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FARMER CARDS: MODEL, DATABASE, ACCURACY, AND IMPROVEMENT IN GOVERMENT QUALITY SERVICE

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ABSTRACT
This study aims to test the model adoption of farmer card innovation by farmers. Data were collected through the use of the survey technique. The respondents were obtained through cluster sampling from six districts that included the greatest numbers of farmer card users in central Java. Data analysis was done through the SEM technique. As a result, from the five variables included, reconstruction and merging of the independent variables were then carried out so that three important antecedent variables appeared regarding influencing the adoption of farmer cards, namely leadership, facility conditions, and the role of government mediated by perceptions of card technology. The application of farmer cards produced such a farmer database, accuracy improvement, and government service to farmers. Future research needs to be directed toward carrying out development research related to increasing the capacity of information technology regarding farmer cards; hence it will bring better welfare to farmers. No previous research has explained how small farmers adopt information technology provided by the government. Many events have transpired, but these dynamics have not been revealed in previous research. This research resulted in an adoption model that enriches the previous Rogers' innovation adoption theory, especially how leadership factors play an important role in the adoption of information technology innovations

Contribution/Originality: This study is one of very few to have investigated the model adoption of farmer card innovation by farmers in which the application produced such a farmer database, accuracy improvement, and government service to farmers. This study contributes to the existing literature on the adoption of Rogers' innovation.

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1. INTRODUCTION
The development of information technology has helped accelerate the growth of the agricultural sector as one that supports economic growth. Information technology has changed the distribution pattern of ideas and/or products to become faster, more precise, broader, and controllable. For example, an agricultural product from a

remote village will be informed and even sold to urban areas; another example is that the findings of an agriculture-based technological innovation require a relatively short time to get to the user (farmers).

Thus, the existence of innovative technologies in agriculture supported by information technology has created a phenomenon that requires prerequisites for agriculture-based innovative technologies to be adopted and implemented at the farmers' level. The prerequisites for the technologies to be adopted include the role of the government in adopting the technologies, the perception of individual farmers in adopting the innovative technologies of agriculture, and the implications of the innovative technologies of agriculture on farmers' performance measured by yield productivity. From these three aspects, the perception of individual farmers in adopting agricultural-based innovative technologies is the central point although the level of farmers' adoption varies. To bridge this, an information technology innovation called farmer card was introduced. Thus, the goal of creating agricultural-based innovative technologies (adoption) is strengthened by the function of the farmer card. One aspect supported by the existence of information technology is the acceleration of agricultural technology dissemination from sources (research institutions) to users (farmers). Even though the transformation of national development is in progress, the agricultural sector is considering becoming the strategic sector in sustaining economies such as in Indonesia, because the use of information technology is positively correlated with income per capita in developing countries in the Asia-Pacific region (Kim, 2002). The use of information technology is also positively correlated with productivity, both at the micro-level (Brynjolfsson & Hitt, 2000) and at the macro-level (Dedrick, Kraemer, & Shih, 2013). Accordingly, Fagerberg and Srholec (2008) argued that countries having succeeded in developing and maintaining capabilities and managing innovation systems and supported by government systems, will positively benefit from the sales of technologies. Technology adoption is influenced by factors of the production process, changes in knowledge, and attitudes of farmers (Mwangi & Kariuki, 2015). Technology adoption has a significant influence on control variables (moderating variables) such as age, gender, and experience (Sun & Zhang, 2006). Besides, motivation influences the level of technology adoption with a high level of significance in the behavioral aspects of usage (Lai, 2017).

Several studies related to the perception of innovative technologies have been carried out by, among others, Rahman, Uddin, and Khan (2018), who identified factors influencing one's perception of technology, namely farmers' characteristics and their communication behavior. Perceptions of usefulness is a measure in which the use of technology is believed to bring benefits to those who use it, from the perspective of how individuals interpret the usefulness or benefits of using a system (Adams, Nelson, Hall, & Todd, 1992). Meanwhile, Wang, Yu-Min, Hsin-Hui, and Tzung-I (2003) stated that perception of the use of technological innovation has a significant positive effect on behavioral interest, and Gardner and Amoroso (2004) also confirmed that the use of technology is the most important factor influencing user acceptance.

