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Effectiveness of Farmer Groups: Roles of Farmer Contact Resources and Field Agriculture Extension in Bengkulu Province, Indonesia

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ABSTRACT

Limited field agricultural extension services hinder productivity. Farmers struggle to achieve optimal yields without sufficient technical support, threatening national food security. This study aimed to develop a model for evaluating the effectiveness of farmer groups in Bengkulu Province, Indonesia. This study involved a population of 220 individuals from eight farmer groups located in the South Seluma Sub-district, Seluma Regency. A survey was conducted with 142 members of farmer groups in Seluma District, selected using simple random sampling. The validity test used had two parts: factor validity and discriminant validity. Structural Equation Model (SEM) was applied to the collected data to develop models that identified the relationships among factors related to agricultural extension performance, farmer contact resources, and the effectiveness of farmer groups. The results indicate that the effectiveness of farmer groups was positively related to the farmer contact resources. However, this was negatively influenced by the performance of agricultural extension services, which faced issues such as limited access, low managerial competency, and fewer business opportunities. The model showed that farmers in the study area were more open to Farmer Contact Resources than to Field Agricultural Extension. Furthermore, enhancing the quality of human capital in agricultural extension services is essential to improving the effectiveness of farmer groups. This can be accomplished by enhancing managerial skills, providing market-oriented training for agricultural extension, and increasing the ratio of agricultural extension to farmers.

Keywords: Field Agricultural Extension; Farmer Contact Resources; Farmer Groups; Effectiveness; Structural Equation Model; Rice Farmers

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1. Introduction

Several policies favoring farmers were adopted to accelerate the development process in agriculture through the ratification of the Indonesian Law Number 16 of 2006 concerning Agricultural, Fisheries, and Forestry Extension Systems on November 15, 2006 [1]. These include increasing the ability of farmers and groups to effectively accommodate and carry out the interests of farmers.

Various studies have proven the importance of group roles in improving the welfare of farmers and families, both domestically and internationally, as shown in Central, Senegal and Burkina Faso, East Africa, and Central Africa [2–5]. In Indonesia, farmer groups are increasingly considered a transformative force for improving rural livelihoods. Salam et al. reported the positive role of groups in improving the social status of rice field farmers [6]. Similarly, Ikbal and Nasution showed that farmer groups contributed to increased income and production [7,8]. The question arising is how farmer groups can achieve this type of performance.

Multiple efforts were carried out to develop outstanding farmer contact (Kontak Tani) resources. These efforts include training, internships, development of extension programs, and engagement in preparing the definitive plan for group needs. Farmer contact plays an essential role in fostering the need of members to develop innovations, which are applied in farming activities [9,10]. Therefore, farmer contact serves as an opinion leader for the community and is expected to play a key role in empowering the groups to become independent [11]. A good farmer contact is often willing to cooperate as an agricultural extension partner in organizing extension activities for farmer groups and surrounding communities. Hanan et al. found that farmer contact was vital in dynamizing groups in problem-solving [12].

Limited resources, such as budget constraints and inadequate facilities, are the primary factors obstructing field agricultural extension workers from effectively communicating innovations and new technologies [13–15]. Additionally, the ratio of agricultural extension workers to the size of some regions and the number of farmers served is disproportionate. This imbalance leads to heavy workloads and insufficient time for extension workers to fulfill roles in providing essential support [16–18]. Hence, the roles of field agricultural extension as agents of change in influencing farmer behavior need to be optimized.

This study aimed to develop a model for evaluating the effectiveness of farmer groups in Bengkulu Province. Both external and intervening variables will be comprehensively examined. External variables include the influence of field agricultural extension, while the intervening variables comprise farmer contact resources. Several stages were used to analyze the influence of field agricultural extension workers on the role of farmer contact resources, contact resources on the effectiveness of farmer groups, and field agricultural extension workers on the effectiveness of farmer groups.

2. Materials and Methods

2.1. Population and Sample

The population used in this study was 220 members from eight farmer groups in the South Seluma Sub-district, Seluma Regency (**Figure 1**). Based on this information, the minimum sample needed can be calculated using the following formula (1) [19]:

$$n = \frac{N\sigma^2}{(N-1)D + \sigma^2} \quad (1)$$

where n = minimum sample size; N = total population; σ^2 = population variant; D = bound of error.

