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The Model of Increasing the Productivity of Lowland Rice Farming is Based on the Socio-Economic Factors of Farmers. In Kerinci Regency *with a Partial Least Square Sem Approach*

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Abstract

This study aims to analyze *the model of increasing the productivity of lowland rice farming based on socio-economic factors of farmers* in Jambi Province, this study was conducted at the rice production center in Kerinci Regency with a purposively selected Keliling Danau district research locus. This research uses primary data obtained directly from farmers with interview methods using questionnaires. The sample size of 75 samples. Sampling of farmers using the *Simple Random Sampling* method. Model analysis using the structural model *SEM-Partial Least Square (PLS)*. The results of the analysis showed that social factors had a positive and significant effect on access to institutions and allocation of production inputs while productivity had no significant effect. Economic factors have a positive and significant impact on institutional access, allocation of production inputs and to productivity. Institutional access and allocation of production inputs each have a significant effect on productivity. Social factors, economic factors with variables of moderation of institutional access or allocation of production inputs are positive and significant influences on the productivity of rice farming.

Keywords: Productivity; Social; Economic; Production input; Institutional access; SEM-PLS.

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1. Introduction

Jambi Province is a province whose population works a lot in the sub-sector of food crops, especially rice fields, which are integral in the government's efforts to realize rice self-sufficiency. The harvest area in 2014 was 121,722 ha and became an area of 144,587 ha in 2018 there was an increase of 5.8% per year, production in 2014 amounted to 587,384 tons to 757,666 tons in 2018 and during that period there was an increase in production of 4.3% per year. While productivity during 2014-2018 was only 4.85ton / ha. In Jambi Province the main center of rice production is Kerinci Regency with an area of 35,215 ha, Production of 191,540 ha productivity of 5.35 tons / ha [1]. In Kerinci Regency the center of rice production is the Keliling Danau District with an area of 2,185 ha, with a productivity of 5.15 tons / ha, this productivity is still relatively low, when compared to the productivity of rice fields in Indonesia which reaches 7.0 tons / ha. Low productivity and has not reached optimally is suspected due to social factors, economic factors of allocation of production inputs and farmers' access to institutions.

The efforts of the Jambi Regional Government to achieve the production target of 850 thousand tons in 2019 were not achieved. Rice farming is faced with low productivity of only 4.5 – 5.5 tons / ha of production potential of 7.5 – 9.5 tons / ha, or technical efficiency level ET< 0.7. This low productivity can occur due to the allocation of inefficient use of factors of production as a result of non-economic socio-economic factors. Socio-economic factors become the main obstacle to farmers' decision-making in allocating factors of production, as a result there is a potential productivity gap of research results ***(Best Cultivation techniques)*** with actual productivity that can be ***achieved.***

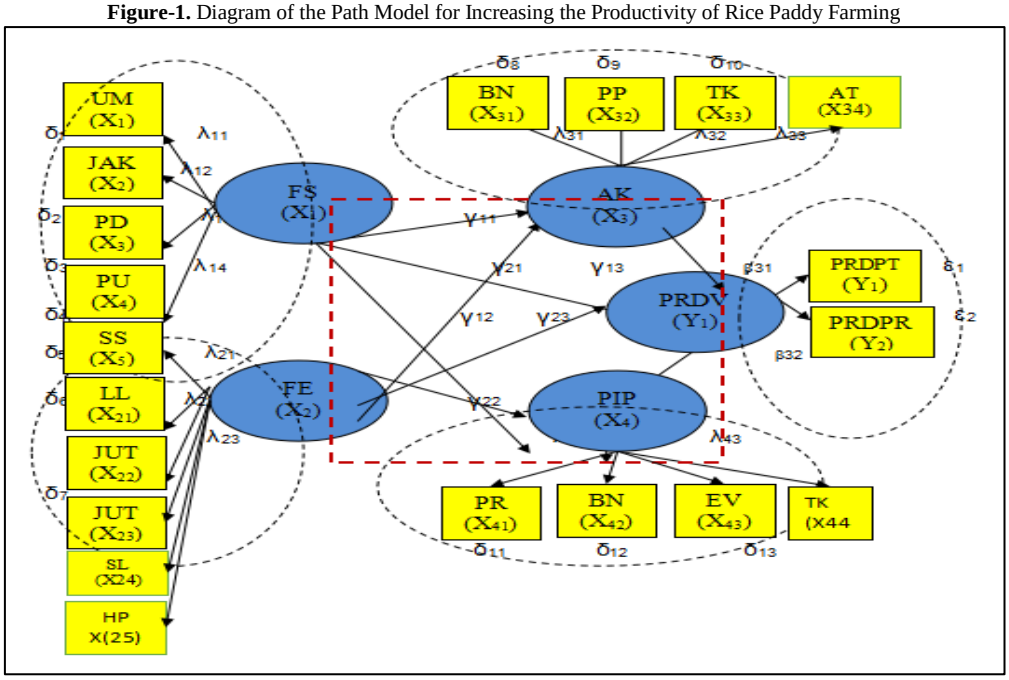
Productivity that has not reached the optimum Wongkar, *et al.* [2], Hoar and Yosefina [3], Setiawan and Wijayanti [4] is suspected due to various sources of constraints. Factors that affect the productivity of rice lowland rice farming are distinguished from: ***First*** social factors (age, income, number of family members, farming experience and social status. ***Second,*** economic factors (land area, other livelihood sources, land status, commodity prices, distance of agriculture with home). ***Third*** institutional access (capital / credit, market, price, procurement of saprodi, technology). ***Fourth*** use of production inputs (quality seeds, chemical fertilizers (NPK), chemical drugs and

