The Effect of social capital on integrated crop management of rice production in Sumber District Rembang Regency

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Abstract. Research objective was to analyze the effect of social capital in the application of integrated crop management on rice production. The study population was a farmer group in Sumber District that implemented a farmer field school on integrated crop management. Purposive random sampling was used to determine respondents. There were 318 respondents in this study. Questionnaire was used to collect data. Path analysis was used for data analysis. Social capital had a significant effect on farmers’ knowledge among farmers in Sumber District, Rembang. Social capital also had significant effect on farmers’ perceptions in the application of integrated crop management on rice production. Moreover, social capital had a significant and direct positive effect on adoption in the application of integrated crop management on rice production.

1. Introduction

Adoption innovation in crop production can be defined as farmer’s willingness to adopt technology in order to get better life’ situation for their family. Choosing appropriate technology for smallholder farming system have to consider that the technology can be easily applied, economically feasible and socially and culturally acceptable as well as environmentally friendly. This means that an innovative technology should be easy to apply, increase farmer’ income and accepted by the market. There are five adoption stages, namely awareness, interest, evaluation, trial, and adoption [1].

Efforts to increase production can be done through integrated crop management (or Pengelolaan Tanaman Terpadu/PTT). PTT is an innovative approach to increase efficiency of rice farming system by combining various technological components using natural resources in order to improve plant productivity. PTT was implemented with the principle of farmer group participation. The intensification technology in a particular area should be based on specific location and problem solving. The PTT technology components are determined participatively with farmers through a technology needs analysis [2]. PTT can be implemented to increase farmers' productivity and income without damaging the environment or environmentally friendly innovation [3].

The concept of farmer field school on integrated crop management (namely: Sekolah Lapang-Pengelolaan Tanaman Terpadu/SL-PTT) in Rembang Regency had been implemented in Sumber District. Geographical condition of Sumber District has opportunity to support agricultural sector as well as social condition of the area had long experience in agriculture sector. Most of the population are working in agriculture to support their daily needs. Hence, all the capital owned by community
have to contribute to local development, social capital, for instance. Social capital is an important factor in driving farmer togetherness at the group level. Social capital is one of the components to share ideas, mutual trust and mutual benefit to achieve mutual goals. Social capital will facilitate and accelerate the delivery of technological innovations in order to influence the absorption of new knowledge. Based on the condition described above, it was necessary to conduct research to analyze social capital that determine the adoption of integrated crop management in rice production in Sumber District, Rembang Regency.

2. Materials and methods

The population in this research were farmers in Sumber district who had attending farmers field school in integrated crop management program of rice production. There were 1,510 farmers in the research area. Determination of the number of respondents was done by using the Slovin formula:

\[
n = \frac{N}{1 + N (moe)^2}
\]

Explanation :

n = sample number
N = population
moe = margin of error (5%)

Based on the formula, there were 318 respondents and it had been chosen randomly. The data were collected using primary and secondary data. Primary data were collected by using a set of questionnaires prepared by researcher. Secondary data were collected through statistical data of Sumber District, Rembang Regency. Path analysis was used to analyze the data. Path analysis is a technique to analyze the causal relationship that occurs in multiple regression if the independent variables affects the dependent variable not only directly but also indirectly [4].

3. Result and Discussion

Integrated crop management have been implemented in Indonesia in the beginning of 90’s. This program introduced the innovative farmer field school model of agro-ecosystem-based participatory learning. These program included empowering activities and participatory approach such as: extension activities, grants and subsidies for agricultural infrastructure (seeds and agricultural machinery) [5].

The implementation of SL-PTT in Sumber District was based on request from farmers through extension agents. Secondly, extension agent will develop the program together with farmer group and local government according to farmers’ need assessment. Moreover, when SL-PTT was formed, thus farmers were required to learn in groups. The PTT technology applied includes: 1) the use of modern varieties (ciherang rice); 2) seed treatment to produce quality and healthy seeds; 3) planting with jajar legowo concept (It is integrated planting system with the aim to improve rice production in one particular area by arranging and expanding the planted area); 4) applying non-chemical fertilizer; 5) application integrated pest management; 6) harvest and post-harvest handling. In addition, the use of farmer field school method in PTT learning was expected to be able to provide knowledge and sharing information among farmer’s community. Implementing farmer field schools (sekolah lapang) requires active participation from farmers. It provides more sustainable learning outcomes [6].

3.1. The Effect of Social Capital Toward Farmers' Knowledge

The results of regression analysis show that social capital (networks, trust, and norms) had an significant effect on farmer’s knowledge about implementation of integrated crop management (p<5%). Regression equation as follow:

\[
Y1 = 2.439 + 0.194 X1 + 0.193 X2 + 0.500 X3
\]

Where : Y = Knowledge; X1 = Norm; X2 = Belief; X3 = Network
Regression coefficient value $X_1$ was 0.194, it means each addition of 1-unit norm will increase knowledge by 0.194 units. Regression coefficient value of $X_2$ was 0.193, it means every 1-unit increase in confidence will increase knowledge by 0.193 units. Regression coefficient value of $X_3$ was 0.500, it means that each additional network of 1 unit will increase knowledge by 0.500 units. Mechanism in introducing a new technology were carried out through discussion and sharing knowledge [7]. Based on this, the role of farmer groups will greatly influence the behavior of their members, especially in the attitude of togetherness and sharing and helping each other. This is related to the role of farmer groups as learning unit and helping farmer to access markets and also production inputs such as credit, seeds, and fertilizers [8]. The network provides opportunities for farmers to connect with external stakeholder and give benefit to improve their knowledge about the application of PTT [9].

