

# REVIEW 1

# 2 Effectiveness of Agricultural Extension on Paddy Rice Farmer's 3 Baubau City, Southeast Sulawesi, Indonesia

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13 **Abstract:** Agricultural extension workers play an essential role in the productivity of agricultural  
14 systems. Based on the actual conditions in the field, it can be seen that the level of extension services  
15 still needs to be higher due to a lack of human resources in the field of extension services. This  
16 research was conducted to determine the effectiveness of agricultural extension services. This study  
17 aimed to determine the factors that influence the effectiveness of agricultural extension to farmers in  
18 Baubau City, Indonesia. The analytical method includes exogenous latent variables: technological  
19 progress, farming capital, farmer age, education, and farming experience. Human resources and the  
20 effectiveness of agricultural extension are used as endogenous latent variables. The research sample  
21 consisted of 110 rice farmers in Baubau City, and the Slovin formula was used to calculate the sample.  
22 The data collection for this research was carried out by distributing questionnaires to respondents, in-  
23 depth interviews, and direct observation in the city of Baubau. Using the AMOS application,  
24 quantitative analysis was carried out through Structural Equation Modeling (SEM). The study results  
25 show that: 1) The factors that influence the effectiveness of agricultural extension in Baubau City are  
26 farming capital, farmer age, education, farming experience, and human resources, and 2) the influence  
27 of these factors on effectiveness. Agricultural extension is as follows: if the farming capital is high,  
28 human resources can be increased. In addition, the higher the farmer's age, the lower the need for  
29 human resources. It is also noted that higher farmer education contributes to increased human capital,  
30 and increased experience in farming is associated with increased human capital. Thus, an increase in  
31 human resources will increase the effectiveness of agricultural extension. Significant factors that  
32 influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi, are farming  
33 capital, farmer age, education, farming experience, and human resources.

34 **Keywords:** extension, rice, Indonesia.

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## 1. Introduction

Southeast Sulawesi has sufficient competence to support the Indonesian food development program because of the high availability of land and the potential for land productivity. Based on data on rice fields area in the rice planting season, Southeast Sulawesi has an area of 82,382 ha of raw rice fields (Data Landsat Satellite 2020). The area of rice fields in Baubau city is 1,375 ha, consisting of an area with technical irrigation of around 1,168 ha.

The agricultural sector of Baubau City can be considered quite productive, as indicated by the contribution of the Baubau City agrarian sector to the gross regional domestic product in 2018, which was 14.4%, with a productivity growth rate of 11.6% in the agricultural sector. This agricultural sector growth rate is greater than the economic growth rate of Baubau City, which was only 6.33% in 2018. This indicates that the agricultural sector is one of the sectors with high priority in Baubau City (Abadi, 2019). Rice production domestically is dominated by lowland rice production. Hence, the extension workers should increase their effectiveness in extension services for the lowland ricer farmers.

51 Extension workers can contribute to the regulatory process by providing expertise and  
52 content for proposed, adopted, and restructured agriculture-related regulations. As  
53 Extension agents have direct interaction with clients in the field, they can communicate the  
54 needs of stakeholder groups. Therefore, they should be involved in the regulatory process.  
55 An evidence-based approach involving input from target groups and practitioners seems to  
56 be an inevitable strategy for the success of a sustainable land grant project (Fouladkhal, A.,  
57 2017).

58 Extension agents are one of the supporting elements in the agribusiness sub-system. In  
59 principle, the agricultural extension supports all sub-systems in agribusiness. Specifically, in  
60 this study, extension workers play a role in supporting the *on-farm* to increase the  
61 productivity of lowland rice. Hence, to increase the productivity of rice farming, extension  
62 workers are needed. The role of the extension worker is to provide guidance and knowledge  
63 in the form of the latest information or innovation to improve their farming system,  
64 ultimately increasing their crop yields. In addition, the purpose of agricultural extension is  
65 to change the behavior of farmers, for instance, their ability to adapt to situations and  
66 conditions that keep changing. Thus, they can improve their farming systems, increase  
67 production, and reduce the possibility of crop failure. While simultaneously improving their  
68 living standards.

69 However, there are some significant issues, such as a lack of active participation from  
70 agricultural extension workers and the difference in the extension worker to farmer ratio,  
71 leading to fewer extension workers to many farmers. This problem causes the workload of  
72 each extension worker to be quite large because either the extension area or the number of  
73 assisted farmer groups is quite large. The current condition is forcing agricultural extension  
74 workers to work hard despite a limited number of workers, and they must be able to  
75 perform optimally to increase their work productivity.

76 Currently, there are 44,890 agricultural extension workers (25,734 civil servant  
77 agricultural extension workers and 19,156 THL-TB agricultural instructors). They assist  
78 71,479 agricultural villages, but they still need around 26,589 extension workers  
79 (Pusluhtan/ Agricultural Extension Center), (2016).

80 The role of extension workers can increase sustainable agricultural productivity and  
81 food security (Olorunfemi, T. O., et al. 2020). One of the most crucial things is to ensure that  
82 leaving agricultural extension and education programs has a positive impact on farmers  
83 (Salehi, M., et al. 2021). Consequently, the crucial role of extension workers is to create  
84 awareness among farmers to apply guidelines for food needs (Fiaz, S., et al. 2018). The  
85 findings of the study (Jamil, M.H., 2017) show that the development of agricultural  
86 extension workers has a positive effect on the agricultural extension program.

87 Agricultural extension programs and policies can play an important role in achieving  
88 production (Mahir, M. E. A. E., & Abdelaziz, H. H. 2011). Additionally, this agricultural  
89 policy discussed by (Baloch, M. A., & Thapa, G. B, 2019) who said that agricultural policies  
90 must be implemented effectively to the needs of farmers and the problems they face. One  
91 example is that the Government of Pakistan has adopted a policy of providing agricultural  
92 services to promote agricultural production by disseminating appropriate knowledge and  
93 technology to farmers (Baloch, M. A., & Thapa, G. B., 2018).

94 The agricultural industrial revolution has had an impact on efficiency and productivity  
95 in agricultural extension services in the agricultural sector (Nyarko, D. A., & Kozári, J. 2021).  
96 The effects of community-based strategies on food security has a positive impact (Wellard,  
97 K., et al. 2013). It is suggested that extension services provide information and  
98 communication technology training ( ICT) for agricultural extension workers to improve  
99 extension services. In addition, according to (Umbara, D.S., Sulistyowati, L., Noor, T.I., and  
100 Setiawan, 2021) The dissemination of agricultural technology information by utilizing the  
101 internet network is very helpful for agricultural extension workers in carrying out their  
102 main tasks. Information and communication Technology are also can be used to facilitate  
103 the delivery of information and knowledge sharing between farmers, extension workers,  
104 and other stakeholders. (Annor-Frempong, F., et al. (2006). In the article (Haghighi, N. F., et  
105 al. 2008) stated the perspective on the application of information and communication  
106 technology in agriculture, some issues with using ICT in organizations, however, in  
107 contrast, in accordance (Diaz, R. T., et al. (2021). It was found that services Extension  
108 services in the study area are not sufficient when farmers face difficulties.

109 From the literature, it can be gathered that an agricultural extension worker plays an  
110 essential role in the productivity of a farming system. Based on the actual conditions in the  
111 field, it can be acknowledged that the extension service rate is low due to a lack of human  
112 resources in the extension field. Therefore, to solve the problems that arose from the current  
113 predicament, this study was conducted to determine the effectiveness of agricultural

114 extension services. The primary purpose of this study is to determine the factors that  
115 influence the effectiveness of agricultural extension services to lowland rice farmers in  
116 Baubau City and to find out how these factors can affect the effectiveness of agricultural  
117 extension services.

## 118 **2. Materials and Methods**

119 Interventionary studies involving animals or humans, and other studies that require  
120 ethical approval, must list the authority that provided approval and the corresponding  
121 ethical approval code. A simple random sampling was used. The sample measurements  
122 were calculated using the Slovin formula. This sample size was determined with an error  
123 rate of 10% or based on the desired level of confidence (precision) of 90%, and the sample  
124 size based on the Slovin formula amounted to 93 respondents. To meet the minimum  
125 requirements in the SEM analysis, the number of samples was increased to 110 samples of  
126 rice farmers. The study sample for extension agents was based on the population of  
127 extension workers in Baubau City, which amounted to 26 personnel. From which 30% of the  
128 total were sampled, resulting in 8 extension workers.

129 The data collection techniques used to carry out the study were questionnaires, direct  
130 interviews and observations to determine the characteristics and behavior of the research  
131 object. The data obtained were analyzed descriptively and quantitatively using the SEM  
132 (*Structural Equation Modeling*) - Amos method.  
133

## 134 **3. Results**

135 The demographic characteristic of the farming communities involves 96% of male and  
136 4% of female farmers (table 1). There is a division of household tasks between husband and  
137 wife. Based on in-depth interviews with several respondents, they stated that working in the  
138 fields is the husband's duty while the wife takes care of the household. Results based on age  
139 indicated that 34% of farmers were 36-45 years old, and 6% were under 25 years old.  
140 Farmers who work at productive age will be better and more optimal than non-productive  
141 age (Productive age 15-64). In addition, age can also be used as a benchmark to see the  
142 activities of farmers at work (Hasyim, 2006).

143 It was revealed that the respondents with non-educational levels were 10%.  
144 Respondents with the last education at the elementary, junior school, and senior high school  
145 levels were 41%, 13%, 31%, respectively, and at the tertiary level added to 5%; according to  
146 (Soehardjo and Patong, D. 1999) higher levels of education results to more straightforward  
147 implementation of innovations. Farmer education is not only oriented toward increasing  
148 production but the social life of the farming community farmers with a high education level  
149 will be relatively faster in implementing technology adoption and innovation. Farmers who  
150 have low education may have difficulty implementing the adoption of innovation quickly.  
151 The level of education possessed by farmers depicts the knowledge and insight a farmer has  
152 in applying technology and innovation to increase farming activities (Lubis, 2000).  
153 Demographic characteristics based on the main occupation of farmers show that farming is  
154 the respondents' main occupation, totaling 97%. In comparison, the remaining 3% of the  
155 main occupation are civil servants and farming as their side employment.

156 Based on the study's results, farmers with a land area of less than 1 ha was 16%, 1 to 5  
157 ha was 82%, and more than 5 ha was 2%. The number of farmers that own their land is 93%,  
158 and 6% of the farmers are tenants, while the remaining 1% amounts to farmers being  
159 landowners and tenants. It is important to note that more land ownership means more  
160 potential to increase productivity and efficiency by adopting modern technology. Land  
161 tenure is vital in spreading and adopting modern agricultural practices among farming  
162 communities (Aldosari et al., 2019).

163 Next, the results show that a significant percentage of the farmers had more than 10  
164 years of experience resulting in a total of 76%, followed by farmers with 5-10 years with 14%  
165 and farmers with less than 5 years of experience with 10%. The farming experience  
166 significantly affects farming activities, as evident from the production results. Farmers who  
167 have been farming for a long time have high knowledge, experience, and skills in running a  
168 farm. Farming experience is divided into three categories, namely less experienced (< 5  
169 years), moderately experienced (5-10 years), and experienced (10 years). Farmers have  
170 different farming experiences or lengths of farming (Soehardjo and Patong, D. 1999)  
171 Furthermore, it can be seen that respondents have chosen "hereditary" as their farming  
172 background surmounting 90% or as many as 99 people from the total number of  
173 respondents, and none of the respondents chose the "has the farming ability" as a farming

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background and in this case the respondent's last education determines the farming background. The remaining percentage were recorded for farming backgrounds are as follows "economic need, availability of adequate land, the ability to farm and willingness based on agriculture as a promising field." The percentage for each are as followed 3%, 4%, 1% & 2% respectively.

