

INNOVATION CHARACTERISTICS IN CONFIGURING FARMERS' DIGITAL LITERACY ON E-REPORTING POLYGON IN WUKIRSARI INDONESIA

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Abstract. The e-reporting polygon is an effort of the Ministry of Agriculture to maximize agricultural cultivation activities, especially on the availability of subsidized fertilizers. However, not all agricultural extension agents and farmers are familiar with this innovation. It is possible that elder farmers will experience difficulties in accessing the innovation. Therefore, this study aims to: 1) Understand the characteristics of polygon e-reporting innovation and 2) Analyze the influence of the characteristics of polygon e-reporting innovation on farmers' digital literacy in Wukirsari. This research applied a quantitative approach and was conducted in Wukirsari Village, Cangkringan Sub-district, Sleman Regency. The 60 farmers were collected through simple random sampling. The data were analyzed through simple regression. The results showed that the five categories of innovation characteristics presented good values in terms of relative advantage, compatibility, complexity, trialability and observability. The characteristics of innovation also positively and significantly influenced the digital literacy level of farmers in Wukirsari Village. Nevertheless, the digital literacy of farmers needed to be highly improved particularly on gadget operation, agricultural information access, networking, and information sharing to other farmers.

Keywords: digital innovation, e-reporting polygon, innovation characteristics, innovation dissemination, digital literacy

1 Introduction

The rapid growth of technology in the agricultural sector has already started a few years ago along with the emergence of the 4.0 industrial revolution. The Ministry of Agriculture gradually started to introduce cyber extension in the extension activities. A form of cyber extension that started to be developed in the agricultural sector is initiated from obtainable extension materials in online sources, followed by the existence of agricultural machinery that is remotely operated using gadgets, to the digitalisation of agriculture.

The agricultural digitalisation has received many responses from farmers be they positive or negative. Nonetheless, there are multiple benefits that can be gained from agricultural digitalisation such as a program of e-reporting polygon prompted by the Ministry of Agriculture. Previous study mentioned that when the literacy level of farmers is low, farmers are unable to optimally functionalize technology [1]. Therefore, to survive in the midst of technological onslaught, ones must balance that with the ability to respond to the technology itself. One of the ways is by improving the literacy level.

An example of digitalization starting to be implemented today is the E-reporting polygon which has started to be implemented for farmers in the Wukirsari Village since 2021. Through the implementation of this innovation,

the characteristics of an innovation that can be accepted by the community are possible to be identified. Therefore, it is important to know how far the impact of the suitability of innovation characteristics with farmers' conditions is so that farmers' digital literacy levels can be measured.

2 Literature Review

Innovation

According to Rogers [2] in Ahmad [3] innovation is an idea, thought, practice, and product (goods and services) that has novelty, new characteristic, or different approach, but not new to study. The study stated that innovation is a diffusion process of ideas or new things in an effort to transform society continuously from a place to another, from a certain period to the next period, from a certain field to another into a group of members from the social system [3].

Agricultural innovation is understood as the implementation of thoughts, practices, or or new ideas on agriculture that becomes a new way which has commercial value but efficacious in improving the living standard of the community in an equitable way [4]. Thus, it can be concluded that agricultural innovation is an idea, thought, practice, and new thing

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in the world of agriculture that has renewal and can be functional for society. Whether or not an innovation can be easily accepted by society can be indicated from the characteristics of the innovation.

Innovation Characteristics

According to [2], there are 5 characteristics of innovation, they are: relative advantage, compatibility, complexity, trialability, and observability. Relative advantage is related to the advantages of existing innovations both in terms of economy, performance, social and convenience. Compatibility is an assessment of an innovation, whether it is compatible with existing values and needs. Complexity refers to the complexity level of an innovation to be adopted. The easier an innovation to be learnt and understood, the easier it gets to be adopted. Trialability refers to whether the innovation can be put into a trial before it is implemented. Observability is a standard of how visible is the application of the innovation to other people. The easier people see the result of the innovation, the greater chance of adoption to occur.