By using the estimated percentage magnitude of 5%, the randomly selected samples were:

$$n = \frac{220(0.25)}{(220-1)0.000625 + 0.25} \quad (2)$$

$$= 142.1648 \approx 142 \ farmers$$

Interviews using a questionnaire designed in advance were conducted on 142 members of farmer groups from May to December 2019.

Figure 1. The Study Area in Seluma Regency, Bengkulu Province, Indonesia (1:20.000.000).

2.2. Research Variables

This study consists of 3 (three) variables, namely: 1 (one) independent variable (Farmer Contact Resources), 1 (one) intermediate independent variable (the role of Field Agricultural Extension Officer), and one dependent variable, namely *the effectiveness of* farmer groups.

The indicators of each variable are as follows:

(1) Farmer Contact Resources, consisting of facilitating farmer group members in achieving farmer group goals, assisting members in meeting their needs, realizing group values, and representing the opinions of farmer group members in interacting with other parties.

(2) The role of Field Agricultural Extension Workers consists of Facilitating the learning process; the enhancement of access facilities; improvement of leadership, managerial and entrepreneurial skills; assisting the main actors in growing their organizations; Analysis and problem-solving as well as response to opportunities and challenges; Growing environmental awareness; Institutionalization of cultural values; and Advanced and modern agricultural development.

(3) The effectiveness of the farmer group, consists of: The income level of the farmer group members; Proactive and compliant farmer group members, and Satisfaction of members of farmer groups.

The effectiveness of farmer groups is assessed based on the indicators contained in Farmer Contact Resources, and the role of Field Agricultural Extension Workers, which will be measured with the value of the *Likert Scale* (**Table 1**).

Table 1. Effectiveness of Farmer Groups Based on Farmer Contact Resources and Field Agricultural Extension.

Information	Skor
Strongly Agree	5
Agree	4
Neutral	3
Disagree	2
Strongly Disagree	1

2.3. Questionnaire Validity and Reliability Test

The validity test used consisted of two parts, including *factor validity* and *discriminant validity*. Altheide and Johnson defined reliability as finding stability and validity as finding truthfulness [20]. Validity and reliability tests were conducted to ensure the study questionnaire was reliable enough to reveal a particular phenomenon of a group of individuals. Kimberlin and Winterstein reported that these tests were intended to assure the integrity and quality of a measurement instrument [21]. In this study, Cronbach Alpha was used to assess the internal consistency of the variables.

2.4. Data Analysis Method

The collected data were first examined using descriptive analysis to explain each indicator applied to all variables. Secondly, the Structural Equation Model (SEM) was used to determine the structural relationship between variables. This method was initially known as path analysis and later narrowed down to a SEM analysis [22]. According to Hair et al. [23], the two basic components characterizing SEM are 1) the path model relating independently to the dependent variables, even when the dependent variables become independent in another relationship, and 2) a measurement model that allows analysts to use multiple variables or indicators for a single independent or dependent variable. Ghozali explains that SEM is an evolution of multiple equation models developed from econometric principles and combined with regulatory principles from psychology and sociology [24]. Based on the study by Silva et al. [25], SEM provides the pertinent and most efficient simultaneous estimation for several separate multiple regression models.

A conceptual model explains the relationship between latent and manifest variables in this study. Three latent variables include Field Agricultural Extension (FAE), Farmer Contact Resources (FCR), and Farmer Groups (FG). FAE has seven manifest variables including facilitation of the learning process (X1), striving for easy access (X2), increasing leadership, managerial, and entrepreneurial abilities (X3), assisting the main actors in developing organizations (X4), responding to business opportunities (X5), growth of environmental awareness (X6), and institutionalization of cultural values, as well as the development of advanced and modern agriculture (X7). Meanwhile, FCR has four manifest variables, namely, facilitating members of farmer groups to achieve group goals (Y1), helping to improve production facilities (Y2), achieving the value of farmer groups (Y3), and farmer contact interaction in representing opinions (Y4). FG comprises three manifest variables, including the level of income of farmer group members (Z1), the proactive and compliance of members (Z2), and increased satisfaction with knowledge and skills (Z3). The relationship between evaluated latent and manifest variables is shown in **Figure 2**.