**Table 1.** Demographic Characteristics Data of Rice Farmers in Baubau City, Southeast Sulawesi

Gender	n	%	Age ( years)	n	%
Male	106	96	Less than 25	7	6
Female	4	4	25 – 35	25	23
Total	110	100	36 – 45	17	15
			46 – 55	37	34
			More than 55	24	22
			Total	110	100
Last Education	n	%	Main occupation	n	%
No Education	11	10	Farmers	107	97
Elementary school	45	41	Other than farmers (PNS)	3	3
Junior high school	14	13	Total	110	100
Senior high school	34	31			
Higher education	6	5			
Total	110	100			
Land Area (ha)	n	%	Land Ownership Status	n	%
Less than 1	18	16	Owner	102	93
1 – 5	90	82	Tenant/tenant	7	6
More than 5	2	2	Owner and tenant	1	1
Total	110	100	Total	110	100
Time of farming (years)	n	%	Farming background	n	%
Less than 5	11	10	Hereditary	99	90
5 – 10	15	14	Economic needs	3	3
More than 10	84	76	Availability of adequate land	5	4
Total	110	100	Has the ability to farm	1	1
			Willingness from within because farming is a promising field	2	2
			Total	110	100

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n = Total; % = Percentage

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**Table 2.** Data on Demographic Characteristics of Agricultural Extension Respondents based on Working Area and Distance from Work Area Baubau City, Southeast Sulawesi

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No. Sample	Working Area	Distance from Working Area (Km)
1	Lea-lea Subdistrict	15
2	Tampuna Subdistrict	21
3	Liabuku Subdistrict	9
4	Bungi Subdistrict and Lea-Lea Subdistrict	10

5	Ngkaring-ngkaring Subdistrict	5
6	Waliabuku Subdistrict	13
7	Lowu-lowu	15
8	Subdistrict Kalia-lia	15

An extension work area is a place or an area that becomes the territory of authority in carrying out its duties as an extension worker, whether within the ward, sub-district, district/city, or wider area. The extension worker's work area can affect productivity in carrying out his duties as an extension worker. Meanwhile, the distance from the working area is the distance from the instructor's residence to the extension location. In Table 2, it can be seen that each respondent has a different work area and length from the work area. The distance from the farthest working area is 21km, and the closest is 5 km.

**Table 3.** Data on Demographic Characteristics of Agricultural Instructor Respondents in Baubau City, Southeast Sulawesi

Duration as an Extension (years)	n	%	Status	n	%
Less than 5	1	12	Civil Servants	5	63
5 – 10	2	25	Honorary Employee	1	12
More than 10	5	63	THL- TBPL	2	25
Total	8	100	Total	8	100

THL- TBPL: Agricultural extension workers

Duration as an extension refers to this study, each respondent has been an extension worker from the time of appointment until this research is carried out, expressed in units of years. The length of time an extension worker determines the level of experience each agent has. In this case, the duration of an extension worker is divided into three categories: less experienced (<5 years), moderately experienced (5-10 years), and experienced (>10 years). Table 3 shows the highest percentage (63%) 5 out of 8 agents have experience of more than 10 years as an extension worker. While extension agents with moderate experience equal to 2 out of 8 (25%), and extension agents with less than 5 years of experience totaled to 1 out of 8 (12%).

The status of the extension workers refers to the position an agent holds, which corresponds to their employment descriptions. Table 3 displays that of the 8 surveyed workers, 63% (5 agents) are Civil Servants, 12 % are honorary employee, and 25% are THL-TBPL position holders.

### 3.1. Descriptive Statistical Analysis

#### 3.1.1. Technological Progress Variables

**Table 4.** Frequency Distribution of Technological Progress Variables (X1) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming Businesses in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Use of <i>transplanter</i>	110	52	27.22	52.3	Not good
2	Use of <i>indo combine harvester</i>	110	52	23.68	45.5	Not good
3	Use of KATAM (predicted planting season)	110	50	38.22	76.4	Enough
4	Use of KATAM (fertilizer dose)	110	50	35.51	71.02	Enough
5	Use of <i>drones</i> (irrigation sensor/measuring soil pH)	110	16	12.94	80.9	Good

6	Use of expert system applications	110	17	13.35	78.5	Enough
7	Use of social media	110	50	23.57	47.1	Not good
Average				24.91	64.53	Not good

Based on Table 4 above, the average technological progress variable is 24.91 with a respondent's level of achievement is 64.53% which favors the not good category. Thus, it can be said that technological advances have less than the desired effect on agricultural extension. The indicator with the lowest TCR value in the table above is the use of *indo combine harvester* with an average score of 23.68, gravitating in the bad category. While the indicator with the lowest average score is for the use of *drones* (irrigation sensor/measuring soil pH) which is 12.94, and the TCR value is 80.9 falling into the good category.

The impact of the extension approach on the use of technology, food security was found to be positive (Wellard, K., et al. (2013). Dissemination of agricultural technology information is helpful for agricultural extension workers in carrying out their main tasks. Agriculture (Umbara, D.S et al., 2021 ). In recent years, the agricultural industry has experienced an increase in the application of information and communication technology globally. This new revolution is said to have an impact on efficiency and productivity in agricultural extension services in the agricultural sector (Daniel et al., 2021). Information and Communication Technology can be used in a cost-effective and practical way to facilitate information sharing and knowledge sharing among farmers, extension workers and other stakeholders (Joseph Kwarteng, 2006). This new revolution is said to have an impact on efficiency and productivity in agricultural extension services in the agricultural sector (Daniel Ayisi Nyarko and József Kozári, 2021). Attitudes towards the application of information and communication technology in agricultural extension, the extent of the problems faced by extension organizations to use ICT, Knowledge of ICT and personal characteristics (Negin Fallah Haghighi et al., 2008).

### 3.1.2 Farming Capital Variable

**Table 5.** Frequency Distribution of Farming Capital Variables (X2) in Research on Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Land area	110	54	39.60	73.3	Sufficient
2	Labor	110	51	23.03	45.1	Not good
3	Fertilizer use	110	52	42.85	82.4	Good
4	Pesticide use	110	56	42.36	75.7	Enough
5	Agricultural machinery use	110	67	42.98	64.1	Poor
Average				38.16	68.12	Enough

Based on Table 5 above, the average farming capital variable is 38.16 with a TCR value of 68.12, portraying the sufficiency of the indicator. In other words, the influence of the farming capital variable on the effectiveness of agricultural extension is satisfactory. The labor indicator in the table above has the lowest TCR value of 45.1, and the average score is 23.03, which is the indicator value with the lowest score; hence, it is portrayed in the bad category. In comparison, the indicator with the highest TCR value is the use of fertilizer, which is 82.4 with an average value of 42.85 and is present in the Good category.

### 3.1.3 Farmer Age Variable

**Table 6.** Frequency Distribution of Farmer Age Variable (X3) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Rice Field Farming in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Farmer Productivity Level	110	57	38.82	68.1	Enough

2	Attitude in Making Decisions	110	57	41.33	72.5	Enough
3	Acceptance of Information	110	57	36.05	63.2	Poor
Average				38.73	67.93	Adequate

In table 6 above, the average farmer age variable is 38.73 with a TCR value of 67.93 and is in the Adequate category. It can be stated that the influence of the age variable of farmers on the effectiveness of agricultural extension is reasonably influential. The attitude indicator in decision making has the highest average value of 41.33 and the TCR value of 72.5; hence, classified in enough sections. While the indicator with the lowest average value, namely the acceptance of information, is 36.05 with a TCR value of 63.2, which falls in the designated section of Poor.

#### 3.1.4 Farmer Education Variable

**Table 7.** Frequency Distribution of Farmer Education Variables (X4) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Education Level	110	57	18.25	32.01	Not good
2	Type of Education	110	51	15.58	30.6	Not good
3	Perception about Education	110	54	13.95	25.8	Not good
4	Training	110	58	18.48	32.4	Not good
Average				14.56	30.20	Not good

Based on Table 7, the average farmer education variable is 14.56 with a TCR value of 30.20 which is Not good. In other terms, the influence of farmers education on the effectiveness of agricultural extension is not present. The Perception Indicator of Education has the lowest average score of 13.95 and the TCR value of 25.8, indicating that the variable component is in a bad category. Likewise, the other three indicators fall in the not good category, as evident in the table above.

#### 3.1.5 Farming Experience Variable

**Table 8.** Frequency Distribution of Farming Experience Variables (X5) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Farming time	110	60	40.51	67.5	Enough
2	Farming background	110	56	28.13	50.2	Not good
3	Farmers skills	110	57	43.72	76.7	Enough
Average				37.45	64.8	Poor

Referring to table 8, the average farming experience variable was 37.45 with a TCR value of 64.8, indicating that the experience variable categorizes in the poor section. From the three indicators, it shows that the farming background indicator has an average value of 28.13 and a TCR value of 50.2, while being categorized as not good; however, the indicators of the farming time and farmer skills are in the sufficient category with TCR values of 67.5 and 76.7 respectively.

#### 3.1.6 Extension Problem Variables

Table 9 shows the average variable of extension problems is 35.28 with a TCR value of 83.26, indicating that these variables are in a good category. The indicator of the number of assisted farmers has an average value of 44.00 and shows a TCR value of 78.6 which means it is in the sufficient category. The extension media indicator has an average value of 25.63 and

shows its TCR value of 91.5, presenting as Very Good, followed by indicators of the experience of the extension worker, the frequency of extension, the amount of working time of the agricultural instructor, the extension method, and the extension material, which were both in the good category. The indicator of the distance of the extension location is in the enough category.

**Table 9** Frequency Distribution of Extension Problems Variables (X6) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Number of Assisted Farmers	8	56	44.00	78.6	Enough
2	Distance of Extension Locations	8	21	15.00	71.4	Enough
3	Total Working Time of Agricultural Instructor	8	23	19.88	86.4	Good
4	Extension Media	8	28	25.63	91.5	Very good
5	Extension Methods	8	31	25.38	81.9	Good
6	Extension Frequency	8	44	38.13	86.7	Good
7	Extension Materials	8	46	37.13	80.7	Good
8	Extension Experience	8	53	47.13	88.9	Good
Average				35.28	83.26	Good

### 3.1.7 Extension Materials

Based on table 10, the average of the Extension Materials variable is 3.53 with a TCR value of 83.94, indicating that this variable is in a good category. The table's fertilization, harvesting, and post-harvest indicators have the same average value of 3.63 and the same TCR value of 90.75, indicating that the three indicators are in the very good category. Then followed by indicators of good planting time, seed sowing, and planting, which all have the same average value of 3.50 and the same TCR value of 87.5, indicating that the variable components are in a good category. While the nursery and maintenance indicators are in the enough category.

