



Adoption of Integrated Crop Management (ICM) Level On Rice Paddy Farming Agricultural Business

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**Adoption of Integrated Crop Management (ICM) Level On
Rice Paddy Farming Agricultural Business**

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8 **abstrak**

Poor level of knowledge and low level of technology adoption can reduce the production of a rice paddy in an agricultural business run by the farmer. Integrated Crop Management (ICM) is an innovation elaborated by the government to deal with these issues. Kepulauan Bangka Belitung Province through the Institute of Agricultural Assessment already implemented ICM to improve the production of crops. The study aims were to describe the Integrated Crop Management (ICM) and to analyze the factors that affected the ICM adoption in agricultural rice paddy business in Rias Village, Toboali District. This study was a survey study conducted in March until June 2019 involving 50 participants from farmer groups who implemented ICM, namely, Sinar Bone and Mekar Berkembang farmer group. Scoring method and multiple linear regression used to analyze the study result. There were three indicators used to describe the ICM level adoption: low, moderate, and high. Statistical analysis showed that the ICM components' adoption level was classified into a high category with a mean of 118.17 points or 78.78%. But on the other side, the component of integrated pest management (IPM) was still classified on the low category with a total of point of 80 or 53.33%. The tillage system component was obtained the highest score with a total of point of 140 or 93.33%. Factors affected the ICM adoption level were education level, agricultural business experience, agricultural extension and the wide of the agricultural area.

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INTRODUCTION

The implementation of ICM is an effort conveyed to increase the production of food commodities (rice paddy, corn, and soybean) by the agricultural field. Sumarno (2015) stated that ICM is an approach in crop cultivation conducted to improve production and efficiency through a correction and re-organization a location-specific technology component. The ICM implementation is emphasizing in farmer active participation in choosing and evaluating appropriate technology for their biophysical environment, social-cultural, and economic aspect. ICM was specifically implemented based on its location to improve agricultural commodity production.

Technology adoption is a psychological and change of behavior in terms of knowledge, attitude, and action/skill on the technology implementation (Roger and Shoemaker in Hanafi 1981). The decision to adopt an innovation started since they recognize the innovation until they decided to accept or refuse the innovation.

Kepulauan Bangka Belitung Province is an area that developing a rice paddy agricultural field in Indonesia. The wide of the rice paddy field area in *Kepulauan Bangka Belitung Province* was 25,058 ha and 27,435 ha, while the irrigation system only exists in the 4,234 ha rice paddy field area. Unfortunately, the rice paddy field productivity still classified in a low level, with a total production of 2.30 ton/ha (*Kepulauan Bangka Belitung Statistical Institute*, 2018), while the nation rice paddy field productivity was 5 ton/ha (Indonesia Ministry of Forestry, 2018). Poor level of knowledge and low level of technology adoption is a major factor that contributes to these issues.

As an effort to increase the rice paddy production in *Kepulauan Bangka Belitung Province*, the Institute of Agricultural Assessment was directed an ICM through a Field School-ICM. Ahmadi (Bangka Belitung 2011, in Fachrista, 2013) stated that the Field School-ICM accompaniment in Bangka Belitung already done in 2009. The Field School accompaniment was conducted in three regencies: *Bangka Selatan, Bangka*, and *Belitung*. In 2010, Bangka Belitung Institute of Agricultural Assessment was conducted the Field School-ICM on 60% Field School-ICM unit in five regencies: *Bangka Selatan, Bangka, Bangka Tengah, Belitung*, and *Belitung Timur*. The technology implementation was giving a significant impact on the productivity of the rice paddy field. Before the implementation of the technology, the rice production was 3.48 tons/ha while after the implementation of the technology, the rice production was able to reach 4,58 tons/ha or around 1.1 ton/ha.

Toboali district is an area with the largest rice paddy field in *Bangka Selatan Regency* with the total of wide of the area of 6,375 ha in comparison with *Airgegas District* with paddy rice field as wide as 4,071 ha, *Lepar Pongok District* 104 ha, *Payung District* 600 ha, *Simpang Rimba District* 2,350 ha, *Tukak Sadai District* 0 ha, *Pulau Besar District* 3,325 ha and *Kepulauan Pongok District* 25 ha (*Bangka Selatan Statistical Institute*, 2018).