labor) In this regard the research is aimed at analyzing models of increasing the productivity of lowland rice farming based on the factors that affect it.

2. Methods

This research was conducted in Jambi Province in the production center of Kerinci Regency. The locus research in the Keliling Danau District. With sample villages Benik Village, Semerap Village and Koto Dian Village To the three villages taken *purposively*. With the consideration that the three villages have diversity in terms of social factors, economic factors, institutional access to production input allocation and productivity of rice paddy farming business. The primary data on this research is obtained by means of observation and structured interviews. The number of farmers in the three villages as many as 1,460 farmers. Benik Village as many as 515 farmers, Semerap Village as many as 482 farmers, and Koto Dian Village as many as 456 farmers. Determination of sample size using formula from Taro Yamane or Slovin. Using the formula Slovin obtained a sample size of 75 respondents. Respondents from Benik Village as many as 27 respondents, Semerap Village as many as 25 respondents and Koto Dian Village as many as 23 respondents. Sampling of farmers using the *Simple Random Sampling* method**.** The data analysis method using the SEM –Partial Least Square (PLS) model which refers to Jaya, *et al.* [5], Latan [6], Rozandy, *et al.* [7] and Gunarto [8].

Figure-1. Diagram of the Path Model for Increasing the Productivity of Rice Paddy Farming



Information:

SS	= Social Status	AP	= Market Access
UM	= Age	APK	= Akses Capital/Credit
JAK	= Number of Family Members	AT	= Access to Technology
PD	= income	API	= Input Procurement Access
PU	= Farm Experience	AK	= Institutional Access
HP	= Rice Price	PIP	= Use of Production Inputs
LL	= Land Area	VB	= Seed Varieties
JUT	= Distance of Farm with House	Pk	= Chemical Fertilizer (Urea and NPK)
SL	= Land Status	TK	= Labor
SMP	= Other source of Livelihood	OK	= Chemical Drugs
λ (small Lamda) δ (Delta) ε (Efsilon) γ (Gamma) β (Beta) ζ (Zeta) parameters that will be expected to be large			

= Latent variable

= Indicator

= Path coefficient.

Model Fit of Goodness

2.1. Outer Model

For the model fit test, it can be seen from the outer model which is indicated by the validity of the convention, has validity if the outer loding > 0.7 and gives discriminant validity > 0.5 and if composite reliability ≥ 0,7.

2.2. Inner Model

Goodness of Fit Model **uses** ***Q-square predictive relevance.*** *Q-square* value *indicates predictive relevance.model:* ^{Q2} **= 1- (1-** $R_1^{2)}$**(1-** R_2^{2}**)... (1-**$R_n^{2),}$ where $R_1^{2,}R_2^{2,}$ ... R_{n2} is the endogenous variable R-square in the equation model.

