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THE IMPACT OF ONLINE COMMUNITY ON FARMER EMPOWERMENT: A STRATEGICAL ANALYSIS FOR DEVELOPMENT THE TECHNOLOGY-TO-PERFORMANCE

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ABSTRACT

This research provides empirical evidence for the benefit of social media in the online farmer community. The benefit that focus on empowerment value. The case study is used to explore the ICT usage in the community of Laying Hens Farmer in East and Central Java implementing the multi-feed and additive supplement. The research develops The Technology-to-Performance Chain (TPC) approach to analysis the strategy of farmer empowerment. The performance that was addressed by empowerment values. The study results that the farmer's empowerment are influenced significantly by task-technology fit with a path coefficient of 0,704. It means that utilization of social media as the online media of community will encourage empowerment if the information and knowledge sharing activities inside are related to the task or farmer's livelihood. The farmer's characteristics and the facilitating condition affect the empowerment insignificantly. However, the facilitating condition determines the task-technology fit with the path value 0,868. This study discusses 3 important layers in farmer empowerment strategies through online communities. The first is the underlying factors which includes internet access, product innovation and agents of change (facilitators/agricultural extensionists), the second is the adoption process (both internet adoption and product knowledge adoption) while the third is the impact of empowerment which is direct (output) and indirect (outcome).

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KEYWORDS	Online Community, Empowerment, Technology-To-Performance Chain

INTRODUCTION

The issue of community empowerment has become a concern after many challenges emerged from the development of communication technology and the digital economy. The utilization of technology is highly dependent and constrained by socio-economic conditions (Authorities et al., n.d.; Torero & von Braun, 2005; Ullah, 2017). Digital inclusion inadvertently reproduces inequality and exploitation. The emergence of individual entrepreneurs tends to relocate the locus of development responsibility to the poor themselves (Yu, 2017) and even strengthens existing power. The distribution of power is also an issue in the development of smart farming (Regan, 2019; van der Burg et al., 2019). Market structure and trade are also their obstacles in the development of the digital economy (Kumar, 2014).

In Indonesia, the development of the digital economy in the agricultural or rural sector faces more complex challenges. Many factors influence the adoption and utilization of the digital economy. These factors are the condition of the digital divide in farmer households (Susanto, 2018), demographic, socio-economic conditions, market system, and trade structure. However, several studies describe that digital technology is used to encourage farmer empowerment. Empowerment is observed by increasing access to information ((Narayan-Parker, 2002), (Kumar, 2014); (Babu & Asokhan, 2010; Khushk et al., 2016), increasing decision-making abilities (Jairath & Yadav, 2012; Khushk et al., 2016) supply chain efficiency, rural business development (Galloway et al., 2011; Kour et al., 2019). Therefore, the use of digital technology by farmers in Indonesia is an important thing to be observed.

This study takes a case study of developing an online community for laying hens in Central and East Java. A community formed due to the development of multi-feed and additive supplements to encourage egg productivity and economic sustainability for farmers. The research develops the technology to performance chain framework to strategical analysis in empowering the farmers. Previous researches have used a behavioral information approach, but they were limited to the adoption of a technology (technology acceptance model) and have not yet reached the benefits of technology adoption (Shah et al., 2013; Zaremohzzabieh et al., 2015). The Technology to Performance Chain (TPC) approach that has been introduced by Goodhue and Thompson in 1995. TPC was used to see the performance impact of using online communities for the farmer empowerment. The empowerment of farmers is the actualization of the performance of an information system/digital technology used. Therefore, this study tries to answer how the online community affects the farmer empowerment and what strategies to develop the empowerment.

RESEARCH METHOD

This research is a case study of an online community of laying hens using a multi-feed and additive supplements. An online community excised along with the on-farm product innovations development for chicken farms. The online community uses social media: YouTube Channel and WhatsApp Group. The use of social media began as the part of digital marketing from the development of multi-feed products and additive supplements. However, the online communities are formed and have members spread across the provinces of Indonesia. There are 109 members in the online community which consist of farmers, extension agents, off-taker agents, and suppliers of input products. Most of the community members are in East Java and Central Java, so the analysis in this study uses a majority area approach in observing several conditions or regional factors that influence them.