3.2. The Influence of Social Capital on farmer’s perception on application of PTT
Based on data analysis, social capital had significant effect on farmer’s perception. Farmers’ perception was influenced by the role of extension workers. Frequent and positive social interactions will be able to increase farmers’ perceptions of technology being introduced by the extension workers [10]. The success of implementation of new technology is also determined by the degree of farmers’ participation in developing need assessment based on their problem. Extension worker together with farmers need to collaborated to design extension program based on their condition. Abdullah (2008) stated that the success of extension program is influenced by the materials, methods and media of extension as well as active involvement by the farmer to design the program [11].

3.3. The Influence of Social Capital on the Adoption of PTT using Path Analysis
Figure 1 shows that there was an influence relationship between social capital (norms, trust and networks) on the adoption of PTT innovation through variable of knowledge and farmer perceptions. There was direct influence of social capital owned by farmer groups on their decision to adopt PTT innovation. Social capital had an influence on increasing farmers’ knowledge and perceptions of PTT innovation, which then provides considerations for farmers to adopt PTT innovation. The results of the path analysis using the AMOS program show in Figure 1.

Unstandardized estimates

| Description | Value |
|-------------|-------|
| The arrows are the direction of influence | |
| The number parallel to the arrow is the value of the path coefficient between variables | |
| The number on the top of the box is the coefficient of determination ($R^2$) | |
- **Unstandardized estimates** the result will be the same as the usual regression in the model coefficient table, especially the unstandardized beta coefficient which forms an ordinary regression equation consisting of constants + exogenous variables. Meanwhile, the standardized estimates of the results will be the same as the usual regression on the model coefficient table, especially the standardized beta coefficient which will form an ordinary regression equation consisting of exogenous variables only (without constants).

Figure 1. Diagram of Path Analysis Results

All analyzed pathways show a significant positive causal relationship. Variables of norms, trust, and networks had a positive effect on increasing the variable of farmers' knowledge. Variables of knowledge, network, trust, and norms had a positive effect on increasing farmers' perceptions of PTT innovation. Hence, farmer's perception and knowledge farmers had a positive effect on the adoption of PTT innovation (P<5%).

Regression analysis above mention could show the relationship between independent variable and dependent variable either simultaneously or partially, then in path analysis can combine the flow between the regression analysis which is interconnected. The influence between variables in path analysis can be developed into a direct influence and an indirect effect. The results of the path analysis test both direct, indirect and total effect are shown in Table 1.

| Table 1. Direct Effect, Indirect Effect and Overall Effect between Exogenous and Endogenous Variables |
|--------------------------------------------------|---------------------------------|----------------|---|---|---|
|                                          | Norm    | Network | Trust    | Knowledge | Perception |
| **Indirect Effects (Group number 1 - Default model)** |          |          |          |            |            |
| Knowledge                                | .000    | .000    | .000    | .000       | .000       |
| Perception                               | .246    | .634    | .245    | .000       | .000       |
| Adoption                                  | .209    | .540    | .244    | .037       | .000       |
| **Direct Effects (Group number 1 - Default model)** |          |          |          |            |            |
| Knowledge                                | .194    | .500    | .193    | .000       | .000       |
| Perception                               | .937    | 2.465   | 2.185   | 1.269      | .000       |
| Adoption                                  | .000    | .000    | .000    | .901       | .029       |
| **Total Effects (Group number 1 - Default model)** |          |          |          |            |            |
| Knowledge                                | .194    | .500    | .193    | .000       | .000       |
| Perception                               | 1.182   | 3.099   | 2.429   | 1.269      | .000       |
| Adoption                                  | .209    | .540    | .244    | .938       | .029       |

Source: Primer data analysis (2019)

The relationship between norms, networks, and trust toward farmer’s decisions to adopt PTT technology cannot be explained directly. This relationship requires an intermediary variable of knowledge and farmer perceptions about PTT technology. Table 1 shows that there was no direct effect between norms, networks, and trust in adoption. However, there were indirect effects. In addition, Table 1 also shows that the effect of norms as social capital on adoption was 0.209. This shows that an increase of 1 norm unit would increase the adoption by 0.209 units. The effect of network as social capital on adoption was 0.540. This indicates that an increase in 1 network unit would increase the adoption by 0.540 units. The effect of total trust on adoption was 0.244. This shows that an increase in 1 network unit would increase the adoption by 0.244 units. However, social capital, adoption was also influenced by farmers' knowledge (0.938) and perception (0.029). Wahyuni (2003) stated that farmer groups play a role in implementing innovation for their member [12]. Moreover, social capital play important role in providing benefit to community not only economically and socially. Social capital will influence community whenever they work together and share...
resources. Collaboration and cooperation can facilitate people for getting things done for community. Without social capital, farmer and community could not work together to achieve their goal for better life. Social capital is the shared values, norms, trust, and social belonging among people in community.

4. Conclusions
The social capital in the form of norms, trust, and networks had a direct and significant effect on farmers’ knowledge. Social capital and farmer knowledge had a direct and significant positive effect on farmers’ perceptions. Moreover, farmers’ knowledge and farmer’ perceptions had a direct and significant positive effect on the adoption of PTT innovations. Social capital of farmer groups had a positive indirect and significant effect on the adoption of PTT innovations. Based on the research results, it can be suggested 1). The implementation of government policies in the agricultural sector requires a large roadmap and requires an approach through farmer groups in transmitting knowledge in order to create a social atmosphere that supports the government program; 2). Farmer’ participation in their groups needs to be carried out not only through the management function but also through a collective action based on social capital; 3). Maximizing the role of extension workers as supervisors of farmer groups accompanied by improving infrastructure and improving capacity if farmers’ group; 4). Further research is needed, especially on efforts to improve group dynamics and a sense of belonging to farmer groups by its members.

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