The results of previous studies indicated that several technology adoptions have been studied and tested for their role even though they have not been categorized based on the level of individuals, groups, and the role of government in various research models, with results that are not yet conclusive in terms of the application of new technological innovations. In other words, research on innovative technologies needs to be further studied in more depth so that the opportunity to develop technology adoption models, by either individuals or groups, might be advanced (Ismail & Yusof, 2010).

An innovative technology intended to exchange ideas, knowledge, and technology during the innovation process will be increasingly developed and beneficial to human resources (Brambor, Clark, & Golder, 2006). Several studies have also been widely carried out, such as the research conducted by Kapoor, Dwivedi, and Williams (2014), who stated that the antecedent and descendent factors of technology adoption can be measured based on a variable, instrument, measure, innovation, and adoption of the unit approach. McCarthy and Schurmann (2015) argued that sociological and psychological factors have a relationship to rejection of technology adoption, while Krizaj, Brodnik, and Bukovec (2014) examined the level of each adoption at the adopter level. Ayhan, Öztemel, Aydin, and Yue (2013) examined every stage of the innovation process, namely the labor component and costs incurred.

Furthermore, Lemos et al. (2016) stated that external factors in the adoption process in rural areas have a positive contribution to agriculture development. Pannell et al. (2006) also argued that understanding and principles in the process of technology adoption are needed by the adopter. Partala and Saari (2015) proposed that emotion and attention influence the process of technology adoption. Besides, Nambisan, Lyytinen, Majchrzak, and Song (2017) identified an interrelated phenomenon, agent innovation, as a central part of the process of adoption and efforts to change.

The development of technology adoption theories is quite dynamic and is marked by the emergence of various theories and models. These models include (1) Theory of Reasoned Action (TRA), (2) Theory of Acceptance Model (TAM), (3) Theory of Planned Behavior (TPB), (4) Motivational Model (MM), (5) Personal Computer Utilization Model (MPCU), (6) Social Cognitive Theory (SCT), (7) Combined Theory of Acceptance and Use (Unified Theory Acceptance or UTAUT), and (8) Innovation Diffusion Theory (IDT) (Dillon & Morris, 1996; Tarhini, Arachchilage, & Abbasi, 2015).

Given the description above, the objective of this study is to explain the independent variables, such as individual aspects, the dynamics of farmer groups, social support, infrastructure conditions, and the role of the government, and also the effect of mediation variables on farmers' perceptions towards farmer card technology on the adoption of farmer cards.

Table-1. Samples obtained from this research.

No.	District	Subdictrict	Samples)no.)
1	Temanggung	Ngadirejo	60
2	Purbalingga	Kutasari	60
3	Banyumas	Sumbang	60
4	Wonogiri	Girimarto	60
5	Karanganyar	Mojogedang	60
	Total		300

Table-2. Summary of operational definitions and measurement of research variables.

Variable	Conceptual definitions	Indicators	Sources
Individual	Individual characteristics include several basic characteristics pertaining to certain individuals: perception, attitude, personality, learning, motivation, and technology. The scope of these characteristics forms a certain environmental nuance that marks the basic characteristics for an organization.	Attitude (X1) Motivation (X2) Enterpreneurship (X3)	Lumpkin and Dess (2001); Rahman et al. (2018); Schiffman and Kanuk (2007); Touré-Tillery and Fishbach (2014)
Group dynamic	A group is a party that influences a person's attitude or behavior that is constantly interacting. The influence itself can be done in either direct or indirect ways.	Cohesiveness (X4) Leadership (X5)	Balachandra, Briggs, Eddleston, and Brush (2019); Buckner (1988);
Social support	Social influence is defined as the extent to which an individual perceives that the interests that are trusted by others will influence them using a new system.	Level of family support (X6) Village administration support (X7)	Davis (1989); Moore and Benbasat (1991)
Conditions of the facility	Defined as the extent to which a person believes that organizational and technical infrastructure is available to support the system.	The supporting facility(X8) The availability of information (X9) The availability of the instuction manuals (X10)	Compeau, Higgins, and Huff (1999); Davis (1989); Moore and Benbasat (1991); Thompson, Higgins, and Howell (1991)
Government	The idea of government is explained thus: "This term comes from the word command, which means someone is told to do something and that matter must be done. Government is a person, institution, or the one giving an order to society."	Extention (X11) Training (X12) Socialization (X13)	Kousar, Sabri, Zafar, and Akhtar (2017)
Perceived technology	Individual perception is related to the ease of use of the technology by which individuals believe that using a particular system will be error-free. This perception will then have an impact on the individual's behavior, i.e. the higher a person's perception about the ease of use of the system, the greater the utilization of the information technology is increased.	Relative advantages (X14) Suitability (X15) Ease of use (X16) Result visibility (X17) Possible trial (X18) Visibility (X19)	Anandarajan, Igbaria, and Anakwe (2000)
Farmer card adoption	Farmer cards are used as a transaction instrument in the form of debit cards, is similar to ATM cards, which can be used to buy subsidized fertilizer. From the farmers' perspective, this card will make it easier for them to acquire subsidized fertilizer outlets and various other business credit facilities.	Quality (X20) References (X21) Sustainability (X22)	Djamaludin (2018)