Data were collected using online surveys and in-depth interviews with farmers and business actors in this online community. By with some limitations, the online survey was only collected by 32 respondents. Data collected were processed using the PLS structural equation model approach. It was processed by smartPLS software to analyse the structural relationship between factors in the development of online communities for increasing farmer empowerment.

Model Development

The Technology to Performance Chain (TPC) approach is the one of approaches in behavioural information systems. This approach explains that the positive impact of technology/information systems on the performance of its users will happen if the technology or information system is utilized and supports the tasks of its users. The Task-Technology Fit construct affects the utilization and the performance of individual users directly or indirectly. Figure 1 shows a simple construction of the Technology to Performance Chain. The use of technology in its development is either mandatory or voluntary. For a mandatory technology, the task-technology fit construct will influence the performance impact directly. However, for technologies whose use is voluntary, the intensity/involvement of users in the use of technology becomes a moderating variable in the performance impact.

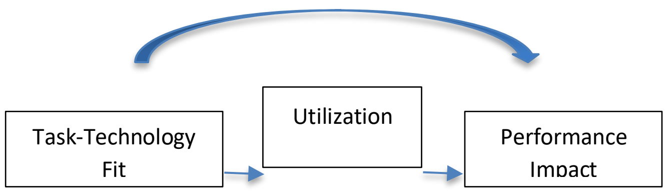

Figure 1 The Technology to Performance Chain Model (Simplified)

In the context of this research, the use of social media in online communities has been common and formed since 2019. Active users in online communities were conducted in this survey. Therefore, we ruled out the utilization variable in this study. The task-technology construct is a concern to be observed. In this study, the performance impact is proxied as the empowerment impact of farmers. The Empowerment of farmers is reflected in the ease of access to information (Babu & Asokhan, 2010; Kumar, 2014; Narayan-Parker, 2002; Ullah, 2017) increased knowledge & psychology (Jairath & Yadav, 2012; Khushk et al., 2016; Rashid et al., 2016) economic & social impacts (Atkinson & McKay, 2007; Khushk et al., 2016; Lokeswari, 2016; Rashid et al., 2016; Ullah, 2017; Walter et al., 2017). Meanwhile, task-technology fit is influenced by the farmer characteristics and facilitating conditions. Figure 2 shows the structural model of research. Then Table 1 shows the detail of indicators used in building each construct of the research. This study proposes 5 (five) hypotheses of structural relationships as follows:

H1: There is a relationship between Task-Technology Fit and Empowerment Impact.
H2: There is a relationship between Farmer Characteristics and Empowerment Impact.
H3: There is a relationship between Facilitating Condition and Empowerment Impact.
H4: There is a relationship between Farmer Characteristics and Task-Technology Fit.
H5: there is a relationship between Facilitating Condition and Task-Technology Fit.

There are eight reflective indicators to measure empowerment impact. These reflective indicators are the increased access to daily egg price (SE1) as a benchmark for farmers to determine the selling price, the ease of access to the tools and equipment market (SE2), and the community strengthening (SE3). Others, the increased chicken population (SE4), higher selling price (SE5); innovation capability (SE6), innovation adaptability (SE7), and research ability (SE8). Likewise, the characteristics of farmers are reflected in the farmer's age, education, land area, the number of chicken populations, variations in income/work, and experience in raising livestock. Task – Technology Fit consists of indicators of ease of use/interaction in online communities (TT1), ease of learning of content (TT2), ease of problem-solving in the field (TT3), content supporting livestock management (TT4), the accuracy of information (TT5) and clarity information (TT6). While the Facilitating Conditions consist of mentoring & consultation (EP1), availability of internet access (EP2), expert opinion (EP3), practice comparison (EP4), and product enhancement and innovation (EP5).

