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Digital Inequality and Development: Using Short Message Service for Agricultural Development in Indonesia

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Abstract: Technology tends to have positive and negative impacts on the community. In agricultural development, information and communication technology (ICT) is deemed able to provide agricultural knowledge and practices to increase farmers' welfare. However, at the same time, there is a notion that ICT can also cause inequality among farmers. This research aims to study whether or not short message service is beneficial for farmers and whether or not it creates inequality in an agricultural society. The research is by way of surveys conducted among 200 farmers in West Java, Indonesia. This research shows that SMS can increase farmers' knowledge in farming. The most important result, as a novelty, is that the research proves that the digital divide and digital inequality take place in the use of SMS for agricultural development.

Keywords: digital inequality, information and communication technology, rural development, short message service.

数字不平等与发展：使用短信服务促进印度尼西亚的农业发展

摘要: 技术往往会对社区产生积极和消极的影响。在农业发展中，信息和通信技术（信息通信技术）被认为能够提供农业知识和实践，以增加农民的福利。然而，与此同时，有一种观点认为，信息通信技术也会导致农民之间的不平等。本研究旨在研究短信服务是否对农民有益，以及它是否会在农业社会中造成不平等。该研究是通过对印度尼西亚西爪哇的200名农民进行的调查进行的。这项研究表明，短信可以增加农民的农业知识。最重要的结果，作为一个新奇，是研究证明了数字鸿沟和数字不平等发生在使用短信促进农业发展的过程中。

关键词：数字不平等、信息和通信技术、农村发展、短信服务。

1. Introduction

Information is a basic human need for survival and overcoming uncertainty and a means for better living [1]. Without a doubt, information is very important for the well-being of human life. The revolution of Information and Communication Technology (ICT) is currently flooding human life with an overabundance of information. In the current digital era, information disseminated through various gadgets can become a ladder for social mobility [2].

However, some people can access information with ease, while others face difficulties. Accordingly, [3] mentioned that existing (dis)advantage is magnified in ways that give rise to new digital dimensions of poverty in an increasingly digital society. Marginalized and vulnerable populations are the least able to afford or use cutting-edge technology or high-speed internet connections. In addition to this, the gap between the poor and the rich information society is called a knowledge gap [4], [5].

The inequalities in digital development are generically known as the digital divide [6]. On the other hand, some authors differentiate the terms digital divide and digital inequality [7]. Digital divide is generally defined as a division between people who have access to and use of digital media and those who do not [8]. Meanwhile, Digital inequality essentially means the difficulty encountered by certain social categories or entire countries to take advantage of technologies [9].

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In agriculture, information concerning innovations is the key requirement for sustainable agricultural development. Without innovations, agriculture will not be able to provide adequate food to meet the world's needs. Hence, the agricultural extension system has been developed to enable the dissemination of agricultural information. Many countries have used ICT to disseminate agricultural information because it is considered reliable for the rapid and inexpensive dissemination of information. However, there is a question of how useful the information disseminated by ICT is in changing farmers' farming behaviors.

According to [10], several aspects are to be emphasized in designing ICT interventions for agriculture. The first one is farmers' access to ICT relating to physical proximity and accessibility to ICT infrastructures, tools, and services, ease of use, and application model in line with local physical condition, environment, and culture.

[11] states that the benefits of using information technology are: overcoming distance barriers through online service, increasing social capital among society, and attaining economic benefit through the enablement of participation in the digital economy.

Previously, [10] identified four aspects in which mobile applications can promote agricultural and rural development. These are better access to market information, disease, climate, and extension services. In addition to this, [12] farmers are willing to learn and use new technology, but introducing these innovations does not always result in immediate gains in their welfare. Major knowledge gaps require evidence to educate policy and practice so that stakeholders can use the potential of ICT-based agricultural innovations available in SSA [13].

Meanwhile, the issue of inequality on account of agricultural information service has been alleged by Everett M. Rogers [24]. Rogers said that inequality due to service and technology has resulted in inequality in social-economic benefits. According to this, the issue of digital inequality should be taken seriously because it has resulted in increased social inequality. Furthermore, inequality in the digital sphere reinforces social and economic inequity.

In Australia, [11] also finds indications of digital inequality. Internet is more accessible in cities than in rural areas. Indications of digital inequality are even more acute when there are differences in education, work, and other social-demographic aspects.

