders represent the farming activities in the current time of agriculture in Indonesia. It is essential to understand the smallholder’s phenomena and its transformation of ICT for agriculture development. The aim of the research is to identify the transformation and persistence of smallholders in Central Java Province with ICT development. This research was conducted using a qualitative approach to identify the characteristics of smallholders, the availability of ICT infrastructure, the potential for ICT development and the sustainable development of rural areas in the study area. Research using primary data was collected using interviews based on a questionnaire distributed in three regency’s in Central Java, namely: Grobogan Regency, Semarang Regency, and Demak Regency. The results of this study show that smallholders in two villages in the two study areas that have the lack of digital infrastructure challenge can persist in developing their agricultural products. The institutional transformation factor is the key to fill the needs of technological infrastructure, while smallholders in the other village are still individual and traditional.

1. Introduction

1.1. Background

The agricultural sector in Indonesia as an agricultural country still remains one of the main economic sectors. The area of Indonesia’s Raw Rice Fields (LBS) is 7,463,948 hectares. Java dominates the ownership of the largest area of paddy fields. East Java is the province with the largest LBS in Indonesia. It has an LBS of 1.2 million hectares. Central Java and West Java have LBS of 1,049,661 hectares and 928,218 hectares, respectively (BPS, 2019). Reported by the Central Statistics Agency (BPS) in Nugraheni, 2019 recorded in 2018, workers in the agricultural sector were 35.7 million people or around 28.79% of the total 124.01 million Indonesian population. Whereas in 2017, agricultural sector workers were 35.9 million people or 29.68% of the 121.02 million. This condition indicates the agricultural
sector, especially rice products remain being important commodity. The first indication of this sector is still a source of livelihood for some Indonesian people, and secondly, rice is still a staple food for most of the Indonesian population.

The development of agriculture in Indonesia with a large number of farmers has several problems such as a significant decrease in the amount of agricultural land. Isdyiana K. A. (2018) explained the Central Statistics Agency calculates that the area of paddy fields continues to decline and, in 2018, the area of land remained 7.1 million hectares. This figure was lower compared to 2017, i.e. 7.75 million hectares. The basis of this land conversion is that the land area is getting smaller; this is the spotlight where farmers with small land severity are called *petani gurem/smallholders*. In Indonesia, based on research conducted by Rigg et al. (2019), Small farmers are identified as having land under 2 ha, in which 56% of small farmers cultivate agricultural land under 0.5 ha. Density in Java also has a large influence on changes in agricultural land. Central Java Province, as one of the contributors to farmers in Indonesia, also experiences the same thing in which farmers have small land.

In developing countries, the problems of agriculture as an impact of land ownership are the reduced production and poverty [4]. These conditions are also experienced by small farmers in Indonesia, especially in Java. From the 2018 BPS data, it was identified that the informal sector working in agriculture reached 91.72%, thereby proving the economic condition of small farmers is still low. The low productivity in small farmers aside from limited land is also influenced by the production and marketing processes of yields.

The application of information and communication technology in agriculture is a new thing, being implemented in the past 2 decades [5]. However, small farmers face some problems such as accessing ICT due to limited tools and information. Utilization of ICT itself, according to Leary & Berge, (2006), can help and create increased agricultural production, increase farmers’ incomes, and further reduce poverty among rural farmers if managed properly. This problem is often referred to as the digital divide which means that the gap between individuals, households, businesses (groups of people), and geographical areas at different socioeconomic levels in accessing information and communication technology. Digital divide, according to Baszlink in Ariyanti, (2015), reflects various gaps in the use of telematics and due to differences in utilization within a country.

The development of technology from the point of view of the regions and cities greatly influences the diverse fabric of people’s lives. Basically, technology is considered very important as a productivity tool in achieving added value and enabling tools for the community. As developing countries, digital divide or disruptions in accessing information technology and this imbalance factor can be physical (do not have access to computers and other IT devices) or the nature of the skills needed to be able to participate as a digital citizen. If division leads to groups, then digital disparities can be related to socioeconomic (rich/poor), generation (old/young), or geographical (urban/rural) differences [7]. The causes of the digital divide include infrastructure, lack of skills (HR), and lack of internet utilization.

Facing the demands of sustainable village development, Miyoshi (2013) expressed the opinion of Friedman and Douglas, that a suitable rural development strategy is to pay attention to the following matters, namely: (1) the agricultural sector must be seen as the leading sector; (2) the gap in income and living conditions between cities and villages must be reduced; and (3) small scale production for local marketing must be protected against competition from large entrepreneurs. In this rural development process, some regions experience digital disparities, especially with their superior agricultural products. The lack of digital infrastructure in sustainable rural development can be seen from how the relationship between the provision of infrastructure and the quality of human resources with local economic activities in supporting the economy, social conditions such as population conditions, and environmental conditions which can be supported by information and communication technology.