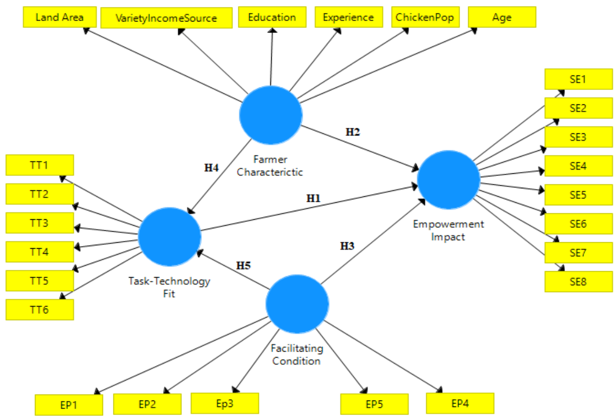

Fig. 2 The structural model of the research

Table I Latent Variables And Indicators

No	Construct	Code	Indicator
1	Empowerment impact	SE1	access to daily egg price
		SE2	access to tools & equipment market
		SE3	community strengthening
		SE4	increase in chicken population
		SE5	higher selling price
		SE6	innovation capabilities
		SE7	innovation adaptability

		SE8	research ability (trial error)
2	Farmer Characteristics		age
			education
			land area
			chicken population
			variety of income sources
			farming experience
3	Task-Technology Fit	TT1	ease of use
		TT2	ease of learning
		TT3	ease of problems solving
		TT4	content appropriateness
		TT5	information accuracy
		TT6	information clarity
4	Facilitating Condition	EP1	assistance and consultancy
		EP2	internet access availability
		EP3	support/expert opinion
		EP4	practical comparison
		EP5	Product enhancement & innovation

In this study, several indicators are invalid and not significant in reflecting the construct. Therefore, these indicators are removed from the model. Then re-estimation of the structural model is carried out. And the results can be seen in Figure 4. The re-estimation result shows the loading value of the indicators on the latent construct which valid model. Table II shows the results of the outer loading of the re-estimated model. R-Square values for endogenous variables, Task-Technology Fit and Empowerment Impact are 0.801 and 0.504 respectively. It means that the Task-Technology Fit can be explained together with the Farmer Characteristics and Facilitating Condition variables of 80.01%. Meanwhile, the Empowerment Impact is explained by Task-Technology Fit, Farmer Characteristics, and Facilitating Condition for 50.4%.

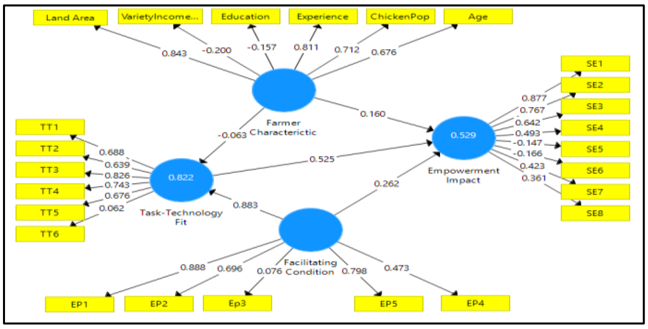

Fig. 3 Initial estimation of the model.

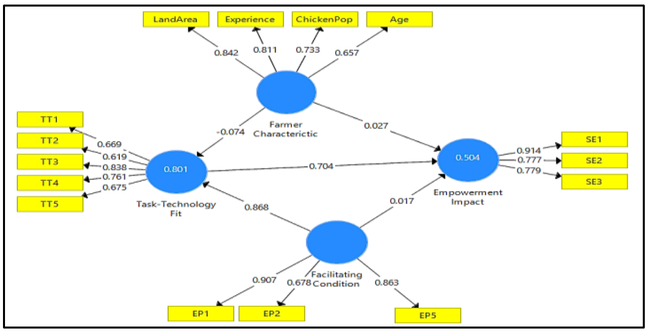

Fig. 4 Re-Estimated Result Model

Table 2 Outer Loading Of The Model

Indicators <- Latent Construct	Loading Values	Tstat	PValues
Age<-Farmer Characteristic	0,657	2,267	0,0234
ChicekenPop <- Farmer Characteristic	0,732	4,510	0,0000
EP1 <- Facilitating Condition	0,907	24,607	0,0000
EP2 <- Facilitating Condition	0,678	3,707	0,0002
EP5 <- Facilitating Condition	0,863	11,373	0,0000
Experience <- Farmer Characteristic	0,811	4,191	0,0000
LandArea <- Farmer Characteristic	0,842	3,741	0,0002
SE1 <- Empowerment Impact	0,914	5,609	0,0000
SE2 <- Empowerment Impact	0,777	3,571	0,0004
SE3 <- Empowerment Impact	0,778	3,403	0,0007
TT1 <- Task-Technology Fit	0,669	3,554	0,0004
TT2 <- Task-Technology Fit	0,619	3,119	0,0018
TT3 <- Task-Technology Fit	0,838	18,614	0,0000
TT4 <- Task-Technology Fit	0,761	7,806	0,0000
TT5 <- Task-Technology Fit	0,675	4,105	0,0000