**Table 10.** Frequency Distribution of Extension Material Variables (X7) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Good Planting Time	8	4	3.50	87.5	Good
2	Tillage	8	5	4.00	80	Good
3	Nurseries	8	4	2.63	65.75	Enough
4	Nurseries	8	4	3.50	87.5	Good
5	Planting	8	4	3.50	87.5	Good
6	Maintenance	8	5	3.75	75	Enough
7	Fertilizing	8	4	3.63	90.75	Very good
8	Harvesting	8	4	3.63	90.75	Very good
9	Post-harvest	8	4	3.63	90.75	Very good
Average				3.53	83.94	Good

### 3.1.8 Human Resources

Table 11 shows that the average score of the Human Resources variable is 4.20, and the TCR value is 84.12, hence, summarizing the variable in the Good category. In the five indicators below, one indicator is in the bad category, namely the quality of education

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related to work skills/expertise, with an average value of 1.80 and a TCR value of 36. In contrast, the other four indicators are in the very good category.

**Table 11.** Frequency Distribution of Human Resources Variables (Y1) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Farmers' knowledge of rice cultivation techniques	110	5	4.90	98	Very good
2	Farmers' knowledge of good rice seeds	110	5	4.92	98.4	Very good
3	Determination of labor needs	110	5	4.65	93	Very good
4	Quality of education related to Skills/work skills	110	5	1.80	36	Not good
5	Health quality (physical and psychological) of farmers	110	5	4.76	95.2	Very good
<b>Average</b>				4.20	84.12	Good

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### 3.1.9 Effectiveness of Agricultural Extension

The results of table 12 show that the average variable of Extension Effectiveness Agriculture is 3.73 and has a TCR value of 74.76 which means that the variable is in the sufficient category. This Agricultural Extension Effectiveness variable has six indicators, of which one indicator is in a bad category, that is, the number of farming families. Then two indicators are in the very good category: farmer participation and the level of cosmopolitan farmers with TCR values of 97 and 92.6. Then followed by indicators of rice farming income in the good category, and indicators of rice production and land productivity in the sufficient category.

**Table 12.** Frequency Distribution of Extension Problems Variables (X6) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Rice Field Farming in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Rice Production	110	5	3.65	73	Enough
2	Rice Farming Income	110	5	4.20	84	Good
3	Land Productivity	110	5	3.65	73	Enough
4	Number of Farmer Families	110	5	1.45	29	Not good
5	Farmer Participation	110	5	4.85	97	Very good
6	Cosmopolitan Level Farmers	110	5	4.63	92.6	Very good
<b>Average</b>				3.73	74.76	Fair

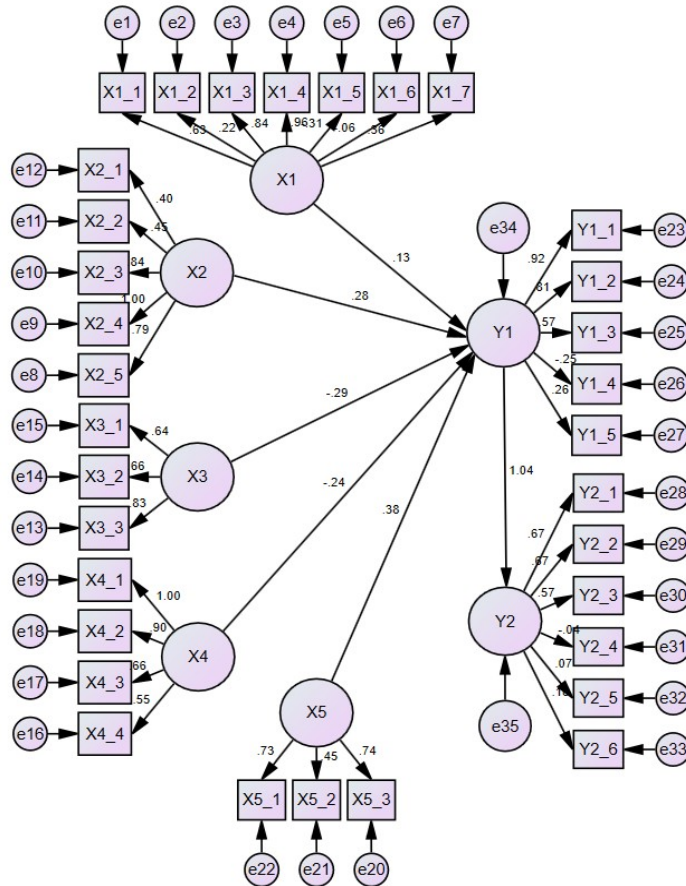
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## 3.2 Analysis of Structural Equation Modeling (SEM)

### 3.2.1 Evaluation of Measurement Model

This research model consists of 7 (seven) constructs, including the variables of Technological Progress (X1), Capital (X2), Farmer Age (X3), Education (X4), Farming Experience (X5), Human Resources (Y1), and Effectiveness of Agricultural Extension (Y2). Evaluation of the measurement model is a stage to test the validity and reliability of a construct.

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1. Validity Testing

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Construct validity testing is intended to determine whether the indicators used in measuring latent variables are valid. The validity of each indicator in measuring the latent variable is indicated by the size of the loading factor (Standardized Weights). An indicator is declared valid if an indicator's loading factor is positive and greater than 0.5. The results of the validity test are presented in table 13.

Table 13 shows that the question indicators X1\_2, X1\_5, X1\_6, and X1\_7, which measure the Technological Progress variable (X1), are declared invalid because they produce a loading factor value of less than 0.5. Then the question indicators X2\_1 and X2\_2 which measure the Modal variable (X2), are declared invalid. Furthermore, the question indicators X5\_2, Y1\_4, and Y1\_5 which measure the variables of Farming Experience (X5) and Counseling Problems (Y1), are declared invalid because they produce a loading factor value of less than 0.5. Then the question indicators Y2\_4, Y2\_5, and Y2\_6 which measure the Agricultural Extension Effectiveness variable (Y2), are declared invalid because they produce a loading factor value of less than 0.5.

When viewed from the strength of the loading factor (Standardized Weights) on each variable, the X1\_4 indicator has the highest contribution to the Technological Progress variable (X1) of 95.6%. Then on, the Capital variable (X2), it is dominated by the X2\_4 indicator of 99.6%. Furthermore, the X3\_3 indicator has the highest contribution to the Farmer Age variable (X3) at 82.9%. Then the Education variable (X4) is dominated by the X2\_4 indicator of 90.5%. Then the X5\_3 indicator has the highest contribution to the variable Age of Farming Experience (X5) at 73.6%. Furthermore, the Human Resources variable (Y1) is dominated by the Y1\_1 indicator of 91.8.0%. The variable of Agricultural Extension Effectiveness (Y2), is dominated by the Y2\_1 indicator of 67.1%.

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Validity can not only be seen through the loading factor but also through the Average Variance Extracted (AVE). An instrument is said to meet the validity test if it has an Average Variance Extracted (AVE) above 0.5. The results of the convergent validity test are presented in table 14:

**Table 13.** Construct Validity Test

Variable	Indicator	Loading Factor	Criteria	Description
Technology advances (X1)	X1_1	0.626	0.5	Valid
	X1_2	0.220	0.5	Invalid
	X1_3	0.837	0.5	Valid
	X1_4	0.956	0.5	Valid
	X1_5	-0.306	0.5	Invalid
	X1_6	-0.058	0.5	Invalid
	X1_7	0.362	0.5	Invalid
Capital (X2)	X2_1	0.398	0.5	Invalid
	X2_2	0.451	0.5	Invalid
	X2_3	0.839	0.5	Valid
	X2_4	0.996	0.5	Valid
	X2_5	0.786	0.5	Valid
Farmer Age (X3)	X3_1	0.644	0.5	Valid
	X3_2	0.659	0.5	Valid
	X3_3	0.829	0.5	Valid
Education (X4)	X4_1	1.002	0.5	Valid
	X4_2	0.905	0.5	Valid
	X4_3	0.658	0.5	Valid
	X4_4	0.548	0.5	Invalid
Farming Experience (X5)	X5_1	0.732	0.5	Valid
	X5_2	0.445	0.5	Valid
	X5_3	0.736	0.5	Valid
Human resources (Y1)	Y1_1	0.918	0.5	Valid
	Y1_2	0.813	0.5	Valid
	Y1_3	0.573	0.5	Valid
	Y1_4	-0.248	0.5	Invalid
	Y1_5	0.263	0.5	Invalid
Effectiveness of Agricultural Extension (Y2)	Y2_1	0.671	0.5	Valid
	Y2_2	0.668	0.5	Valid
	Y2_3	0.567	0.5	Valid
	Y2_4	-0.043	0.5	Invalid
	Y2_5	0.074	0.5	Invalid
	Y2_6	0.179	0.5	Invalid

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Based on table 14, it can be seen that overall, the indicators on the variables of Technological Progress (X1), Farming Experience (X5), Extension Issues (Y1), and Agricultural Extension Effectiveness (Y2) are declared invalid together in measuring the variables because they have fewer AVE values of 0.5. While the other variables produce an Average Variance Extracted (AVE) value that is greater than 0.5.) dari 0.5. Thus the indicators on these variables as a whole are declared valid to measure the variables.

Because some indicators and variables are not valid, the indicators are deleted or removed, and the following results are obtained (figure 2):

Table 14 Validity Test

Variable	AVE	Description
Technology advances (X1)	0.326	Invalid
Capital (X2)	0.535	Valid
Farmer Age (X3)	0.512	Valid
Education (X4)	0.639	Valid
Farming Experience (X5)	0.425	Invalid
Human resources (Y1)	0.393	Invalid
Effectiveness of Agricultural Extension (Y2)	0.210	Invalid

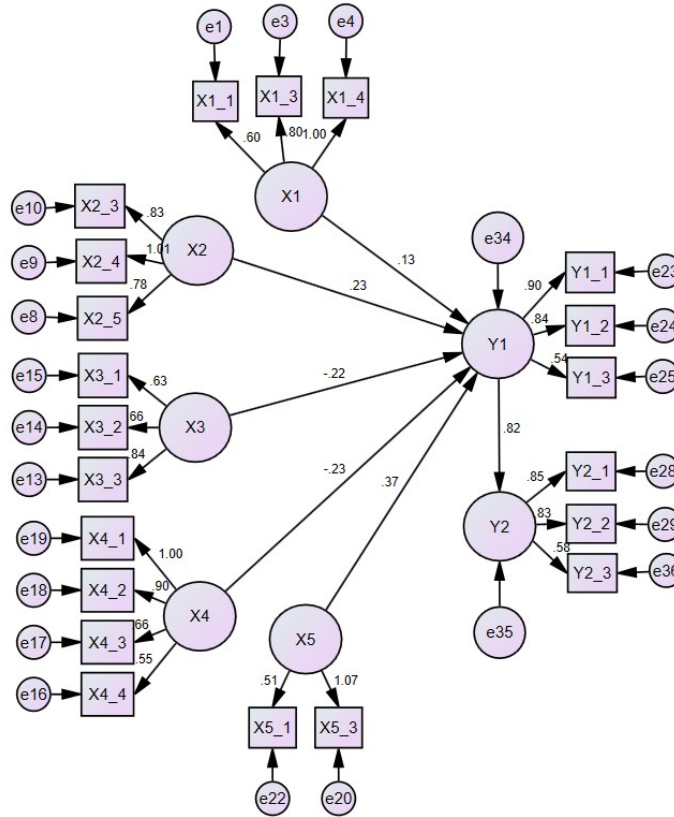


Figure 2 Path Diagram After Invalid Indicator Drop

The validity of each indicator in measuring the latent variable is indicated by the size of the loading factor (Standardized Weights). An indicator is declared valid if the loading factor of an indicator is positive and is greater than 0.5. Hasil pengujian validitas disajikan dalam tabel 15.

In addition to the loading factor, the Average Variance Extracted (AVE) value is also obtained, which is presented in table 16.