3. Results and Discussions

3.1. Characteristics of Farmers

Farmers are mostly at a productive age in farming rice. There are 92.45% of farmers in productive age with ages ranging from 25< 60 years and as many as 7.55% of unproductive farmers with more than 60 years of age. The formal education level of farmers is mostly (71.22%) at the elementary school education level so it will affect decision-making patterns in farming. The business experience of farmers is relatively high with an average of 22.3 years. This farming experience helps farmers in the allocation of adaptive use of production inputs. The number of dependents of farming families averages 3-4 people so that *the dependency ratio* is relatively low. The land area cultivated by farmers ranges from 0.20-1.50 ha with an average of 0.41 ha per farmer. 93.5% of farmers are farmers who own cultivators. Rice field farming is an important source of income for 62.5% of farmers.

3.2. Description of the Application of Technology to Rice Farming

The implementation of rice paddy farming in general with the concept *of Integrated Crop Management* (PTT). There are 85% of farmers following the PTT pattern, and 15% less following the PTT pattern. Ptt components include the use of superior varieties, 92% of farmers use varieties as recommended and 8% do not as recommended. The superior variety used is the ***ciherang variety.*** The use of seeds as much as 15-20 kg / ha, the age of seedlings in transplanting 18-25 days. Soil processing is carried out by piracy 2 times, inundated 7-15 days, and the ratio of mud with water 1:1. Planting distance 15x15 cm, planting with legowo planting system 2:1:3 or 1:4:1. Farmers fertilize with the amount and time not in accordance with the recommended dose. The recommended dose of urea is 150 – 250 kg / ha, SP 36 100-160 kg / ha and KCL fertilizer 80-100 kg / ha. Planting patterns on farmland with rice-bera-padi patterns.

3.3. Use of Input and Production of Rice Farming

The end result of a production process is the product (rice). Production can vary due to differences in the use of factors of production. Table 1 describes the use of inputs and production of rice farms.

Table-1. Use of Rice Farm Production Inputs in Research Areas, 2021

Description	Range	Average	Suggestion
Land area (ha)	0,20 – 1,50	0,41	
Production (kg)	2,850 – 6,750	5,560	
Production inputs			
a. Seeds (kg)	15 -25	17,5	10 – 15
b. Urea fertilizer (kg)	35 – 100	75	150 – 250
c. Fertilizer SP 36 (kg)	30 – 90	35	100 – 160
d. KCL fertilizer (kg)	15 – 50	17	80 – 100
e. Organic fertilizer (kg)	650 – 1000	850	5000 – 7000
f. Pesticides (ml)	500 – 1000	1.100	
Labor (HOK)	55 – 115	90,6	

3.4. The Estimation of Model Increase in Productivity Rice Field Farming

3.4.1. Goodness of Fit Measurement Model

O*uter model* is a framework for how *manifest* or *observed* variables can describelatent constructs. There are 3 ways of evaluation on outer models, namely *Convergent Validity*, *Discriminal Validity* and *Composite Validity.* The results of the outer model estimate can be seen in Table 2.

Table-2. Validity and Reliability manifest of latent variables

Instruments	Validity		Reliability	
	Loading Factor	**AVE**	***Cronbach's Alpha***	***Composie t Realibiliy***
Social Factors (X_1)				
- Age (X_{11})	0,785			
- Number of family members (X_{12})	0,742			
- Income	0,856	0,754	0,553	0,788
- Farm experience	0,751			
- Social Status(X_{14})	0,953			
Economic Factors ($X_{2)}$)				
- Land	0,823			
- Farm Distance	0,714			
- Land Status ($X_{22)}$)	0,705	0,756	0,836	0,913
- Source of Livelihood ($X_{23)}$)	0,813			
- Price				
Institutional Access	0,951			
- - Credit Access				
(Capital)	0,834			
- Market access	0,821			
- Input Access	0,945	0,885	0,925	0,952
- Access to Technology	0,723			
Use of Production Inputs ($X_{3)}$)				
- Seed Varieties	0,823			
- Chemical Fertilizer ($X_{32)}$)	0,935	0,923	0,943	0,971
- Chemical Drugs	0,714			
- Manpower ($X_{33)}$)	0,756			
Productivity(X_4)				
- High Productivity ($X_{41)}$)	0,886	0,943	0,901	0,882
- Low Productivity ($X_{42)}$)	0,763			