In South Korea, [14] shows a significant positive correlation between the informatization level of farmers and household income. The larger the household income, the more information they receive. Moreover, [15] showed that the use of climate text messages is significantly related to increasing awareness and knowledge of farmers. Previously, the research on small farmers in rural areas in Thailand showed that farmers who could operate information technology also could increase their agribusiness productivity [16]. In addition to this, Agro-met Advisory Services have also proven effective in disseminating information such as farm management information based on the weather for various agricultural operations such as sowing, irrigation scheduling, fertilizers, weedicide and pesticide application, and harvesting [17, 25].

In this connection, the level of farmers' utilization of SMS for agricultural activities is also inseparable from influencing factors, both internal and external. The internal factors denoted in this research are related to farmers' characteristics that are referred to in [13], [18], [19], [20], [21], [22], [23]; however, this research also indicates more signs or tendencies of digital inequality occurring among farmers.

In Indonesia, there are various ICT services for agricultural development. Among them is the use of ICT for agricultural development provided by *Mercy Corps Indonesia*, a nongovernmental organization that introduces ICT for the empowerment of farmers. This organization, through Agri-Fin Mobile, provides access to technological and financial information for rice, corn, chilly, and potato farmers in several areas. The service is known as LISA, short for *Layanan Informasi Desa* (Rural Information Service), which uses a cell phone device for Short Message Service (SMS).

In connection with the above matters, the objective of this research is to identify the extent of the use of information technology (particularly SMS for farmers) by farmers in Karawang, West Java. The second objective is to examine further the implications of using this service to increase farmers' knowledge. The third objective is to analyze indications of digital inequality occurring in Karawang District, West Java, Indonesia.

2. Method

This research was conducted from July until October 2017 in five subdistricts: Pangkalan, Karawang Timur, Jatisari, Pedes, and Rawamerta, in the Regency of Karawang, East Java Province. The selection of locations was conducted purposively with a sampling of 200 farmers who were LISA service users. The list of farmers using the LISA service was obtained from the Office of Mercy Corps Indonesia.

The research was designed using a quantitative approach by a survey method. The quantitative data were collected through structured interviews using a questionnaire as the instrument. Meanwhile, qualitative data were collected through in-depth interviews and group interviews. The in-depth interviews were carried out with the staff of Mercy Corps Indonesia (in the head office and in Karawang) and with field extension workers whose working area is within the LISA service area.

3. Results and Discussions

3.1. Description of the Agricultural Short Message Service

Layanan Informasi Desa (Village Information Service), abbreviated as LISA, is an information service provided by Agri-Fin Mobile. The program was developed by Mercy Corps Indonesia and PT 8Villages Indonesia, which provide an integrated service for farmers. The program was developed to help farmers overcome their limitations in accessing information needed for farming activities. Such information includes weather, consumers' needs, prices of commodities, and expenses required for farming.

At the beginning of the program implementation, Mercy Corps Indonesia and 8Villages, together with the local government (especially the Office of Agriculture and the Office of Extension Coordination), conducted training activities. The training was attended by all field agricultural extension workers and farmer leaders, particularly heads of farmer groups within the LISA service area. The objectives of the training were to introduce LISA services and train farmers how to access these services, and to show how field extension workers and farmer group heads can help farmers access the services.

LISA uses short message service (SMS). It was introduced in December 2012 in Karawang Regency. The coverage area of LISA encompasses four districts in West Java Province, covering Karawang, Purwakarta, Subang, and Bogor.

Information service using SMS was adopted because it is the most simple or uncomplicated service and is relatively inexpensive. It is accessible by farmers who own very simple cell phones. It is cheap because it does not require an internet connection. However, due to its simplicity, messages sent through SMS are very brief and unable to include pictures. Thus, this service is incapable of disseminating complicated information.

Agricultural SMS service includes tips and questions and answers on agriculture and family financial literacy. Materials for tips are organized by operators, and the materials refer to government programs, information originating from or trending in society, or topics that are of concern to the users of the interactive question and answer service. Those who intend to become users of this service in Agri-Fin Mobile should register first, by sending an SMS to the operator. Once registered as users, they can benefit from the services provided. From the commencement of this program in December 2012 until April 2015, agricultural tips were disseminated to users every day. Due to the limited number of characters that can be used in short messages, LISA operators disseminated tips on one agricultural issue in two short messages. However, starting in May 2015, agricultural tips have been disseminated twice a week. Messages to be disseminated are prepared by Mercy Corps in cooperation with agricultural universities. Experts from the universities formulate the information and answer questions raised by LISA users.