## 2. Construct Reliability Test

The construct reliability test was carried out using the Construct Reliability (CR) technique. The test criteria state that the coefficient of Construct Reliability (CR) and Cronbach's alpha 0.6 means that it can be stated that the construct is reliable or the indicator is consistent in measuring the variables it measures. The summary of the reliability test results is presented in table 17.

Based on table 17, it can be seen that the value of Construct Reliability and Cronbach's alpha on all variables is greater than 0.6. Thus, based on the calculation of Construct Reliability and Cronbach's alpha, the variable is declared reliable.

3.2.2 SEM Model Evaluation

1. Model Fit Test

Testing the feasibility/fitness of the model (construct) is intended to determine whether the construct formed is appropriate (feasible) or not. There are several test indices in SEM analysis, namely CMIN/DF, RMSEA, TLI, and CFI. The test criteria use CMIN/DF; if the CMIN/DF value is the cut-off value (2.00), then the construct formed is appropriate (feasible). The criteria using RMSEA state that if the RMSEA value is the cut-off value (0.08), then the construct formed is appropriate (feasible). The criteria using TLI and CFI state that if the goodness of fit value is the cut-off value (by 0.90), then the model formed is appropriate (feasible). The results of the model feasibility test are summarized in table 18:

**Table 15** Construct Validity Test After Drop Invalid Indicator

Variable	Indicator	Loading Factor	Criteria	Description
Technology advances (X1)	X1_1	0.600	0.5	Valid
	X1_3	0.805	0.5	Valid
	X1_4	0.999	0.5	Valid
Capital (X2)	X2_3	0.830	0.5	Valid
	X2_4	1.008	0.5	Valid
	X2_5	0.776	0.5	Valid
Farmer Age (X3)	X3_1	0.633	0.5	Valid
	X3_2	0.659	0.5	Valid
	X3_3	0.838	0.5	Valid
Education (X4)	X4_1	1.004	0.5	Valid
	X4_2	0.903	0.5	Valid
	X4_3	0.656	0.5	Valid
	X4_4	0.548	0.5	Valid
Farming Experience (X5)	X5_1	0.510	0.5	Valid
	X5_3	1.066	0.5	Valid
Human resources (Y1)	Y1_1	0.900	0.5	Valid
	Y1_2	0.839	0.5	Valid
	Y1_3	0.544	0.5	Valid
Effectiveness of Agricultural Extension (Y2)	Y2_1	0.849	0.5	Valid
	Y2_2	0.835	0.5	Valid
	Y2_3	0.578	0.5	Valid

**Table 16.** Validity Test After Drop Invalid Indicator

Variable	AVE	Description
Technology advances (X1)	0.669	Valid
Capital (X2)	0.769	Valid
Farmer Age (X3)	0.512	Valid
Education (X4)	0.639	Valid

Farming Experience (X5)	0.698	Valid
Human Resources (Y1)	0.757	Valid
Effectiveness of Agricultural Extension (Y2)	0.709	Valid

432 **Table 17.** Reliability Test

Variable	Construct Reliability	Cronbach's Alpha	Description
Technology advances (X1)	0.814	0.807	Reliable
Capital (X2)	0.854	0.884	Reliable
Farmer Age (X3)	0.791	0.729	Reliable
Education (X4)	0.872	0.782	Reliable
Farming Experience (X5)	0.700	0.704	Reliable
Human Resources (Y1)	0.829	0.681	Reliable
Effectiveness of Agricultural Extension (Y2)	0.804	0.776	Reliable

433 **Table 18.** Goodness Of Fit Model

Index	Goodness Of Fit	Cut Off Value	Description
CMIN/DF	2.709	≤ 2.00	Poor of Fit
RMSEA	0.148	≤ 0.08	Poor of Fit
TLI	0.673	≥ 0.90	Poor of Fit
CFI	0.714	≥ 0.90	Poor of Fit

434 Based on the summary of the goodness of fit, it can be seen that the 4 (four) indicate,  
 435 namely CMIN/DF, RMSEA, TLI, and CFI do not meet the criteria. Thus the SEM model that  
 436 has been formed is declared not feasible.

437 Because the model is not feasible, modifications to the covariance index of the model  
 438 are carried out to obtain a fit model. Basically, the Structural Equation Modeling (SEM)  
 439 model in Amos is a Covariance Based SEM (CB-SEM) which needs to be accommodated by  
 440 the covariance element. The following is a path diagram after modification of the index  
 441 covariance model (figure 3):

442 The results of the model feasibility test after modification of the covariance index have  
 443 been summarized in table 19. Based on the summary of the goodness of fit (table 19), it can  
 444 be seen that the 4 indices, namely CMIN/DF, RMSEA, TLI, and CFI, all meet the criteria.  
 445 From the results of the index criteria, it can be concluded that the SEM path diagram that has  
 446 been formed is declared suitable for use.

447 2. Model Hypothesis Test

448 a. Direct Effect Test

449 Hypothesis testing is intended to test whether exogenous variables have a direct effect  
 450 on endogenous variables. The significance test can be known through the p-value. The test  
 451 criteria state that if the CR statistic is > 1.96 or if the p-value is < 0.05, it is stated that there is  
 452 a significant effect of exogenous variables on endogenous variables. The analysis results can  
 453 be seen in the summary in table 20.

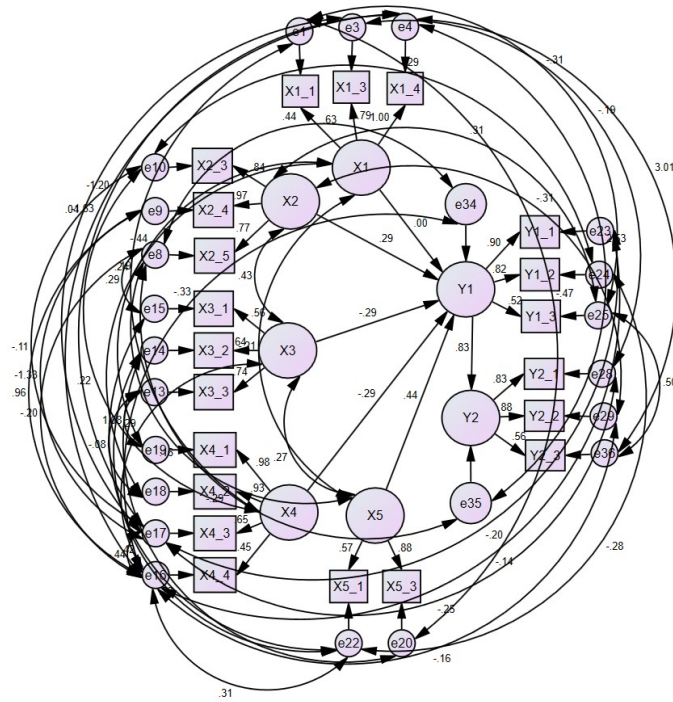


Figure 3 Path Diagram After Index Modification

Table 19 Goodness Of Fit Model

Indeks	Goodness Of Fit	Cut Off Value	Description
CMIN/DF	1.400	≤ 2.00	Good of Fit
RMSEA	0.061	≤ 0.08	Good of Fit
TLI	0.945	≥ 0.90	Good of Fit
CFI	0.963	≥ 0.90	Good of Fit

Table 20 Hypothesis test

Hypothesis	Track	Standardized Coefficient	SE	CR	p-value	Description
H1	X1 → Y1	0.001	0.003	0.019	0.985	Not significant
H2	X2 → Y1	0.289	0.006	3.255	0.001	Significant
H3	X3 → Y1	-0.287	0.008	-2.389	0.017	Significant
H4	X4 → Y1	-0.294	0.005	-3.908	***	Significant
H5	X5 → Y1	0.440	0.013	4.467	***	Significant
H6	Y1 → Y2	0.828	0.114	9.027	***	Significant

Description: \*\*\* p-value < 0.001

Based on table 20, it can be informed that:

1. Testing the effect of Technological Progress (X1) on Human Resources (Y1) produces a CR statistic of 0.019 and a p-value of 0.985. The test results show that the p-value (0.985) > alpha 0.05 meaning no significant effect of technological progress on human resources.
2. The test of the effect of Capital (X2) on Human Resources (Y1) produces a p-value of 0.001. The test results show that the statistical p-value (0.001) < alpha 0.05, which means that there is a significant effect of Capital on Extension Issues. The positive coefficient of 0.289 indicates

that capital positively affects Human Resources. This means that the higher the capital, the higher the human resources.

3. Testing the effect of Farmer Age (X3) on Human Resources (Y1) produces a CR statistic of -2,389 with a p-value of 0.017. The test results show that the statistical p-value (0.017) < alpha 0.05, meaning that Farmer Age has a significant effect on Human Resources. A negative coefficient of -0.287 indicates that Farmer Age harms Resources
4. Humans. This means that the higher the farmer's age, the lower the human resources.
5. The effect of Education (X4) on Human Resources (Y1) test produces a CR statistic of -3.908 with a p-value of 0.001. The test results show that the p-value (0.001) < alpha 0.05, which means that Education has a significant effect on Human Resources. This means that the higher the education, the higher the human resources.
6. Testing the effect of Farming Experience (X5) on Human Resources (Y1) resulted in a CR statistic of 4.467 with a p-value of 0.001. The test results show that the statistical p-value (0.001) < alpha 0.05 meaning that farming experience has a significant effect on human resources. A positive coefficient of 0.440 indicates that the farming experience positively affects human resources. This means that the better the farming experience, the better human resources.
7. The test of the influence of Human Resources (Y1) on the Effectiveness of Agricultural Extension (Y2) resulted in a CR statistic of 9.027 and a p-value of 0.001. The test results show that the statistical p-value (0.001) < alpha 0.05, which means that Human Resources has a significant influence on the Effectiveness of Agricultural Extension. The positive coefficient of 0.828 indicates that Human Resources positively affect the Effectiveness of Agricultural Extension. This means that better Human Resources can increase the Effectiveness of Agricultural Extension.

b. Indirect Effect Test

Hypothesis testing is intended to test whether exogenous variables have an indirect effect on endogenous variables through mediating variables (intervening). Mediation testing can be known through the Sobel test. The test criteria state that if the z statistic > z table (1.96) or p-value < alpha 0.05, it is stated that there is a significant indirect effect of exogenous variables on endogenous variables through mediating variables (intervening). The analysis results can be seen in the summary in table 21.

**Table 21** Hypothesis test

Hypothesis	Track	Indirect Coefficient	Std. Error	p-value	Description
H7	X1 → Y1 → Y2	0.001	0.002	0.739	Not Significant
H8	X2 → Y1 → Y2	0.239	0.033	0.000	Not Significant
H9	X3 → Y1 → Y2	-0.238	0.034	0.000	Not Significant
H10	X4 → Y1 → Y2	-0.243	0.034	0.000	Not Significant
H11	X5 → Y1 → Y2	0.364	0.051	0.000	Not Significant

Based on table 21, it can be stated that the test of the effect of Capital (X2), Farmer's Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2) through the mediation of Human Resources (Y1) produces a statistical p-value < alpha 5% which means that there is an indirect effect of Capital Progress (X2), Farmer Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2) through the mediation of Human Resources (Y1) or by. In other words, the Human Resources variable (Y1) can mediate the effect of Capital (X2), Farmer Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2).

