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The innovative characteristics and obstruction of technology adoption for management of integrated plants (PTT) of corn in Gowa Regency Indonesia

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Abstract. The research aimed to analyze the effects of the farmer's characteristic, innovation characteristics, and the obstruction faced in the technology adoption for the management of integrated plants corn in Gowa Regency. The method used was explanative in character. Respondents comprised 80 corn farmers chosen randomly. Data were collected using the interviews method which were then quantified using likers scale. The data was analyzed by logistic binary regression. The research results indicated that the farmer's characteristics which consisted of the age, education, experience, and the land area had no significant effect on the technology adoption of maize integrated crops management (PTT). The obstruction of the adoption, which consisted of the limited capital, availability of inputs, and intensity of counseling had a significant effect on the adoption of maize integrated crops management. While the farmer's knowledge had no significant effect on the adoption of maize integrated crops management. The variable of the limited capital had a positive coefficient, the more available the farmer's capital the higher was the chance of farmers to adopt technology integrated crops management. The higher of the extension intensity, the higher of farmer's chance to adopt the technology of the maize integrated corps management.

1. Introduction

Integrated crop management technology (PTT) in corn commodities has increased corn productivity in the range of 4 to 5 tons per hectare [1]. Compared to the productivity that combines high-quality varieties of free-sized corn or hybrids and innovative application of innovative technologies through the PTT approach, productivity is achieved between 7 to 9 tons per hectare [2]. Productivity gaps at farmers' level with the results of the study indicate low adoption of PTT at the farm level. Referring to the theory of Innovation-Difusion; the speed of adoption of an innovation is influenced by innovation characteristics consisting of relative advantage, compatibility, complexity, trialability, and observability. Research conducted in 2015 by the Agency for Agricultural Research and Development, Ministry of Agriculture of the Republic of Indonesia, showed that efforts to increase corn production



still encountered problems namely the adoption of PTT components have not been intact and constraints of capital limitations and availability of production facilities.

The above facts are also shown by Dahlan's research results [3] where farmers in Bantaeng District 73.5% only adopt 1 to 3 basic components, while farmers who adopt 4 to 5 basic components as much as 26.5% of total respondents 83 people. These results indicate that the adoption of farmers on the component of PTT maize technology is still low. This fact reinforced the discovery of [4], which states that of all the basic components of PTT corn technology, balanced fertilizer technology components and the lowest planting distance adopted by farmers, respectively 21.7% and 37.3% of the total respondents.

The low adoption of PTT components has been identified by Ginting [5] where technological obstacles adopted by farmers are: (a) technical factors i.e. technological effect on yield improvement, income, and farming profits not yet believed by farmers. Limited information and infrastructure networks, causing outside information and knowledge to be unacceptable to farmers; (b) factors, namely the lack of knowledge of agricultural technology dissemination systems (extension, demonstration plots and performances technology) and a low level of education and knowledge of farmers making it difficult to translate the benefits of new technologies; (c) social factors where generally small farmers are afraid of low selling price risk, inefficient marketing system, and high transportation cost [6].

According to Rogers [7], from the communication side, the low adoption of PTT is caused by the inhibiting factor of technology adoption that is the inhibiting factor of communication in the form of Source, Message, Channel and Recipient / Client. Adoption will not take place if there are obstacles to the communication process between extension workers and farmers [8]. Based on the above description, it is very interesting to analyze the effect of innovation characteristics and barriers to adoption of maize PTT technology in Gowa regency, South Sulawesi, Indonesia.

2. Research Design

The design of this study is explanatory, i.e. research that examines the relationship between variables and test the hypotheses that have been formulated and explain the influence between independent variables (characteristics of innovation and adoption barriers) to the dependent variable (adoption of basic components of PTT corn technology) using logistic binary regression analysis.

The study was conducted in three sub-districts with two typologies, namely lowland (Bontomarannu and Bontonmpo sub-districts) and highlands (Parangloe sub-district) Gowa District, South Sulawesi, Indonesia. The research population is farmers who are members of farmer group and have conducted PTT corn activity with certain quality and characteristic according to criteria to be achieved in this research [9]. The samples were drawn using a simple random sampling method preceded by a proportional sampling method using the Slovin formula, resulting in 80 samples.