Smallholders face the challenges of the lack of digital infrastructure. Some of them have made some breakthroughs and innovations, while the others carry out activities traditionally. The three study areas (Mlatiharjo Village in Demak Regency, Ketapang Village in Semarang Regency, and Menduran Village in Grobogan Regency) are areas with rice farming characteristics. Two regions were identified as having strong institutions in facing the challenges of the lack of digital infrastructure, while one village was
still traditional in nature. The involvement of key actors and institutions was indicated to have a large role in overcoming the problems of small farmers towards the lack of digital infrastructure. This research identified the development of rural agriculture with innovation of ICT to solve the problem of the lack of digital infrastructure.

This paper is organized into four main sections. First section, introduction, provides the background and research framework. The second part explains the material and methodology used in conducting research. The third section explains the theoretical framework and empirical findings of the role of ICT in the transformation and persistence of smallholders. The last section presents the conclusions of this paper.

2. Method
This research was conducted in three Regencies (Demak, Grobogan, and Semarang Regencies) in Central Java Province. The components examined include the characteristics of smallholders in terms of their transformation and resilience, the availability of ICT infrastructure in the agricultural process, and the potential for development. Data collected include primary data and secondary data. Secondary data were collected through intensive surveys from government institutions, while primary data were collected through in-depth interviews with farmers in the three study areas represented by the head of the farmer group, and interviews with stakeholders such as Bappeda. The materials explored cover issues related to the transformation of small farmers and the use of information and communication technology in overcoming the lack of digital infrastructure.

3. Analysis
3.1. Characteristics and Transformation of Smallholders
Small farmers in Indonesia, especially in Central Java, are the result of the transformation of agricultural concepts or paradigms. Agricultural conditions occurred widely in Indonesia in the period of traditional, modern (productivism), and post-modern agriculture [10]. In the period of traditional agriculture, this traditional farming system of agricultural activities is intended to meet local food needs. Therefore, the developing agricultural paradigm shows relatively low agricultural productivity, the use of traditional tools, and small-scale production to meet local needs.

In the modern agriculture or productivism concept which emphasizes intensification, industrialization and agricultural expansion for production and which is characterized by a green revolution (green revolution), agricultural development is conducted by increasing agricultural productivity through agricultural intensification using agriculture chemical fertilizers and pesticides [11]. In the study sites in the villages of Mlatiharjo and Ketapang in 1970-2000, agricultural activities were aimed at meeting national food needs which were realized through intensification programs such as the application of the garden season twice a year, the application of agricultural systems that could increase production, and use of seeds relatively short-lived seedlings. They were to increase the production of processes or techniques. In accordance with the concept of productivism the agricultural production, intensification program has received support from the government in the forms of seeds, fertilizers (starting to use chemical fertilizers), and mechanization (tractors) in order to achieve self-sufficiency in rice.

The agricultural development at the beginning of the 20th century was a post-productivism era in which organic farming systems developed and prioritized the health factors of agricultural products. Farmers approached through an environmentally friendly farming system. The needs of a global community led to the awareness of the importance of healthy products which were in line with the concept of organic farming. The concept of post-productivism emerged along with the concept of deagrarianization. This concept emphasized economic diversification which did not only produce agricultural products, especially rice [10]. Diversification of agriculture in the study location can be done such as running village tourism or tourism development in the agricultural area. In addition, it can
increase the rural conditions and new economic activities for the local community which is in line with the emergence of new livelihoods.

The impact of changes in the agricultural paradigm in Indonesia, especially in Java, is the change in land use. The phenomenon of changes in the function of land use from one land use to another land use such as the change in agricultural land to non-agricultural land. Land-use change is a dynamic event, where the demand and supply of land results in a different new production system [12]. In addition, economic growth and population growth were identified as being concentrated in urban areas around the study location (Demak Regency, Semarang Regency, and Grobogan Regency) to form a wider space for settlement and land-use change. The results of the census conducted by BPS in 2018 (Figure 1) show an increase in land ownership on national agricultural land, indicating a split in land ownership. This condition is in line with the increase in small farmers who own land less than 0.5 ha.