2. RESEARCH METHODS

This study used a quantitative-explanatory design, which means research that explains the relationship between variables through hypothesis testing (Edoun & Gama, 2020). The population of this study is farmers who have adopted farmer cards in 35 districts/cities in the redemption of subsidized fertilizer with the transactions >30% in 2019 (source: Simpi.BRI.co.id). The research area is the region with the highest use of cards in central Java, which was the first province in Indonesia to implement farmer cards. Those cards were implemented in the districts of Temanggung, Karanganyar, Wonogiri, Purbalingga, and Banyumas (Table 1). In this research there were 26 indicators, according to Hair, Black, Babin, Anderson, and Tatham (2006), and the sample total was 5–10 indicators. Concerning this matter, the number of samples was 300 respondents. To acquire the sample, this study used a probability sampling approach with cluster sampling technique (area sampling), with the following details are (Table 1). Table 1 details the districts and subdistricts with the highest applicability to farmer cards; each subdistrict consists of 60 samples, while Table 2 details the variables included.

Data collection techniques utilized a survey with interview techniques using a questionnaire. The measurement scale used was the 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The Likert scale was chosen because it is commonly used for opinions and behavior (Sekaran & Bougie, 2016), which follows the characteristics of this study.

The data analysis was done through the Structural Equation Modelling technique, with AMOS application. The research instrument testing was done before the analysis. This testing includes validity testing, which was done by looking at the total correlated item, and also includes reliability testing, using the reliability of extract and content.