Data collection techniques using questionnaires, formulated with questions containing all indicators of the dimension of research variables. Prior to the first data collection conducted testing instrument (questionnaire) to test the validity and reliability of the instrument. Next is a structured interview and record the answers given by respondents.

Data processing is done through stages; editing of the data that has been collected by sorting to maintain the validity, reliability and accuracy; then coding and scoring in accordance with the classification of data that has been determined using Likert scale; followed by data entry using SPSS 21.00 program. Meanwhile, to determine the effect of innovation characteristics and constraints faced in adopting the basic components of integrated crop management technology (PTT) maize used logistic regression analysis Binary.

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3. Results and Discussion

3.1. Test Validity and Reliability

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Validity test is done by correlating the score of each item with the total score of each variable.

Decision-making is based on value r_{count} (Corrected Item-Total Correlation) $> r_{\text{table}}$ of 0.2199, for $df = 80 - 2 = 78$; $\alpha = 0.05$ then the question item is valid and vice versa. Data processing shows all research questions declared valid, because the value of r_{count} (Corrected Item-Total Correlation) $> r_{\text{table}}$ of 0.2199 (table 1).

Table 1. Validity Test Results of Innovation Characteristics and Adoption Barriers

Concept	Dimension	Value of r_{count}	Value of r_{table}	Explanation
Innovation Characteristics	Relative Advantage	0.440 – 0.742	0.29	Valid
	Compatibility	0.539 – 0.699		
	Complexity	0.433 – 0.691		
	Trial	0.357 – 0.448		
	Observability	0.330 – 0.515		
Adoption Barriers	Limited of Capital	0.486 – 0.595	0.29	valid
	Limited of production facilities	0.578 – 0.640		
	Knowledge	0.651 – 0.671		
	Intensity of Counseling	0.468 – 0.588		

Reliability test was carried out using Alpha Cronbach method. Alpha Cronbach value $> r_{\text{table}}$ of 0.2199, for $df = 80 - 2 = 78$; $\alpha = 0.05$ then the question item is reliable and vice versa. The test results show that each questionnaire question in this study is stated reliable, because the value of Alpha Cronbach $> r_{\text{table}}$ of 0.2199 (table 2).

Table 2. Reliability Test Results of Innovation Characteristics and Adoption Barriers

Concept	Alpha Cronbach	Value of r_{table}	Explanation
Innovation Characteristics	0.741	0.2199	Reliable
Adoption Barriers	0.644	0.2199	Reliable

3.2. Logistic Binary Regression Test

The results show; variables of innovation characteristics with relative profit sub-variables, compatibility, complexity, trialability and observability have a significance value of 0.564 each; 0.201; 0.263; 0.214 and 0.161 is greater than $\alpha = 0.05$. This shows that the variable characteristic of innovation does not significantly influence the adoption of integrated corn plantation integrated management (PTT) component of maize.

While the variable of adoption constraint with sub variable of capital limit, and availability of production and intensity of extension have significance value equal to 0.000 and 0.006 and 0.012 $< \alpha = 0.05$. This indicates that the adoption barrier variable consisting of capital limitations, availability of production facilities and intensity of extension significantly influence the farmer's decision to adopt the basic components of PTT corn completely, while the knowledge of farmers has a significance value of 0.663 $> \alpha = 0.05$ which has a meaning that the knowledge of farmers does not have a significant influence on the farmers' decision to adopt the basic components of PTT maize completely.

The variable of capital limitation has positive coefficient value, which means that the more available the farmer's capital, the higher the chance of the farmer to adopt the basic component of integrated corn plant management technology with probability equal to 423,525 times compared with the farmer with limited capital. While variable of production facility have positive coefficient value. The more available and timely means of production, means the higher the chance of farmers adopting the complete PTT maize technology with a probability value of 24,460 times. Likewise, extension intensity variable has a positive coefficient value. The more intensively held counseling the higher the

chance of farmers to adopt the basic components of PTT maize technology complete with probability value of 25,183 times.