Overall, the model shows good reliability where the composite reliability value is above 0.7. Likewise, the convergent validity is sufficient with the Average Variance Extracted (AVE) value above 0.50. Its means that each indicator validly reflects the latent construct/variable.

The results of the inner weight from the model are shown in Table IV. A significant relationship between variables/constructs occurred between Task-Technology Fit and Empowerment Impact with a path coefficient value of 0.704. Likewise, the relationship between Facilitating Condition and Task-Technology Fit shows a significant value with a path coefficient of 0.868. Structural relationships between other variables also occur, but the value is insignificant. There is even a negative coefficient value. It is explained further in the explanation of each research hypothesis.

Table 3 Realibility And Construct Validity

No	Construct	Composite Realibility	Average Variance Extracted (AVE)
1	Empowerment impact	0,865	0,682
2	Farmer Characteristic	0,848	0,583
3	Task-Technology Fit	0,839	0,514
4	Facilitating Condition	0,861	0,676

Table 4 Inner Weight Result

No	Constructs	Path Coeffficient	T-Stat	P-Value
1	Task-Technology Fit -> Empowerment Impact	0,704	2,049	0,040*
2	Farmer Characteristic -> Empowerment Impact	0,027	0,159	0,873
3	Facilitating Condition -> Empowerment Impact	0,017	0,045	0,946
4	Farmer Characteristic -> Task-Technology Fit	-0,073	0,660	0,509
5	Facilitating Condition -> Task-Technology Fit	0,868	13,405	0,000*

RESULT AND DISCUSSION

Based on the results of the structural model analysis, this study finds the answer to the research hypothesis as below:

H1: The relationship between Task-Technology Fit and the Empowerment Impact

The path coefficient shows a value of 0,704 and a t-statistic of 2,049. The relationship between Task-Technology Fit and the Impact of Empowerment is positive and significant at α 5%. It means that Job-Technology Fit affects Farmer Empowerment. The implementation of technology or information systems will impact the empowerment of farmer communities if the technology/information system is following their work/livelihood needs. This suitability was the ease of use of technology, ease to learn technology, appropriateness of content in solving problems, content according to farming management, and accurate information.

H2: The Relationship between Farmer Characteristic and Empowerment Impact.

The path coefficient value is at 0,027 and not a significant t-statistic value. This study finds the influence of Farmer Characteristics on Farmer Empowerment, but this is not significant.

H3: The Relationship of Facilitating Condition and Empowerment Impact.

The Facilitating Condition has a positive relationship with the Empowerment Impact with a path coefficient value of 0,017. However, the value is insignificant because it only has a t-statistic value of 0,045.

H4: The Relationship between Farmer Characteristics and Task-Technology Fit.

The path coefficient test results show a negative relationship between Farmer Characteristics and Task-Technology Fit. These are explained in these conditions. The influence of age in adopting technology, the older tend to low familiar than the younger in technology. The online media is used to share knowledge or experience. It will tend to be considered normal or not very interesting for the farmers who have many experiences of raising livestock/farming. They tend to be less enthusiastic in discussing and sharing knowledge. Inversely, the new ones are enthusiastic because they are still learning and trying to develop their farming skills. As for the condition of the livestock population, it can affect the opportunity for the farmers to be active in online communities because of their busy life. In some cases, in the field for small to medium-scale on-farm farms, maintenance management is still highly dependent on self-activities and not to have an employee for cost-efficiency reasons.

H5: The Relationship of Facilitating Conditions and Task-Technology Fit.

