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Application of Cyber Extension as Communication Media to Empower the Dry Land Farmer at Donggala District, Central Sulawesi

[1,*]Muh. Amin, [2]Sugiyanto, [2]Keppi Sukesi, and [2]Ismadi

[1]Ph.D. Student, Faculty of Agriculture, University of Brawijaya, Malang, Indonesia
[2)] Faculty of Agriculture, University of Brawijaya, Malang, Indonesia

ABSTRACT

Cyber Extension-based information technology is one communication structure for agriculture counselling. Cyber Extension represents an innovation to accelerate the dissemination of agriculture information to the user. The information is obtained faster, more precise and more relevant to the demand of farmers. The objectives of the research are (1) to analyse the effectiveness of the use of Cyber Extension as the communication media in the dry land farming; and (2) to analyse the factors affecting the behaviour and empowerment of farmer in using Cyber Extension as the communication media. The research was located at Sindue Sub district, Donggala District, Central Sulawesi Province. The location was purposively selected as this location was accessible for the agriculture information system as the pioneer of Cyber Extension implementation either through self-support work or through organization-based program. The research method was survey and the data were analysed using *Structural Equation Modelling* (SEM). The result of the research indicated that there was a significant effect of farmer interaction on the effectiveness of the use of Cyber Extension (p-value of 0.003 < alpha (0.05). Farmer behaviour in using cyber influence was significantly farmer perception and farmer effectiveness in using Cyber Extension p-value of 0.00 and 0.001<alpha (0.05). Farmer empowerment rate influence was significantly farmer interaction, farmer perception, and the effectiveness of Cyber Extension and farmer behaviour using Cyber Extension (p-value of 0.000, 0.008, 0.042, and 0.0011 < alpha (0.05).
Keywords: Cyber Extension, farmer empowerment, dry land farming.

INTRODUCTION

Agricultural development is carried out not only to increase the productivity of farmers and their family but also to improve their welfare. The increased human resource quality through education, training and mastery of information technology is one important effort that shall be considered by the community and family of farmers to increase their competing ability. The development of information and communication technology has an obvious contribution to the development of agriculture information system, especially the development of communication media for agriculture innovation. Indeed, the use of information and communication technology in the agriculture development requires a specific education and capacity building because there are numberous technical and skill gaps in its implementation [1]. The development of information and communication technology was begun since the emergence of cellular phone and the internet which produced a dramatic change in the social aspect of society. Werner [2] admitted that information technology, including the internet, offers a more decentralized and more democratic form of communication rather than that offered by mass media. It is not surprise if information and communication technology is advancing fast and possessing great diversity in disseminating the information.

Cees Leeuwis [3] added that many recent media were combined with new package and, therefore, the dividing line between media categories was blurred. For instance, phone and the internet are always used more simultaneously in the interaction with audience than radio and television programs. Meanwhile, the agriculture development has faced challenges, and if passed, agriculture will be able to compete globally. In majority, farming is managed by farmers with narrow land, small capital, relatively low education background, and less bargaining position. The development of agriculture commodity, especially produced in dry land, is a strategic option to increase the production and to support the national food survivability. A problem related to how to increase the productivity is that the adoption of technology is slower although the dissemination is already conducted through seminar, symposia, journal, printed and electronic media, leading to farmers' limited and ineffective access to these media [4]. The lack of information faced by farmers, either about technology or market, surely prevents them from having further understanding. Information dissemination media are less suitable to the delivered material and the farmer characteristic. Information about innovation may be understood well but it shall be difficult to implement because of limited resource. Farmers may not see yet the benefit and

***Corresponding Author:** Muh. Amin, Ph.D Student, Faculty of Agriculture, University of Brawijaya, Malang, Indonesia.. Email: muh_amin71@yahoo.com

direct impact of innovation. Most farmers are risk-averse type in that they hesitate to accept the less familiar innovation [5].