While the test of the effect of technological progress (X1) on the effectiveness of agricultural extension (Y2) through the mediation of human resources (Y1) resulted in a statistical p-value (0.985) > alpha 5%, which means that there is no indirect effect of technological progress (X1) on the effectiveness of extension. Agriculture (Y2) through the mediation of Human Resources (Y1) or, in other words, the Human Resources variable (Y1) is not able to mediate the effect of Technological Progress (X1) on the Effectiveness of Agricultural Extension (Y2).

### 3. Convert Path Diagrams to Structural Equations

The conversion of path diagrams into structural equations is intended to find out how the shape of the influence between constructs is based on their mathematical equations. Based on the attachment, it can be seen that the mathematical models formed are:

$$\text{Equality 1: } Y_1 = 0.001 X_1 + 0.289 X_2 - 0.287 X_3 - 0.294 X_4 + 0.440 X_5$$

$$\text{Equality 2: } Y_2 = 0.828 Y_1$$

### 4. Conclusion

1. The factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi are farming capital, farmer's age, education, farming experience, and human resources.
2. The influence of these factors on the effectiveness of agricultural extension in Baubau city is as follows: : if farming capital is high, human resources can be increased. Moreover, the higher the farmers' age, the lower the need for human resources. It was additionally noted that higher education of farmers contributes to improvement in human resources, and the increased experience in farming corresponded to an increase in human resources. Hence, increasing human resources will increase the effectiveness of agricultural extension.
3. Extension issues and materials are factors that affect the effectiveness of agricultural extension in Baubau City, where in this case the influence can be categorized as good or influential.

### 5. Acknowledgments

The author would like to express his gratitude to all parties who have helped and participated in this research. Especially to the Hasanuddin University, Faculty of Agriculture, especially the Agribusiness Study Program. And also to the supervising lecturers who helped and guided me from the beginning to the completion of this research.

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# Response to Reviewer 1 Comments

Point 1: The aim of this article is of great practical interest: to determine the factors influencing the effectiveness of agricultural extension services for farmers through a case study, rice farmers in Baubau city in Indonesia.

**Response 1:** This research was conducted to determine the effectiveness of agricultural extension services and determine the factors that influence the effectiveness of agricultural extension to farmers in Baubau City, Indonesia

Point 2: The analytical method used is correct and includes exogenous latent variables (technological progress, agricultural capital, farmer's age, education and agricultural experience). However, I consider the research to be very limited since the sample consists of only 110 rice farmers selected by simple random sampling who have been surveyed through questionnaires and interviews. The data obtained were analyzed descriptively and quantitatively using SEM 132 (Structural Equation Modeling).

**Response 2:** Baubau City has eight districts, but of the eight districts, only two districts are agricultural areas. The districts in question are Bungi District and Lea-Lea District. So that the population of this study was farmers from the two sub-districts, with a total of 1257 people. This sample size was determined with an error rate of 10% or based on the desired level of confidence (precision) of 90%, and the sample size based on the Slovin formula amounted to 110 respondents. The study sample for extension agents was based on the population of extension workers in Baubau City, which amounted to 26 personnel. From which 30% of the total were sampled, resulting in 8 extension workers.

Point 3: The methodology has consisted in the application of a broad and complex statistical instrument that leads to multiple quantitative results whose description and explanation is dedicated to most of the article, from page 3 to page 17.

**Response 3:** We have revised the methodology including, 2. Research Hypothesis, research method and analysis method

Point 4: There are, however, some insufficiencies in the qualitative interpretation of the results that, in my opinion, originate the main deficiency of the work, the weakness of the conclusions.

**Response 4:** We have revised the conclusion to the qualitative interpretation of the results

Point 5: There are practically no explained conclusions. The conclusions section is extremely simplified and is limited to a brief summary (16 rows from 505 to 521) in which 3 ideas presented in the results chapter are repeated without further explanation.

It also lacks a necessary "discussion" heading, however brief, to discuss the relationship between theoretical hypotheses, academic literature, and the results obtained.

It is suggested that the authors expand and complete in more detail the explanation of the conclusions drawn from the results so that these conclusions acquire a more general meaning and a value that can be extrapolated to other territories and situations beyond the small sample of farmers surveyed.

## **Respons 5:**

### **5. Conclusion**

1. The factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi are farming capital, farmer's age, education, farming experience, and human resources.
2. The influence of these factors on the effectiveness of agricultural extension in Baubau city is as follows: : if farming capital is high, human resources can be increased. Moreover, the higher the farmers' age, the lower the need for human resources. It was additionally noted that higher education of farmers contributes to improvement in human resources, and the increased experience in farming corresponded to an increase in human resources. Hence, increasing human resources will increase the effectiveness of agricultural extension.
3. Extension issues and materials are factors that affect the effectiveness of agricultural extension in Baubau City, where in this case the influence can be categorized as good or influential.
4. Farming capital is land area, labor, use of fertilizers, pesticides, and use of agricultural tools and machines. There is an influence of farming capital variables on the effectiveness of agricultural extension. According to research by (Kusnadi, N., et al, 2011)., the wider the land owned, the higher the farming income.

Human resources describe the knowledge possessed by education, training, experience, and information received. Activities that must be carried out by agricultural extension workers in the city of Bau Bau are optimizing socialization and training related to agricultural land, for example, making demonstration plots so that farmers can see directly and have no doubts about the theory provided. In addition, one way to achieve extension effectiveness is to increase human resources (agricultural extension workers) as program implementers so that the programs that have been designed can be implemented. The lack of extension workers resulted in a significant workload for each extension agent because the extension area assisted by the extension worker was large, and the number of assisted farmer groups was significant. Currently, there are 44,890 agricultural extension workers. These agricultural extension workers serve 71,479 villages, so they still need as many as 26,589 agricultural extension workers (agricultural extension center Indonesia, 2022). Many agricultural extension workers can supervise the assistance funds given to farmers so that they are appropriately managed to realize farmer welfare, distribute farmers' knowledge about the latest agricultural technologies, and develop rice farming. For example, they help to provide production facilities, distribute fertilizer and seed aid, and provide cooperative institutions to assist farmers in procuring farming capital. Agricultural extension agents have roles as facilitators, communicators, motivators, and consultants. Indonesian government regulation no. 16 of 2006 concerning the Agricultural Extension System, one of the critical points in this law is the need to build extension institutions in the regions at the provincial and district/city levels.

Age affects productivity level, making decisions, and receiving information. The dominant number of respondents is 46 – 55 years old. This shows that the productive age in this study is in

the age range of 46-55 years. At a productive age, it will be easier to get new ideas and quickly understand the use of technology. Information obtained by farmers, especially from agricultural extension workers, will increase their paddy rice production. This follows the research results (Hasyim, 2006) that those who work at productive age will be better and maximal than non-productive age.

Education is influential in taking action in making programs for agricultural development. The low level of education in this study indicates that the quality of human resources needs to be improved in efforts to develop farming performance. Improving the skills and knowledge of farming will encourage the achievement of planned production targets. According to (Lubis, 2000), having a high level of education will be relatively faster in implementing technology and innovation adoption, having low education is usually challenging to implement innovation adoption quickly.

The indicators included in the Technological Progress variable are the use of transplanters, the use of indo combine harvesters, the use of KATAM (planting season prediction), the use of KATAM (fertilizer dose), the use of drones (irrigation sensors/measuring soil pH), the use of expert system applications, and the use social media. The average variable of technological progress is 24.91, with an achievement level of 64.53% in the Less Good category. Farmers should optimize information technology, such as using the internet to find the latest information. Advances in technology play a role in supporting the availability of relevant and timely agricultural information. Information on the results of research and technological innovations in agriculture helps efforts to increase the production of agricultural commodities. According to research results (Prayoga, K. 2017), the use of technology is considered less optimized by the Indonesian Ministry of Agriculture. Extension activities that utilize social media must continue to be optimized because the number of users continues to increase.

5. Matters related to extension include the number of assisted farmers, the distance to extension locations, the amount of agricultural extension work time, extension media, methods, frequency, materials, and the instructor's experience. Extension media has the most significant contribution to the problem variables of extension agents. Through extension media, it can attract farmers to attend training. Agricultural extension agents use various media that are adjusted to the farmer's age. Then followed by indicators of instructor experience, frequency of extension, amount of working time of agricultural extension workers, extension methods, and extension materials. Extension material is everything that extension agents propose to farmers, including the suitability of the material with the needs and benefits. Based on the assessment of the extension workers in the field, it was assessed that the absorption of the material and the most suitable application were in fertilization, harvesting, and post-harvest materials. This is followed by good planting time, nurseries, planting, nursery, and maintenance indicators. Agriculture is a critical sector in national development. In national development, it is necessary to support human resources, who have the capacity, who can produce solutions to answer the challenges. It is necessary to carry out an agricultural extension to develop agriculture. Agricultural extension is also one of the efforts to produce quality human resources. Agricultural extension is an empowerment effort or an effort to motivate and change the behavior of farmers and their families so that they have the will and can solve the problems they face in doing their farming. Therefore the role of extension is crucial and becomes a strategic matter in national development.

The Ministry of Agriculture is targeting Indonesia to become a world food barn by 2045. To achieve this mission, the Ministry of Agriculture places farmers as the main actors in agricultural development. Attention is needed to farmers through agricultural extension workers. In general, the knowledge farmers have to lack in renewal and the existence of agricultural extension can help agricultural development.

# Response to Reviewer 2 Comments

Point 1: The article covers an undoubtedly interesting topic, however the structure of the manuscript is confusing and does not allow to understand the methodology, the results and the related discussion. The main problem is that Section 3 hosts research hypotheses, data collection, formulation of the statistical model, together with sample description, results and discussion. I therefore ask the Authors to restructure the manuscript by including the following sections:

- research hypotheses, definition of the constructs, indicator selection;
- data collection and sample characteristics;
- formulation of the statistical model (SEM);
- results from the SEM, with the discussion;
- concluding remarks.

## Response 1:

### 2. Research Hypothesis

- It is suspected that the variables of technological progress (X1), farming capital (X2), farmer age (X3), farmer education (X4), and farmer experience (X5) have a significant relationship and have a direct influence on human resources (Y1).
- Allegedly, the variables of technological progress (X1), farming capital (X2), farmer age (X3), farmer education (X4), and farmer experience (X5) have a significant relationship and give an indirect effect but are thought to influence the variable effectiveness of agricultural extension (Y2).
- It is suspected that the variable human resources (Y1) have a significant relationship with the variable effectiveness of agricultural extension (Y2).

### 3. Research methods

#### 3.1 Place and time

This research is located in Bau-bau City, Southeast Sulawesi, and was carried out in January-July 2022.

#### 3.2 Data Collection

Data collection techniques in this study were carried out using interviews, questionnaires, and observation.

#### 3.3 Population and Sample

The population of this study were all farmers in Baubau City. The population of this study was 1257 people (Data from the Baubau City Agriculture Office, 2021). In addition, the population of agricultural extension workers in Baubau City is 26 people.

A simple random sampling was used. The sample measurements were calculated using the Slovin formula.

$$n = \frac{N}{1 + N(E)^2} \dots\dots\dots(1)$$

$$n_i = \frac{N_i}{N} \times n \dots\dots\dots(2)$$

Description :

- n = Number of samples
- N = Population
- e<sup>2</sup> = Precession set (5%)
- n<sub>i</sub> = Standard sample size i
- N<sub>i</sub> = Population size i

This sample size was determined with an error rate of 10% or based on the desired level of confidence (precision) of 90%, and the sample size based on the Slovin formula amounted to 110 respondents. The study sample for extension agents was based on the population of extension workers in Baubau City, which amounted to 26 personnel. From which 30% of the total were sampled, resulting in 8 extension workers.

