Relationship Between Farmers Knowledge Level and Technologies Implementation in Tidal Swamp Land in South Sumatra

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Abstract: Mechanization and recent technology use in tidal swamp land is encouraged in order to increase farming efficiency and effectiveness. However, a lot of farmers still have less knowledge of new technologies thus field meeting is held as one of ways to accelerate information spread as well as to obtain feedback from farmers shortly. The study aims to determine the relationship between farmers’ level of knowledge and technology implementation by farmers; and farmers’ response on recent technologies introduced. It used purposive sampling method with 100 participants of field meeting as respondents. Data was retrieved using questionnaires and analyzed descriptively to determine the level of knowledge and technology implementation by farmers while non-parametric Coefficient of Contingency test is used to know its relationship. The study revealed that there is no significant relationship between farmers’ level of knowledge and technology implementation. However, farmers responded well and are interested in implementing recent technologies in the future and hence technology dissemination through field meetings and other dissemination channels should carried out continuously.

Keywords: Applications, farmers, knowledge, mechanization

1. Introduction

Agricultural production and productivity improvement particularly food crops continues to be triggered by any efforts including land optimization such as suboptimal lands. Swamp land is classified as suboptimal lands which remain to be strived in Indonesia for its potential. It is divided into swamp land and tidal swamp land that reaches 273,919 hectares in South Sumatra itself, the larger in Sumatra Island [1]. However, its productivity is not followed by its large size due to diverse constrains faced particularly its physical, checimal, and biological characteristics [2]. It deals with many problems such as poor water management, low soil fertility, different level of land typology, pests and disease, and many more which result in high yield gaps [3]. According to reference [4] post harvest shrinkage reach 10 to 37 percent while yield loss reach 15 to 16 percent.

Generally, 70 percent of farm labors source comes from family while the rest were hired other farmers as farm labors [5]. With decreasing numbers of farm labors nowadays, this becomes another obstacles in rice production including tidal swamp land aside from physical, checimal, and biological characteristics of tidal swamp land itself. Tidal swamp land requires extra efforts to manage and mechanization in farming is one of solution to overcome these. Agricultural machinery use is one of many ways to increase productivity and farming efficiency, as well as to
increase quality and value added of products, and empower farmers [6]. Furthermore, it is expected to increase labor efficiency, farmers’ welfare, increase yield and its quality, enabling farm business growth from subsistence farming to commercial farming, as well as to accelerate economic transition from agricultural based economic to industrial based economic [7]. A well assessed and planned agricultural mechanization application has proven to increase both quantity and quality as well as continuity of agricultural production which led to increase food security and farmers’ welfare in many countries [8].

The happening of 4.0 industry era requires agricultural sector to implement precise and controlled IT-based technology. The Indonesian Ministry of Agriculture (MoA) has conducted considerable efforts in distributing tools and machineries (alsintan) grants through various projects and programs that significantly increase continually. The average growth rate of alsintan grants (tractors, water pumps, rice transplanters) reaches 11 to 124% during the period of 2010-2014 is increase to 63-1,190 percent in the period of 2104-2016 [9].

Mechanization in agriculture is not a new trend in Indonesia. It has been intensively introduced since 1980s, but still no significant development found [10]. The main reason of this failure was less appropriateness of tools and machines to farmers’ needs as well as low acceptance of technologies due to farmers’ less readiness both technical, socio-economic and cultural aspect [11].

Therefore, the increase of alsintan grants as well as new technologies introduction should be followed with proper assistance since many farmers were still unfamiliar with new technologies introduced. There should be more efforts to accelerate distribution of information through any dissemination channels. One of those is through field meeting which may gain feedback from farmers as well. This study aims to determine the relationship between farmers’ level of knowledge and technology implementation by farmers; and farmers’ responses on recent technologies introduced with field meeting participating farmers as the respondents.

The effectiveness of alsintan implementation depends on type of activities and local needs, as well as in accordance with environmental strategy [12]. Furthermore, new technology introduction efforts for farmers, both technologies developed within the area or adapted from other area, should be considered and align with local condition [13].

This study examines recent technologies introduced in tidal swamp land which has been claimed as specific location technologies or has proven applicable in this type of land. Those technologies are four wheel drive tractors, Laser Land Leveling (LLL), modified direct seed planters pulled by tractor (AMATOR), Trap Barrier System (TBS), and application of Bio silica. Laser Land Leveling is a recent land preparation technology in Indonesia; in fact it was introduced and demonstrated firstly in tidal swamp land in South Sumatra [14].