Cyber Extension is a mechanism to develop the communication network for agriculture innovation. It is effectively programmed. The implementation of *Cyber Extension* involves integrating educational institution, developmental agency, and review organization, with the innovation disseminator (counsellor), educator, farmer and other *stakeholder* group. Each group has different demand of type and form of information, thus synergy and the habit to share with each other are developed. Cyber Extension represents a system to push forward the mechanism of managing, disseminating, documenting, researching, and synergizing the agriculture innovation which is required by agriculture development actor in order to support the sustainable innovation development. This research is aimed (1) to analyse the effectiveness of the use of *Cyber Extension* as the communication media in the dry land farming; and (2) to analyse the factors affecting farmers' behaviour and farmers' empowerment in using *Cyber Extension* as the communication media.

MATERIALS AND METHODS

The research was located at Sindue Sub district, Donggala District, Central Sulawesi Province. The location was selected purposively by considering that this location could be accessed by the agriculture information system as the pioneer of Cyber Extension implementation either through self-support work or through organization-based program.

The survey method was employed with 86 farmers as the samples obtained from random sampling technique. The sample criterion is the farmers who cultivated dry land with horticulture and vegetables as the commodities. The variables observed included the farmers' characteristics, interaction, perception, effectiveness, and behaviour and empowerment rate in using *Cyber Extension*.

The data collected comprised primary and secondary data. Primary data were obtained by having structured interview using questionnaire, while secondary data were collected from many sources to support the information required by research. Singarimbun and Effendi [6] declare that the key of sampling technique is the representativeness of population, meaning that member/element of sample can describe the situation or the distinctive marker of the population. Sugyono [7] asserts that the sample is part of population with shared characteristics of the population. The device for hypothesis testing was *path analysis*. The steps in the path analysis, according to Solimun [8] and Riduan and Kuncoro [9], were as following:

1. First Step: The development of theoretical model
   The theoretical model development for this research was carried out by exploring scientifically the variables and the relationship between variables through literature review to justify the theoretical model.
   Based on the relationship between variables, a theoretical model was developed in the form of path diagram as the following:

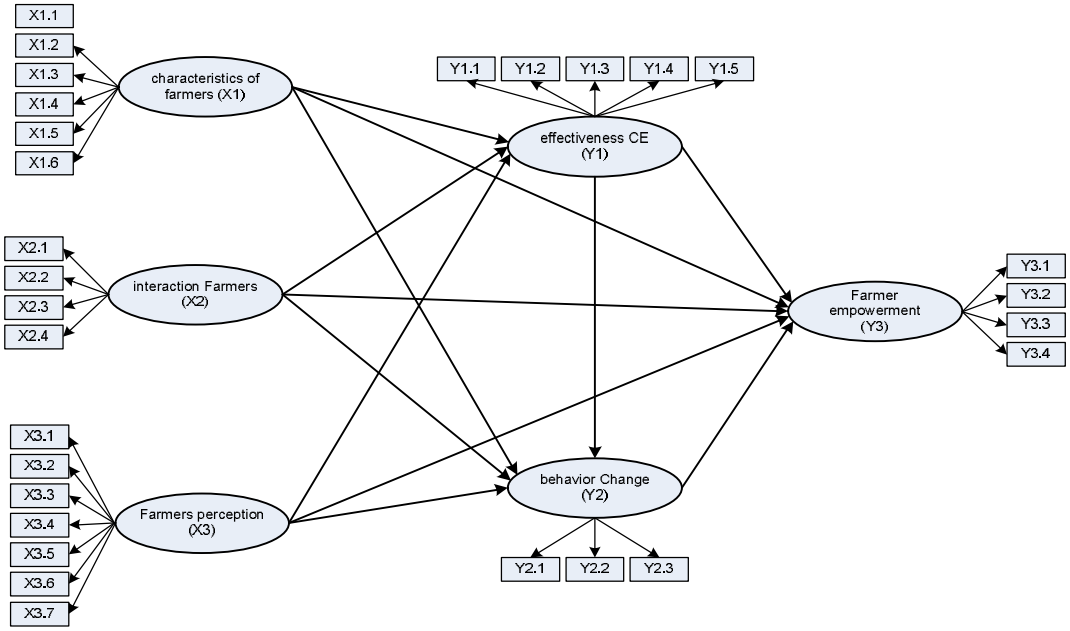

Figure 1 Path Diagram from Research Theoretical Model

The constructs in the path diagram were categorized into two groups, i.e. exogenous variables and endogenous variables. Exogenous variables involved (X1) farmers' characteristic, (X2) farmers' interaction with counsellor, and (X3) farmers' perception on material and method of counselling. Endogenous variables included (Y1) the effectiveness of using *Cyber Extension*, (Y2) the behavioural change, and (Y3) farmers' empowerment in using *Cyber Extension*. Moreover, *exogenous constructs*, so-called *source variables*, were those not predicted by other variables in the model. Meanwhile, *endogenous constructs* were variables in which their values were determined in the model. The description of Figure 1 may be elaborated in the equation form as the following:

$Y_1 = P_1 X_1 + P_2 X_2 + P_3 X_3 + \varepsilon_1$

$Y_2 = P_4 X_1 + P_5 X_2 + P_6 X_3 + P_7 X_1 + \varepsilon_2$

$Y_3 = P_8 X_1 + P_9 X_2 + P_{10} X_3 + P_{11} X_1 + P_{12} X_2 + \varepsilon_3$

2. Second Step: The examination towards assumption underlying path analysis showed that:
   a. The relationship in the model was linear and additive. The linear assumption could be examined from the resultant plot. According to Gujarati [10], one objective to examine the resultant plot is to understand whether the variables in the model are linear or not. If the resultant plot is distributed against the predicted value, and it shows a random pattern, therefore, the abnormality of data is absent and the relationship between variables is linear.
   b. The data of each residual model were normally distributed. Normal distribution is theoretical distribution with continuous random variables. To test whether the research sample was normally distributed, Kolmogorov-Smirnov's *Goodness of Fit Test* was employed. The testing criterion was if the significance rate (sig.) was > 0.05, then the data were normally distributed.
   c. Variables were measured without mistakes (valid and reliable).

3. Third Step: The calculation of Path Coefficient (Parameter Estimation).
   Solimun and Rinaldo [11] clarified that path coefficient is a standardized regression coefficient (coefficient beta). In other words, path coefficient is a regression coefficient calculated from the data which are set into standard number or Z-score (data which are set with means = 0 and deviation standard = 1). *Standardized path coefficient* was used to explain the effect of independent (exogenous) variables on other variables, that is, the dependent (endogenous) variables. According to Supranto [12], coefficient beta of Y against X (B_{yx}) was similar to coefficient beta of X against Y (B_{xy}). It was also similar with correlation coefficient (r_{xy}). The path coefficient was calculated by using the correlation matrix, or using the standardized regression coefficient (beta coefficient), which mainly produced similar value.

4. Fourth Step: The testing of the significance of the effect in the path analysis.
   The significance of direct effect was tested by examining calculated t and t-table. If calculated t < t-table, then H-0 was accepted but H-a was rejected. In other words, it meant that there was no significantly direct effect of independent variables on dependent variables. If calculated t > t-table, then H-0 was rejected but H-a was accepted. This meant that there was a significantly direct effect of independent variables on dependent variables.

5. Fifth Step: The examination on model validity
   The examination on model validity used total coefficient of determination. The data variance total was explained by the model through the following equation:
   $R^2_m = 1 - P^2_{el} P^2_{e2} \ldots P^2_{ep}$
   The interpretation of R^2_m was similar to the interpretation of determination coefficient (R^2) in the regression analysis. The model was valid if it had higher precision and higher accuracy. The accuracy rate of the model was that its determination coefficient (R^2) ranged from 0 to 1.
   The examination on model validity was carried out through *theory trimming* norm.