The data collection techniques used to carry out the study were questionnaires, direct interviews and observations to determine the characteristics and behavior of the research object. The data obtained were analyzed descriptively and quantitatively using the SEM method (*Structural Equation Modeling*) – Software Amos (*Analysis of Moment Structure*) .

### 3.4 Analysis Method

#### 3.4.1 Descriptive Statistical Analysis

Descriptive statistical data was interpreted using the TCR criteria (Respondent Achievement Level), and the following formula was used:

$$TCR = \frac{Mean}{Skor Max} \times 100 \dots\dots\dots(3)$$

**Table 1.** TCR criteria

No.	Scale Range	TCR
1	90% - 100%	Very good
2	80% - 89,99%	Good
3	65% - 79,99%	Enough
4	55% - 64,99%	Not good
5	0% - 54,99%	Not good

The percentage formula used in this study is:

$$P = \frac{f}{N} \times 100 \% \dots\dots\dots(4)$$

Description:

P = Percentage Number

f =The number of frequencies of each answer that has become the respondent's choice

N=The number of frequencies or the number of individuals

To determine the level of criteria with a descriptive analysis of the percentage, which is divided into five indicators, namely:

**Table 2.** Percentage Descriptive Analysis Criteria

Number	Percentage	Criteria
1.	0 % – 20%	Very low
2.	21% – 40%	Low
3.	41% – 60%	Moderate
4.	61 % – 80 %	High
5.	81%– 100%	Very high

3.4.2 Quantitative Analysis

A simple random sampling was used. The sample measurements were calculated using the Slovin formula.

$$n = \frac{N}{1 + N(E)^2} \dots\dots\dots(1)$$

$$n_i = \frac{N_i}{N} \times n \dots\dots\dots(2)$$

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SEM (Structural Equation Modeling) analysis in this study was carried out using Amos 24 software to answer problems related to variables that influence the effectiveness of agricultural extension in Baubau City.

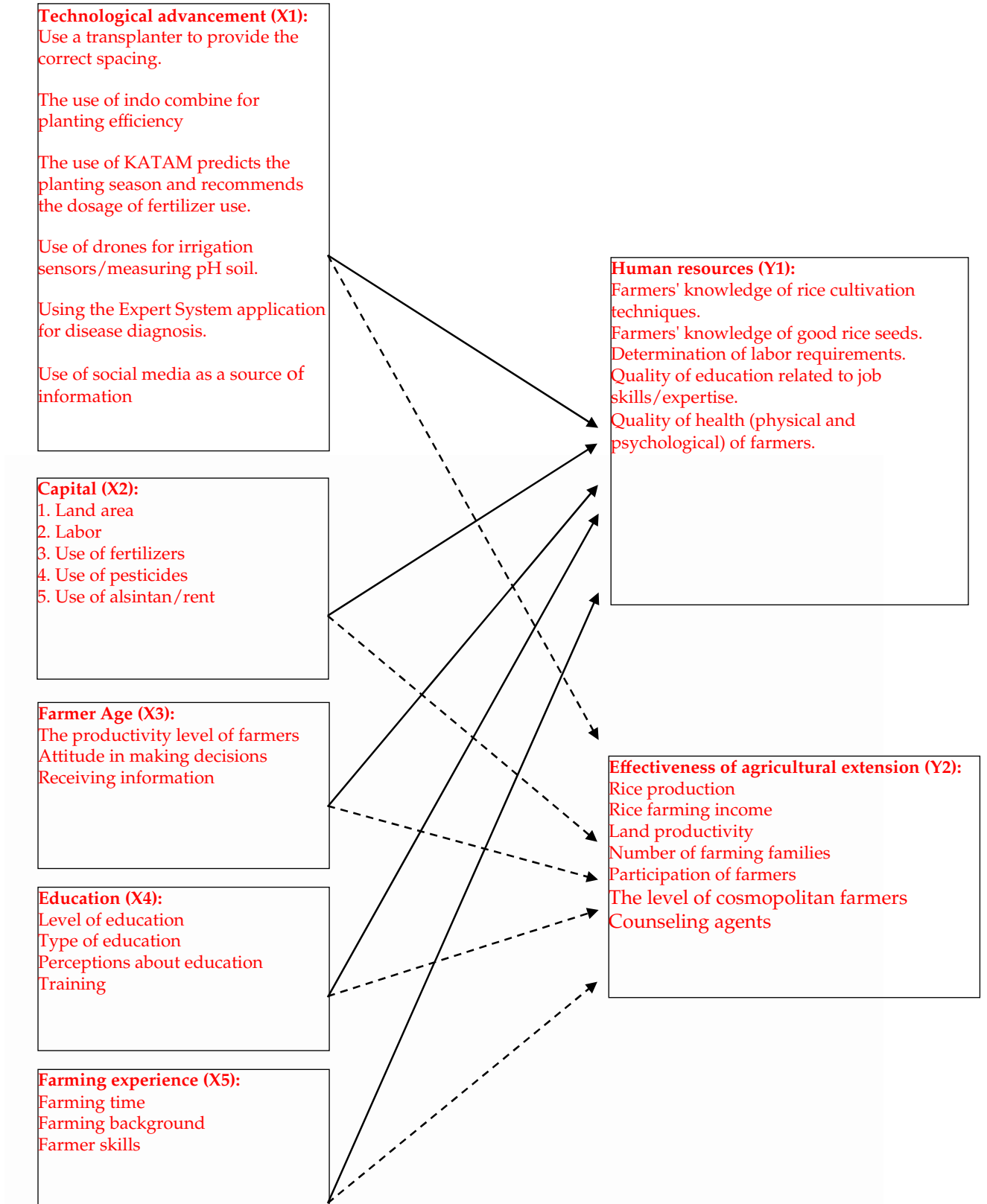
The formula used in this study is:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + e \dots\dots\dots(5)$$

Description:

- Y1 = Effectiveness of Agricultural Extension
- Y2 = Human Resources
- β = Constant
- E = Standard error
- X1 = Technology advances
- X2 = Capital
- X3 = Farmer Age
- X4 = Education
- X5 = Farming experience

### 3.4.3 Constructs, Indicator, and code variable



## 5. Conclusion

1. The factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi are farming capital, farmer's age, education, farming experience, and human resources.
2. The influence of these factors on the effectiveness of agricultural extension in Baubau city is as follows: : if farming capital is high, human resources can be increased. Moreover, the higher the farmers' age, the lower the need for human resources. It was additionally noted that higher education of farmers contributes to improvement in human resources, and the increased experience in farming corresponded to an increase in human resources. Hence, increasing human resources will increase the effectiveness of agricultural extension.
3. Extension issues and materials are factors that affect the effectiveness of agricultural extension in Baubau City, where in this case the influence can be categorized as good or influential.
4. Farming capital is land area, labor, use of fertilizers, pesticides, and use of agricultural tools and machines. There is an influence of farming capital variables on the effectiveness of agricultural extension. According to research by (Kusnadi, N., et al, 2011)., the wider the land owned, the higher the farming income.

Human resources describe the knowledge possessed by education, training, experience, and information received. Activities that must be carried out by agricultural extension workers in the city of Bau Bau are optimizing socialization and training related to agricultural land, for example, making demonstration plots so that farmers can see directly and have no doubts about the theory provided. In addition, one way to achieve extension effectiveness is to increase human resources (agricultural extension workers) as program implementers so that the programs that have been designed can be implemented. The lack of extension workers resulted in a significant workload for each extension agent because the extension area assisted by the extension worker was large, and the number of assisted farmer groups was significant. Currently, there are 44,890 agricultural extension workers. These agricultural extension workers serve 71,479 villages, so they still need as many as 26,589 agricultural extension workers (agricultural extension center Indonesia, 2022). Many agricultural extension workers can supervise the assistance funds given to farmers so that they are appropriately managed to realize farmer welfare, distribute farmers' knowledge about the latest agricultural technologies, and develop rice farming. For example, they help to provide production facilities, distribute fertilizer and seed aid, and provide cooperative institutions to assist farmers in procuring farming capital. Agricultural extension agents have roles as facilitators, communicators, motivators, and consultants. Indonesian government regulation no. 16 of 2006 concerning the Agricultural Extension System, one of the critical points in this law is the need to build extension institutions in the regions at the provincial and district/city levels.

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workers. In general, the knowledge farmers have to lack in renewal and the existence of agricultural extension can help agricultural development.

Furthermore, I have several specific issues reported below.

Point 2: Line 122: the Slovin formula needs to be reported and/or cited.

Respon point 2: A simple random sampling was used. The sample measurements were calculated using the Slovin formula.

$$n = \frac{N}{1+N(E)^2} \dots\dots\dots(1)$$

$$n_i = \frac{N_i}{N} \times n \dots\dots\dots(2)$$

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Point 3: Line 124: I suppose that the established error rate of 10% is a II type error, equating to a statistical power of 0.9.

Respons point 3: In this study, sample measurements were calculated using the Slovin formula. The sample size was determined with an error rate of 10% or based on the desired confidence level (precision) of 90%.

Point 4: Line 126: explain the increase in sample size to meet the SEM requirements. Precisely, for which requirement and based on which criteria? I suppose it is for identification. There are many criteria for assessing identification of a SEM, which obviously depends on the model formulation. Therefore, you cannot assess whether the sample size is correct before reporting how the model is specified.

Respons point 4: we have revised. This sample size was determined with an error rate of 10% or based on the desired level of confidence (precision) of 90%, and the sample size based on the Slovin formula amounted to 110 respondents.

Point 5: Line 132: AMOS is a software, not a method. SEM is the method. Please, provide a citation of AMOS.

Respon point 5: we have revised. The data collection techniques used to carry out the study were questionnaires, direct interviews and observations to determine the characteristics and behavior of the research object. The data obtained were analyzed descriptively and quantitatively using the SEM method (*Structural Equation Modeling*) – Software Amos (*Analysis of Moment Structure*) .

Point 6: Statistical model: the description and the motivation of the statistical method (SEM) in this research study is completely absent. Please add and provide citations. Also, the formulation of the SEM must be clearly provided: which are the constructs? Which are the indicators for each construct? What is the structure among the constructs and how it reflect the research hypotheses?

Respon point 6: A simple random sampling was used. The sample measurements were calculated using the Slovin formula.