Table 2 shows that *Convergent Validity* is good meaning that all *manifest* variables can interpret construct variables. The *outer loading* value is above 0.7 and the AVE value above 0.5 means that the *construct* variable and *manifest* variable are of good quality. *Discriminal Validity* can be seen from the magnitude of *the Rule Of Thumb* where the loading *indicator* > the entire *Cross loading* and square root of AVE > correlation between latent constructs. This indicates that each *manifest* variable is a good measurement or against a construct variable. *Composite Reability* is intended to look at the accuracy of *construct* variable relationship models and *manifest* variables. All *manifest* variables produce a high this is seen when from the magnitude of *Composite reability* > 0.7 and *cronbachs alpha* > 0.7 [9].

3.4.2. Goodness of Fit Structural Model *(Inner Model)*

The evaluation of *the inner model* can be seen from the magnitude of R – Squared (R^2). The value of R^2 is used to measure *the level of goodness of fit* structural models used the results of R^2 estimates can be seen Table 3.

Table-3. Estimated Value Results R^2 Structural Model

	R Squared	**R^2Adj**
Institutional Access (AK)	0,562	0,574
Use of Production Input (PIP)	0,394	0,416
Productivity (PRDV)	0,956	0,961

Table 3 shows that institutionalaccess (AK)) produces an R^2 value of 0.562 meaning the model is in the moderate category (Chin 1998 in Sarwono and Narimawati [10]) the variable use of production input (PIP) has an R^2 of 0.394 meaning the model is in the weak category. This means that the use of production inputs is only influenced jointly by social factors and economic factors of 39.4% The variable productivity of rice farming (PRDv) produces an R^2 value of 0.956 meaning the model has an excellent accuracy category (Sarwono and Narimawati [10]).

Structural models produce *good goodness of fit* can be seen from the magnitude of Q^2 value of 0.9876 this means that the model produces predictive relevance of 98.76% and is very high.

4. Direct Influence

Table-4. PathCoefficients / Direct Influence of Relationships Between Variables in Structural Models

Relationships between Variables	Path Coefficient	*Average sample*	*Standard Deviation*	t-statistics	*P Value*	Information
Social factors$_{(X1)->}$Institutional Access (X_3)	0,752	0,687	0,341	1,094	0,044	Positive and Significant
Social factors ($X_{1)->}$Use of Production Inputs (X_4)	0,653	0,642	0,202	1,017	0,041	Positive and Significant
Social factors$_{(X1)->}$Productivity (Y)	0,351	0,340	0,135	1,032	0,746	Positive , non-significant
Economic factors - > Use of production inputs (X_3)	0,856	0,842	0,096	1,016	0,000	Positive and Significant
Economic factors ($X_{2)->}$Institutional Access (X_4)	0,652	0,641	0,205	0,017	0,043	Positive and Significant
Economic factors$_{(X2)->}$Productivity (Y)	0,765	0,747	0,156	1,024	0,004	Positive and Significant
Institutional Access$_{(X3)}$-> Productivity(Y)	0,624	0,605	0.432	1,031	0,092	Non-significant positives
Use of Production Input ($X_{4)}$-> Productivity (Y)	0,788	0,755	0,146	1,016	0,000	Positive and Significant

Table 4 shows that social factors (X1) have a direct, positive and significant effect *(p-value* = 0.044 < α = 0.050)) to institutional access. Social factors have a positive and significant effect on the use of production inputs and have a real effect*(p-value* = 0.041 < α = 0.05 0).) Social factors have a positive and significant effect and influence on the productivity of rice farming*(p-value* = 0.0446 < α = 0.050). Strengthening social factor variables by 10% will occur strengthening institutional access by 7.52%, increasing the use of production inputs by 6.53% and against rice productivity by 3.51%. %. In contrast to Darmawaty [11], Wongkar, *et al.* [2] that social factor do not have a significant effect on the productivity of rice farming.