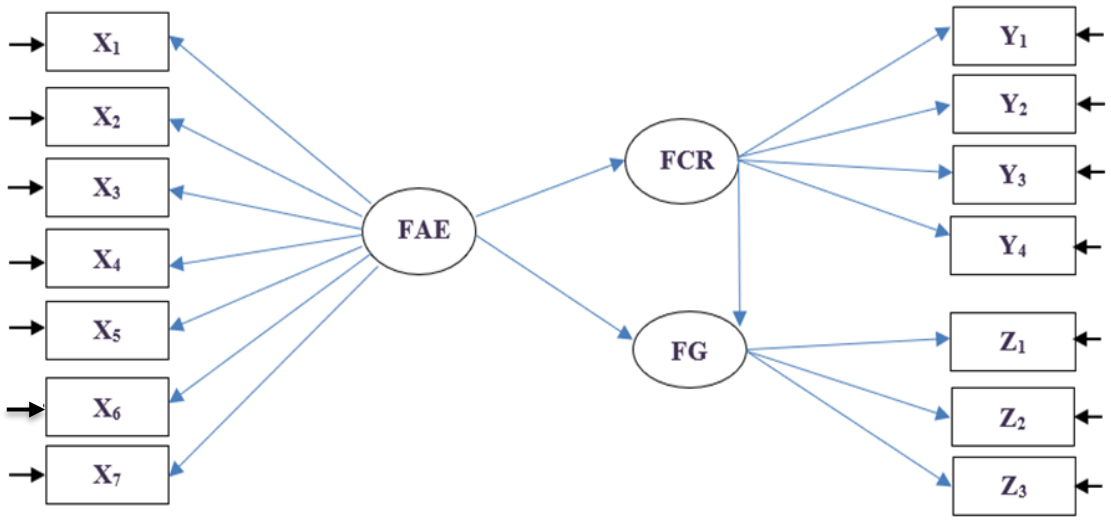

Figure 2. The Basic Model for the Conceptual Study of FCR and FAE Roles in Increasing the Effectiveness of Farmer Groups.

Confirmatory Factor Analysis (CFA) is a confirmatory method that is theory-driven. Therefore, the planning of the analysis is driven by the theoretical relationships between the observed and unobserved variables. CFA is used to test the conformity of the confirmatory model through the goodness-of-fit indexes, including chi-square, probability, General Fit Indices (GFI), Adjusted GFI, Population Discrepancy Function Value (FO),

Expected Cross Validation Index (ECVI), and Comparative Fit Indices (CFI) [26,27].

3. Results

3.1. The Profile of Farmer Group Members

The socio-demographic characteristics of the rice farmers interviewed are presented in **Table 2**.

Table 2. Respondent Characteristics.

No	Variable	Category	%	Average	Minimum	Maximum
1	Age	20 – 42	54.23	44.48	20	85
		43 – 65	38.73			
		66 – 85	7.04			
2	Educational attainment	Elementary school	50.70	-	-	-
		Junior High School	40.85			
		High School	8.45			
3	Number of Household members	1 – 3	24.65	4.18	1	7
		4 – 5	64.79			
		6 – 7	10.56			
4	Membership period of the Farmer Group (years)	1 – 12	57.75	12.64	1	36
		13 – 24	34.51			
		25 – 36	7.74			
5	Farming Experience (Years)	2 – 10	23.76	18.80	2	53
		11 – 20	43.66			
		21 – 30	16.90			
		31 – 40	11.27			
		>40	1.41			

The ages of farmers in all groups ranged from 20 to 85 years, with an average of 44.48 years. Rogers et al. stated that older adults tended to be slower than their younger counterparts in adopting new technologies [28]. Utama et al. reported that age did not influence technology adoption [29]. Most respondents had an educational background from elementary to junior high school. Compared to age, education has a significant role in the adoption of agricultural technology in Indonesia [30]. The farmers had an average of 4 individuals in each family and were members of the groups for more than 12 years. Membership in farmer groups is very important. Policies, programs, and government subsidies are often provided through farmer groups or Integrated Farmer Groups (*Gapoktan*). Therefore, being members of farmer groups is a distinct advantage due to providing farmers with facilities from the government. The average farming experience of farmers was 18.80 years, ranging from 2 – 53 years. The smallest and the highest percentage of farming experience from total respondents were 1.41% (> 40 years) and 43.66% (11 – 20 years), respectively.

3.2. Validity and Reliability Test for the Study Questionnaire

A validity test was performed to show the validity or accuracy level of an instrument in carrying out the measurement function. The indicator was the result of estimating the **r** (rho) *Pearson product-moment* correlation with the calculation criteria. When the r count was greater than the r_{table}, these factors were considered to be valid. The results of the calculation conducted using SPSS 16.0 for Windows software showed that the value of $r_{count} > r_{table}$ for all items X1, X2, X3, X4, X5, X6, X7, Y1, Y2, Y3, Y4, and Z1, Z2, Z3 on the variables contained in the study, denoting all of the questions were valid (**Table 3**).

