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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

Abstrak (Indonesia): Mekanisasi pertanian dan teknologi baru terus digalakkan sebagai solusi efisiensi dan efektivitas usahatani di lahan suboptimal pasang surut. Namun masih banyak petani yang belum mengenal teknologi sehingga temu lapang merupakan salah satu cara untuk mempercepat penyaluran informasi ke petani serta untuk memperoleh umpan balik secara cepat. Tujuan penelitian adalah untuk mengetahui hubungan tingkat pengetahuan dan penerapan teknologi oleh petani serta respon petani terhadap teknologi yang relatif baru di petani. Penelitian menggunakan metode purposive sampling dengan 100 orang petani peserta temu lapang sebagai responden. Pengambilan data menggunakan kuesioner, dianalisis secara deskriptif dan non-parametrik Cooeficient Contingency untuk mengetahui tingkat pengetahuan dan penerapan teknologi oleh petani dan hubungan antara keduanya. Hasil penelitian menunjukkan bahwa tidak terdapat hubungan yang nyata antara tingkat pengetahuan dan penerapan teknologi oleh petani. Akan tetapi petani memiliki respon yang baik terhadap teknologi dan minat yang besar untuk menerapkan teknologi kedepan sehingga diseminasi teknologi harus terus dilakukan.
Kata Kunci: Aplikasi, petani, pengetahuan, mekanisasi

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 nowdays, 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 assesed 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 ascpect [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 consider 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	=	Range Value
HSV	=	Highest Score Value
LSV	=	Lowest Score Value
IL	=	Interval Length
NI	=	Number of Intervals

Thus:
Class Interval Value (total score)

RS = (8 indicator × 5 technology × 3) - (8 indicator × 5 technology × 1)
= 120 – 40
= 80
IL = 80/3
= 26.67

Class Interval Value (per indicator)
RS = (5 technology × 3) - (5 technology × 1)
= 15 – 5
= 10
IL = 10/3
= 3.33

Class Interval Value (per technology)
RS = (1 technology × 3) – (1 technology × 1)
= 3 – 1
= 2
IL = 2/3
=0.66

Table 1. Interval value and criteria of farmers' responses

No	Interval Class Value (total score)	Interval Class Value (per indicator)	Interval Class Value (per technology)	Criteria
1.	$40.00 < x \leq 66.67$	$5.00 < x \leq 8.33$	$1.00 < x \leq 1.66$	Low
2.	$66.68 < x \leq 93.35$	$8.34 < x \leq 11.67$	$1.67 < x \leq 2.33$	Medium
3.	$93.36 < x \leq 120.00$	$11.68 < x \leq 15.00$	$2.34 < x \leq 3.00$	High

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	%	Num	%
1. TR 4	100	100.0	7	7.0	89	89.0	4	4.0	97	97.0
2. LLL	90	90.0	95	95.0	1	1.0	4	4.0	12	12.0
3. AMATOR	90	90.0	74	74.0	21	21.0	5	5.0	10	10.0
4. TBS	90	90.0	94	94.0	1	1.0	5	5.0	27	27.0
5. Bio silica	84	84.0	86	86.0	5	5.0	9	9.0	10	10.0

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 (TR 4), Laser Land Leveling (LLL), modified direct seed planters pulled by tractor (AMATOR), Trap Barrier System (TBS), and application of Bio silica.

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.

Table 3. Relationship between farmers' knowledge and technology implementation

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 α = 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).

Table 4. Farmers' response to technology

	TR 4		LLL		AMATOR		TBS		Bio silica	
	Score	Criteria	Score	Criteria	Score	Criteria	Score	Criteria	Score	Criteria
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.

Table 5. Farmers' ways to implement technology

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.

4. Conclusions

The *Coefficient Contingency test* shows that there is no significant relationship between farmers' level of knowledge and technology implementation by farmers. However, farmers have favorable responses to the technologies disseminated and interested in the technologies. They are willing to implement it in the future thus other activity or project of mechanization and new technology dissemination should be continue.

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References

[1] Statistics Indonesia. 2017. South Sumatra in Figures 2017. Statistics Indonesia. South Sumatra Provinsi. Palembang.