Economic factors have a direct, positive and significant effect*(p-value* = 0.043 < α = 0.050)) to institutional access, use of production inputs, and productivity Strengthening economic factors by 10% then there will be a strengthening of institutional access by 6.52%. %. Increased use of production inputs by 8.56% and increased agricultural productivity by 7.56%. The use of production inputs has a direct, positive and significant effect*(p-value* = 0,000 < α = 0.050)) on agricultural productivity. Increasing the use of production inputs by 10% will increase productivity by 7.88%. Increased institutional access has a direct effect, marked positively but not significantly on productivity. Strengthening institutional access by 10% resulted in an increase in productivity by 6.2%. In line with Darmawaty [11], Sukayat and dan Rumna [12] that economic factors have a positive and significant effect on the productivity of rice farming.

5. Indirect Influence

Table-5. Indirect Effects of Relationships Between Variables in Structural Models

Relationships between Variables	Original Sample (SO)	Sample Mean (M)	Standard Deviation (STDEV)	T-Statistics	P-Value
FS -> AK -> PRDV	0,256	0,228	0,086	1,032	0,035
FS-> PIP-> PRDV	0,231	0,156	0,062	1,480	0,021
FE-> AK-> PRDV	0,437	0,417	0,054	1,047	0,006
FE-> PIP -> PRDV	0,531	0,508	0,035	1,045	0,000
Total Indirect Influence					
FS -> PRDV	0,211	0,203	0,083	1,039	0,062
FE -> PRDV	0,352	0,343	0,024	1,026	0,041

Table 5 shows that the correlation coefficient of social factors through moderation of institutional access to productivity positively affects productivity and is significant *(p-value* = 0.035 < α = 0.050).) The social factor through moderation of the use of production inputs on agricultural productivity is positive and significant *(p-value* = 0.021 < α = 0.050). The increase of social factors by 10% through moderation of institutional access will increase the productivity of farmers by 2.56% and through moderation of the use of production inputs will increase the productivity of farmers by 5.31%.

Economic factors through variable moderation of institutional access to agricultural productivity are positive and very significant influences *(p-value* = 0.006> α = 0.050).). The increase in economic factors by 10% through moderation of institutional access will increase productivity by 4.37%. The magnitude of the correlation coefficient of economic factors through moderation of the use of production inputs to agricultural productivity is a positive and significant effect *(p-value* = 0,000 < α = 0.01). The increase in economic factors by 10% % through variable moderation in the use of production inputs will increase productivity by 3.51 %.

For more details the results of the estimate can be seen Figure 2.

Figure-2. Diagram of the Path Model for Increasing the Productivity of Rice Farming