This study shows that Facilitating Condition has a positive and high relationship with Task-Technology Fit. The path coefficient value is 0.868 with a significant t-statistic even at the 1% level. We conclude that the indicators of the Facilitating Condition variable, namely Mentoring & Consulting, Internet access, and Products enhancement/innovation support the use of online media in community development. The social media used in the farmer social learning need conducive facilitation conditions. There is a role of mentoring/extension agents in coloring discussion and interaction of problems through online community media. The internet access drives importantly the smooth activities in online communities. Meanwhile, the development/innovation of multi-feed products and additive supplements are strategic solutions in on-farm management

Strategical Analysis of Farmers Empowerment

Various factors influence the impact of farmer empowerment through the development of online communities. Based on the TPC quantitative model, it was found that's very important to pay attention to 3 (three) layers in the strategy of developing farmer empowerment through online communities. The first is the underlying factors which include internet access, product innovation and agents of change (facilitators/agricultural extensionists), the second is the adoption process (both internet adoption and product knowledge adoption) while the third is the impact of empowerment which is direct (output) and indirect. direct (outcome). Figure 5 shows the transformation from TPC model to strategic layer.

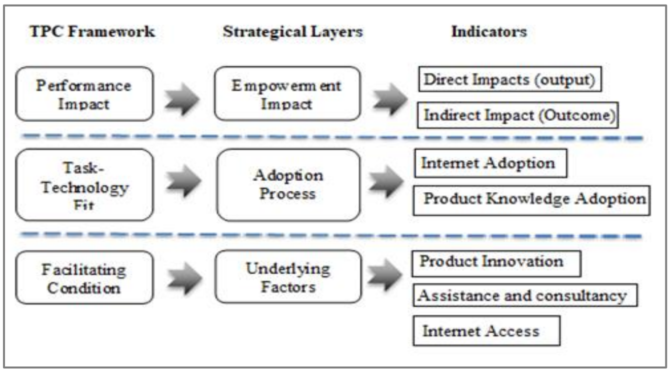

Figure 5. Strategical Layer Of Farmer Empowerment

Underlying Factors

The underlying factors are the factors that form the basis for the formation of an online farmer community. The first factor is the development and innovation of multi-feed products and additive supplements (product innovation). This study found some notes in the innovation of the product. First, product innovation should increase the added value of products produced by the farmers. Interest and tangible evidence of the use of this innovation felt by farmers will encourage the others. The online community is a form of value co-creation that involves in product development. It is reflected by farmer practices shared in online community and any farmer's experiment. The product innovation should become the framework of sustainable development. Multi-nutrient products and additive supplements are agricultural innovations in chicken farming. This innovation has relied on probiotics and multi-nutrient utilization. It will be an advantage in growth and livestock production. Therefore, it will maintain the sustainability of the livestock business. The innovations encourage eco-friendly farms, strengthen production stability and productive period.

The second factor is assistance and consultancy. This role was played by extension workers as the agents of change at once as agent of product sales. They work to facilitate the product deployment to farmer, give assistance and build interaction among farmer and other actor in the community. The third factor is internet access. Although this study uses farmers in Central Java and East Java, there are still limitations in internet access by the farmers. Online activities are not possible without equitable internet access with sufficient bandwidth speed. The development of ICT infrastructure is important for equitable access in areas that are still a blank spot.

By paying attention to the important role of these underlying factors, institutional strengthening becomes the main issue in the strategy of developing farmer empowerment through online communities. This institutional development can be directed at networked socio-entrepreneurs. This is because community development is based on the values of farmer empowerment. Even though there is a profit motivation, the values of empowerment make the relationship between actors complementary as also discussed by (Murphy & Coombes, 2009). Networked socio-entrepreneurs will also be able to encourage the situational learning process of farmers (Hasdiansyah & Suryono, 2021) and become a forum for co-creation for the development of farming practices.

Adoption Process

The limited human resources and the characteristics of laying hen's farmers have affected their involvement and interaction in the online community. Demographic factors affect the level of farmer adoption, both digital adoption (interaction in online communities) and product knowledge adoption. Older farmers tend to be more difficult to adopt in online communities, therefore the role of extension agents is to accompany farmers' practices as well as share their experiences in online communities. The study found that there is a paradox of experience for farmers. The experience of other farmers in adopting product knowledge is not necessarily accepted by experienced farmer. Psychologically they are confident enough to practice product knowledge according to their respective experiences. This condition is indeed important as input in the development of product practice, however, if it is not accompanied by direct consultation and assistance, the results may differ from expectations.