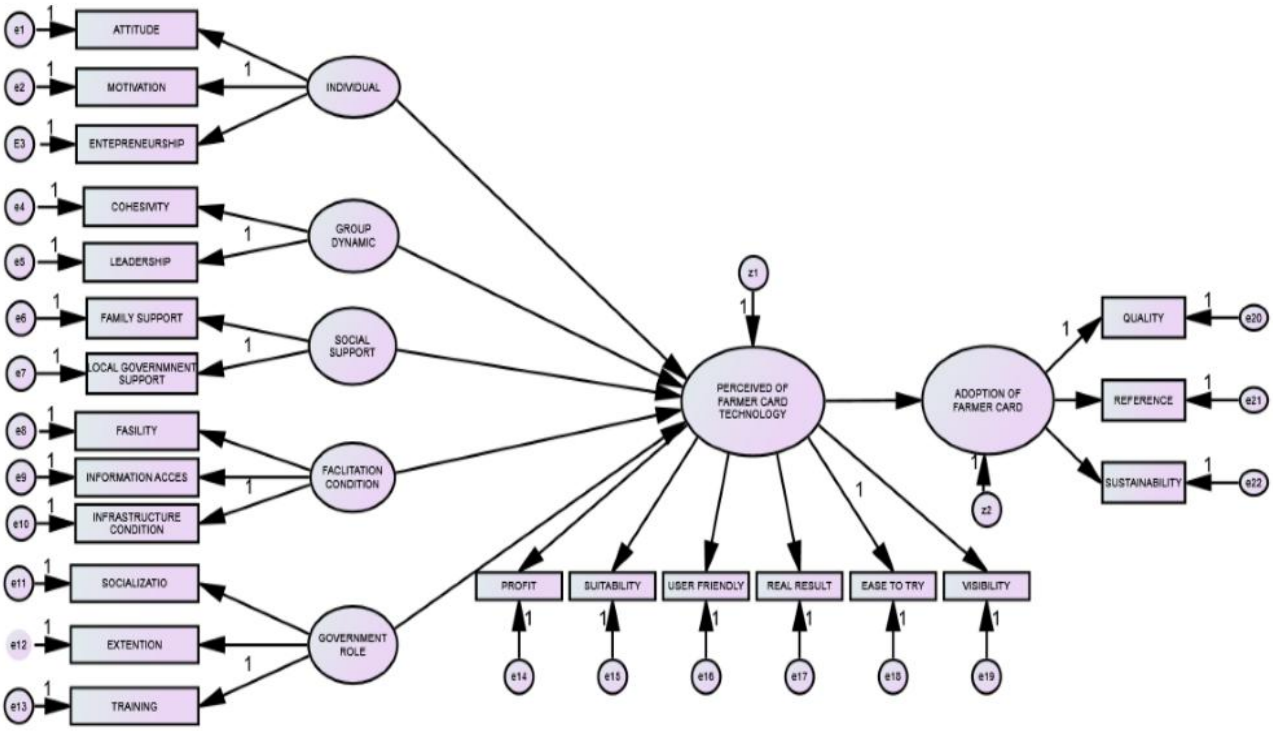

Figure-1. Operational research model.

Figure 1 shows a research model that will be examined for goodness of fit. Individual latent variables, group dynamics, social support, facilitation conditions, and governmental role all affect the perceived farmer card technology and adoption of farmer cards.

3. RESULTS AND DISCUSSION

After application for almost 5 years, only about 20% of the total number of distributed cards had been used for fertilizer redemption and banking transactions. Many farmers are reluctant to use those cards since their benefits are not sufficiently clear, it is difficult for them to redeem the subsidized fertilizer, some are not connected to the internet and they also are not accustomed to using farmer cards.

The aims of this research were to test the adoption model of farmer cards. Confirmatory analysis of all factors showed that all indicators had a standardized regression weight >0.5 at significance <0.05. Thus, measurement of these variables was carried out using predetermined indicators. The indicators observed reflected that the factors analysed, and in combination, reflected the presence of unidimensionality.

After analyzing the level of unidimensionality of the dimensions/indicators forming latent variables tested by Confirmatory Factor Analysis (CFA) to obtain results, a Structural Equal Modeling (SEM) analysis was performed in the full model. To test the accuracy of the model, the model fit index is used as presented in Table 3.

Table-3. Model fit index.

Goodness of fit index	Cutoff value	Result	Conclusion
Chi-square (df = 165)	< 195.973	194.900	Fit
Probability	≥ 0.05	0.056	Fit
CMIN/DF	≤ 2.00	1.181	Fit
GFI	≥ 0.90	0.922	Fit
AGFI	≥ 0.90	0.900	Fit
TLI	≥ 0.95	0.881	Marginal
CFI	≥ 0.95	0.897	Marginal
RMSEA	≤ 0.08	0.027	Fit

Source: Primary data 2019, processed.

Model fit index indicated that, overall, the testing criteria were in good categories and met assessment criteria that had been required or determined, because the chi-square value was 245.799 and the critical value/chi-square table with df = 144 was 387.4. As the calculated value of the chi-square was loweer than the value given in the table, the research model was not different from the estimated population/model and therefore was accepted.

Furthermore, the results of SEM regression estimation show that all pathways are positive and significant variables (Table 4.. In other words, all hypotheses in this study were accepted.

Table-4. Hypothesis testing.

Hypothesis	CR	*P*	Note
Facilitating condition→perceived technology	2.855	0.004	Accepted
Government role→perceived technology	3.183	0.001	Accepted
Leadership→ perceived technology	3.674	***	Accepted
Perceived technology→ farmer card adoption	10.144	***	Accepted
Farmer card adoption→performance of human resource	15.488	***	Accepted

Note: *** = 0.000, significant at the 1% confidence level.