To attract users to utilize the program, every week Mercy Corps Indonesia holds quizzes. Through these quizzes, Mercy Corps can measure users' knowledge and what they remember about the messages sent to them. Each week, 10 winners are selected, and each receives Rp 10,000 worth of phone credit. The users try to answer all the questions they receive through SMS. In order to increase users' enthusiasm and activity, LISA sometimes gives Rp 5,000 worth of credit phone to users who raise questions.

3.2. Farmer Profiles

The use of information and communication technology (ICT) cannot be detached from the influence of farmers' characteristics. According to [18], factors related to the use of cell phones are education, farming experience, and land ownership. Furthermore, other researchers, such as [13], [19], [20], [21], [22], [23], reveal that those characteristics influence the level of ICT use; in fact, characteristic differences can cause digital inequalities.

Farmers' characteristics that are measured in this research are age, formal education, land ownership, land tenure, and number of communication devices owned. The following table shows data on the number and percentage of farmers in this study according to individual characteristics.

Table 1 shows that only 13 percent of the farmers are categorized as young, that is, less than 30 years old. This is common around the world; fewer and fewer young people want to become farmers.

On average, the level of the farmers' formal education is low. The formal education of 88 percent of the farmers is only elementary school. However, 4 percent of the farmers graduated from a university. These data are in line with the data submitted by the 2016 Extension and Agricultural Human Resources Development Agency. According to this agency, the majority of agricultural laborers (farmers) in Indonesia have a low-level education, with the percentage around 74 percent. Moreover, 34 percent among them are without any educational background or did not finish elementary school.

Meanwhile, although Karawang District is known as one of the richest rice granaries in Indonesia, the data show that only a small portion of farmers, fewer than 15 percent, own large land (> 1 hectare). Almost half (47 percent) of the farmers own only a small piece of land, less than a half hectare. This fact is in conformity with the data that show that 30 percent of farmers own no land, so their status is only as farm laborers.

Table 1 Number and percentage of farmers in Karawang based on their characteristics

Characteristics	Category	Number of Farmers	Percentage
Age (year)	Young (< 30)	28	14
	Mature (30-50)	124	62
	Old > 50	48	24
Formal Education	Elementary School and below	176	88
	High School	17	8
	Higher Education	7	4
Land Ownership (m²)	Small (≤ 4.000)	94	47
	Medium (> 4.000 - ≤ 12.000)	81	41
	Large (> 12.000)	25	13
Land Tenure Status	Laborer	66	33
	Collateral	17	9
	Rent	57	29
	Owned	60	30
Gadget Ownership	Small (= 1)	86	43
	Medium (2-3)	16	8
	Many (≥ 4)	98	49

The above table also shows an indication of inequality in terms of land ownership. Some farmers, 13 percent, own more than 1.2 hectares of land, and there is even a case of one farmer who owns 20 hectares; meanwhile, 30 percent of farmers have no land. This indication of polarization of land ownership is a threat that may cause difficulties in agricultural development.

Next, based on data of communication device ownership, it shows there is inequality among farmers. Almost half of the farmers (43%) own no more than one device, and the most common device is television. Meanwhile, the other half (49%) have more than four devices: television, radio, cell phone, computer, and even a laptop.

3.3. Farmer Exposure to LISA

Information received by LISA users is the same for all who have already registered. LISA disseminates information to farmers at the same time and in the same amount for each farmer.

In this research, farmers' usage level of SMS on agriculture is measured by using three indicators: number of information sources, frequency of access, and number of information varieties. Data on the number of information sources show the number of sources of agricultural information accessed within one month. Information varieties are measured based on the diversity of information in relation to farming activities. As for frequency of information, access is measured based on the number of times each farmer accesses agricultural information from various information sources within one month. The following table shows data on farmers' usage level of agricultural SMS.

Table 2 Number and percentage of farmers based on variable of agricultural SMS usage level in Karawang Regency, 2017

Usage Level	Category	Number of Farmers	Percentage
Information Variety	Few (1-3)	185	93%
	Moderate (4-6)	15	8%
	Many (7-8)	0	0%
Frequency of Access	Low (1-10)	88	44%
	Moderate (4-6)	46	23%
	High (21-30)	66	33%

There are three sources of information: information on prices, tips and question-answer on agriculture, and family financial literacy. LISA operators organize the materials for tips. The materials refer to government programs or originate from trends developing in society or issues that are of concern to users in an interactive question-answer service. Research results show that almost all farmers have a moderate number of information sources, i.e., 4–6 information sources.