Digital literacy

Digital literacy is the ability to create and share in different modes and forms; to create, collaborate and communicate more effectively, and to understand how and when to properly use digital technology to support those processes. The characteristics of digital literacy do not only refer to skills to operate and use various information and communication technology devices (hardware and software platforms), but also to the process of reading and understanding the contents of technological devices and the process of creating and writing new knowledge [5]. Digital literacy can also be interpreted as an individual's ability to apply functional skills to digital devices so that they can find and select information, think critically, create, collaborate with others, and most importantly, communicate effectively [6]. Digital literacy includes various types of literacy so that it becomes more complex. Similar to media literacy, digital literacy also requires the ability to critically analyze and evaluate so as to obtain quality understanding. In digital literacy, messages in the media are constructed in such a way thus they can function optimally in even more complex communication situations. Digital literacy has a broader scale and usually addresses important issues [7].

Innovation Dissemination

Dissemination of innovation is an important communication activity in encouraging the process of dissemination and application of technology in a rural social system. The act of dissemination is a prepared act according to careful planning, through discussions or other forums that are intentionally programmed, so agreement to carry out the innovation is reached [8]. Information dissemination in agricultural digitization is required in this era. This is intended to increase farmer literacy in receiving all available agricultural information.

3 Research Methods

The method used in this study is a descriptive method with a quantitative approach. Quantitative is a method of research using numerical data that serves a quantitative function to predict population conditions and or future trends [9]. The location of this research is the Wukirsari Village which is located in Cangkringan District, Sleman Regency. The hamlets selected in the research activities were Jambu Bangkok Hamlet, Glagahwero Hamlet, Dawung Hamlet and also Karangpakis Hamlet. Some of these locations were chosen because they have implemented agricultural digitization, namely the use of polygon e-reporting in the series of Definitive Plan for Group Activities (RDKK). The respondents in this study were 60 farmers from several hamlets in Cangkringan District, Sleman Regency, Yogyakarta Special Region who have received information about e-reporting polygons from relevant stakeholders. Data collection methods were interviews and questionnaires conducted on each farmer. Based on the number of respondents, 15 respondents were taken from each hamlet using simple random sampling techniques. The data analysis method used to answer the objectives of this study is descriptive statistical analysis and also a regression test.

3.1. Resources and Facility Support in Cangkringan Sub-district

Human Resources

Wukirsari is located in the Cangkringan District. Cangkringan has 10,929 residents and is categorized as a very dense population based on Law no. 56/PRP/1960, as it reached 750.6 people/km². The number of men and women has a sex ratio of 98.5%. This figure means that the population of men and women has an almost equal ratio in which there are 5,161 male residents and 5,240 female residents. In terms of age, the majority of the population in Wukirsari belong to the productive age category, as there are 65.71% residents in the age range of 15-65 years old, while 22.66% and 11.63% of the population are aged 0-14 years old and over 65 years old respectively. The dependency ratio shows a figure of 52.2% that indicates medium category.

A crucial aspect used to measure digital literacy is education level. Most residents of Cangkringan are senior high school graduates. The following table shows the distribution of the population based on the education level.

Table 1. Education level of rural community in Cangkringan Sub-district

Education	Population	Percentage (%)
Not-school	1,736	15.88
Not graduated from elementary school	1,005	9.20
Graduated from elementary school	1,660	15.19
Graduated from junior high school	1,459	13.35
Graduated from senior high school	3,891	35.60

Diploma/ Undergraduate/ Graduate/ Postgraduate	1,178	10.78
Total	10,929	100.00

Source: Central Bureau of Statistics (2022)

The occupation data from Central Bureau of Statistics shows that Cangkringan consists of 13.89% of students, 5.92% of non-working group, 18.65% of households, 22.10% farmers in agrocomplex sector, and 39.44% non-agricultural workers. The farmers works in 429 hectare of upland area and 757.36 hectare of dry land area.

Farmers in Wukirsari cultivate superior commodities such as mangosteen, avocado and durian. According to the [10], the total production of mangosteen in Wukirsari Village reaches approximately 2,500 quintals. The total production of avocado plant commodities is approximately 6300 quintals. Meanwhile, the total durian production in Wukirsari Village reaches 1,500 quintals.