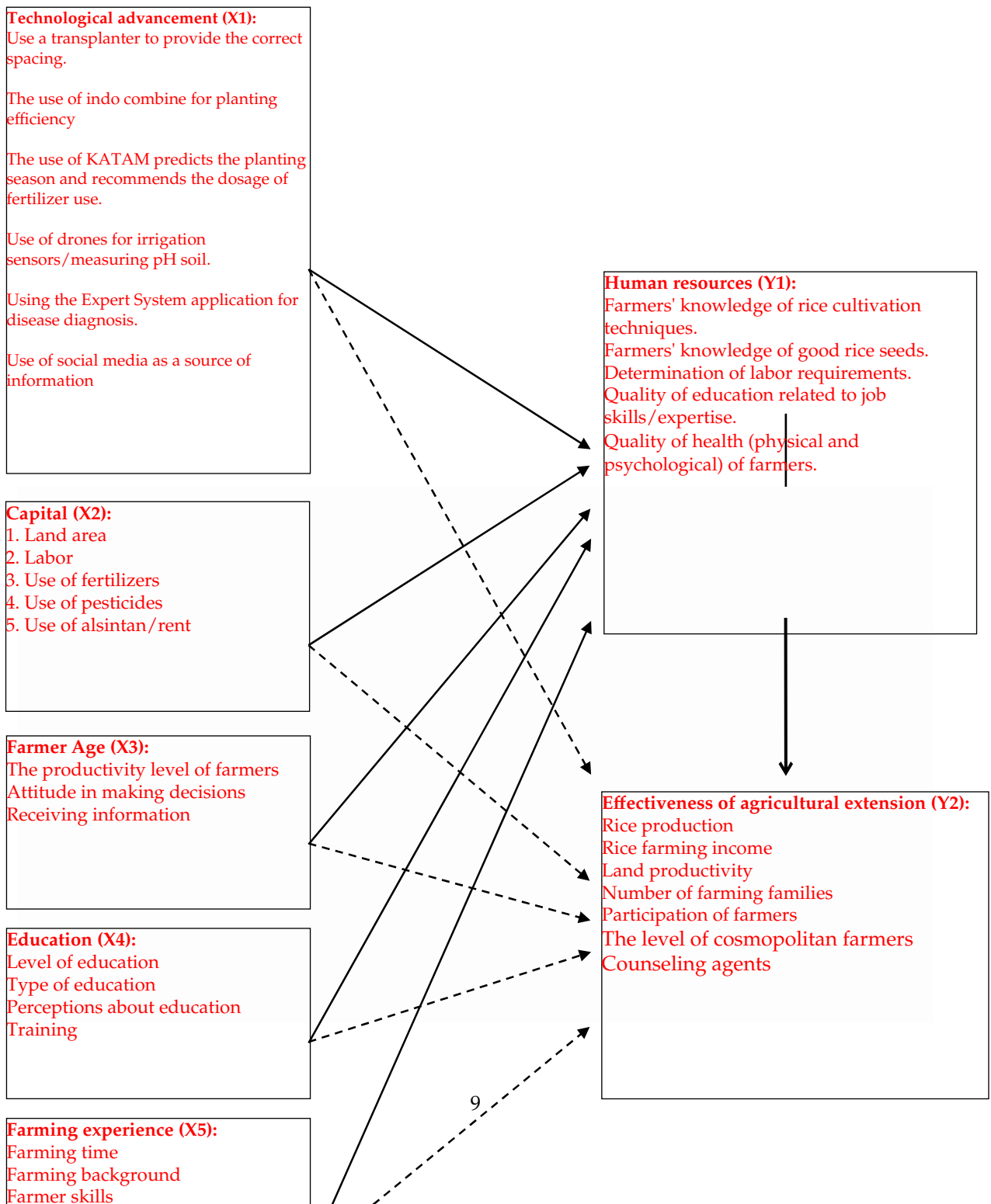
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### Constructs, Indicator, and code variable



#### 4. Research Hypothesis

- d. It is suspected that the variables of technological progress (X1), farming capital (X2), farmer age (X3), farmer education (X4), and farmer experience (X5) have a significant relationship and have a direct influence on human resources (Y1).
- e. Allegedly, the variables of technological progress (X1), farming capital (X2), farmer age (X3), farmer education (X4), and farmer experience (X5) have a significant relationship and give an indirect effect but are thought to influence the variable effectiveness of agricultural extension (Y2).
- f. It is suspected that the variable human resources (Y1) have a significant relationship with the variable effectiveness of agricultural extension (Y2).

Point 7: Table 2: what does 'No. sample' mean? Specify in the caption.

Respon point 7: we have revised, it should be No.

Point 8: Diagnostic of the measurement part of the SEM: in tables 13 and 14, it is not necessary to include a column stating whether each indicator or construct is valid or not, but it is sufficient to state clearly the criteria in the text. In my opinion, these two tables could be merged into a unique one to increase clarity. The same holds for tables 15-17. Please, also add Cronbach's alpha and composite reliability indices, and provide a citation of the criteria employed to assess the validity of the constructs.

Respon point 8: **Table 15. Construct and Validity Test**

Variable	Indicator	Loading Factor	Criteria	AVE
Technology advances (X1)	X1_1	0.626	0.5	0.326
	X1_2	0.220	0.5	
	X1_3	0.837	0.5	
	X1_4	0.956	0.5	
	X1_5	-0.306	0.5	
	X1_6	-0.058	0.5	
	X1_7	0.362	0.5	
Capital (X2)	X2_1	0.398	0.5	0.535
	X2_2	0.451	0.5	
	X2_3	0.839	0.5	
	X2_4	0.996	0.5	

	X2_5	0.786	0.5	
Farmer Age (X3)	X3_1	0.644	0.5	0.512
	X3_2	0.659	0.5	
	X3_3	0.829	0.5	
Education (X4)	X4_1	1.002	0.5	0.639
	X4_2	0.905	0.5	
	X4_3	0.658	0.5	
	X4_4	0.548	0.5	
Farming Experience (X5)	X5_1	0.732	0.5	0.425
	X5_2	0.445	0.5	
	X5_3	0.736	0.5	
Human resources (Y1)	Y1_1	0.918	0.5	0.393
	Y1_2	0.813	0.5	
	Y1_3	0.573	0.5	
	Y1_4	-0.248	0.5	
	Y1_5	0.263	0.5	
Effectiveness of Agricultural Extension (Y2)	Y2_1	0.671	0.5	0.210
	Y2_2	0.668	0.5	
	Y2_3	0.567	0.5	
	Y2_4	-0.043	0.5	
	Y2_5	0.074	0.5	
	Y2_6	0.179	0.5	

**Table 18.** Reliability Test

Variable	Construct Reliability	Cronbach's Alpha	Description
Technology advances (X1)	0.814	0.807	Reliable
Capital (X2)	0.854	0.884	Reliable
Farmer Age (X3)	0.791	0.729	Reliable
Education (X4)	0.872	0.782	Reliable
Farming Experience (X5)	0.700	0.704	Reliable
Human Resources (Y1)	0.829	0.681	Reliable
Effectiveness of Agricultural Extension (Y2)	0.804	0.776	Reliable

Point 9: Table 17: what does the column 'Construct reliability' include?

Response point 9: the Construct Reliability and Cronbach's alpha values for all variables are more significant than 0.6. Thus, these variables are declared reliable based on the calculations of Construct Reliability and Cronbach's alpha.

Point 10: Diagnostic of the structural part of the SEM: please report a citation of the criteria

employed in tables 18 and 19. At line 122, the Authors says that the formulated SEM is not valid and implement a new formulation. However, this formulation is not described and it is impossible to understand from the path diagram. Please, be precise about deletion/addition of edges and unstructured correlations.

**Respones point 10: We have revised at line 122.**

The results of the model feasibility test after modification of the covariance index have been summarized in table 20. Based on the summary of the goodness of fit (table 20), it can be seen that the 4 indices, namely CMIN/DF, RMSEA, TLI, and CFI, all meet the criteria. From the results of the index criteria, it can be concluded that the SEM path diagram that has been formed is declared suitable for use.

**Table 20.** Goodness Of Fit Model

Indeks	Goodness Of Fit	Cut Off Value	Description
CMIN/DF	1.400	≤ 2.00	Good of Fit
RMSEA	0.061	≤ 0.08	Good of Fit
TLI	0.945	≥ 0.90	Good of Fit
CFI	0.963	≥ 0.90	Good of Fit

Point 11: Table 20: I suppose that 'SE' stands for standard error. Please say this. How the standard errors were computed? Based on the asymptotic formula or, maybe, bootstrap? The term 'CR statistic' sounds strange to me. The usual term is 'z statistic'.

**Respones point 11: SE is standard error**

Point 12: Line 498: I do not understand this section (Convert Path Diagrams to Structural Equations): no formulas, no citations, no discussions. What do these equations represent and what is their utility in this research? Please add these details or delete this section.

**Respones point 12: Structural equations (structural equations) are formulated for states the causal relationship between the various constructs. Endogenous variable = exogenous variable + endogenous variable + error**

:

Point 13: Conclusions: this section appears as a simple summary of the findings. In my opinion, it needs to be enlarged with comparions with existing studies, policy implications, limitations, future work.

**Respones point 13: We have revised the summary**

# Response to Reviewer 3 Comments

**Point 1: Line 16-18, In the abstract, there are two objectives. One is to determine the effectiveness of agricultural extension services. The other one is to determine the factors that influence the effectiveness of agricultural extension to farmers in Baubau City, Indonesia.**

**Response 1:** We have revised. This research was conducted to determine the effectiveness of agricultural extension services and determine the factors that influence the effectiveness of agricultural extension to farmers in Baubau City, Indonesia

**Point 2: Line 20, if both the Human resources and the effectiveness of agricultural extension are used as endogenous latent variables. Why the author still found that Human resources was one of the factors that influence the effectiveness of agricultural extension?**

**Response 2:** one of the hypotheses Allegedly the variable human resources (Y1) has a significant relationship to the variable effectiveness of agricultural extension (Y2). Human resources describe the knowledge possessed by education, training, experience, and information received. Activities that must be carried out by agricultural extension workers in the city of Bau Bau are optimizing socialization and training related to agricultural land, for example, making demonstration plots so that farmers can see directly and have no doubts about the theory provided. In addition, one way to achieve extension effectiveness is to increase human resources (agricultural extension workers) as program implementers so that the programs that have been designed can be implemented. The lack of extension workers resulted in a significant workload for each extension agent because the extension area assisted by the extension worker was large, and the number of assisted farmer groups was significant. Currently, there are 44,890 agricultural extension workers. These agricultural extension workers serve 71,479 villages, so they still need as many as 26,589 agricultural extension workers (agricultural extension center Indonesia, 2022). Many agricultural extension workers can supervise the assistance funds given to farmers so that they are appropriately managed to realize farmer welfare, distribute farmers' knowledge about the latest agricultural technologies, and develop rice farming. For example, they help to provide production facilities, distribute fertilizer and seed aid, and provide cooperative institutions to assist farmers in procuring farming capital. Agricultural extension agents have roles as facilitators, communicators, motivators, and consultants. Indonesian government regulation no. 16 of 2006 concerning the Agricultural Extension System, one of the critical points in this law is the need to build extension institutions in the regions at the provincial and district/city levels.

**Point 4: Line 28, what is the “influence of these factors on effectiveness.” It should be better to put the result at here.**

**Response 4:** I have mentioned these factors in the previous sentence.

1) The factors that influence the effectiveness of agricultural extension in Baubau City are farming capital, farmer age, education, farming experience, and human resources, and 2) the influence of these factors on effectiveness agricultural extension is as follows: if the farming capital is high, human resources can be increased. In addition, the higher the farmer's age, the lower the need for human resources. It is also noted that higher farmer education contributes to increased human capital, and increased experience in farming is associated with increased human capital. Thus, an increase in human resources will increase the effectiveness of agricultural extension. Significant factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi, are farming capital, farmer age, education, farming experience, and human resources.