[2] Suriadikarta, D.A. 2012. Technology for Sustainable Management of Tidal Swampy Areas: Case Study in former PLG in Central Kalimantan Povince. Journal of Land Resources Vol. 6 No. 1, July 2012.

[3] Djamhari, S. 2009. Increasing Rice Production in Swamp Land as an Alternative of Agricultural Land Development Beyond Java Indonesian. Journal of Science and Technology Vol 11 No 1: 64-69

[4] Purwanto. 2011. Our Postharvest Rice Loss is Still High. Accessed from http://io.ppijepang.org/ in December 8, 2019

[5] Komaruddin, D.R. Ahmad, E.E. Ananto, Astanto, and T. Alihamsyah. 2000. Evaluation of Technical and Socio-Economic Feasibility of Direct Seed Planter in Farmer Level. *In* Ismail et al. (*ed*). Triggering Agricultural Development in Tidal Swamp Land. Proceeding of Agricultural Research and Development in Tidak Swamp Land – ISDP Result Conference, Jambi, March 27-28 2000. p. 93-101

[6] Aldillah, R. 2016. Agricultural Mechanization and Its Implications for Food Production Acceleration in Indonesia. Agro Economic Research Forum Vol 34 No.2 Dexember 2016: 163-177

[7] Wijanto. 2002. *Farming Tools and Machineries*. Yogyakarta (ID): Gadjah Mada University Press

[8] Syuaib, M.F. 2003. Ergonomic Study on the Process of Mastering Tractor Operation. Doctoral Dissertation. The United Graduate Scholl of Agricultural Science. Tokyo

University of Agriculture and Technology. Japan

[9] Aldillah. A. 2016. Performance of Agricultural Mechanization Utilization and its Implication in Food Production Acceleration Efforts in Indonesia. *Agro Economic Research Forum*. Vol. 34 No. 2. December 2016: 163-177

[10] Akbar, A.R.M., S. Herodian, and S. Ali. 2007. The Stury of Anthropometry of Hand Tractors for Operators in Paddy Field. Journal of Technical Agriculture Vol 21 No. 2 June 2007

[11] Umar, S., and T. Alihamsyah. 2014. Agricultural Mechanization for Rice Production in Tidal Swamp Land. IAARD Press. Jakarta

[12] Alihamsyah T. 2007. *Agricultural Mechanization in Supporting Industrial Food Crop Agricultura System*. Paper in the Fifth Food Crop Symposium in Bogor; 28-29 August 2007; Bogor. Indonesia.

[13] Djamhari, S. 2009. Assessment of Agricultural Mechazation Application in Swamp Land of Putak Village Muaraenim. Indonesian Journal of Sains and Technology Vol. 11 No. 3, December 2009:157-161

[14] Raharjo. B.. Syahri. R.U. Somantri. P. Sasmita. *An Assessment on The Effects oif Laser-Assisted Land Leveling to Soil Properties and Rice Yield in South Sumatera*. Presented on Workshop on Agricultural Risk and Dryland Development for Poverty Alleviation. Bogor. 8-9 May 2018.

[15] Sukardi. 2012. Education Research Methodology. Jakarta: Bumi Aksara

[16] Siegel. S. 1997. *Statistic Non-parametrik for Social Science*. Gramedia Pustaka Utama. Jakarta

[17] Erythrina. A., Muharam. R. Indrasti. H. Andrianyta. M. Mardiharini. and U. T. Agustin. 2012. The Assessment Study of The Nature of Technology Innovation of Integrated Crop Management to Determine Specific Location Dissemination Pattern. *Final Report. Indonesian Center for Agricultural Technology Assessment and Development (ICATAD).*

[18] Mardiyanto, T.C., and T.R. Prastuti. Effectiveness of Garlic Environmental Friendly Production Training Using Lecture Method in Karanganyar District. Journal of Agraris. Vol. 2 No. 1 January 2016. DOI:10.18196/agr.2126.

[19] Hamdani. 2012. Assistance and Extension. Bandung: CV Pustaka Setia

[20] Silviana. N.. K. Sobri. & S. Afriyatna. 2015. Farmers Responses to Integrated Pest Management Field School (IPM-FS) of Tidal Low Land (Assessment Survey in Pulau Borang Village. Banyuasin I Sub District. Banyuasin District). *SOCIETA* IV-1 : 33-38. June 2015. ISSN 2301-4180.