RESULTS AND DISCUSSION

Result of Factors Analysis

Factor analysis with a *loading factor rate* showed that the weight of each indicator was a measurer of each latent variable. The indicator with great *loading factor* meant that this indicator was the strongest variable measurer (dominant). The result of *measurement model* is presented in Table 1 (the complete is shown in the enclosure).

Table 1 the *Loading Factor* Rate of Each Variable

Indicator	X1		X2		X3		Y1		Y2		Y3	
1	**X1.1**	0.466*	**X2.1**	**0.782***	X3.1	0.698*	Y1.1	0.545**	Y2.1	0.669*	Y3.1	0.532*
2	**X1.2**	0.555*	**X2.2**	0.726*	X3.2	0.550*	Y1.2	0.655*	Y2.2	0.669*	Y3.2	0.591*
3	**X1.3**	0.563**	**X2.3**	0.636**	X3.3	**0.702****	Y1.3	**0.770***	Y2.3	**0.715****	Y3.3	0.450**
4	**X1.4**	0.533*	**X2.4**	0.611*	X3.4	0.625*	Y1.4	0.605*			Y3.4	0.605*
5	**X1.5**	**0.672***			X3.5	0.666*	Y1.5	0.648*			Y3.5	**0.666***
6	**X1.6**	0.372*			X3.6	0.574*	Y1.6	0.657*				
7					X3.7	0.584*						

Note:
Sign * meant that the weight was significant (at p-value < 0.05).
Sign ** meant that the weight was fixed (determined).

Pursuant to Table 1, it was showed that:

1. The variable of Farmer Characteristic (X1) had six indicators such as Age (X1.1), Formal Education (X1.2), Land Ownership (X1.3), *Cyber Extension* Possession (X1.4), Motivation (X1.5), and Network Availability (X1.6). The highest *loading factor* rate was obtained by the indicator of Motivation (X1.5), meaning that it was the most dominant indicator in determining the variable of Farmer Characteristic.
2. The variable of Farmer Interaction (X2) had four indicators including the Ability to Cooperate/Synergize (X2.1), Interaction in using information technology (X2.2), Interaction in selecting information media (X2.3), and Interaction in selecting material type (X2.4). The highest *loading factor* rate was shown by the indicator the Ability to Cooperate/Synergize (X2.1), meaning that it was the most dominant indicator in determining the variable Farmer Interaction.
3. The variable Farmer Perception (X3) had seven indicators including The Suitability of Material (X3.1), Easiness to understand the material content (X3.2), Easiness to select information (X3.3), Punctuality in selecting information (X3.4), Easiness to apply (X3.5), The Suitability of Counselling Method (X3.6), and The Suitability with Local Culture (X3.7). The highest *loading factor* rate was obtained by the indicator Easiness to select information (X3.3), meaning that it was the most dominant indicator in determining the variable Farmer Perception.
4. The variable The Effectiveness of The Use of *Cyber Extension* (Y1) had six indicators including the Performance of Farmer in the Farming (Y1.1), the Performance of Counsellor in the Counselling Activity (Y1.2), the Suitability of Information Required (Y1.3), the Satisfaction with the Result Obtained (Y1.4), the Suitability of Information Required with Demand and Punctuality (Y1.5), and the Suitability of Counselling Method (Y1.6). The highest *loading factor* rate was shown by the indicator the Suitability of Information Required (Y1.3), meaning that it was the most dominant indicator in determining the variable The Effectiveness of The Use of *Cyber Extension.*
5. The variable Behavioural Change (Y2) had three indicators including the Knowledge on the Use of *Cyber Extension* (Y2.1), the Attitude toward the Application of *Cyber Extension* (Y2.2), and the Skill in Using Information Technology (Y2.3). The highest *loading factor* rate was obtained by the indicator the Skill in Using Information Technology (Y2.3), meaning that it was the most dominant indicator in determining the variable Behavioural Change.
6. The variable Farmer Empowerment (Y3) had five indicators including the Ability to determine the commodity type (Y3.1), the Ability to have two-ways communication (Y3.2), the Ability in managing input and in marketing the output (Y3.3), the Ability to access the information (Y3.4), and the Ability to manage the agriculture output (Y3.5). The highest *loading factor* rate was shown by the indicator the Ability to manage the agriculture output (Y3.5), meaning that it was the most dominant indicator in determining the variable Farmer Empowerment.