The other condition that limits farmers' adoption of online communities is time constraints. The scope of agricultural control (land area and production capacity) become the boundaries of online adoption. Small-scale farmers still base all activities on their own or with their families. Therefore, they become passive members of the online community. With these conditions, strategic steps are needed. The development of a cooking book needs to be done as a data bank from various experiences and practices of farmers. This cooking book can serve as a guide to farming practices, but still requires active assistance or consultation from extension agents. The form of interaction can be done online or offline. Then in general, with the existence of the cooking book, digital literacy training programs for agricultural SMEs can be carried out in a combination of digital knowledge and product knowledge.

Empowerment Impact

This study finds that the empowerment impact of the farmer is visible. It is still limited to increase the access of market information, both the daily price of egg products and input products such as livestock equipment and supplies. Likewise, the strengthening of networks in the community is an empowerment impact. These are the direct impact (output) of the empowerment impact. However, the impact of empowerment in the form of outcomes for farmers is still felt to be limited. Whereas the online communities are used as a means of sharing experience and learning media. It has encouraged the proper use of multi-feed products and additive supplements. It also can improve the quality of production and egg products produced by the farmers. However, there are still few farmers who can add value to these products to increase their empowerment.

Several factors make the output and outcome unable to occur at the same time. These were the input market (animal feed and DOC/Daily Old Chicken), and the trading structure of egg products, especially in Central Java and East Java. The same factors are confirmed in the earlier research. It is about the existing condition of the socio-economic and market structure influenced the development of the digital economy in the farming and rural sector.

Although it has not changed the existing market structure, the online community can encourage the market development to a specific market niche. In the context of high-quality egg products, it can capture the upper-middle market segment. Online communities have utilization in expanding off-taker networks and developing farmers' entrepreneurial skills.

CONCLUSION

This study has provided an overview of the need for a strategy for developing farmer empowerment through an online community with 3 layers, namely the underlying factor, the adoption process, and the impact of empowerment. The three layers are obtained from the development of the Technology to performance chain model.

In the context of underlying factor, this research confirm that these factors are the foundation of online community development. Without these factors, online communities will not be formed and run well. Internet access is an absolute requirement for online interactions. Agricultural extension agents are key actors who encourage information dissemination on the benefits of share-practice and solutions to farmers' problems. Meanwhile, product enhancement & innovation is the root of the real benefits of sustainable agricultural innovation. These three factors can involve many actors such as the government, universities, and the private sector. Therefore, the triple-helix model is a form of cooperation of ICT in agriculture. In practice, business implementation can take the form of a socio-entrepreneur or a mutual-benefit business.

In the context of adoption process layer, the use of social media in the development of online communities can impact the empowerment if their use is following the needs of farmers in terms of increasing knowledge on on-farm skills, knowledge of products that can increase added value, and providing solutions to farmers' problems. Therefore, it is what makes task technology fit as an urgent factor in digital technology in agricultural communities. This research recommends concern of digital knowledge and product knowledge when developing the ICT in agriculture. Product knowledge is formed by the evidence of the use of an agricultural product/innovation in the field, how to use the product/innovation, and the participation of farmers as part of developing agricultural products/innovations.

Then, in terms of the impact of empowerment. This study concludes that strategic efforts are still needed to reduce the gap between output and outcome. The existence of an online community has helped access information and production facilities, however, the added value of the product (wider market access) has not been felt by all farmers. Many limiting conditions are affected by market structure and t(Authorities et al., n.d.; Jairath & Yadav, 2012; Khushk et al., 2016)rading. Online community as a solution if the development of the network is directed at strengthening the market niche for the middle-up class of quality egg products.

Because the size effect is small, a future study needs to identify additional factors or variables that affect Task-Technology Fit. In addition, the following research needs to develop the networked socio-entrepreneur as one of empowerment model that combine between business, social and networking for the context of agriculture development.

REFERENCES

Atkinson, R. D., & McKay, A. S. (2007). Digital prosperity: understanding the economic benefits of the information technology revolution. *Available at SSRN 1004516*.

Authorities, E., Services, N., Economic, B., & Agency, D. (n.d.). *Information and Communication Technology Cluster*.