Internet Access for Agricultural Sector in Wukirsari Village

Most of the farmers in Wukirsari use smartphone-type devices. Smartphone is a communication device that is functioned not only for making calls and exchanging messages but also for other various activities such as information seeking, entertainment seeking, studying, business running, negotiating and so on. To support the use of a smartphone, it requires a network or connection to the internet. The available internet networks options are very diverse today, starting from cellular networks that use quota from a particular provider, wi-fi, personal hotspots and others. The farmers in Wukirsari Village use smartphones in their daily lives. They maximize their gadget's function with their personal cellular networks. The village authorities have not yet provided internet access to the community. Based on the interview with the farmer groups, internet access is also not provided by the farmer group. The following data shows the internet access that is available in Wukirsari.

Table 2. Internet access in Wukirsari Village

Internet Access	Physical Condition
<i>Wi-fi</i>	Owned by each person
Phone tower	6 towers in good condition
Operator for service	4 towers in good condition
Signal	Strong

Source: Central Bureau of Statistics (2022)

Based on [10] the Wukirsari sub-district has 4 cellular towers. This is the largest number of cellular towers among the number of towers in all of the sub-districts in Cangkringan. Similar to the cellular tower, the number of communication operator service providers in Wukirsari is also the largest in Cangkringan as it has 6 operators in total. While for the signal, it is

also considerably strong. Therefore, it will be convenient for farmers in the Wukirsari sub-district to get internet access with such availability of many operators, cellular towers, and strong signal conditions. Therefore, the use of smartphones in Wukirsari can be optimized even though internet connection cost is unsubsidized by either village authorities or farmer groups.

3.2. Characteristics of e-Reporting Polygon Innovation

e-Reporting Polygon to support smart agriculture

Smart farming is an agricultural concept using digital and information technology that aims to support agricultural activities to be more effective and efficient. This is in line with the goal of e-reporting polygons implementation in which the e-reporting polygons play a significant role in arranging Definitive Plan for Group Activities (RDKK). The arrangement of the Definitive Plan for Group Activities (RDKK) is synced with the results of land calculations listed in the e-reporting polygon. When the implementation process of polygon e-reporting runs smoothly and optimally, it will affect the results given. The land area listed will be more accurate and simplify the RDKK process. The submission process of RDKK can be said to be simplified because when submitting the RDKK proposal to the relevant agency (agricultural ministry), the accuracy of land measurement determines the opportunity of the proposal to be approved. When the land area listed in the proposal complies with the actual land area, the proposal will be accepted and the fertilizer subsidy will be received by farmers in an optimal amount.

The Characteristics of e-Reporting Polygon

Table 3. Characteristics of e-Reporting Polygon innovation

No	Indicator	Category
Relative Advantage		
1	Innovation support the networking among farmers	Average
2	Innovation enhance farmer's income	Low
3	Innovation effectively help farmers to achieve the group goals	High
4	Innovation efficiently support on-farm based on energy, time, and fund	High
Average		Average
Compatibility		
5	Innovation is compatible for farmers' condition (easy to apply)	Average
6	Innovation is compatible for social norms in farmers community	Average
7	Innovation compatible for for farmers' need	Average
Average		Average
Complexity		
8	Innovation is applicable based on farmers' skill	Low

No	Indicator	Category
9	Innovation is accessible	High
	Average	Average
	Triability	
10	Innovation is applicable in demonstration farm	Average
11	Innovation is applicable in group practice	High
12	Innovation can be implemented by limited labours	Average
	Average	Average
	Observability	
13	The results of innovation can be observed without additional tools	Average
14	The plant growth can be used for further research	Low
15	Innovation result can be observed by anyone in group or other farmers	Low
	Average	Low
	Total Average	Average

Source: Primary data analysis (2023)