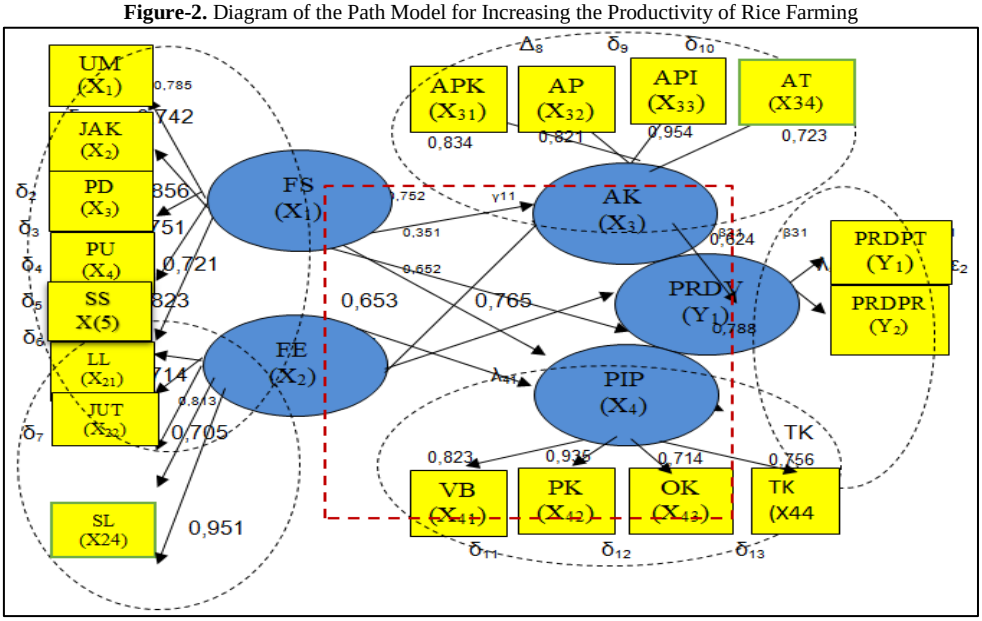


Figure 2 shows that total influence is almost equal to direct influence. The difference lies in the value of the corelation coefficient between social factor variables to productivity and the value of the coefficient of economic factors to productivity. Social factors (X1) are in total positive but insignificant influence *(p-value* = 0.058 > α = 0.050) on the use of production inputs (X3), and significant positive influences*(p-value* = 0.064 > α = 0.050) to productivity rice farming (Y). Strengthening social factors in total by 10% will increase the use of production inputs by 2.41 %, increase productivity by 2.28 %.

Economic factors in total have a positive and significant effect on the use of production inputs, institutional access, and productivity. Strengthening economic factors by 10% will strengthen the use of production inputs by 3.73%, strengthen institutional access by 1.87% and strengthen agricultural productivity by 4.15%. The total influence of the use of production inputs and institutional access to productivity has a positive and significant effect. It can be interpreted that every strengthening of the use of production inputs and institutional access by 10% there will be a strengthening of productivity by 9.84% and 0.54%. The motivating factor determines the progressivity of farmers in the adoption of new technologies and the intensification of rice farming is determined by the economic social factor of farmers. Nainggolan, *et al.* [13] that the technical inefficiencies of rice farming are influenced by the characteristics of farmers as social factors, and economic factors. Land area, age of farmers and distance of farming add technical inefficiencies. While income, business experience, education, product prices and the number of outbound members reduce technical inefficiencies. Socio-economic factors of farmers are classified as determinants to efforts to increase farming productivity. Bananiek and Abidin [14], Setiawan and Wijayanti [4], that the adoption of new technologies is determined by price, farm income, land area, formal education, farmer's age and farming experience. While government support in the field of saprodi assistance, alsintan assistance, extension support and the development of farming groups did not have a significant effect on increasing rice-farming production. Economic factors that affect the productivity of rice farming are access to credit access (capital), access to input procurement, market and price access and access to new technologies.

Sukayat and dan Rumna [12], Hoar and Yosefina [3] that social factors that correlate strongly with farming productivity are social status, age, farming experience and formal education of farmers. The four variables are determinants of the motivation of farmers. The adoption and innovation and innovation of farming technology depend on the social faxor of farmers. Utilization of economic opportunities in locality of farming is determined by social factors. Strengthening social factors and strengthening economic factors will encourage the strengthening of farmers' efforts in increasing agricultural products.

Santorck (2007) *in* Indrawati [15] said that socio-economic factors, institutional access can be viewed as determinants of farmers' performance. Commercialization of farmers depends on the ability of farmers to utilize economic resources. Differences in the ability to control economic resources will cause differences in terms of productivity achievement. The social factors of farmers determine the high success of increased productivity. The economic factors of farmers determine the scale of production that farmers strive to be determinants of the productivity of rice farming. Institutional access factors are factors that affect farmers in working capital access, credit, input procurement, and adoption of new technologies. This institutional access factor is classified as a

supporting factor in farmers' efforts to increase the productivity of rice farming. The use of production inputs is the main condition in achieving high productivity allocation and the combination of production factors determines optimal results. The determination of the optimal combination is largely determined by the socio-economic factors of the farmer.

6. Analysis of the Influence of Indicators on Latent Variables

Endogenous latent variables in this study consist of 2 variables, namely social factor variables and economic factors. Exogenous latent variables consist of 3 variables, namely institutional access, the use of production inputs, and farming productivity. Each latent variable has several manifests capable of explaining the latent variable. The influence of the imanifest on its latent variables can be seen in Table 6.