Institute of Agricultural and Fishery Extention in Toboali District (2018) was stated that rice paddy field which uses irrigation system in Toboali District was only located in Rias Village which involving 43 farmer groups and each group already got an ICM accompaniment through a Field School-ICM which conducted by Bangka

Belitung Institute of Agricultural Assessment. There were two farmer groups from those farmer group which conducted the ICM. These data showed that ICM did not completely adopt by the farmers.

An effort done by using technology and accompaniment to farmers through a Field School-ICM is relatively limited. A study conducted by Fachrista (2013) showed that the ICM adoption could be affected by some factors: the education level, the wide of the farming area, the accessibility on the farming agricultural business, market, and technological sources. Kariyasa and Dewi (2013) also found that the ICM adoption was affected by age, level of education, productivity, the distance between the farmer's house to the technological sources and the assembly point. This result was contrary to the result of a study done by Sadikin (2011) which stated that social-economic factors did not affect the ICM implementation on the farmers. Based on those explanations, the lack of information related to the ICM on the farmers could affect the implementation of ICM in Rias Village, Toboali District. A further study to know the factors that affected the level of technology adoption on the Integrated Crop Management (ICM) on rice paddy farming (*Oryza sativa* L.) in Rias Village, Toboali District needs to be conducted. The aims of this study were: (1) To describe the level of technology adoption on the Integrated Crop Management (ICM) on the rice paddy farming agricultural business (*Oryza sativa* L.) in Rias Village, Toboali District and (2) To analyze factors that affected the level of technology adoption on the Integrated Crop Management (ICM) on the rice paddy farming agricultural business (*Oryza sativa* L.) in Rias Village, Toboali District.

RESEARCH METHODS

This study conducted in Rias Village, Toboali District, Bangka Selatan Regency in March-June 2019. The purposive sampling technique employed to determine the study location. Rias Village was selected because of two reasons: has the largest agricultural area and has the highest rice paddy productivity in Bangka Selatan.

This was a survey method study. The inclusion criteria used were farmer groups who accepted Field School ICM accompaniment in 2012 and already implemented the ICM. Sinar Bone and Mekar Berkembang farmer group which consisted of 93 farmers were chosen as the study population based on the inclusion criteria.

Mahmud (2011) stated that the minimum number of a participant in a study using statistical data analysis was 30. Parallel with this statement, Sugiyono (2012) stated that if a study using multivariate analysis (correlation or multiple regression), the number of participants at least must be ten times from the number of variable used in the study. There were 5 variables involved in this study, therefore there were 50 participants required to participate in this study.

The participants chosen to participate in the study were taken from half of the population (50 participants) and able to represent the population used. To represent the two farmer groups: Sinar Bone and Mekar Berkembang, the 25 participants were chosen from each farmer group.

According to the study's aims, the analysis and data processing method are shown in Table 1.

Table 1. Analysis and Data Processing

No.	Aims	Data Type	Data Processing Method
1	Describing the level of technology adoption on the Integrated Crop Management (ICM) on the rice paddy farming agricultural bussiness (<i>Oryza sativa L.</i>) in Rias Village, Toboali District.	Primary	Scoring Method
2	Analysing factors that affected the level of technology adoption on the Integrated Crop Management (ICM) on the rice paddy farming agricultural bussiness (<i>Oryza sativa L.</i>) in Rias Village, Toboali District.	Primary	Multiple Linear Regression

Source : Primary Data, 2019

The scoring method was used to measure the level of ICM adoption. The impact point which consisted of six basic components of ICM and six optional components of ICM was used to determine the score of the ICM adoption.

The level of ICM adoption classified into three types: low, moderate, and high. The classification is done using the Formula of Sturges to determine the number of class intervals in a data classification (Supranto 2008). The formula of Sturges used was as follow:

$$C = \frac{Xn - Xi}{K}$$

Where:

- C : Class Interval
 Xi : Minimum Score
 Xn : Maximum Score
 K : The number of class

Table 2 shows the the method used to determine the level of ICM adoption score on rice paddy farmer in *Rias Village, Toboali District* using adoption level interval class on its each category.

The interval for each category based on the Table 2 is as follows:

1. Adoption level of ICM by the farmer:
 - a. Low : 12 – 20
 - b. Moderate : 21 – 28
 - c. High : 29 – 36
2. The level on the basic and the optional CM adoption:
 - a. Low : 6 – 10
 - b. Moderate : 11 – 14
 - c. High : 15 – 18
3. The adoption level of ICM on each component:
 - a. Low : 50 – 83
 - b. Moderate : 83 – 116
 - c. High : 117 – 150

The adoption level of ICM on each component was obtained from the total point from the questionnaire used in this study. The lowest point was 50 and the highest point was 150 with three number of classes.

