Implementation of Smart Farming as a Modern Farming Method to Improve the Welfare of Farmers in West Bandung Regency

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Abstract. This study aims to examine the application of smart farming as a modern agricultural method to improve the welfare of farmers in the West Bandung regency to accelerate the technological transformation that is very necessary in order to achieve optimal targets, add value and increase competitiveness. Adopting Smart Agriculture (Smart Farming) becomes a future solution that can be applied to agricultural products to ease the potential of domestic, regional, and international agricultural markets to improve farmers' welfare.

Keywords: Smart Farming · Modern Agriculture · Welfare of Farmers

1 Introduction

The agricultural sector is a sector that contributes greatly to Indonesia's gross domestic product (GDP) to date, one of which is agriculture. According to data from the Central Statistics Agency, the contribution of the agricultural category to gross domestic product (GDP) refers to the current price basis in 2020 with a percentage of 13.70%, an increase of 0.99% from the previous year. The order of the largest contribution to GDP in 2020 in the agricultural sub-group is plantation crops (3.63%), food crops (3.07%), fisheries (2.80%), livestock (1.69%), horticultural crops (1,62%) Forestry (0.70%), agriculture and hunting services (0.20%).

Agricultural potential is very superior in West Bandung Regency in the plantation sector, namely vegetables, fruits such as bananas, peppers, tomatoes, chilies, avocados, guavas, and ornamental flowers such as roses, chrysanthemums, gladiolus, and orchids. In West Bandung Regency, which is located in the north, namely in the Districts of Lembang, Parongpong, and Cisarua, there are several distributions of working groups of farmers. The sub-district with the most planting area is Gunung Halu District covering an area of 3,804 Ha, with a total agricultural land for the area in West Bandung Regency starting from wetlands (rice fields and ponds) covering an area of 12,168 Ha, and a land area of 118,409 Ha. However, the facts show that the opposite condition with areas that have the potential to be fertile as agricultural land does not support the welfare of the community better, while the level of Human Development (IPM) of West Bandung Regency (KBB) in 2020 is around 68.08 after becoming a New Autonomous Region (DOB) in 2015. 2007, this level is still below the average HDI position in West Java of

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72.09. There has been no significant increase, and is still below Bandung Regency with 72.39 HDI as the parent district.

For this reason, the West Bandung Regional Government (PEMDA) is one way to increase people's welfare by encouraging the agricultural sector of the West Bandung Regency government and several agencies to launch a technology-based modern agricultural breakthrough. Farming has been implemented in several sub-districts in West Bandung Regency.

Based on theoretical phenomena, several studies reveal that the Indonesian agricultural sector greatly influences the modern agriculture-based economy. Indonesia has developed agriculture using the smart farming method, which is allegedly related to the importance of measuring community participation, knowledge, and technology. However, the application of the smart farming method has not been tested to improve the welfare of farmers.

In connection with the description in the thinking and problem identification chapter, the formulation of the problem can be drawn as follows.

1. How does community participation affect smart farming and farmer welfare in KBB?
2. How does technology affect smart farming and farmer welfare in KBB?
3. How does knowledge affect smart farming and farmer welfare in KBB?
4. How does Smart farming affect the welfare of farmers in KBB?

1.1 Framework

The success of implementing Smart Farming cannot be separated from the critical role of community participation, as research (Sumodiningrat, G., B. Santosa, and M. Marwan. 1999) shows that the success of poverty reduction programs is considered to be caused by active community participation.

The basic thing that becomes the rationale for this research is conducting research on farmer welfare as a measure of the success of the application of precision agricultural technology, namely: Smart Farming which is supported by the following factors, including community participation, technology, and knowledge. So the basic assumption is that the more accurate the use of agricultural technology, the higher the production. The higher the production, the higher it can increase the income and welfare of farmers in West Bandung Regency.

Based on the theories and thoughts described, the research paradigm can be presented schematically in Fig. 1:

2 Methods

To get accurate research results, research that applies mixed methods is research that uses quantitative and qualitative data coverage, combines 2 (two) forms of data, and uses different designs that may contain philosophical assumptions and theoretical frameworks.