Table 3. Validity of Study Variables.

Variable	Manifest Variable	r_{count}	r_{table}	Conclusion
Field Agricultural Extension	X1	0.522	0.361	Valid
	X2	0.571	0.361	Valid
	X3	0.793	0.361	Valid
	X4	0.775	0.361	Valid
	X5	0.670	0.361	Valid
	X6	0.621	0.361	Valid
	X7	0.585	0.361	Valid
Farmer Contact Resources	Y1	0.770	0.361	Valid
	Y2	0.868	0.361	Valid
	Y3	0.723	0.361	Valid
	Y4	0.881	0.361	Valid
Farmer Group	Z1	0.866	0.361	Valid
	Z2	0.810	0.361	Valid
	Z3	0.900	0.361	Valid

Reliability shows the stability, accuracy, consistency, and the extent to which the measurement results with the measuring instruments used can be trusted. This was tested for the study variables using the Cronbach Alpha formula. According to the results in **Table 4**, all $\mathbf{r}_{count}$ (Cronbach Alpha) were above $\mathbf{r}_{tab}$ (0.70), signifying that the data collection tool using the three variables was reliable in expressing certain phenomena at different times.

Table 4. Reliability of Study Variables.

Variable	**r** Cronbach Alpha	r_{table}	Conclusion
Field Agricultural Extension	0.762	0.70	Reliable
Farmer Contact Resources	0.823	0.70	Reliable
Farmer Group	0.818	0.70	Reliable

3.3. The Role of FCR

The role of FCR is inseparable from the sustainability of farmer groups due to being leaders of the groups [31,32]. Therefore, this is responsible for the performance of members and the groups. The high responsibility of FCR causes more technical and non-technical capabilities [33]. The FCR role is a latent variable consisting of four manifest variables, as described in the study method.

Table 5 shows the frequency distribution of FCR roles in the high to very high category, with a cumulative score ranging from 86.34% to 90.28%, signifying that members of farmer groups can rate the impact of FCR. The majority were in the range of high to very high, while only a few had a score of zero, implying that no members felt displeased with the FCR role.

Table 5. Frequency Distribution of FCR.

Manifest Variable	Criteria (%)					Cumulative Score (%)
	Very High	High	Moderate	Less	Very Less	
Facilitate farmer group members in achieving the goals of farmer groups	45.07	45.07	6.34	3.52	0.00	**86.34**
Assist members in meeting needs	48.59	42.25	8.45	0.70	0.00	**87.75**
Realize group values	52.82	39.44	7.04	0.70	0.00	**88.87**
Represents the opinions of farmer group members in interacting with other parties	59.87	32.39	7.04	0.70	0.00	**90.28**

3.4. The Role of FAE

Agricultural extension services are indispensable and often offer not only expert assistance in increasing the production and processing of agricultural products but also allow information flow as well as the transfer of scientific knowledge and results to be put into practice [34,35]. These activities are carried out following the rules governing the formation of organizations, functions, objectives, and areas of operation, as well as the procedure, obligations, and rights of extension workers [36–39]. Additionally, agricultural extension workers play an important role in developing farmer groups, connecting farmers with a variety of technical and non-technical services and markets, as well as being the main channel for sharing knowledge [40–43]. The roles of agricultural extension workers can be executed in seven activities, namely (a) facilitating the learning process, (b) seeking easy access, (c) improving leadership, management, and entrepreneurial skills, (d) assisting the main actors in developing organizations, (e) analyzing and problem-solving as well as responding to opportunities and challenges, (f) developing environmental awareness, and (g) Institutionalization of cultural values and the development of advanced and modern agriculture.

Table 6 shows FAE Role in the study area with a cumulative score of 63.52% – 85.92%, ranging from moderate to high criteria. Manifest variables provide high criteria for institutionalizing cultural values and developing advanced agriculture above 90%. These signified that the farmer groups were concerned about the environment as well as the development of advanced and modern cultural values.

Table 6. Frequency Distribution of FAE Role.