The data showing only a small number of farmers have information sources confirm the findings on the number of accessed information varieties. On average, farmers access only 1–3 kinds of information. Therefore, it can be stated that almost all farmers are not exposed to all the information available in LISA's agricultural SMS service. Furthermore, the kind of information often accessed by farmers is the question-answer service. Farmers claim they have never accessed the family financial literacy service because some deem such information unnecessary, while others think it is difficult to understand.

Through in-depth interviews, it is evident that the small number of and differences in information sources, number of information varieties, and frequency of information received are due to unequal ownership of cell phones. Cell phones are not "personal belongings" but are family belongings for many families in the research locations. It is possible that when LISA disseminated information related to agricultural technology, the farmers' cell phones were brought to school by their children. Or, when there was information on household economic matters, the phones were being used by the household head. As a result, the information was not accessed by individuals who are supposed to access them.

Things become more difficult because usually, the cell phones' memory space is small. When several short messages are received, the phone's limited space becomes full and causes some information to be deleted.

These are the causes for differences in the information received by respondents.

Concerning varieties of information accessed by farmers, Table 3 shows data on farming information accessed by farmers in Karawang Regency through the usage of LISA service.

Table 3 Number and percentage of farmers based on varieties of information of farming obtained from LISA source in Karawang, 2017

Information Topic	Number	Percentage
Land management	92	46.0
Irrigation	48	24.0
Seed Selection	71	35.5
Planting	76	38.0
Fertilizing	92	46.0
Pest Management	93	46.5
Post Harvest	46	23.0
Marketing	15	7.5

Obviously, the information LISA can disseminate is restricted because complicated technological details cannot be sent through SMS.

Despite this restraint, Table 3 reveals that LISA can still provide information that is discussed between agricultural extension workers and farmers in various settings.

Apparently, information on land preparation is of great interest to farmers. However, further in-depth interviews show that farmers do not automatically apply this information to their farming activities. An example is LISA's advice that farmers not burn stalks but let them decompose in the field to improve soil fertility. Nevertheless, most farmers ignore this advice. They burn the stalks because they think it is the easiest and fastest way to prepare the land for cultivation in the next planting season. It takes longer for stalks to decompose in the field, causing farmers to fall behind the planting season.

Other information widely received by farmers regards Pest Management (46.5%), Fertilizing (46.0%), and Land Management (46.0%). LISA information of less interest to farmers concerns Irrigation (24.0%), Seed Selection (35.5%), Planting (38.0%), and Post Harvest (23.0%).

Interestingly, of least interest to farmers is Marketing (7.50%). This implies that farmers merely accept already-set prices, especially the price of rice. Indeed, farmers have only a few options regarding rice prices because the merchants ultimately determine the prices of farmers' products. Institutionally, farmers have very little protection regarding the marketing of their agricultural products. Rice farmers often become victims of the rice trading system. During the harvest season, farmers sell rice at low prices due to an abundance of supply. However, when rice is scarce, they have to buy it at high prices. A serious problem is that many farmers have no barns. Thus, they cannot store large amounts of rice to fulfill their needs until the following season.

Even though only a few farmers have many sources and types of information, the frequency of farmers accessing LISA services is quite good. Table 2 shows that 33% of farmers claim that, on average, they access LISA services 21-30 times per month. The farmers in this category said that they used LISA services at least once a day.

On the other hand, almost half of the farmers admitted that they seldom accessed LISA services, with a frequency of fewer than 10 times a month. This is because, on average, farmers in this category have only one cellphone and it is shared by all family members. Thus, they take turns in using the cellphone. Another constraint in accessing LISA services is farmers' lack of capability in using cellphones, as 24% of farmers in this research belong to the old age category (above 50 years old) with most having graduated only from an elementary school. Accordingly, farmers in this category need assistance from their family members in using cellphones, especially in accessing LISA.

Furthermore, according to farmers, the low frequency in utilizing the question-and-answer forum in LISA services is partly due to the characters on the cellphone being too small and, thus, difficult to read. They also considered the explanations given through SMS to be insufficient and unclear. As their questions are not responded to immediately, farmers tend to use this facility with declining frequency. Some also thought that the answers were too long.