The purpose of using this mixed method is between the variables that use the independent variables, namely, community participation, technology, and knowledge. The dependent variable is the hypothesis that has been previously established between farmer

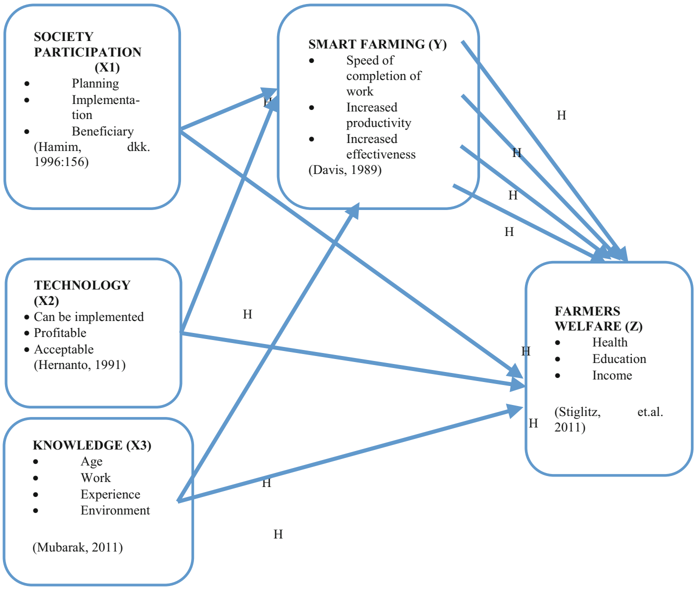

Fig. 1. Research Conceptual Framework

welfare and smart agriculture as an intervention/mediation variable tested whether it is to describe the relationship. Intervening variables can connect the independent variable and the dependent variable in an indirect relationship (Liana, 2009). The purpose of the intervening variable in the study is to find the intervening variable or smart farming that can strengthen the impact of community participation, technology, and knowledge variables on the welfare of farmers. Survey respondents are farmers who apply smart farming technology.

2.1 Variable Operation

The research applies independent, intervening, and dependent variables, where community participation, technology, and knowledge (X) is the independent variable, smart farming (Z) is the intervening variable or mediator, and farmer welfare (Y) is the dependent variable.

2.2 Data Analysis Methods

The data processing in this study applies the Partial Least Square (PLS) analysis tool. PLS is carried out based on elements to be tested for structural equation models. PLS is a predictive model where PLS is divided into the form of measurement (measurement model or outer model) and structural model (structural mode or inner model). The PLS method was developed to test data theory and weak theory, for example, the number of samples in small or less than 100 data or data normality problems (Gozahali & Latan, 2015).

Table 1. Variable Operation

Variables and Variable Concepts	Indicator	Size	Scale
Partisipasi Masyarakat (X)	Planning	Level of role in planning	Likert
	Implementation	Level of role in implementation	
	Result Recipient	Level get receive results	
Teknologi (X)	Can be implemented	Ease of implementation	Likert
	Profitable	Levels give advantage	
	Acceptable	Acceptable by society	
Pengetahuan (X)	Age	Age level	Likert
	Work	Profession level	
	Experience	Long experience in the profession	
	Environment	Surrounding environmental conditions	
Smart Farming (Y)	Speed of completion of wor	Level of speed of completion of work	Likert
	Increased productivity	Possible rate of productivity growth	
	Increased effectiveness	The rate of possible increase in effectiveness	
Kesejahteraan Petani (Z)	Health	Health facilities available	Likert
	Education	Level of education obtained	
	Income	Income Amount	

3 Results and Discussion

3.1 Results of Equation Modeling Partial Least Square (SEM PLS) Structure Analysis

This stage is related to forming the initial concept of structural equations. The initial concept is formulated based on a method or previous article (Fig. 2).

From the results of data processing using smartPLS, it obtained the magnitude of the t-count significance value in the image below, which states the magnitude of the significance value between the tested variables, is presented in the form of arrows. The t-count value in the figure states the magnitude of the significance value between the research variables. The magnitude of the significance value between the variables tested is presented in the form of the value contained in the arrow that connects one of the variables to the variable that is the goal. The path coefficient value and t count in each variable obtained the following calculation results (Fig. 3):