3.1. Hypothesis testing

After evaluating the assumptions in SEM, hypothesis testing was performed. Testing of the four hypotheses proposed in this study was carried out by analyzing the value of the Critical Ratio (CR) and the probability of a causal relationship.

Hypothesis 1 (H1): *Effect of facilitating conditions on perceived technology.*

The estimated parameter for testing the effect of conditions that facilitate the perceived technology (Table 4) showed that the CR value of regression weights was 2.855 with a probability of 0.004, which was <0.05. Therefore, H0 was rejected and H1 was accepted. Thus, the variables of condition that facilitate significantly and positively affected the existence of perceived technology.This finding suggested that the availability of technical and organizational infrastructure supports systemic perception and organization of sensory information about people or social situations (Oskamp & Schultz, 2005). Perception, according to Umstot (1988), is the process of filtering, organizing, and interpreting information from the environment. The higher the perception of a person about the ease of using the system, the higher the level of information technology utilization (Anandarajan et al., 2000).

Thus, the conditional variables facilitating perceived technology having indicators received facilities and information availability, as well as facilities and infrastructure availability, indicated the individual's readiness for change due to the existence of innovative technology. In other words, adequate facilitation, individual readiness to change, and level of adopter confidence that the organizational and technical infrastructure available were intended to support the use of technology would increase the use of technological innovation–in this case, technology of the farm card. On the other hand, Venkatesh, Morris, Davis, and Davis (2003) stated that facilitation of conditional variables significantly influences the use of information technology only if it is moderated by age and experience. Facilitated conditions do not affect personal computer. In this case, Thompson examined respondents among highly educated employees in national companies (Thompson et al., 1991) Meanwhile, the educational background of most of the respondent farmers in this study did not involve graduation or completion of elementary school.

Hypothesis 2 (H2): *Effect of the government's role on perceived technology.*

The estimated parameter for testing the role of government on perceived technology (Table 4) showed that the CR value of regression weights was 3.183 with a probability of 0.001, which was <0.05. Therefore, H0 was rejected and H2 was accepted. Thus, the role of government variables proved to have a significant effect on perceived technology. This finding suggested a significant role of the government in relation to the farmers' adoption in utilizing the farmer card. The significance of this role was essential, as according to Rogers, Medina, Rivera, and Wiley (2005), adoption of technology gives freedom to the adopter to determine whether a technology will be adopted or not; this entirely depends on the decision of the adopters. The findings of this study followed up on the suggestions proposed (Kousar et al., 2017) that the role of government is an independent variable that needs to be examined. Furthermore, Oskamp and Schultz (2005) proposed that although there are many factors influencing adoption, the formation of attitudes requires experiences, especially direct personal experiences with attitude objects. Moreover, according to Gibson (1997), the existence of the power of legitimacy is one's ability to influence others

because of its position; in this case the government and its policy instruments. The existence of the legitimacy power, in a positive way, accelerates the process of readiness for change so as to create perceptions and interpretations that are based on attitudes, feelings, and behavior. Holt, Armenakis, Feild, and Harris (2007) argued that readiness for change is a comprehensive attitude that is simultaneously influenced by the content, process, context, and individuals involved in a change. Collective readiness reflects the extent to which individual tendencies approve, accept, and adopt innovative technologies and specific plans aimed at changing current conditions. Meanwhile, Lemos et al. (2016) stated that external factors in the adoption process in rural areas have a positive contribution to agricultural development, while Larrasquet, Pilnière, and Jayaratna (2016) stated that understanding and principles in the process of technology adoption are urgently needed by adopters. Thus, the dimension of the role of the government, consisting of socialization, training and counselling, was able to provide a change to the perceived farmer card technology.

Hypothesis 3 (H3): *Effect of leadership on perceived technology.*

The estimated parameter for testing the influence of leadership on perceived technology (Table 4) shows that the CR value of regression weights was 3.674 with a probability of 0.000, which was <0.05. Therefore, H0 was rejected and H3 was accepted. Thus, the leadership variable proved to have a significant effect on perceived technology.