This study shows that innovation characteristics consisting of relative advantage, compatibility, complexity, trialability, and observability have no significant effect on the adoption of basic components of PTT maize completely. Nevertheless, the farmers of the respondents have a positive perception on the characteristics of innovation, because the application of basic components of PTT has been in accordance with the needs of farmers who want increased production of corn crops and income increase. The basic components of PTT are very easy to understand by farmers, but for the application of the plant population fulfillment of 60,000-75,000 plants / ha through planting spacing of 70 x 40 cm for 2 seeds of plants / holes and 70 x 20 cm for 1 seed of plant / difficult to apply in Parangloe and Bontolempangan sub-districts, due to the sloping and rocky soil topography which makes it difficult to adjust the spacing according to recommendation. Farmers' decision to adopt the basic components of maize PTT is related to their owned capital, availability of seed and fertilizer and intensity of counseling. In addition, adoption barriers consisting of capital limitations, availability of inputs and intensity of extension significantly influence the adoption of basic components of PTT corn completely. While the knowledge of farmers has no significant influence on the adoption of basic components of PTT corn completely. This shows that in the corn farming, farmers are very concerned about the capital, the availability of production facilities in the form of seeds and fertilizers and intensively counseling held.

The use of high quality and superior varieties of corn seeds is the key to success in the application of maize PTT. Of course this is accompanied by plant spacing arrangements to meet the plant population of 66,000-75,000 plants / ha and the application of balanced fertilizer as recommended. The acquisition of high yielding corn seeds and fertilizers is obtained by farmers with high prices, which is not suitable with the limited capital of farmers. While at harvest time, the price received does not match the capital they spend. The higher the price of seeds and fertilizers, the more difficult the farmers to resume the planting of superior corn seed varieties and difficult to use fertilizer as recommended without any subsidy from the government.

According to Schiffman and Kanuk [9] and Joni *et al.* [10], price is one of several factors that influence consumers buying seed decisions. Likewise, with Sumiati in [11], which states that one of the factors affecting the farmer's decision to use seed is the price of seed. Purwantini and Sejati [12] argued that the availability of production facilities is not a constraint, precisely the problem of limited capital becomes the dominant factor. Capital is very important role in technology adoption especially related to the cost required to use new technology [13]. Research by Irawan *et al.* [14], shows that farmers do not plant superior seeds because they lack the capital to buy superior seeds, and other production costs such as fertilizer in Malaysia. While the case study in Sumatra also shows that the lack of capital is a major constraining factor for farmers to grow superior rubber seeds [8].

The availability of production facilities is one of the obstacles in adopting complete maize PTT. Seed production facilities and fertilizers are always available on time and in exact quantities, but can only be obtained by ordering advance to the chairman of gapoktan in Parangloe, Bontonompo and Bontolempangan areas. However, in Bontomarannu area, this production suggestion can be obtained more easily through retailers around their area.

Manure (organic fertilizer) that is needed in large numbers in the highlands is difficult because of the limited availability of transportation facilities to distribute it. In addition, some farmers think the condition of land in the highlands is still quite fertile and does not require manure. Irawan *et al.* [14] showed that farmer inputs needed by farmers in general are always available in the market, especially for the main types of inputs such as urea and pesticides. Meanwhile, according Supriadi and Chamala [8], the availability of fertilizers and pesticides is sufficient, but with a relatively high price. This causes farmers who have limited capital choose not to use fertilizer in accordance with the recommended standard.

The intensity of counseling at the research sites is routinely conducted, both at the agricultural extension office (BPP), at the home of one farmer and at the farm site. Field guides (extension

workers) play an active role in disseminating information and solving problems related to farmer cultivation. This indicates that stepping up of agricultural extension (based on social learning process), which becomes a push factor towards independency group in finding new innovation [15]. In addition, stepping up agricultural and non-agricultural extension services, could also significantly reduce poverty, though indirectly [16]. They establish intimacy with farmers, so even though outside the schedule of meetings, farmers can still communicate intensively with extension workers. However, access to information on agricultural technology through mass media (television, newspapers, agricultural and radio magazines) has not been effectively implemented by farmers. Most farmers think that the information is more easily obtained through extension workers.

3. Conclusion

The characteristics of innovation has no significant effect on the adoption of PTT corn technology. Adoption barriers consisting of limited capital, availability of means of production, and intensity of counseling have significant influence with positive coefficient value on adoption of PTT maize technology, while farmers' knowledge has no significant effect. Strengthening of farming capital through the provision of low-interest credit assistance needs to be provided by the government. In addition, agricultural insurance for farmers will minimize losses to the failure of production and basic pricing for Besides, the guarantee of availability of production facilities and extension are regularly important to be maintained.

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