On the characteristics of innovation, the relative advantage reported is 59.38%. This value indicates that the relative advantage is in the sufficient category. In the relative advantage indicator, it is found that digitalization (e-reporting polygon) can increase the effectiveness of agricultural activities, for instance by facilitating the farmer groups in achieving their goal. In this account, the achievements of farmer groups can be interpreted as the goal of farmer groups in maximizing farming activities through the fulfillment of fertilizer subsidies needed by the group. Optimizing the implementation of polygon e-reporting will facilitate the RDKK planning process and the need for fertilizer subsidies will be met to the fullest. In addition, it is also found that the digitalization of agriculture makes agricultural activities more efficient in terms of time, effort and cost. By the use of digitalization, it will make it easier to fulfill the need for fertilizer subsidies, which in turn can also lead to more efficient time, costs and manpower needed. The innovations carried out in the dissemination process to farmers in the Wukirsari Village are considered improving compared to previous innovations. The next innovation characteristic is compatibility of innovation (compatibility) that has a value of 52.22% which can be categorized as sufficient. Meanwhile, the complexity of innovation characteristics is in the range of 52.50%. This shows that the complexity level of this innovation is still in the sufficient category and can still be well adopted by farmers since the more complicated an innovation is the slower the innovation adoption process will be. Based on the trialability and observability characteristics of innovation, it has a value of 54.44% and 54.00% which means that the ease of the innovation to be observed and tested out is categorized as sufficient. The following table will present the characteristics of agricultural innovation more clearly and concisely.

e-Reporting Polygon Dissemination Process

Based on the results of interviews conducted with farmers in the four farmer groups in the Wukirsari Village, it is reported that each of them has a regular agenda in the form of group meetings. Each farmer group has a different schedule or meeting date according to the agreement of each group. For example, the farmer group in Dawung Hamlet holds a farmer group meeting every two months on the 25th day of that month. On the other hand, the farmer groups in Jambu Bangkok Hamlet hold group meetings every night of Legi Sunday (market day in the Javanese calendar). The farmer group in the Karangpakis Hamlet meets on the 2nd day of every month. As for the Glagahwero Hamlet farmer groups, they hold regular meetings on Saturday Pahing (Javanese calendar market day) which is held once every 35 days.

In these regular meetings various activities are carried out such as rotary savings (arisan), information exchange and also discussions on other topics. Farmer group meetings play a significant role in the innovation dissemination process. This is because the pattern of how innovations spread in the Wukirsari Village began in the Wukirsari Farmer group Association meeting at the end of each month which was attended by the chairmen or representatives of the farmer groups from every hamlet in the Wukirsari Village. The findings of the Farmer Groups Association meeting will be delivered by the head of the farmer group in the farmer group meeting and followed by a discussion on the delivered information. Based on the results of the interviews, it is also stated that the dissemination of agricultural information on polygon e-reporting, was first carried out in the Farmer Groups Association meetings. The Farmer Groups Association meeting was attended by agricultural extension agents in Wukirsari Village, the heads of farmer groups from each farmer group in the Wukirsari Village, and also resource persons with relevant expertise (in this case is the Directorate General of Agricultural Infrastructure and Facilities of the Central Ministry of Agriculture). In the meeting, information regarding polygon e-reporting is delivered, from the benefits and objectives of the program to the steps in utilizing e-reporting polygons. The follow-up of the Farmer Groups Association meeting was the transfer of information to the farmer groups which was carried out by the head of the farmer group from the Farmer Groups Association meeting report. From the presentation delivered by the researcher, it can be seen that the percentage value indicates that regular meeting agenda associated with the dissemination of innovations are often carried out in accordance to what is happening in the field. Although the dissemination activity has a low percentage value and is considered in the seldom category, regular meetings play a role in every agricultural innovation dissemination activity that takes place in the Wukirsari Village.