![Figure 1: Holding Agricultural Area in Indonesia 2018](image)

The conditions of small farmers in Java are in line with national conditions. Data on changes in the number of smallholders identified from 2013 and 2018 in three provinces in Java (Figure 2) has increased. Central Java Province as the number two contributor of small farmers in Indonesia has increased the changes as an indication of the division of land by farmers. In terms of the availability of agricultural land, both in Mlatiharjo and in Susukan showed a relatively similar phenomenon. The extent of agricultural land ownership has decreased from year to year. This happens because the inheritance system is implemented in rural areas. Generally, parcels of land are inherited from their children so that from time to time the area of agricultural land owned by each person tends to be narrower. Based on community information, in the 1970’s, the average area of ownership of agricultural land was 0.5 hectares per person. However, in subsequent periods, land ownership began to decrease to an average of about 0.2 hectares per person.

The characteristics of smallholders in the study area (sample of three regencies) were identified from land ownership. In Ketapang Village (Semarang Regency), the average area is 100-500 m² with 53% of the sample, indicating that the land they are working on is leasing and the remaining 47% is working on their own land. Unlike the samples in other locations, the condition of the study area in Katekan Village (Grobogan Regency) was identified as having an average area of 100-500 m² with a percentage of 44% with 60% of farmers are working their own land. Similar characteristics were also identified in the study area in Mlatiharjo Village (Demak Regency) with an area of 100-500 m² with 55% of small farmers working their own land.
The third identification was seen from agricultural products in the three study areas. Two of the study areas have superior organic agricultural products (Mlatiharjo Village in Demak and Ketapang Village in Semarang Regency), while Katekan Village (Grobogan Regency) has conventional/traditional agricultural characteristics. In the area of Mlatiharjo and Ketapang villages, agriculture is professionally managed by institutions that support the production and marketing process even though they have members who have the characteristics of smallholders.

3.2. Utilization of ICT by Smallholders

Rapid technological development has an impact on the development of regions and cities, especially developing countries such as Indonesia. The implementation of technology in all aspects is a driving factor for development justice. The development of information and communication technology becomes an integral part of life in the development of regional and urban communities. The benefits of developing ICT can also solve social problems such as poverty and inequality. Inequality in the affordability of ICT services is the term the lack of digital infrastructure. The lack of digital infrastructure is a challenge faced by developing countries that currently do not have the infrastructure and unequal distribution, especially in rural areas [13].

The utilization of information technology in rural areas especially for small farmers was identified by BPS in 2018 with a census of internet use. From the results obtained in 3 provinces in Java (Figure 3), an average of 10% of the total number of registered farmers can be identified. This figure is a small value since the census location is carried out in Java which is generally served by the internet. While internet usage data in the three regencies shows that Semarang Regency has more farmers, compared to the Grobogan and Demak regencies. Meanwhile, Grobogan Regency identified earlier was related to the agricultural transformation that still uses traditional farming. In addition, farmers who use the internet are lower than those who do not use the internet.

The transformation process of the use of agricultural technology in the production process in Mlatiharjo Village Demak Regency and Ketapang Village in Semarang Regency has a relatively similar pattern. In the era of traditional agriculture, agricultural technology used is relatively simple which is characterized by the use of buffalo to assist in the process of land management and the use of ani-ani in the process of separating rice from grain. In Ketapang Village, the use of machinery for agricultural activities began in 1975 with a marked use of tractors. As in Mlatiharjo Village, the use of modern technology only began in the 1980s. Over the years, the use of modern technology has evolved along with the development of technology. Generally, the use of technology begins with the use of tractors for tillage in the paddy fields, then only followed by further developments such as the use of grain thresher machinery and rice grinding machines. In the postmodern era, technology began to develop for things
that are of added value to the product such as the product packaging process using vacuum machines. Although the machine used is still simple, there is at least an increase in the added value obtained.

![Figure 3. Number of Farmers by Province & Regency and Internet Use in 2018](image)

The use of ICT in the three locations was identified only in two villages that used technology, while another village was not identified as using ICT. If seen from the transformation process of small farmers, most of them have not used ICT for agricultural processes. The utilization of ICT in agriculture was initiated from institutional farmers/farmer groups in Mlatiharjo and Ketapang Villages. Farmer groups in these two villages began to introduce ICT for the marketing and communication process between small farmers and communication using telephone and smartphone networks. Most of the marketing is done in the marketing process of agricultural products. This product marketing is carried out using websites and e-commerce/online shop facilities.

### 3.3. ICT as a Supporting Factor for the Transformation and Persistence of Smallholders

The transformation of small farmers with increasingly smaller land issues is helped by the existence of institutional/farmer groups that accommodate agricultural development, especially for two study areas (Ketapang Village and Mlatiharjo Village) by introducing organic planting systems. The farmers’ group in these two regions was initiated by the champions who was a native of the village but brought external knowledge. In addition to providing the concept of organic farming, the role of farmer groups is also providing assistance from the upstream-downstream process. For example, the group also accommodates the provision of seeds, production processes to marketing.