Based on the above analysis, it can be said that the farmers' accessibility level of LISA services is not yet high. The reasons are, among others, the time it takes to receive responses and the insufficiency of answers. Due to this, they prefer to ask questions directly to other farmers. Another reason is that the language used is too sophisticated for the farmers to be able to understand the message.

3.4. Effects of LISA on Farmers' Knowledge

The research [17] showed that phone-based SMSes lead to greater compliance of agri-met advisories in the scheduling of operations based on crop growth cycle, as well as led to greater use of forecasts for substituting rainfall for groundwater or surface irrigation by treatment group farmers. So, can SMS increase farmers' knowledge of agriculture in Indonesia? Materials presented through LISA were asked to 100 farmers. Farmers' knowledge is categorized as follows: low (know less than 30%), intermediate (know 31-60%),

and high (know more than 61%). The results are presented in Table 4.

The table shows that SMS can increase farmers' knowledge at different levels of change. In general, farmers have an intermediate-high knowledge of information distributed by LISA, at relatively normal distribution. Farmers' low level of knowledge is only on the marketing aspect.

Table 4 Percentage of farmers based on level of knowledge of information materials distributed by LISA

Topic	Category	Percentage
Land Preparation	Low	28.0
	Intermediate	28.0
	High	44.0
Irrigation	Low	37.0
	Intermediate	22.0
	High	41.0
Seeds	Low	31.0
	Intermediate	34.0
	High	35.0
Fertilization	Low	29.0
	Intermediate	36.0
	High	35.0
Planting	Low	23.0
	Intermediate	43.0
	High	34.0
Pest & Disease Control	Low	32.0
	Intermediate	35.0
	High	43.0
Harvesting	Low	24.0
	Intermediate	39.0
	High	37.0
Marketing	Low	51.0
	Intermediate	30.0
	High	19.0

Table 4 also shows that, in general, farmers' knowledge of various agricultural aspects is already at intermediate and high levels. In Indonesia's agricultural development history, farmers in Karawang are the first farmers to have received agricultural modernization services.

3.5. Digital Inequality Tendency

For studying the tendency of digital inequality, the following data are presented concerning correlation test results between variables of farmer characteristics and variables of the level of information accessibility.

Table 5 Coefficient of relationship between variables of farmers' characteristics and level of SMS usage in Karawang Regency in 2017

Farmers' Characteristics	Use of Information			
	Types of Information		Frequency of Information	
	r	Sig	r	Sig
Age	0,016	0,826	-0.206**	0.003
Level of formal education	0.240**	0.001	0.210**	0.003
Land ownership	0.087	0.219	0.503**	0.000
Status of land tenure	0.196**	0.005	0.179*	0.011
Communication device ownership	0.200**	0.004	0.356**	0.000

Notes: ***** Significant at α 0.05
****** Significant at α 0.01

Table 5 proves a tendency of digital inequality in the access of information provided by LISA. There are four variables of individual characteristics that have a relationship with the number of information types accessed by farmers. These are formal education, land ownership, land tenure status, and ownership of communication devices. The higher the level of education, land tenure status, land ownership, and communication device ownership, the more varied the information accessed through LISA. The same tendency is also observed by [22] and in the research conducted by [21] in Trinidad.

Furthermore, the frequency of communication is influenced by all variables of individual characteristics. There are some interesting data. Among others are the results of the correlation test between age and information frequency, which show a negative and significant correlation at the significance level (α) 0,003. The negative correlation shows that the older the farmer, the less frequency he/she accesses agricultural SMS. This reinforces the thesis that the older generation (digital migrants) have difficulties in using digital information. Old generation farmers tend to be awkward in using digital media, so their frequency of media usage tends to be lower than the digital generation.

The relationship between land tenure and farmers' SMS usage level has been confirmed by [18]. They show that the use of cell phones in agricultural activities is influenced positively by land owned and cultivated. This research also shows the same results. The relationship between the size of land owned by farmers and agricultural SMS usage level is positive. The indicators used in the level of usage are the number of information sources and frequency of information. In other words, the larger the land owned by farmers, the more resources the farmers access and the more frequently they access the services.

This condition is also related to farmers' capacity to take risks and their opportunity to use technology. Large-scale farmers, or farmers who have extensive farming activities, have greater opportunities to use various kinds of technology in their farming. Meanwhile, small-scale farmers, who have limited

farming activities, often refrain from using a great deal of new technology because of the risk in farming and the cost of innovation. Large scale farmers are more willing to endure losses in attempting to use innovations because they have sufficient assets, unlike small scale farmers who have limited finance and few assets.