Table 2. ICM Adoption Evaluation Category Component

No	Variable Indicator (s)	Minimum Score	Maximum Score
1.	Basic Technology Component:		
	- Superior varieties	1	3
	- Quality seed	1	3
	- The use of organic material	1	3
	- Crop population	1	3
	- Fertilization	1	3
	- Integrated Pest Management (IPM)	1	3
	Total	6	18
2.	Optional Technology Component:		
	- Tillage system	1	3
	- The use of young seed	1	3
	- Row planting system	1	3
	- Effective irrigation	1	3
	- Weeding technique	1	3
	- Harvest period and post-harvest period	1	3
	Total	6	18
	Total	12	36

Source : Primary Data, 2019.

The score for the ICM adoption level was obtained from the total of point from the chosen participants. The interval class range was decided using the lowest point (50) and the highest point (150) with the total of the number of the third class.

The percentage of the ICM adoption level was determined as using some steps stated by Ridwan (2004) as follows:

$$DP = \frac{n}{N} \times 100\%$$

Where:

DP : Descriptive Percentage

n : Score obtained

N : Maximal score in each component

The multiple linear regression was used to know the correlation between ICM adoption level on rice paddy agricultural bussiness (*Oryza sativa L.*) and some factors that may effected this adoption level in Rias Village Toboali District. The formula for the multiple linear regression is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon$$

Where:

Y = farmer level of adoption

X₁ = age (year)

X₂ = agricultural bussiness experience (year)

X₃ = the level of education (year)

X₄ = agricultural extentions (the frequency of extention meeting happened)

X₅ = the size of farming area (Ha)

β₀ = constanta

ε = error

RESULT AND DISCUSSION

ICM Adoption Level

Based on the study result, the mean of the ICM adoption was categorized at a high level with a total of a mean of 118.17 or 78.7%. The percentage of the level of adoption on each component means is shown in Table 3.

Table 3. ICM Adoption Level for Each ICM Component in Rias Village 2019

No	ICM Component	The Amount of Point	Percentage (%)	Keterangan
1	New superior varieties (NSV)	136	90.67	High
2	Quality seed	131	87.33	High
3	The used of organic material	116	77.33	Moderate
4	Crop population	125	83.3	High
5	Fertilization	116	77.33	Moderate
6	Integrated pest management (IPM)	80	53.33	Low
7	Tillage system	140	93.33	High
8	The used of young seed	117	78	High
9	Row planting system	130	86.67	High
10	Effective irrigation	100	66.67	Moderate
11	Efficient weeding	100	66.67	Moderate
12	Harvest Period and Post-Harvest Period	127	84.67	High
The Total of Mean		118.17	78.78	High

Source : Primary Data, 2019

Table 3 shows that generally, rice paddy farmers in Rias Village are having a good level of knowledge about the importance of ICM adoption in improving their outcome, although not all ICM components already implemented successfully by the farmer. The basic technology component was still categorized on the low and moderate range: the use of organic material (low), integrated pest management (low), and fertilization (moderate). While on the optional component, the effective irrigation and effective weeding were still on a moderate category. This result could be indicated that ICM was not completely adopted in Rias Village.

The level of ICM adoption in Rias Village was affected by the activity of Field School-ICM and agricultural extentions. These methods are still considered effective and efficient in improving the level of technology adoption in the agricultural field.

On the other side, the result showed that the ICM adoption by the farmer in Rias Village was classified in the stable category between the moderate and high categories with the number of the farmer of 25 farmers or 50%. This result could happen due to the level difference of the ICM adopted by the farmer.

The Level of ICM Adoption on the Basic Component

Based on the result, the majority of the participant (60%) were on the high category in adopting the basic component of ICM and 40% of the participants were on a moderate category in adopting the basic component of ICM.

The highest percentage of components adopted by the farmer was the new superior varieties (NSV) as much as 136 points or 90.67%. The varieties used by the farmer were Mekonga, Ciharang, and Inpari as recommended on ICM. The

component of the use of material organic and fertilization was still classified on the moderate category with a total of point of 116 or 77.33 %. The integrated pest management (IPM) was categorized on the low range with the total points of 80 or 53.33 %. The farmer in Rias Village was still using chemical pesticides in their agricultural activities.