The Testing against Assumption in the Path Analysis

A Linearity Test for the relationship between variables used Curve Fit method, which to show that the whole effects were in the form of linear model. Next, normality assumption was tested against residual of each equation in the path analysis. Kolmogorov-Smirnov's Significances for three equations were 0.356, 0.658, and 0.870, which all of these were greater than 0.50, indicating that the residual normality assumption was met.

Path Analysis Result

The first stage in the path analysis was testing against goodness of fit of the model. The total determination coefficient was 98.61%. It indicated that the data variance explained by the model was 91.78%, or, in the other words, 91.78% information within the data could be explained by the model. The remaining 8.22 % were explained by other variables (not mentioned in the model).

The testing of hypotheses was done by T-Statistic which was conducted partially against each direct effect path. The complete result of the analysis is shown in Enclosure 1. Graphically, the result of path analysis testing is presented in Figure 2.

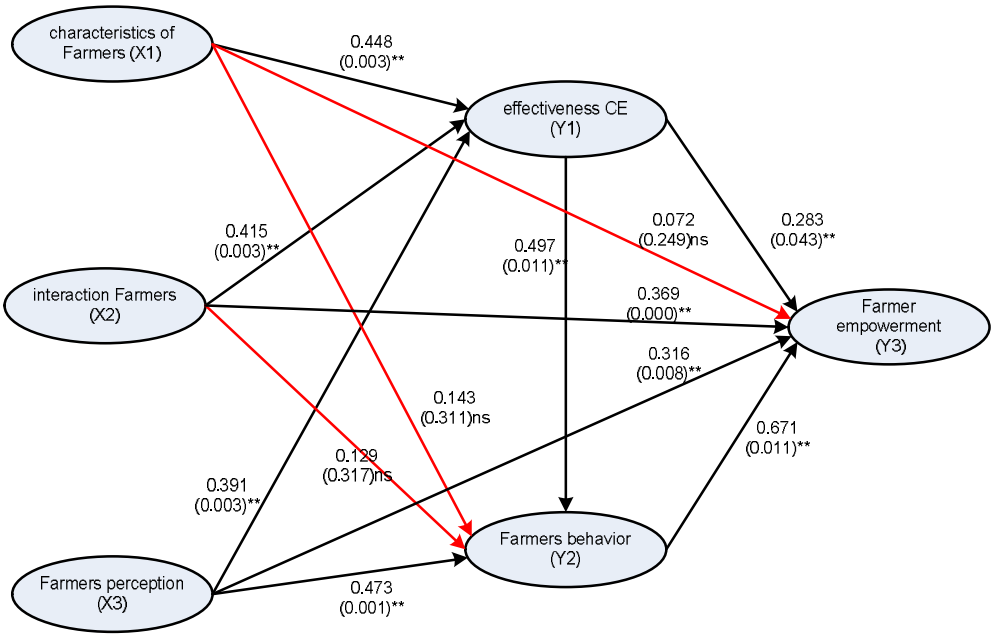

Figure 2 the Result of Path Analysis

Graphic in the Figure 2 showed that the result of structural model testing was as follow:

1. There was a significant effect of Farmer Characteristics on the Effectiveness of the Use of *Cyber Extension*. It was confirmed by p-value of 0.003 < alpha (0.05). Positive coefficient meant that the relationship of both was parallel. It also meant that the higher level of Farmer Characteristics was related to the higher level of Effectiveness of the Use of *Cyber Extension*.
2. There was a significant effect of Farmer Interaction on the Effectiveness of the Use of *Cyber Extension*. It was supported by p-value of 0.003 < alpha (0.05). Positive coefficient indicated that the relationship of both was parallel. It also meant that the higher level of Farmer Characteristic was related to the higher level of the Effectiveness of the Use of *Cyber Extension*.
3. There was a significant effect of Farmer Perception on the Effectiveness of the Use of *Cyber Extension*. It was determined by p-value of 0.003 < alpha (0.05). Positive coefficient meant that the relationship of both was parallel. It also meant that the higher level of Farmer Perception was related to the higher level of the Effectiveness of the Use of *Cyber Extension.*
4. There was no significant effect of Farmer Characteristic on Behavioural Change. It was shown by p-value of 0.311 > alpha (0.05) or (0.10). It meant that any levels of Farmer Perception were not influencing the level of Behavioural Change.
5. There was no significant effect of Farmer Interaction on Behavioural Change. It was shown by p-value of 0.307 > alpha (0.05) or (0.10). It meant that any levels of Farmer Interaction do not influence the level of Behavioural Change.
6. There was a significant effect of Farmer Perception on Behavioural Change. It was confirmed by p-value of 0.000 < alpha (0.05). Positive coefficient meant that the relationship of both was parallel. It also meant that the higher level of Farmer Perception was related to the higher level of Behavioural Change.
7. There was a significant effect of the Effectiveness of the Use of *Cyber Extension* on Behavioural Change. It was supported by p-value of 0.011 < alpha (0.05). Positive coefficient meant that the relationship of both was parallel. It also meant that the higher level of the Effectiveness of the Use of *Cyber Extension* was related to the higher level of Behavioural Change.
8. There was no significant effect of Farmer Characteristic on Farmer Empowerment. It was determined by p-value of 0.249 > alpha (0.05) or (0.10). It meant that any levels of Farmer Characteristic do not influence the level of Farmer Empowerment.
9. There was a significant effect of Farmer Interaction on Farmer Empowerment. It was supported by p-value of 0.000 < alpha (0.05). Positive coefficient indicates that the relationship of both was parallel. It also meant that the higher level of Farmer Interaction was related to the higher level of Farmer Empowerment.
10. There was a significant effect of Farmer Perception on Farmer Empowerment. It was shown by p-value of 0.008 < alpha (0.05). Positive coefficient meant that the relationship of both was parallel. It also meant that the higher level of Farmer Perception was related to the higher level of Farmer Empowerment.

11. There was a significant effect of the Effectiveness of the Use of *Cyber Extension* on Farmer Empowerment. It was confirmed by p-value of 0.042 < alpha (0.05). Positive coefficient indicates that the relationship of both was parallel. It also meant that the higher level of the Effectiveness of the Use of *Cyber Extension* was related to the higher level of Farmer Empowerment.
12. There was a significant effect of Behavioural Change on Farmer Empowerment. It was supported by p-value of 0.011 < alpha (0.05). Positive coefficient meant that the relationship of both was parallel. It also meant that the higher level of Behavioural Change was related to the higher level of Farmer Empowerment.

According to the results of the present study through the SEM analysis, it is found out that the effectiveness of the use of cyber extension was greatly affected by the farmers' characteristics, interactions, and perceptions. Among these factors, the one that strongly influenced the effectiveness was the farmers' characteristics as shown by 0.448, the highest SEM coefficient (Fig. 1). This fact was reflected from the availability of IT equipments and the farmers' great motivation to seek needed information within the dry land activities. Factors that influenced the farmers' behaviour were directly affected by their perceptions and effectiveness in making use of cyber extension. From the analysis, it is found out that it was the effectiveness of the use of cyber extension that greatly affected the farmers' behaviour as shown by the highest SEM coefficient 0.497 (Fig. 1). The effectiveness of the cyber extension was evident from the supervisors' performance in terms of the quality of service and their immediate response to the farmers' needs. The use of cyber extension have generated some benefits to the farmers, two of which are easiness in seeking information and the availability of information technology needed for farming. Furthermore, factors that influence the level of the farmers' ability in drawing benefits from cyber extension are the farmers' interactions, perceptions, behaviour, and the effectiveness of CE. Among other factors, the one that has the highest influence on the farmers' ability is the farmers' behaviour as shown by the highest SEM coefficient 0.671 (Fig. 1). A change in the farmers' behaviour was shown by their ability to access and manage the information as well as their ability to control production inputs.