There are two factors that influence the diffusion of innovation: external (Wright, Upritchard, & Lewis, 1997) and internal (Rogers et al., 2005). The influence of external factors, also called innovation factors, reflects the power of innovation in achieving responses of early adopters or innovators; meanwhile, the internal factors, called imitators, are the power generated from the interaction of prospective adopters with previous adopters. Innovators always existed throughout the period of adoption although their number decreased; in this case, leadership variable was categorized as internal factors or imitators. Leadership in farmer groups is carried out by contact farmers who function as organizing activities, teachers, mentors, mobilizers, self-help instructors, and role models for members of the farming community. Northouse (2019) stated that transformational leadership is a process in which people engage with others and create relationships that increase the motivation and morality of leaders and followers. Meanwhile, Greenberg and Baron (2003) defined transformational leadership as a leadership behavior whereby a leader uses his/her charisma to transform and revitalize an organization. Some research results showed that transformational leadership significantly and positively influences readiness for change (Abbasi, 2017). Thus, the better the transformational leadership applied to an organization, the better the readiness for change.

In relation to the adoption of innovative technology (the farm card) with the hypothesis that there was a significant influence between the leadership variable and perceived technology, it was concluded that leadership in farmer groups in adopting farmer card technology was needed in perceived technology to form readiness for change attitudes on other members of farmer groups to implement innovative technology of farmer cards and disseminating technology that had been practiced naturally, authoritative, and influential on its environment.

The results of research conducted on farmer groups revealed that leadership in groups affects the level of farmer participation in various group activities related to efforts to increase farm productivity. The strong leadership dimension is reflected in the respective indicators, namely group leader and village administrator. Furthermore, the type of leadership in the farmer group belongs to the type of paternalistic leadership, as agrarian societies that still hold traditional perspectives (Dedahanov, Bozorov, & Sung, 2019). Gary (2005) identified that the popularity of paternalistic leaders in an agrarian society is due to the strength of primordial ties, extended family systems of communalistic community life and strong customs in social life. Therefore, the leadership dimension significantly influenced perceived technology with indicators of village leadership. As village administrators, powerful officials who were also supervisors of farmer groups, their presence was always considered as social facility for group member farmers. Whenever village administrators attended in a group meeting, they gave more guidance so that farmer groups could be advanced, especially in agriculture even though they did not convey agricultural innovation because it was not their expertise.

Hypothesis 4 (H4): *Effect of perceived technology on adoption of the use of farmer cards.*

The estimated parameter for testing the effect of perceived technology on adoption of the use of farmer cards showed that the CR value of regression weights was 10.144 with a probability of 0.000, which was <0.05. Therefore, H0 was rejected and H4 was accepted. Thus, the perceived technological variable was proven to have a significant effect on the adoption of farmer cards. The significance of H4 indicated that the perceived technology variables and the adoption of the use of farmer cards with significant influence could be explained by the adoption of the use of farmer card technology in that individuals interpreted certain objects in different ways using their senses and then tried to interpret them. In this case, Jahangir and Begum (2008) argued that the perception of usefulness is defined as how individuals interpret the usefulness or benefits of system usage. Wang et al. (2003) and Satrio, Priyanto, and Nugraha (2020) found that the perception of the usefulness of innovative technologies has a significant positive effect on behavioral interest. Sun and Zhang (2006) and Gardner and Amoroso (2004) also confirmed that the use of technology is the most important factor in influencing user acceptance. Furthermore, the combined variables obtained are related to the technology acceptance and use models. The variables are perceived behavioral control (Ajzen, 1991) and compatibility (Moore & Benbasat, 1991).

The results of this study are in line with the theory of perception that individuals are related to the ease of using technology (perceived ease of use), where individuals believe that using a particular system will be free from errors. Perceived technology has an impact on behaviour – that is, the higher a person's perception of the ease of using the system, the higher the level of information technology utilization (Anandarajan et al., 2000).

This finding is also in line with the that of Wang et al. (2003); Sun and Zhang (2006); Gardner and Amoroso (2004) and Oskamp and Schultz (2005), who examined perceptions, namely reception and organization of sensory

information about people or social situations, showing that the perceived influence of technology on the adoption of the use of farmer cards is based on their interpretation of information technology on farmer cards used in agricultural sector.