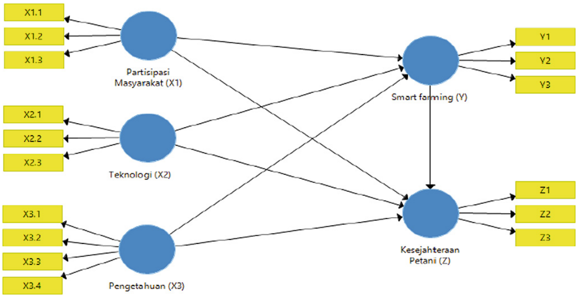

Fig. 2. Partial Least Square Model Conceptual Diagram

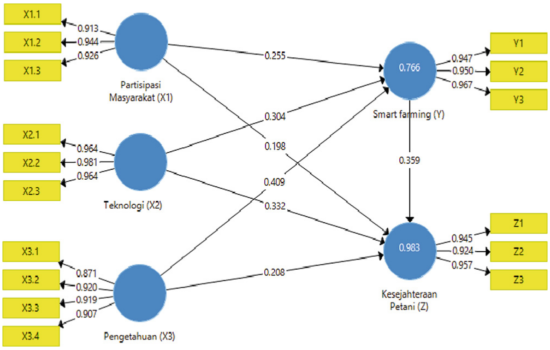

Fig. 3. Structural Model (Path Coefficient, Beta)

3.2 Result of Path Coefficient Value and t-count

Influence	Path Coefficient	Standard Deviation	T Statistics	P Values
X1 - > Y	0.255	0.111	2.297	0.022
X2 - > Y	0.304	0.102	2.986	0.003
X3 - > Y	0.409	0.135	3.035	0.003
X1 - > Z	0.198	0.044	4.539	0.000
X2 - > Z	0.332	0.044	7.622	0.000
X3 - > Z	0.208	0.075	2.768	0.006
Y - > Z	0.359	0.061	5.871	0.000
X1 - > Y - > Z	0.092	0.045	2.012	0.045
X2 - > Y - > Z	0.109	0.040	2.712	0.007
X3 - > Y - > Z	0.147	0.051	2.890	0.004

1. Effect of Community Participation (X1) on Smart farming (Y), it can be concluded that H0 is rejected, meaning that Community Participation (X1) has a significant effect on Smart farming (Y).

2. The Effect of Community Participation (X1) on Farmer Welfare (Z), it can be concluded that H0 is rejected, meaning that Community Participation (X1) has a significant effect on Farmer Welfare (Z).
3. The effect of Community Participation (X1) on Farmer Welfare (Z) through Smart farming (Y) it can be concluded that H0 is rejected, meaning that Community Participation (X1) has a significant effect on Farmer Welfare (Z) through Smart farming (Y).
4. The influence of Technology (X2) on Smart farming (Y) can be concluded then H0 is rejected, meaning that Technology (X2) has a significant effect on Smart farming (Y).
5. Effect of Technology (X2) on Farmer Welfare (Z), it can be concluded that H0 is rejected, meaning that Technology (X2) has a significant effect on Farmer Welfare (Z).
6. The effect of Technology (X2) on Farmer Welfare (Z) through Smart farming (Y), it can be concluded that H0 is rejected, meaning that Technology (X2) has a significant effect on Farmer Welfare (Z) through Smart farming (Y).
7. The effect of Knowledge (X3) on Smart farming (Y), it can be concluded that H0 is rejected, meaning Knowledge (X3) has a significant effect on Smart farming (Y).
8. Effect of Knowledge (X3) on Farmer Welfare (Z), it can be concluded that H0 is rejected, meaning Knowledge (X3) has a significant effect on Farmer Welfare (Z).
9. Effect of Knowledge (X3) on Farmer Welfare (Z) through Smart farming (Y). It can be concluded that H0 is rejected, meaning that Knowledge (X3) has a significant effect on Farmer Welfare (Z) through Smart farming (Y).
10. Effect of Smart farming (Y) on Farmer Welfare (Z). It can be concluded that H0 is rejected, meaning that Smart farming (Y) has a significant effect on Farmer Welfare (Z).

4 Conclusion

The author tries to draw conclusions and provide suggestions based on the results of the analysis that has been presented in the previous discussion. Community participation affects the welfare of farmers directly or through the use of the smart farming method at each stage of community participation, namely: planning, implementation, and recipients of the results have an important role in affecting the final result. Technology affects the welfare of farmers directly or through the use of the smart farming method, the technology used is very user-friendly and accommodates the needs of modern farmers because technology can be implemented, profitable and acceptable. Knowledge affects farmers' welfare directly or through the use of smart farming methods. Knowledge is the key basis for farmer success, where this knowledge is influenced by age, occupation, experience, and environment. The better the knowledge of farmers, the more innovative farming methods will be.

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