Manifest Variable	Criteria (%)					Cumulative Score (%)
	Very high	High	Moderate	Less	Very Less	
Facilitating the learning process	2.11	22.54	66.19	9.15	0.00	**63.52**
Seeking easy access	9.86	36.62	44.37	9.15	0.00	**69.44**
Leadership, managerial, and entrepreneurial skills	12.67	66.90	16.19	4.23	0.00	**77.61**
Assisting the main actors in developing organizations	11.27	70.42	16.90	1.41	0.00	**78.31**
Analyzing and problem-solving, as well as responding to opportunities and challenges	28.87	60.56	8.45	1.41	0.70	**83.09**
Developing environmental awareness	30.99	46.48	16.19	6.34	0.00	**80.42**
Institutionalization of cultural values and the development of advanced and modern agriculture.	34.51	60.56	4.93	0.00	0.00	**85.92**

3.5. Effectiveness of Farmer Groups

Effectiveness shows the extent to which programs/activities have achieved from the results and benefits for a planned target [44]. This study referred to the indicators used by Kusnadi in West Java, Indonesia [45], where the effectiveness of farmer groups was measured through three manifest variables consisting of *the income level, proactive compliance, and satisfaction of members*.

Table 7 shows the answers of respondents about the effectiveness of farmer groups with three indicators contained in the manifest variables, including changes in income, proactive members, and satisfaction of members. The obtained cumulative score ranged from 85.92% – 91.83%, while the combination of the two criteria exceeded 90%, showing the dynamics and changes experienced by members before joining the farmer groups.

Table 7. Frequency Distribution of Effectiveness of Farmer Groups.

Manifest Variable	Criteria (%)					Cumulative Score (%)
	Very High	High	Moderate	Less	Very Less	
The level of income of farmer group members	36.62	59.86	3.52	0.00	0.00	**88.02**
Proactive compliance of farmer group members	38.03	54.23	7.04	0.70	0.00	**85.92**
Satisfaction of farmer group members	64.79	30.99	2.82	1.40	0.00	**91.83**

3.6. SEM Assumptions

3.6.1. Normality

The normality test was conducted on all manifest variables, including the role of FCR and FAE, as well as the effectiveness of farmer groups, due to their being a prerequisite in SEM. Meanwhile, the univariate normality test requires a value originating from the critical ratio (cr) in skewness and kurtosis at a significance of 0.10. The normality results showed skewness and kurtosis values of all variables at intervals of −2.58 to 2.58, signifying that the data were normally distributed and SEM tests could be performed subsequently (**Table 8**).

Table 8. Test of Normality.

Manifest Variable	Variable	Minimum	Maximum	Skewness		Kurtosis	
				Statistic	Std. Error	Statistic	Std. Error
Role of Field Agricultural Extension	X1	2.00	5.00	0.456	0.203	0.812	0.404
	X2	2.00	5.00	0.136	0.203	−0.404	0.404
	X3	2.00	5.00	−0.727	0.203	1.282	0.404
	X4	2.00	5.00	−0.449	0.203	1.328	0.404
	X5	2.00	5.00	−0.570	0.203	0.551	0.404
	X6	2.00	5.00	−0.663	0.203	−0.071	0.404
	X7	3.00	5.00	−0.014	0.203	−0.551	0.404
Role of Farmer Contact Resources	Y1	2.00	5.00	−1.110	0.203	1.343	0.404
	Y2	2.00	5.00	−0.788	0.203	0.126	0.404
	Y3	2.00	5.00	−0.926	0.203	0.427	0.404
	Y4	2.00	5.00	−1.177	0.203	0.846	0.404
Farmer Group Effectiveness	Z1	3.00	5.00	−0.218	0.203	−0.858	0.404
	Z2	2.00	5.00	−0.494	0.203	0.262	0.404
	Z3	2.00	5.00	−0.582	0.203	0.665	0.404

3.6.2. The Goodness-of-Fit Index Model Test

The significance of SEM usage was tested with the *goodness-of-fit* model obtained through several criteria, including (F0), Non-Normed Fit Index (NNFI), CFI, Incremental Fit Index (IFI), ECVI, and Root Mean Square Residual (RMR). Riadi stated that several index criteria could test the fitness of a used model [46]. In this study, six indices were considered, and the developed model was found to be fit (**Table 9**) by meeting the goodness of fit criteria under specified conditions. **Figure 3** shows the assessment of the fit model with various criteria and the development of an unstandardized basic model.

Table 9. The Goodness-of-Fit Index Model Assessment.