2. Methods

The study was conducted in Telang Jaya Village, Muara Telang Sub District, Banyuasin District, South Sumatra. It used purposive sampling methods with 100 farmers participating in field meeting as respondents. Questionnaire was used to gather the data since it has several advantages such as may capture individual information or responses to particular problems on a large sample in a short time [15]. The field meeting was part of a project called “Dissemination of Mechanization based Rice Farming Technology to Decrease Rice Yield Gaps in Tidal Swamp Land in South Sumatra” which the main activity was to disseminated recent technologies to farmers either known or newly known which not widely implemented. Nonparametric statistical analysis using Coefficient Contingency test by SPSS 16.0 was used to determine the relationship between farmers’ level of knowledge and technologies implemented by farmers [16] while eight indicators was used to measure farmers’ responses to technologies introduced in field meeting [17;18]. Those indicator measurements are benefits of technology, technology ease, technology advantages, technology compatibility to the needs, interested in using the technology, desire to use the technology, easiness to see technology result, and planning to implement technologies. A score was given to each item for score criteria as follows: score 3 indicates high, score 2 indicates medium, and score 1 indicates low. The respondents’ answers then categorized into interval class using formula from [19] in [20] as follows.

\[ RS = HSV - LSV \]
\[ IL = RS / NI \]

where:
\[ RV = \text{Range Value} \]
\[ HSV = \text{Highest Score Value} \]
\[ LSV = \text{Lowest Score Value} \]
\[ IL = \text{Interval Length} \]
\[ NI = \text{Number of Intervals} \]

Thus:
Class Interval Value (total score)
Farmers’ level of knowledge was measured from technologies recognition by farmers as well as knowledge of technologies functions. Those technologies are four wheel drive tractors (TR4), Laser Land Leveling (LLL), modified direct seed planters pulled by tractor (AMATOR), Trap Barrier System (TBS), and application of Bio silica.

3. Result And Discussion
3.1 Farmers’ Level of Knowledge and Technology Implementation

Technologies introduced in the field meeting were tools and machineries either known or newly known by farmers. Thus, farmers’ level of recognition and knowledge of technologies, and technologies implementation by farmers were gathered in which are presented in Table 2.

Table 2. Farmers’ Level of Knowledge

| Item | Technology Recognition | Knowledge of Technologies Functions | Technology Implementation |
|------|------------------------|-------------------------------------|---------------------------|
|      | True | False | Neutral | Num | % | Num | % | Num | % | Num | % |
| 1. TR 4 | 100 | 7 | 73 | 89 | 90.0 | 4 | 40 | 97 | 97.0 |
| 2. LLL | 90 | 95 | 90.0 | 1 | 100 | 4 | 40 | 12 | 12.0 |
| 3. AMATOR | 90 | 74 | 74.0 | 21 | 21.0 | 5 | 50 | 10 | 10.0 |
| 4. TBS | 90 | 94 | 94.0 | 1 | 100 | 5 | 50 | 27 | 27.0 |
| 5. Bio silica | 84 | 86 | 86.0 | 5 | 50 | 9 | 90 | 10 | 10.0 |

All of respondents (100.0%) has known TR4 and 97.0% has been using it. Deeper interview revealed that farmers had known TR4 since 2013 and has commonly used it since 2016. Merely 3.0 percent of respondents had chosen hand tractor (TR2) instead of TR4 due to smaller land ownership therefore it is more practical to use smaller machine like TR2. In terms of TR4 function, only 7 respondents (7.0%) knew the complete function of TR4 which are plowing, tilling, planting, harvesting, transporting, and agricultural product processing; while the remaining 89 respondents (89.0%) knew TR4 function as plowing and tilling only. This limited knowledge resulted limited use of TR4 by farmers. However, farmers’ less of knowledge is not merely caused by farmers themselves but also the accessibility and availability of the TR4 units in the village. The majorities of farmers do not have the TR4 units themselves and rented it from Agricultural Equipment Service Business (UPJA) or private company (owned by individual farmers) anytime they need it. However, TR4 numbers are also limited in the village. Farmers should wait their turns and hence TR4 function is still limited to plowing and tilling only, which consider as the main functions, and other functions were not widely applied.

Another technology known by farmers since 2013 is Trap Barrier System (TBS). There are 90.0 percent respondents has known TBS and 94.0
percent of them know that TBS aim is to control rodent using plastic fence. Moreover, 27 respondents have been implementing this technology.

Other new technologies known by farmers recently (in 2018) are Laser Land Leveling (LLL), modified direct seed planters pulled by tractor (AMATOR), and application of Bio silica. As many as 90.0 percent respondents had known these technologies especially through demonstration plot of a project by South Sumatra AIAT named “Dissemination of Mechanization-Based Rice Production Technology to Reduce Yield Gaps in Tidal Low Land in South Sumatra”. In terms of technology function, it is known that almost all farmers know that LLL is aim to do land leveling using laser guide (95.0%); Bio silica is a plant-based fertilizer (86.0%); and AMATOR is a direct seed planter pulled by tractor (74.0%). In terms of technology implementation, 10.0 percent of respondents have been using or at least tried these technologies.