In addition, the usage level of SMS service is an important factor in determining the change in farmers' knowledge due to the amount of information received from LISA services. Results of the correlation test on both variables are presented in Table 6.

Table 6 Coefficient of correlations between variables of information accessibility and knowledge level in Karawang Regency in 2017

Information accessibility	Knowledge Level	
	R	Sig
Information variation	0.155	0.028
Information frequency	0.535**	0.000

Note: ** Significant relationship at α 0.01

By referring to the analysis presented in Table 6, the variable contributing to farmers' knowledge changes is information frequency. In other words, the more frequent a farmer accesses information presented by LISA, the higher is the farmer's level of knowledge. Meanwhile, the variation of information is not related to farmers' knowledge level. The kind of information frequently accessed by farmers is usually question and answer on farming. In general, farmers have never accessed family financial literacy services because some regard such information as unnecessary, while others think it is difficult to understand.

Based on the results, this study can suggest to service providers that the actual need of farmers in terms of information accessed is not related to the type or variation of information provided. Agricultural SMS service providers are expected to focus more on the topic of information most frequently accessed by farmers, which is information related to farming. Therefore, such service providers should provide information as much as possible concerning farming.

Furthermore, the relationship between the frequency of information and the level of farmers' knowledge is very significant. In other words, the more frequent a farmer uses LISA services, the higher is the farmer's knowledge level. According to farmers, the most widely used feature is the question-and-answer service. Farmers feel this service facilitates them. They can directly ask questions to the related extension worker concerning the farmers' problems without having to wait for the extension worker's next visit to their village. In other words, the SMS feature provides quick responses to the farmers' problems.

4. Conclusions and Recommendations

This research shows that use of SMS to disseminate agricultural technology information can be successful in empowering farmers, as messages received by farmers have increased farmers' knowledge level and were used to improve their farming practices. In addition, information received through SMS helped intensify discussions between extension workers and farmers. Thus, to strengthen the effect of messages received by farmers through SMS, discussions with extension workers and between farmers are needed.

This research also revealed some signs of digital inequality among farmers caused by the differences in their socioeconomic status, as some farmers are unable to purchase communication devices, or access and use pertinent information, and are thus not benefiting from the information received through SMS. These disparities need to be addressed as digital inequality can contribute to other kinds of socioeconomic gaps.

This research also shows that digital inequality is also caused by low educational level, due to which many farmers are incapable of interpreting the content of LISA services. In other words, even though information is equally available and accessible to all farmers, there is a considerable variation in their capability to read and understand the messages.

Although there are a number of studies examining the usefulness of SMS in the dissemination of agricultural information services, the factors motivating farmers to use or not use media as a source of information have never been examined. This knowledge gap motivated the present study, focusing specifically on farmers living in rural areas, thus increasing the likelihood that they would not habitually use cellphones to access information. In fact, most farmers tend to use their cellphones solely to communicate with family members and relatives.

Farmer studies that are specific to rural areas are important considering the dependence of farmers in rural areas (especially in Indonesia which was in focus of this research) on extension workers as the most trusted source of information. However, as the number of extension workers operating across Indonesia is not representative of the number of existing farmers, they have many limitations in assisting farmers. In this regard, sharing information via mobile phones has the potential to advance the agricultural sector.

There have been many previous studies linking media (digital and conventional) usage to increasing knowledge. However, the causes of inequalities in media usage and their implications are rarely explored. The most important contribution of this study stems from demonstrating that digital inequality affects the benefits that can be derived from using SMS for agricultural development. All stakeholders should be aware of this phenomenon so that digital technology will

not widen the gap between the rich and the poor. Nevertheless, no correlation between information variation and knowledge level was established due to the minimal variety in the information transmitted via the service. Therefore, authors of further studies in this field should to consider the diversity of data in terms of the variety of information.

Based on the abovementioned conclusions, this research recommends the use of ICT for agricultural development. ICT has been successful in disseminating knowledge to farmers. Extension workers also use the information for topics of discussions with farmers.

However, strategic measures are needed to avoid or reduce inequality in ICT access. For avoiding the digital divide, spots for free Wi-Fi should be developed. Such policy is necessary considering that many agricultural services are channeled through the internet, while the cost of internet access is still high. Providing free Wi-Fi spots for farmer groups is a strategy that will reduce the burden of poor farmers.

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