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The Impact of Online Community on Farmer Empowerment: A Technology-to-Performance Chain Approach

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***Abstract*— This research provides empirical evidence for the benefit of social media in the online farmer community. It uses the case study analysis in exploring the ICT usage in Empowerment 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 and farmer empowerment model. This research use farmer empowerment as the performance impact of the online community. Meanwhile, it also predicts some factors that affect the performance impact. Those are farmer characteristics, task-technology fit, and facilitating conditions. The empowerment impacts 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 performance insignificantly. However, the facilitating condition determines the task-technology fit with the path value 0,868. It means to endorse the ICT becoming fit with the task/livelihood of the farmer need the facilitating condition as the underlying factors. These factors are the internet accessibility of farmers, the innovation of the multi-nutrient and additive supplement product from socio-entrepreneurs, and the assistance/consultancy from the extension agent.**

***Keywords*— Online community, empowerment, Technology-to-Performance Chain**

I. 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 ([1], [2], [3]). Digital inclusion inadvertently reproduces inequality and exploitation. The emergence of individual entrepreneurs tends to relocate the locus of development responsibility to the poor themselves [4] and even strengthens existing power [3]. The distribution of power is also an issue in the development of smart farming ([5], [6]). Market structure and trade are also their obstacles in the development of the digital economy [7].

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 [8], 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 ([9], [7]; [10],[3],[11]), increasing decision-making abilities ([2],[12],[13],[14]), supply chain efficiency [11], rural business development ([15],[16]). 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-feedal products and additive supplements to encourage egg productivity and economic sustainability for farmers. The research uses a behavioural information systems approach as a theoretical basic and model development. Previous research has used a similar approach, but it is limited to the adoption of a technology (technology acceptance model) but has not yet reached the benefits of technology adoption ([17],[18]). This study uses a 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 factors influence it.

II. RESEARCH METHODS

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.

III. 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.

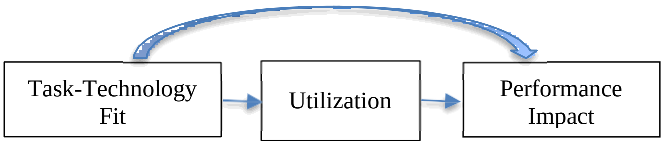

Fig. 1 The Technology to Performance Chain Model (Simplified)

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 ([9], [7], [10], [3], [11]), increased knowledge & psychology ([19],[12],[2], [14], [13]), economic & social impacts ([20], [3], [21], [19], [12], [22]). 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).

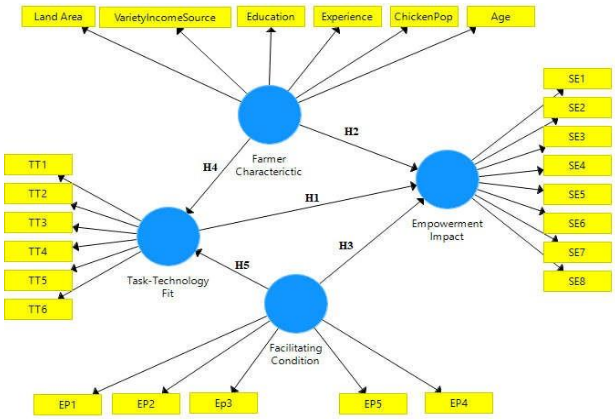

Fig. 2 The structural model of the research

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%.

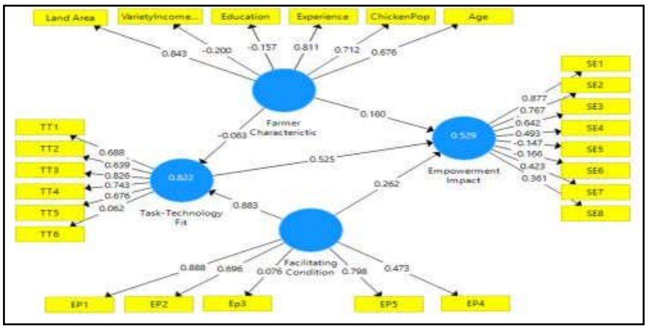

Fig. 3 Initial estimation of the model.

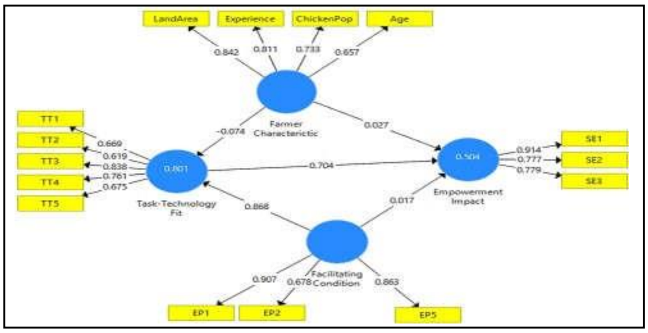

Fig. 4 Re-estimated result model

TABLE II
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 III
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 IV
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*

IV. RESULT AND ANALYSIS

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

Various factors influence the impact of farmer empowerment through the development of online communities. 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.
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. Other conditions have influenced farmer empowerment. 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 ([3], [23],[7]).

The limited human resources and the characteristics of laying hen's farmers have affected their involvement and interaction in the online community. This condition demands the role of extension actors in encouraging the interaction of all farmers. It is used to share information, knowledge, and practical experience in the online community. In addition, the condition of infrastructure and internet access are fundamental factors for active online interactions in the community. Although this study uses farmers in Central Java and East Java, there are still limitations in internet access by the farmers who live in the blank spot zone.

Another factor that encourages the use of online communities in increasing the empowerment of farming communities was the development and innovation of multi-feed products and additive supplements. They can be the role of the private or government sector. This study found some notes in the innovation of the farming 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 farmer practices, product innovation from the private sector, and assistance from extension workers as the agents of change.

Second, 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.

Third, relating this innovation to the scale-up and market development. Although it has not changed the existing market structure, market development should be encouraged 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.

V. CONCLUSIONS

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.

This research also becomes a concern to encourage facilitating conditions as the underlying factor of the use of social media in the online farmer's community. These underlying factors are assistance/consultation, internet network access, product enhancement & innovation. 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.

By considering the factors influencing the use of online communities to farmer empowerment, it needs the following policy concerns, they are:

a. The development of telecommunications infrastructure is thebasis for increasing public access to information and communication technology.
b. The development of agricultural product/innovation needs tobe driven not only on benefits but also on sustainable development.
c. Extension actors are agents of change, which can be carried out not only by the government but also by private or social agencies

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 discuss further the characteristics of farmers that are the limitations in the development of ICT in agriculture.

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