Babu, D. V., & Asokhan, M. (2010). Empowerment of dairy farmers through ICT. *Madras Agricultural Journal*, *97*(4/6), 172–174.

Galloway, L., Sanders, J., & Deakins, D. (2011). Rural small firms' use of the internet: From global to local. *Journal of Rural Studies*, *27*(3), 254–262.

Hasdiansyah, A., & Suryono, Y. (2021). Empowerment of Farmers: The Role of Actor and the Persistence of Coffee Farmers in Rural Pattongko, Indonesia. *The Qualitative Report*, *26*(12), 3805–3822.

Jairath, M. S., & Yadav, H. (2012). Role of ICT in decision making in agricultural marketing–a case of Arid India. *Indian Journal of Agricultural Economics*, *67*(902-2016–67841).

Khushk, G. M., Samah, A. A., Hamsan, H., & Ahmad, N. (2016). Empowerment among small farmers of Sindh Province, Pakistan. *Asian Journal of Agriculture and Rural Development*, *6*(3), 41–49.

Kour, D., Rana, K. L., Yadav, N., Yadav, A. N., Singh, J., Rastegari, A. A., & Saxena, A. K. (2019). Agriculturally and industrially important fungi: current developments and potential biotechnological applications. In *Recent advancement in white biotechnology through fungi* (pp. 1–64). Springer.

Kumar, R. (2014). Elusive Empowerment: price information and disintermediation in Soybean markets in Malwa, India. *Development and Change*, *45*(6), 1332–1360.

Lokeswari, K. (2016). A study of the use of ICT among rural farmers. *International Journal of Communication Research*, *6*(3), 232.

Murphy, P. J., & Coombes, S. M. (2009). A model of social entrepreneurial discovery. *Journal of Business Ethics*, *87*(3), 325–336.

Narayan-Parker, D. (2002). *Empowerment and poverty reduction: A sourcebook*. World Bank Publications.

Rashid, S. M. M., Islam, M. R., & Quamruzzaman, M. (2016). Which factor contribute most to empower farmers through e-Agriculture in Bangladesh? *SpringerPlus*, *5*(1), 1–14.

Regan, Á. (2019). 'Smart farming' in Ireland: A risk perception study with key governance actors. *NJAS-Wageningen Journal of Life Sciences*, *90*, 100292.

Shah, G. U. D., Bhatti, M. N., Iftikhar, M., Qureshi, M. I., & Zaman, K. (2013). Implementation of technology acceptance model in e-learning environment in rural and urban areas of Pakistan. *World Applied Sciences Journal*, *27*(11), 1495–1507.

Susanto, A. (2018). The Digital Poverty and Empowerment Issue in Indonesia. *2018 International Conference on ICT for Rural Development (IC-ICTRuDev)*, 137–141.

Torero, M., & von Braun, J. (2005). *Information and communication technologies for the poor*. International Food Policy Research Institute (IFPRI).

Ullah, M. S. (2017). Empowerment of the rural poor through access to ICT: A case study of the union information and service centre initiative in Bangladesh. *Journal of Creative Communications*, *12*(2), 81–97.

van der Burg, S., Bogaardt, M.-J., & Wolfert, S. (2019). Ethics of smart farming: Current questions and directions for responsible innovation towards the future. *NJAS-Wageningen Journal of Life Sciences*, *90*, 100289.

Walter, A., Finger, R., Huber, R., & Buchmann, N. (2017). Opinion: Smart farming is key to developing sustainable agriculture. *Proceedings of the National Academy of Sciences*, *114*(24), 6148–6150.

Yu, H. (2017). Networking China: The Digital Transformation of the Chinese Economy Yu Hong Urbana, Chicago and Springfield: University of Illinois Press, 2017 225 pp. $28.00 ISBN 978-0-252-08239-9. *The China Quarterly*, *231*, 817–819.

Zaremohzzabieh, Z., Samah, B. A., Muhammad, M., Omar, S. Z., Bolong, J., Hassan, M. S., & Shaffril, H. A. M. (2015). A test of the technology acceptance model for understanding the ICT adoption behavior of rural young entrepreneurs. *International Journal of Business and Management*, *10*(2), 158.