Table-6 Results of Estimated Effect of Manifest Variables On Latent Variables

	Original Sampel (O)	Sampel Mean $(M)_1$	Standard Deviation (STDEV)	T-Statistic (O/STDE)
X_{11}(UM)<- FS	0,785	0,764	0,092	8,532
X_{12}(JAK)<- FS	0,742	0,755	0,043	17,25
X_{13} (PD)<- FS	0,856	0,861	0,083	10,31
X_{14} (PU)<-FS	0,751	0,749	0,086	8,735
X_{15} (SS)<-FS	0,721	0,715	0,088	8,193
X_{21} (LL)<- FE	0,823	0,815	0,095	8,663
X_{22}(JUT)<-FE	0,714	0,725	0,152	4,697
X_{23}(SL)<-FE	0,705	0,718	0,192	3,671
X_{24}(SMP)<-FE	0,813	0,857	0,093	8,741
X_{25}(HP)<- FE	0,951	0,935	0,009	105,6
X_3(APK)<-AK	0,834	0,823	0,105	7,942
X_4(AP)<-AK	0,821	0,818	0,104	7,894
X_5(API)<-AK	0,945	0,927	0,095	10,27
X_6(AT)<-AK	0,723	0,736	0,155	4,664
X_{31}(VB)<- PIP	0,823	0,818	0,152	5,414
X_{32}(PK)<- PIP	0,935	0,928	0,092	10,16
X_{33}(OK)<-PIP	0,714	0,728	0,152	4,789
X_{34}(TK)<-PIP	0,756	0,745	0,151	5,006
Y_{41}<- PRDPT	0,886	0,872	0,096	9,229
X_{42}<- PRDPR	0,763	0,758	0,153	4,986

Table 6 shows that all *manifest* variables *are significantly correlated* with their latent variables. *Value p- value*= 0.000, < = 0.001. ***Social factors*** Age correlation coefficient, 0.785 number of family members correlation coefficient 0.742, income correlation coefficient 0.856, correlation coefficient of farming experience 0.751 and social status correlation coefficient 0.721. This means that every manifest strengthening *occurs;* Age, number of family members, income, farming experience and social status as much as 10% then there will be a strengthening of social factor variables as much as 7.85%, 7.42% and 8.56%, 7.51% and 7.21%. This variable is in line with research that the social factors of farmers can be described by age, number of family members, income, farming experience, and social status.

Economic Factors, coefficient correlation of land area by 0.283, coefficient correlation of agricultural distance 0.714, coefficient correlation of land status 0.705 coefficient correlation of other source of livelihood 0.813 and coefficient correlation of production price 0.951. This means that every strengthening of the *manifest* variable of the land area, of the farm's land distance, is land status, of other sources of livelihood and production price as much as 10% then there will strengthening variable economic factor 8.23%, 7.14%, 7.05%, 8.13%, 9.51%. The results of this study are in line with that *manifest* economic factors are determinants of productivity.

Access to Institutional, credit access correlation coefficient 0.834, market access correlation coefficient 0.821, input access correlation coefficient 0.945 technology acces correlation coefficient 0.723. This means that every strengthening *of credit* access manifest variables, market access, input access, technology access as much as 10% there will be a variable linking of economic factors 0.834%, 0.821%, 0.945%, 0.723%. This research is in line with Bashir and Koestiono [16] that institutional access is a determining factor in farmers' decisions in an effort to increase the productivity of rice farming businesses.

***Use of Production Inputs*.** Seed varieties have a correlation coefficient of 0.823 chemical fertilizer correlation coefficient 0.935, chemical drug correlation coefficient 0.714 labor correlation coefficient 0.756. This means that every strengthening *of the manifest* variable of seed varieties, chemical fertilizers, chemical drugs, labor as much as 10% then there will be a variable harvesting of economic factors 0.823%, 0.935%, 0.714%, 0.756%. The results of this study are in line with, Ifgayani and Damayanti [17] that manifest economic factors are determinants of productivity.

7. Conclusions

Strengthening social factors resulted in strengthening institutional access and allocation of the use of production inputs significantly but had no effecton increasing the productivity of rice farming. Economic factors are determinants, meaning that strengthening economic factors result in strengthening institutional access, allocation of production inputs and significantly increasing productivity. Access to inertia and allocation of production inputs are determinants to productivity. The variables of institutional access moderation and allocation of the use of production inputs are determinant factors in relation to social factors with productivity, and in relation of economic factors to the productivity of rice farming. In this regard, in order to increase the productivity of rice farming, it is necessary to empower farmers by paying attention to social factors through extension efforts, economic factors through increasing the scale of agriculture, institutional access by simplifying the terms of agricultural credit, and allocation of the use of production inputs with subsidies of production facilities that are timely needed, right amount and right price.

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