The mean of the basic ICM component adoption could be classified on the high category with a value of 117.33 or 78.22%. This result indicated that although the participant couldn't completely adopt the ICM, the participants already understand the importance of basic ICM component adoption on their agricultural activities.

The Level of ICM Adoption on the Optional Component

Based on the result, 56% (28 participants) were in a moderate category and 44% (22 participants) were on a high category in adopting ICM optional component.

The highest optional ICM component adopted by the farmer was the tillage system with a total of point of 140 or 93.33%. While the effective irrigation and efficient weeding still classified on the moderate category with a total point of 100 or 66.67 %.

The mean of the basic ICM component adoption could be classified on the high category with a value of 119 or 79.33%. This result indicated that although the participant couldn't completely adopt the ICM, the participants already understand the importance of optional ICM component adoption on their agricultural activities.

Multiple Linear Regression

Based on the Tabel 4, the regression model obtained was $Y = 0.660 + 0.000 X1 + 0.005 X2 + 0.001 X3 + 0.038 X4 + 0.017 X5$. Adjusted R Square Test was 0,697 or 69.7 which means that all the independent variables (age, education level, the experience of agricultural business, agricultural extention, and the size of the agricultural area) can explain the dependent variable with the participation rate of 69.7 %, while another 30,3 % was affected by other factors outside the model. Table 4 also showed that the significant value on the F test was $0.000 < 0.05$. The result of this F test showed that age, education level, the experience of agricultural business, agricultural extentions, and the size of the agricultural area simultaneously affected that level of ICM adoption. While the t partial test showed that some variables were having a lower value than 0.05. These results indicated that partially four variables affect the Y variable (the ICM adoption level on agricultural rice paddy business in Rias Village, Toboali District, they were education (X2), agricultural business experience (X3), agricultural extention (X4) and the agricultural area size (X5). While the variable that did not affect the Y variable was the age (X1).

Table 4. Multiple Linear Regression Analysis

Model	Coefficients		T	Sig.	Collinearity Statistics		
	Unstandardized Coefficients				Beta	Tolerance	VIF
	B	Std. Error					

(Constant)	.660	.044		15.093	.000		
Age	.000	.001	-.039	-.302	.764	.378	2.648
Education Level	.005	.002	.290	2.773	.008	.566	1.767
Experience of							
1 Agricultural Bussiness	.001	.001	.360	2.071	.044	.205	4.881
Agricultural Extentions	.038	.019	.309	2.041	.047	.271	3.695
The Size of Agricultural Area	.017	.008	.187	2.132	.039	.801	1.248
2 Adjusted R Square	.697						
F Test							
3 (simultan) sig.	.000						

Source: Primary Data, 2019

CONCLUSION

The conclusion from this study which finds the level of ICM adoption on rice paddy agricultural business in Rias Village Toboali District are: The farmer ICM level of adoption was classified into the highest category with the mean of 118.17 or 78.78%, while the lowest category on the ICM component was **integrated pest management (IPM)** with the point of 80 or 53.33 %. The highest level of ICM adoption in Rias Village Toboali District was the tillage system with the point of 140 or 93.33 %. Factors affected that ICM adoption level on rice paddy agricultural business in Rias Village Toboali District is education level, agricultural business experience, agricultural extension, and the agricultural area size. The value of Adjusted R Square on the multiple linear regression was 0.697 which means that 69.7% of the ICM adoption level simultaneously affected by education level, agricultural business experience, agricultural extension, and the agricultural area size, while other factors affected the ICM adoption level as much as 30.3%.

RECOMMENDATION

Based on the result and the discussion, we suggest that:

Some ICM components level of adoption such as IPM, the use of organic material, fertilization, effective weeding, and effective irrigation need to be improved to produce high-quality rice in Rias Village, Toboali District. The farmer group of Bone and Mekar Berkembang need further accompaniment and agricultural extensions to improve their skill and knowledge in increasing the quality of the agricultural products and also providing more spaces for the farmer for agricultural innovation.

The use of chemical pesticides in Rias Village, Toboali District needs to be decreased. The excessive use of chemical pesticides could affect the quality of rice

harvested. New pest management needs to be implemented. The use of natural predators or organic pesticides is a novel solution that could be implemented in Rias Village, Toboali District. A further study needs to use other independent variables that not explain specifically in this study but could affect the level of ICM adoption on the farmer.

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