Table 4. e-Reporting Polygon Innovation Dissemination Process di Wukirsari Village

No	Indicator	Category
1	The innovation training from government	Rarely
2	The meeting for innovation dissemination	Often
4	Whatsapp group for sharing new information	Sometimes
5	Leaflet or poster informing the innovation is well disseminated (online or conventional)	Never
6	Discussion with extension agents (<i>door to door</i>) about the innovation	Never
Average		Rarely

Sumber: Primary data analysis (2023)

Dissemination of innovation is an essential communication effort in promoting the process of dispersion and application of technology in a rural social system. The act of dissemination is an innovation effort that is prepared according to careful planning, through discussions or other **spreading forums** that are deliberately programmed, so that there is an agreement to carry out the innovation [11]. Agricultural innovation has an important role in increasing agricultural productivity. Wukirsari is one of the sub-districts in Cangkringan District which has implemented an agricultural innovation that is currently being promoted by the government as polygon e-reporting. E-reporting polygons is an innovation that has been promoted by the Ministry of Agriculture since 2021. This agricultural innovation has the aim of minimizing frauds in the agricultural sector related to false reports of land measurement. The e-reporting polygon is also a determinant of fertilizer subsidies that will be given by the government to farmers.

Wukirsari Sub-district has 32 farmer groups spread across each hamlet. Four out of 32 farmer groups from each hamlet are the focus of this research. The four groups include the Handayani farmer group in Glagahwero Hamlet, the Subur Makmur farmer group in Dawung Hamlet, the Tunas Fajar farmer group in Jambu Bangkong Hamlet and the Sido Makmur farmer group in Karang Pakis Hamlet. All farmer groups in the Wukirsari Village are members of the Makayro Nyoto Farmer Group Association. The Makayro Nyoto Farmer Group has been established since 2009. All agricultural activities that take place in Wukirsari Village are inseparable from the existence of farmer groups and farmer group associations (Gapoktan). This is because Gapoktan is the first target for agricultural extension agents to deliver information before going directly to farmers. Hence, the presence of farmer groups becomes a bridge for information between farmers and agricultural extension agents. So it can be inferred that the information will reach farmers well after the previous stages are carried out well.

The process of disseminating agricultural innovations that took place in Wukirsari Sub-district began at a farmer groups association meeting which was held once a month. The meeting presented all the heads

of farmer groups in Wukirsari Village, agricultural extension agents of Wukirsari Village and also stakeholder associated with agricultural innovation (e-reporting polygon) which at that time was attended by the Directorate General of Agricultural Infrastructure and Facilities of the Ministry of Agriculture. Submission of information related to agricultural innovation was delivered directly by the Directorate General of Agricultural Infrastructure and Facilities of the Ministry of Agriculture. As already mentioned, every Gapoktan meeting will be attended by all farmer group leaders, so the farmer group leaders are an important source of information in the dissemination of agricultural innovations. Furthermore, the follow-up that must be carried out by the head of the farmer group in disseminating this information is by conveying important matters or information at each routine meeting held by each farmer group.

The dissemination of agricultural innovations reached farmers when farmers attended farmer group meetings. This is because at the farmer group meeting, the information on agricultural innovation from the Farmer Group Association meeting was transferred. The results of the research in table 4 state that the process of disseminating agricultural innovations in the Wukirsari Village is dominated by regular farmer group meeting activities. Regular farmer group meeting activities are often carried out by each group. Each farmer group has a different schedule of regular meetings. For example, the Subur Makmur farmer group in Dawung Hamlet holds a farmer group meeting every two months on the 25th of that month. Unlike the Tunas Fajar farmer group in Jambu Hamlet, Bangkok, which holds group meetings every night of Legi Sunday (market day in the Javanese calendar). The Sido Makmur farmer group in Karangpakis Hamlet holds a meeting on the 2nd of every month. As for the Handayani farmer group in Glagahwero Hamlet, they hold regular meetings on Saturday Pahing (Javanese calendar market day) which is held once every 35 days. The high intensity of the meeting will boost the innovation dissemination process. This corresponds with a study by [1] which states that the high intensity of meetings will improve the existing innovation dissemination process. The higher the intensity of the meetings held, the higher the innovation dissemination process that occurs.

3.3. Farmers' Digital Literacy in succeeding the Adoption of e-Reporting Polygon Innovation

Digital literacy is the ability to create and share in different modes and forms; to create, collaborate and communicate more effectively, and to understand how and when to properly use digital technology to support those processes. The characteristics of digital literacy do not only refer to operating skills and using various information and communication technology devices (hardware and software platforms), but also to the process of reading and understanding the contents of technological devices and the process of creating and writing new knowledge [5].