We may now conclude that there are factors that have positive influence on the use of cyber extension by the farmers in *Kecamatan* Sindue, *Kabupaten* Donggala, in the way that they can easily access the information technology whenever they need any information relevant to conducting the dry land activities. Nevertheless, not all farmers are able to quickly do so as some lack knowledge and ability to work with the Internet and there are limited networking equipments. Therefore, trainings and supervisings must be conducted for those with low ability to operate the Internet and additional equipments must be provided. With the sufficient of the facility, the farmers will have a greater chance to access sources for some piece of needed information that will lead to their ability to determine and control their commodity inputs that match with their farming activities.

The use of cyber extension as communication media supported effectively dry land farming of Sindue sub-district, Donggala district as reflected by the higher performance of extension services to respond the farmers' requirement. Results of this research was in line with Adekoya [12], who stated that the use of information technology in extension program supplied farmers more comprehensive, easier and faster information on agriculture they required. Direct involvement of farmers in using information technology is still relatively low, especially related to their low knowledge and capability in operating cyber extension. However, the farmers in fact gave positive respond on the use of cyber extension to support their dry land farming. The same condition was also reported by Mulyandari [1]. Famers' perception on cyber extension was highly positive to support their dry land farming, as cyber extension was facilitating farmers to get fast and comprehensive information they needed and related to their farming. Some farmers have been able to access internet to get advantages of information they get. Zhao [13] reported that internet had large contribution in improving agriculture productivity, especially due to the increase of farmers' access to agriculture technology as well as getting and sharing information, and marketing products. In addition those advantages, Sharma [14] also reported that *cyber extension* is important to improve the market of agriculture products and open market barriers of agriculture products from village level to global market. Mulyandari *et al* [15] reported that ICT application in cyber extension greatly improve vegetable farmers' accessibility in East and West Java Province of Indonesia, especially to market information. Some dominant factors influencing the utilization of cyber extension by the farmers were training and ICT facilities, compatibility and comparative advantage of cyber extension, and the level of farmer's cosmopolitan. Whereas the factors affecting the vegetable farmer empowerment were the level of information technology accessibility, information technology utilization, and information management based on information technology. Two-step-flow communication was the best strategy for cyber extension utilization.

The use cyber extension or information and communication technologies (ICT) in agriculture facilitate the processing and transfer of information. The main focus of ICT application in agriculture is meeting the farmers' needs for information. The following are some vital information needed by farmers that seem to be imperative for the growth and development of agriculture, among others are market information, latest

techniques and technologies, rural development programs and subsidies, weather forecasting, latest (best) packages of practices, post-harvest technology, general agricultural news, information on insurance / claim processing, Input prices and availability, early warning and management of diseases and pests, an soil testing and soil sampling information. Based on the findings, cyber extension in agricultural become more important and accessible, and useful to farmers and their agriculture. This is especially due to the increase of demand for food and the dramatics development of ICT and their use by people, including farmers in the villages [16].

CONCLUSION

1. The higher level of farmer characteristics, farmer interaction, and farmer perception in using *Cyber Extension* were related to the higher level of the effectiveness of the use of *Cyber Extension* in supporting dry land farming.
2. The higher levels of farmer perception and farmer effectiveness in using *Cyber Extension* were related to the higher level of farmer behavior in the dry land farming.
3. The relationship between farmer interaction, farmer perception, the effectiveness of the use of *Cyber Extension*, and farmer behavior in using *Cyber Extension* was parallel. The higher levels of farmer interaction, farmer perception, the effectiveness of the use of *Cyber Extension*, and farmer behavior in using *Cyber Extension* were related to the higher level of farmer empowerment rate in the dry land farming.

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