The implementation of ICT in agriculture especially for small farmers in two study areas (Ketapang Village and Mlatiharjo Village) is assisted by farmer groups. As for Katekan Village, traditional ICT farming is carried out individually. The use of ICT by farmer groups is considered effective in improving the quality of small farmers. For example, improving quality with the use of ICT is integrated information provided by groups to farmers using social media information. Group work programs for farmer members are also easily distributed to members.

### 4. Conclusion & Discussion

The lack of digital infrastructure or the lack of infrastructure in the study area did not diminish the spirit of entrepreneurs in tapping the potential of the region. Local economic development in the study areas utilized both networks owned and fostered by the government or private sectors. Development of information and communication technology is also a step to support the sustainable development of the rural area especially for agricultural product; where the socio-economic and environmental aspects become a major pillar in the concept of sustainable development. These pillars form the basis for the welfare of society and maintain the environmental conditions. With the lack of the digital divide, providing rural infrastructure is expected to be able to build and prosperous society with its potential.
In the case of agricultural transformation in Central Java Province, there is potential for new developments in the agricultural sector and problems in the land ownership that make smallholders exist. Transformation resulted from the development of information technology and communication fosters a healthy awareness of agriculture for products and the environment. The concept of developing organic agriculture in the two study areas has a positive impact on the local economy. In terms of problems due to the transformation of agriculture, an increasingly divided land due to the inheritance system for children, and the scarcity of land management by young farmers, there are indirectly many benefits from the presence of institutions/groups of organic farmers.

Learned from the two villages that successfully develop and use the ICT to involve smallholders, there are some success factors. The critical factors include the human capacity. Leadership from farmer group and knowledge capacity are essential to initiate the ICT use. The data shows that the ICT development initiative are triggered by the external influence/champion. The ICT knowledge and infrastructure come from city. It is known that the priority of public investment on ICT development is limited, especially in rural area. The challenges in the rural development include the pressure of the use of digital technology, encouraging social entrepreneurship, encouraging new farming concepts, improving the capacity of communities, and creating environmental sustainability.

5. References

[1] Nugraheni R A 2019 Kebijakan Publik Mengenai Regenerasi Petani Muda Di Indonesia Administrasi Negara (Depok)
[2] Isdiyana K A B K H 2018 Perlindungan Hukum Terhadap Lahan Pertanian akibat Terjadinya Alih Fungsi Lahan di Indonesia J. Ketahanan Pangan 2 no 2 122–30
[3] Rigg J, Gillen J and Wijaya H B 2019 Asian Smallholders in Comparative Perspective
[4] Roumasset J 2003 Rural Institutions, Agricultural Development, and Pro-Poor Economic Growth Asian J. Agric. Dev. 1 56–75
[5] Burhan A B 2018 Pemanfaatan Teknologi Informasi Dan Komunikasi Untuk Pengembangan Ekonomi Pertanian Dan Pengentasan Kemiskinan J. Komun. Pembang. 16 233–47
[6] Leary J and Berge Z L 2006 Trends and challenges of eLearning in national and international 2 51–9
[7] Ariyanti S 2015 Studi Pengukuran Digital Divide di Indonesia Bul. Pos dan Tel. 11 281
[8] Melissa R Gilbert and Masucci M 2013 Information and Communication Technology Geographies: Strategies for Bridging a Digital Divide Urban Geogr.
[9] Miyoshi T 2013 success and failures associated with growth poles strategy
[10] Syahbana J A 2013 Transformasi Perdesaan Berbasis Pertanian Padi (Studi Kasus Desa Mlatiharjo dan Desa Ketapang Jawa Tengah) Tata Loka
[11] Nugroho W 2018 Konstruksi sosial revolusi hijau di era orde baru J. Sos. Dan Agribisnis 12 54–62
[12] Lambin E F, Geist H J and Lepers E 2003 Dynamics of Land-use and land-cover change in tropical regions Annu. Rev. Environ. Resour. 28 205–41
[13] Erdiaw-Kwasie M O and Alam K 2016 Towards understanding digital divide in rural partnerships and development: A framework and evidence from rural Australia J. Rural Stud. 43 214–24
[14] Badan Pusat Statistik (BPS) 2018 Result of Inter-Censal Agricultural Survey 2018 of Jawa Tengah Province BPS Central Java.

Acknowledgment
This research was supported with the data from the project of Asian Smallholders in Comparative Perspective. In Asian Smallholders in Comparative Perspective, it was funded by NUS and in collaboration with P5 Undip.