Table 5. Digital Literacy of Farmers in Wukirsari Village

No	Indicator	Category
1	Ability to operate gadget	Low
2	Ability to use internet to access agriculture information	Low
3	Ability to find new agriculture information about in society	Average
4	Ability to analyze agriculture information	Average
5	Ability to evaluate the information	Average
6	Ability to communicate in digital space for networking	Low
7	Ability to use digital space to share agriculture information to other farmers	Low
Average		Average

Sumber: Primary data analysis (2023)

The digital literacy of farmers in Wukirsari is evaluated from the ability to create and share in different modes and forms; to create, collaborate and communicate more effectively, and to understand how and when to properly use digital technology to support those processes. Researchers interpret the tabulation results using a number range with 0-20% (very low), 21-40% (low), 41-60% (average), 61-80% (high) and 81-100% (very high). Based on table 4 digital literacy has a value of 41.19% and belongs in the sufficient category. The ability of farmers to operate gadgets and also the internet to access information about agriculture is still relatively low. Even the ability of farmers to communicate through digital space and share agricultural information with members of other farmer groups is still relatively low.

Based on Table 5 digital literacy has a value of 41.19% and is in the sufficient category. The ability of farmers to operate gadgets and also the internet to access information about agriculture is still relatively low. Even the ability of farmers to communicate through digital space and share agricultural information with members of other farmer groups is still relatively low. Based on the results of interviews conducted by researchers, it is found that farmers are more comfortable communicating directly face to face.

The Influence of Innovation Characteristics towards Farmers' Digital Literacy

Innovation characteristics significantly influence farmers' digital literacy.

Table 6. Simple regression analysis (Backward method) of Innovation characteristics influence on farmers digital literacy

Variable	Regression Coef.	t-cal	Sig.	Result
Characteristics of -Reporting Polygon Innovation	0.253	4.508	0.000	**
Constant	2.221			

R squared	0.259
Note: ** means significant at alpha 5%	
Source: Primary data analysis (2023)	

The simple regression analysis shows that independent variable (X) or Innovation characteristics of e-reporting polygon gives significant influence on digital literacy of farmers in Wukirsari village. The result is based on the value of significance of 0.000 that is less than alpha of 5% or 0.05.

$$Y = 2.221 + 0.253 X$$

The regression equation describes a positive influence of the innovation characteristics towards farmers' digital literacy. The improvement of innovation characteristics will support the enhancement of farmers' digital literacy. When innovation characteristics value increase in a unit, the digital literacy will also raise in a 0.253 unit. The better the characteristics of an innovation, the more it will influence the level of digital literacy that farmers have. This is because farmers will more easily understand existing innovations if the innovations are easy to understand and suit the farmers' conditions

Farmers have strong understanding on how *e-reporting polygon* helps them to access the subsidized fertilizer. Thus, the implementation of this program is applicable because farmers have understood that the orientation of *e-reporting polygon* innovation is on the availability of input support from government such as fertilizers. The numbers of the fertilizers will be based on area report on *e-reporting polygon*.

4 Conclusion

The characteristics of e-reporting polygon innovation consisting of *relative advantage, compatibility, complexity, trialability, and observability* was sufficient (advantageous and easy to understand, try, and evaluate) for farmers. In addition, the characteristics of innovation has a significant influence of farmers' digital literacy. The enhancement of the characteristics of e-reporting polygon innovation will improve the digital literacy of farmers on how they understand and implement the digital system. It can help farmers to improve their digital literacy particularly on gadget operation, agricultural information access, networking, and information sharing to other farmers.

Since e-reporting polygon is beneficial for agricultural input support database, extension agents' role in introducing and understanding the innovation characteristics need to be improved. Farmers should have deep understanding about the benefit after finishing e-reporting polygon. Thus, they will be motivated and encouraged to learn more about the innovation. Thus, a training how to input the data on e-reporting polygon should be more intensive until their skills escalate. For the government, the innovation characteristics should be tested before the innovation is disseminated to the farmers as the obligation that will

affect the distribution of agricultural input such as fertilizer.

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