The goodness of the Fit index	Cut-off Value	Model Description	Result
F0	< 3.00	0.41	Fit
TLI/NNFI	> 0.90	0.91	Fit
CFI	> 0.90	0.94	Fit
IFI	> 0.90	0.94	Fit
ECFI	Saturated <Independent Model	0.64 < 6.55	Fit
RMR	< 0.05	0.026	Fit

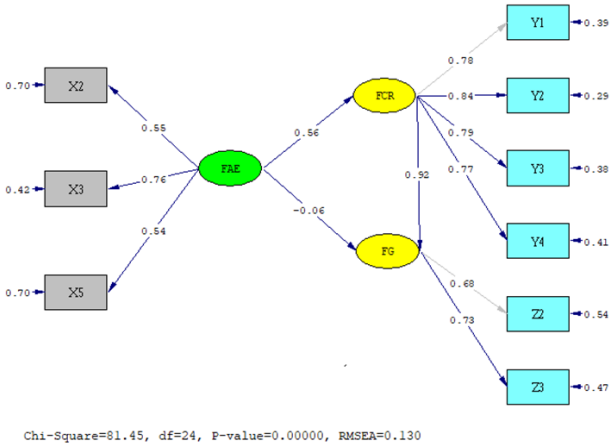

Figure 3. A Complete Model of FCR and FAE Role in Increasing the Effectiveness of Farmer Groups.

3.6.3. SEM Estimation

The overall structural equation (*full model*) was estimated after conducting CFA and declaring the model fit based on the criteria. The SEM analysis results (**Table 10**) showed that FAE role in *seeking easy access* (X2) had a coefficient regression of 0.44 with a close relationship of 0.30 and an error of 0.44 variance. Ease of access to FAE was maintained sufficiently by all members of the farmer groups, which would help support institutional development and empower farmers and integrated farmer groups. An increase in the activity of FAE and farmer groups enhances the ability of farmers to solve more problems, signifying the importance of FAE workers. Based on the SEM estimation results, *FAE* positively improved *leadership, managerial, and entrepreneurial abilities* (X3) by 0.51, with a close relationship of 0.58 and an error variance of 0.19. This can be due to the leadership factor having great power in determining the behavior of farmers. Even managerial and entrepreneurial power occasionally exceeds the characteristics of the farmer group members. Despite all the limitations, FAE had a positive influence on the managerial environment, and FCR would contribute to institutional development as well as the empowerment of farmer groups and members. FAE's role had a positive and very significant influence on analyzing and solving problems, as well as responding to business opportunities (X5) and challenges of farmer groups by 0.37, with a close relationship of 0.30 and an error variance of 0.33. Analyzing and solving problems as well as responding to the opportunities and challenges faced by farmer groups, are part of the group activities arranged and validated to be good in driving collective work among members. This also provides an advantageous influence in predicting future challenges and selecting from any future business opportunities.

Table 10. Results of the SEM Analysis.

Manifest Variable	Coef. Regression	Error Var	Stand. Error	R^2	t Count	t Count Error Var
X2	0.44*FAE	0.44	0.065	0.30	5.83**	6.84**
X3	0.51* FAE	0.19	0.050	0.58	7.87**	3.70**
X5	0.37* FAE	0.33	0.048	0.30	5.77**	6.89**
Y1	0.58*FCR	0.22	0.032	0.61	-	6.79**
Y2	0.57* FCR	0.13	0.022	0.71	10.52**	5.93**
Y3	0.52* FCR	0.16	0.024	0.62	9.76**	6.74**
Y4	0.51* FCR	0.18	0.049	0.59	9.46**	6.95**
Z2	0.43*FG	0.21	0.033	0.46	-	6.40**
Z3	0.45*FG	0.18	0.032	0.53	6.89**	5.62**

Note: *Significant (t count > 1.960) α 0.05
**Highly significant (t count > 2.576) α 0.01

FCR provides a very reliable contribution, which includes facilitating group members (Y1), helping members meet the needs of production facilities (Y2), supporting a collection of aspirations/ideas proposed in achieving the value of farmer groups (Y3), and representing the opinions of group members (Y4), with variant errors of 0.13 – 0.22. This variable had a positive and significant influence on *helping members meet the needs of production facilities* with a coefficient of 0.57, a close relationship of 0.71, and a variance error of 0.13. Furthermore, the results showed that more group members received benefits to meet the needs of production facilities in conducting farming. FCR is a bridge for group members to implement the agricultural technology system in lowland rice farming through integrated agricultural management programs. The positive influence of active FCR and members is reflected in preparing the *Definitive Plan for Group Needs*, which provides the confidence for farmer group members to accommodate the needs of production facilities. Additionally, *the Role of FCR* in effectively communicating the opinions of farmer group members with other parties has a coefficient of 0.51, a close relationship of 0.59, and a variant error of 0.18. This condition implies that the group members assume that FCR will act as a representative in interacting with other parties during activities related to the farming system and market yields.