3.2. Impacts of the Use of Farmer Cards

Before there were farmer cards, farmers relied on the data given by central statistical bureaux and other sources that often provide contradictory information and are not up to date. Starting in 2016, the central Java provincial government developed a farmer card program, which initially aimed to facilitate the distribution of subsidized fertilizers so that it could provide accuracy in terms of quantity, type, time, place, and target. According to the use of farmer cards, these turned out to be able to function as a database for farmers (Shaofen & Guoqing, 2003). As a result, the cards benefited farmers since they give empowerment and protection. All farmers have been recorded and every month the data will be updated so that farmers' data collection is dynamic and based on their conditions. Farmer cards seem to be able to act as a farmer and agricultural information center (Kiplang'at, 1999).

Aside from being a database, farmer cards also guarantee the accuracy of farmer data in real time, which makes it easy for decision makers to identify, design, and implement agricultural development programs. Previously it was very difficult to acquire accurate data, which means that government assistance was often not on target, fertilizer was often misused, and farmers often did not get fertilizer according to their needs. Accuracy of government subsidies to farmers can be achieved by the use of farmer cards based on RFID information technology (Liu, Zang, & Li, 2011), including reducing the problems that arise from the distribution of subsidized fertilizers (Djamaludin, 2018).

With the existence of farmer cards, government services for farmers can be improved, not only for the distribution of subsidized fertilizer, but also for educational programs. Farmer cards can be used for agricultural extension activities (Picciotto & Anderson, 1997; Tavernier, Adelaja, Hartley, & Schilling, 1996). Extension agents can provide farmers with 'data and business conditions through the cards so that it is easier to provide the agricultural extension according to the farmers' needs. With these cards, the government can provide facilitation on technology, seeds, compensation, price subsidies, and income subsidies for them. As a result, services could more likely be on target so that farmers can increase production and access such welfare. Moreover, the existence of farmer cards will ensure both the identity of the farming profession and the legal identity of farmers. Before those cards existed, there were no legal rights in the farmer profession, and these became inferior to even those of factory workers. Farmers do not act as entrepreneurs, as MSMEs, or as employees. The farming profession in the eyes of the law does not have any standing. Socially, it does not have adequate status, most farms being poor and underdeveloped. With the existence of farmer cards, the government can determine who has the right to be entitled to call themselves a farmer, which was not previously clear.

4. CONCLUSIONS AND RECOMMENDATIONS

Several conclusions can be drawn from the research of the model testing, related not only to the model testing but also to other findings. The results showed that the model adoption of farmer cards was influenced by leadership, facilitation of information technology condition, and the role of the government mediated by farmers' perceptions on farmer card technology. From the five large variables, based on data testing, leadership variables were increased as a result of the merger of the social support measuring variable and the dynamics of farmer groups. Individual factors eliminated because they were not statistically significant affected the adoption. The latent variable of leadership was manifested by the group leaders' and village government support.

Farmer cards can function as a farmer database, making it easy for the empowerment and protection of farmers, guaranteeing the accuracy of farmers' data in real time, and also making it easy for decision makers to identify, design, and implement agricultural development programs. With farmer cards, government services for farmers can be improved, not only for the distribution of subsidized fertilizers but also for educational programs, facilitation of technology, seeds, compensation and price subsidies, and income for farmers. Farmer cards can even ensure the identity of a farmer's profession and their legal identity.

The application of farmer card information technology still has many weaknesses. Farmers are still reluctant to use it since there are not many benefits that are deemed to be except for the redemption of subsidized fertilizer. Future research needs to be directed toward carrying out development research related to the increasing capacity of farmer information technology to make farmers more prosperous, such as information technology infrastructure, so that each village can access the internet; farmer cards can be developed with virtual account technology, not physical cards, and thus farmers would not need to carry cards into the fields. Furthermore, farmer cards can be integrated with computer vision technology (Zhao, Zhang, Feng, & Guo, 2010), smart warehouse, and the e-marketplace to achieve precision agriculture (Maohua, 1999; Zhao et al., 2010), from cultivation to market.

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