The Coefficient Contingency test was applied in order to know the relationship of farmers’ knowledge of technologies and its implementation. The hypothesis are $H_1 =$ there is a relationship between farmers knowledge and technology application; $H_0 =$ there is no relationship between farmers knowledge and technology application. The test result is shown in Table 3 below.

| Technology  | C     | $p$-value | Sig |
|-------------|-------|-----------|-----|
| TR 4        | 0.048 | 0.629     | ns  |
| LLL         | 0.084 | 0.397     | ns  |
| AMATOR      | 0.121 | 0.224     | ns  |
| TBS         | 0.036 | 0.719     | ns  |
| Bio silica  | 0.133 | 0.179     | ns  |

$P$-value for each technology (TR4 = 0.629; LLL = 0.397; AMATOR = 0.224; TBS = 0.719; and Bio silica = 0.179) are greater than $\alpha = 0.05$ means accept the $H_0$ thus there is no significant relationship between farmers level of knowledge of technology and technology application by farmers.

3.2 Farmers Response to Technology

Farmers’ response to technologies is important to gather in order to know farmers acceptance and to see the opportunity of technology development in the future. There are eight indicators to measure farmers responses to technology, which are: 1) benefits of technology; 2) technology ease; 3) technology advantages; 4) technology compatibility to the needs; 5) interest in using the technology; 6) desire to use the technology; 7) easiness to see technology result; and 8) planning to implement technology (Table 4).

| Indicator | TR 4 Score | LLL Score | AMATOR Score | TBS Score | Bio silica Score |
|-----------|------------|-----------|--------------|-----------|-----------------|
| Indicator 1 | 2.69 High | 2.57 High | 2.54 High | 2.51 High | 2.54 High |
| Indicator 2 | 2.69 High | 2.56 High | 2.53 High | 2.50 High | 2.53 High |
| Indicator 3 | 2.64 High | 2.52 High | 2.49 High | 2.48 High | 2.44 High |
| Indicator 4 | 2.65 High | 2.52 High | 2.52 High | 2.50 High | 2.47 High |
| Indicator 5 | 2.65 High | 2.51 High | 2.57 High | 2.57 High | 2.56 High |
| Indicator 6 | 2.81 High | 2.74 High | 2.70 High | 2.68 High | 2.69 High |
| Indicator 7 | 2.65 High | 2.44 High | 2.32 High | 2.55 High | 2.50 High |
| Indicator 8 | 2.95 High | 2.76 High | 2.74 High | 2.72 High | 2.76 High |
| Total      | 21.73     | 20.62     | 20.51        | 20.51     | 20.49           |

The data shows that respondents gave higher score for all indicators asked means they perceive technology were useful or give benefit to them, it is easy to apply, give economic advantages if used, and adequate with farmers’ needs. The TR4 has the highest score among all because TR4 has widely used and farmers has known and used it as well as receive its benefits.

High score is also shown in terms of interested in technology and its implementation plan means farmers are very interested to technology. Furthermore, respondents appreciated the result of technology using or in other word, they can see the differences between before and after technology implementation such as rat can easily be controlled by using TBS. Moreover, respondents stated that they were highly willing to
apply the technology which also shown from the highest indicator value obtained among all indicators (13.93). Although the Coefficient Contingency test shows that there is no relationship between farmers’ knowledge and technology, implementation farmers were very interested to apply the technology. The government also plays role in promoting and encouraging agricultural mechanization to farmers. Even though farmers have not yet understood the function of each technology correctly but they have high level of awareness proven from higher level of interest. Farmers’ level of knowledge will increase with frequent increase in implementing or applying the technologies.

There are three levels of respondents’ ways to implement technology as follows. a) High, in which farmer plans to try the technology by himself, with farmers group, and shares it to other farmers; b) medium, in which farmer plan to try the technology by himself and with farmers group; and c) low, in which respondents plan to try the technology by himself only.

| Ways     | Number of Respondent | %   |
|----------|----------------------|-----|
| High     | 62                   | 62.0|
| Medium   | 25                   | 25.0|
| Low      | 13                   | 13.0|

There are 13 respondents whom plan to try or implement technology individually or by himself. 25 respondents would also try it with their farmer group, and 62 respondents would like to share those technologies to other farmers. This result revealed that farmers have high motivation to try and implement new technology together with their farmer group and even willing to share it to other farmers. This attitude is expected since it can trigger dissemination and spreading the new technology in farmers’ level.

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