The Effectiveness of farmer groups had a positive and very significant influence on two of the three manifest variables. These included *proactivity and compliance of members in participating in farmer group activities (Z2)* with a coefficient of 0.43 and a close relationship of 0.46. The second variable is *the satisfaction of group members* (Z3) with a coefficient of 0.45 and a close relationship of 0.53. However, the effectiveness did not significantly influence the income level. Several studies on the effectiveness of farmer groups showed inconsistent results. A study conducted by Achdiyat on Farmer Groups in Malingping Sub-District, Indonesia, showed a relationship between the effectiveness of farmer groups, the satisfaction level, and knowledge relevant to work [47]. This implies higher satisfaction will lead to more effectiveness in the farmer groups. Wambura et al. found strong leadership to be a key factor in determining the effectiveness of farmer groups in Tanzania [48]. In Cukangkawung Village, Ruhimat detected that the effectiveness was directly influenced by the participation level of group members and indirectly influenced by the role of leadership, FAE role, and the characteristics of farmers [49].

3.6.4. Standardized Solution Used Lisrel 8.8 Software

The complete SEM of FCR and FAE Role in Increasing Farmer Group Effectiveness (**Figure 3**) can be given as follows:

$$FG = 0.92 * FCR - 0.063FAE \qquad Errorvar = 0.21(0.12)$$
$$(0.15) \qquad (0.12) \qquad R^2 = 0.79$$
$$FCR = 0.56 * FAE \qquad Errorvar = 0.68(0.15)$$
$$(0.11) \qquad R^2 = 0.32$$

Note: value in parentheses shows standard error

The regression analysis results showed a positive influence of FCR on the effectiveness of farmer groups, with a regression coefficient of 0.92, signifying a strong positive relationship. Furthermore, the direct influence of FAE on improving the effectiveness of farmer groups was found to be small and negative, with a coefficient of −0.063. This negative impact can be attributed to a substantial bias originating from manifest variables such as seeking easy access (0.70) and responding to business opportunities (0.70). Conversely, a positive relationship (0.32) exists between FCR and FAE variables, as shown by a regression coefficient of 0.56.

The described structural relationship states that the role of FCR and FAE workers in increasing the effectiveness of farmer groups will be well achieved when there is a direct positive influence from FAE workers on FCR. Meanwhile, the direct influence of FCR without the role of FAE leads to reduced effectiveness.

In addition to the basic unstandardized model output, unstandardized estimates and standardized solutions were obtained. Path diagrams of unstandardized estimates and standardized solutions show that the structures are identical, but the values obtained are different (Pictures 2 and 3). Based on the description, slightly modifying the basic and structural model relationship is necessary because the resulting model differs from the concept built. This implies the established structural relationship can be flexible, and there is only

a need for a reduction in manifest variables (X1, X4, X6, and X7). Additionally, one manifest variable on the endogenous variables (Z1) should be removed to achieve a well-fitting model based on the obtained data.

Based on the SEM (full model) analysis in **Figure 3** and the variance error values in Table 10, the results can be explained as follows:

1) FAE services significantly influence accessibility, leadership development, managerial and entrepreneurial skills, as well as business opportunities.

2) The role of FCR is crucial in facilitating group members and production facilities, achieving the value of groups, and representing opinions.

3) Farmer groups are more effective when members are active and follow the rules, while member satisfaction helps to improve skills and knowledge.

4. Discussion

This study explores information exchange systems between farmers and agricultural instructors, such as using FCR as intermediaries. The responsibilities of FCR include acting as catalysts in introducing new technology or innovation to members of farmer groups. Moreover, FCR has strong communication skills regarding meeting frequency and the willingness to discuss farming issues openly.

FCR exceeds ordinary community members by including rightful leaders, serving as natural volunteers, additional FAE workers, and partners in agricultural extension. The collaboration is expected to create synergy, increasing production and income. According to Bahfiarti [50], FCR can act as opinion leaders in groups, fostering a sense of closeness and trust among the members.

During the 1991–1998 period in Indonesia, it was observed that opinion leaders were more effective in transmitting knowledge among farmers participating in the Integrated Pest Management (IPM) program. However, excessive socioeconomic distance gaps can reduce the effectiveness of diffusion [51]. The study by Rohi et al. on the effectiveness of communication from farmer group opinion leaders in Kupang Regency showed that leaders possessed the necessary qualities to implement rice technology [52]. In a study on the role of FCR as leaders in the diffusion process of integrated rice crop and resource management technology, Pertiwi and Heryadi similarly found that the leaders played a crucial role in helping the group reach goals [32], enhancing communication, increasing the motivation of farmers, improving farming infrastructure, and resolving problems. These leaders are considered effective communicators due to successfully bridging the gap between Integrated Rice Crop innovation and the farmers, thereby facilitating the dissemination.

FAE in this study did not directly contribute to the effectiveness of farmer groups. Most group members cannot have regular, in-depth discussions with public extension workers (PPLs) about farming issues. Due to the limited number of PPL staff and farmers living far from each other, discussions between the two groups are scheduled for specific times, which directly obstruct the resolution of field issues. This result is consistent with the state of agricultural extension in India [53], which shows that a top-down method, staff shortages, and limited partnerships continue to hinder the effectiveness and efficiency of the public extension system. According to van den Ban and Hawkins [54], FAE workers can play a vital role in enhancing the effectiveness of groups by assisting farmers as active group members in forming opinions and making informed decisions. However, the limited government budgets allocated for agricultural studies and extension in many countries have reduced extension services, leading to the origination of non-governmental organizations and the withdrawal of traditional actors [55]. This area does not yet meet government regulations regarding the protection and empowerment of farmers, which state that there must be a minimum of one agricultural field instructor in each village.

Several studies have examined methods for effectively transferring knowledge and new technologies from FAE workers to farmers. Azumah investigated agricultural technology transfer among rice farmers in Ghana and discovered that the most successful methods included farmer-to-farmer sharing, demonstrations, and household extension [56]. Nakano et al. found that farmer-to-farmer extension programs were practical and cost-effective for training smallholders in Tanzania [57]. In addition, a study conducted by Jamil et al. in Baubau City, Indonesia, showed that farm capital,

farmer age, education, farming experience, and human resources were critical factors influencing the effectiveness of agricultural extension [58]. de Roo et al. identified two significant limitations of the model farmer method used in extension programs in Ethiopia [59]. First, the model farmers faced challenges in effectively communicating knowledge, and the second limitation was that significant social, political, and economic inequalities reduced the effectiveness of the method. Therefore, the effectiveness of an extension model depends on the extent to which recommended practices on technology implementation are achieved [60].

5. Conclusions

In conclusion, the effectiveness model in the study area suggested that farmer group members were more receptive to FCR than FAEs. Therefore, improving various aspects of agricultural extension, such as access, leadership, management, entrepreneurship, and business opportunities, is necessary to increase the effectiveness of farmer groups. Additionally, this study found that the farmers mostly attained junior high school level, signifying a need for an increase in education-related human resources (**Table 1**). Hnoosh reported that education level was a significant factor in FCR and interactions with extension services [61]. Dibba et al. stated that farmers needed to engage with these services to adopt new technology successfully [62].

Improving human resource capabilities would be essential to address the discussed issues. This could be achieved by providing FAE workers and farmers with training and skill development opportunities while maintaining the performance of FCR. Investing in education and training would enhance the performance of the agricultural industry and promote sustainable development. Based on the concept of human capital, these individuals are supposed to be considered valuable resources contributing to the productivity and efficiency of the farming sector. The concept includes perceiving humans as a form of capital that requires maintenance and can be produced [63]. Industries should invest necessary resources in developing human capital due to the great influence on performance [64]. Therefore, future investigations should aim to enhance the effectiveness of farmer groups in adopting new technology by improving the contribution of human capital.

Author Contributions

Conceptualization, S.P.U.; methodology, S.P.U.; software, S.P.U and K.S.; formal analysis, S.P.U. and K.S.; investigation, S.P.U. and K.S.; data curation, S.P.U. and K.S.; writing—original draft preparation, S.P.U. and K.S.; writing—review and editing, S.P.U. and K.S.; project administration, S.P.U.; funding acquisition, S.P.U. All authors have read and agreed to the published version of the manuscript.

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Not applicable.

Data Availability Statement

The data in this study are available on request from the corresponding authors.

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Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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