**Point 5: Line 35, It needs more keywords.**

**Response 5: We have revised**

**Keywords:** effectiveness, agricultural extension, paddy rice, Indonesia.

**Point 6: I suggest the author should rewrite the Introduction session to focus on the research topics. Don't need to talk too much on the importance of agriculture to Baubau City.**

**Response 6: We have deleted some of part about the impotence of agricultue at BauBau City**

**Point 7: In the “2. Materials and Methods”, Additional information is required to let the reader be clear on how the research was conducted. Currently, the introduction is too simple.**

**Response 7: We have revised the material and methods, such as talk about Research Hypothesis, research method and analysis method and some of formula.**

**Point 8: In “4. Conclusion”, no discription on the the effectiveness of agricultural extension services.**

**Response 8: we have revised it**

1. The factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi are farming capital, farmer's age, education, farming experience, and human resources.
2. The influence of these factors on the effectiveness of agricultural extension in Baubau city is as follows: : if farming capital is high, human resources can be increased. Moreover, the higher the farmers' age, the lower the need for human resources. It was additionally noted that higher

education of farmers contributes to improvement in human resources, and the increased experience in farming corresponded to an increase in human resources. Hence, increasing human resources will increase the effectiveness of agricultural extension.

3. Extension issues and materials are factors that affect the effectiveness of agricultural extension in Baubau City, where in this case the influence can be categorized as good or influential.
4. Farming capital is land area, labor, use of fertilizers, pesticides, and use of agricultural tools and machines. There is an influence of farming capital variables on the effectiveness of agricultural extension. According to research by (Kusnadi, N., et al, 2011)., the wider the land owned, the higher the farming income.

Human resources describe the knowledge possessed by education, training, experience, and information received. Activities that must be carried out by agricultural extension workers in the city of Bau Bau are optimizing socialization and training related to agricultural land, for example, making demonstration plots so that farmers can see directly and have no doubts about the theory provided. In addition, one way to achieve extension effectiveness is to increase human resources (agricultural extension workers) as program implementers so that the programs that have been designed can be implemented. The lack of extension workers resulted in a significant workload for each extension agent because the extension area assisted by the extension worker was large, and the number of assisted farmer groups was significant. Currently, there are 44,890 agricultural extension workers. These agricultural extension workers serve 71,479 villages, so they still need as many as 26,589 agricultural extension workers (agricultural extension center Indonesia, 2022). Many agricultural extension workers can supervise the assistance funds given to farmers so that they are appropriately managed to realize farmer welfare, distribute farmers' knowledge about the latest agricultural technologies, and develop rice farming. For example, they help to provide production facilities, distribute fertilizer and seed aid, and provide cooperative institutions to assist farmers in procuring farming capital. Agricultural extension agents have roles as facilitators, communicators, motivators, and consultants. Indonesian government regulation no. 16 of 2006 concerning the Agricultural Extension System, one of the critical points in this law is the need to build extension institutions in the regions at the provincial and district/city levels.

Age affects productivity level, making decisions, and receiving information. The dominant number of respondents is 46 – 55 years old. This shows that the productive age in this study is in the age range of 46-55 years. At a productive age, it will be easier to get new ideas and quickly understand the use of technology. Information obtained by farmers, especially from agricultural extension workers, will increase their paddy rice production. This follows the research results (Hasyim, 2006) that those who work at productive age will be better and maximal than non-productive age.

Education is influential in taking action in making programs for agricultural development. The low level of education in this study indicates that the quality of human resources needs to be improved in efforts to develop farming performance. Improving the skills and knowledge of farming will encourage the achievement of planned production targets. According to (Lubis, 2000), having a high level of education will be relatively faster in implementing technology and innovation adoption, having low education is usually challenging to implement innovation adoption quickly.

The indicators included in the Technological Progress variable are the use of transplanters, the use of indo combine harvesters, the use of KATAM (planting season prediction), the use of KATAM (fertilizer dose), the use of drones (irrigation sensors/measuring soil pH), the use of expert system applications, and the use social media. The average variable of technological progress is 24.91, with an achievement level of 64.53% in the Less Good category. Farmers should optimize information technology, such as using the internet to find the latest information. Advances in technology play a role in supporting the availability of relevant and timely agricultural information. Information on the results of research and technological innovations in agriculture helps efforts to increase the production of agricultural commodities. According to research results (Prayoga, K. 2017), the use of technology is considered less optimized by the Indonesian Ministry of Agriculture. Extension activities that utilize social media must continue to be optimized because the number of users continues to increase.

Matters related to extension include the number of assisted farmers, the distance to extension locations, the amount of agricultural extension work time, extension media, methods, frequency, materials, and the instructor's experience. Extension media has the most significant contribution to the problem variables of extension agents. Through extension media, it can attract farmers to attend training. Agricultural extension agents use various media that are adjusted to the farmer's age. Then followed by indicators of instructor experience, frequency of extension, amount of working time of agricultural extension workers, extension methods, and extension materials. Extension material is everything that extension agents propose to farmers, including the suitability of the material with the needs and benefits. Based on the assessment of the extension workers in the field, it was assessed that the absorption of the material and the most suitable application were in fertilization, harvesting, and post-harvest materials. This is followed by good planting time, nurseries, planting, nursery, and maintenance indicators. Agriculture is a critical sector in national development. In national development, it is necessary to support human resources, who have the capacity, who can produce solutions to answer the challenges. It is necessary to carry out an agricultural extension to develop agriculture. Agricultural extension is also one of the efforts to produce quality human resources. Agricultural extension is an empowerment effort or an effort to motivate and change the behavior of farmers and their families so that they have the will and can solve the problems they face in doing their farming. Therefore the role of extension is crucial and becomes a strategic matter in national development.

The Ministry of Agriculture is targeting Indonesia to become a world food barn by 2045. To achieve this mission, the Ministry of Agriculture places farmers as the main actors in agricultural development. Attention is needed to farmers through agricultural extension workers. In general, the knowledge farmers have to lack in renewal and the existence of agricultural extension can help agricultural development.

**Point 9: In reference section, some literatures lack of standardization.**

**Response 9: We have revised to make sure and follow the standardization of our references**

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	Yes	Can be improved	Must be improved	Not applicable
Is the content succinctly described and contextualized with respect to previous and present theoretical background and empirical research (if applicable) on the topic?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are all the cited references relevant to the research?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are the research design, questions, hypotheses and methods clearly stated?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are the arguments and discussion of findings coherent, balanced and compelling?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
For empirical research, are the results clearly presented?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Is the article adequately referenced?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are the conclusions thoroughly supported by the results presented in the article or referenced in secondary literature?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

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Comments and Suggestions for Authors

The aim of this article is of great practical interest: to determine the factors influencing the effectiveness of agricultural extension services for farmers through a case study, rice farmers in Baubau city in Indonesia.

The analytical method used is correct and includes exogenous latent variables (technological progress, agricultural capital, farmer's age, education and agricultural experience). However, I consider the research to be very limited since the sample consists of only 110 rice farmers selected by simple random sampling who have been surveyed through questionnaires and interviews. The data obtained were analyzed descriptively and quantitatively using SEM 132 (Structural Equation Modeling).

The methodology has consisted in the application of a broad and complex statistical instrument that leads to multiple quantitative results whose description and explanation is dedicated to most of the article, from page 3 to page 17.

There are, however, some insufficiencies in the qualitative interpretation of the results that, in my opinion, originate the main deficiency of the work, the weakness of the conclusions.

There are practically no explained conclusions. The conclusions section is extremely simplified and is limited to a brief summary (16 rows from 505 to 521) in which 3 ideas presented in the results chapter are repeated without further explanation.

It also lacks a necessary "discussion" heading, however brief, to discuss the relationship between theoretical hypotheses, academic literature, and the results obtained.

It is suggested that the authors expand and complete in more detail the explanation of the conclusions drawn from the results so that these conclusions acquire a more general meaning and a value that can be extrapolated to other territories and situations beyond the small sample of farmers surveyed.

Submission Date 03 January 2023

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Is the content succinctly described and contextualized with respect to previous and present theoretical background and empirical research (if applicable) on the topic?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are all the cited references relevant to the research?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are the research design, questions, hypotheses and methods clearly stated?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
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Are the conclusions thoroughly supported by the				

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Comments and Suggestions for Authors

The article covers an indoubtely interesting topic, however the structure of the manuscript is confusing and does not allow to understand the methodology, the results and the related discussion. The main problem is that Section 3 hosts research hypotheses, data collection, formulation of the statistical model, together with sample description, results and discussion. I therefore ask the Authors to restructure the manuscript by including the following sections:

- research hypotheses, definition of the constructs, indicator selection;
- data collection and sample characteristics;
- formulation of the statistical model (SEM);
- results from the SEM, with the discussion;
- concluding remarks.

Furthermore, I have several specific issues reported below.

Line 122: the Slovin formula needs to be reported and/or cited.

Line 124: I suppose that the established error rate of 10% is a II type error, equating to a statistical power of 0.9.

Line 126: explain the increase in sample size to meet the SEM requirements. Precisely, for which requirement and based on which criteria? I suppose it is for identification. There are many criteria for assessing identification of a SEM, which obviously depends on the model formulation. Therefore, you cannot assess whether the sample size is correct before reporting how the model is specified.

Line 132: AMOS is a software, not a method. SEM is the method. Please, provide a citation of AMOS.

Statistical model: the description and the motivation of the statistical method (SEM) in this research study is completely absent. Please add and provide citations. Also, the formulation of the SEM must be clearly provided: which are the constructs? Which are the indicators for each construct? What is the structure among the constructs and how it reflect the research hypotheses?

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susy.mdpi.com/user/manuscripts/review/35182286?report=26323311

Table 2: what does 'No. sample' mean? Specify in the caption.

Diagnostic of the measurement part of the SEM: in tables 13 and 14, it is not necessary to include a column stating whether each indicator or construct is valid or not, but it is sufficient to state clearly the criteria in the text. In my opinion, these two tables could be merged into a unique one to increase clarity. The same holds for tables 15-17. Please, also add Cronbach's alpha and composite reliability indices, and provide a citation of the criteria employed to assess the validity of the constructs.

Table 17: what does the column 'Construct reliability' include?

Diagnostic of the structural part of the SEM: please report a citation of the criteria employed in tables 18 and 19. At line 122, the Authors says that the formulated SEM is not valid and implement a new formulation. However, this formulation is not described and it is impossible to understand from the path diagram. Please, be precise about deletion/addition of edges and unstructured correlations.

Table 20: I suppose that 'SE' stands for standard error. Please say this. How the standard errors were computed? Based on the asymptotic formula or, maybe, bootstrap? The term 'CR statistic' sounds strange to me. The usual term is 'z statistic'.

Line 498: I do not understand this section (Convert Path Diagrams to Structural Equations): no formulas, no citations, no discussions. What do these equations represent and what is their utility in this research? Please add these details or delete this section.

Conclusions: this section appears as a simple summary of the findings. In my opinion, it needs to be enlarged with comparisons with existing studies, policy implications, limitations, future work.

Submission Date 03 January 2023  
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	Yes	Can be improved	Must be improved	Not applicable
Is the content succinctly described and contextualized with respect to previous and present theoretical background and empirical research (if applicable) on the topic?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are all the cited references relevant to the research?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are the research design, questions, hypotheses and methods clearly stated?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
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For empirical research, are the results clearly presented?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is the article adequately referenced?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Are the conclusions thoroughly supported by the results presented in the article or referenced in secondary literature?

Comments and Suggestions for Authors

Line 16-18, In the abstract, there are two objectives. One is to determine the effectiveness of agricultural extension services. The other one is to determine the factors that influence the effectiveness of agricultural extension to farmers in Baubau City, Indonesia.

Line 20, if both the Human resources and the effectiveness of agricultural extension are used as endogenous latent variables. Why the author still found that Human resources was one of the factors that influence the effectiveness of agricultural extension?

Line 28, what is the "influence of these factors on effectiveness." It should be better to put the result at here.

Line 35, It needs more keywords.

I suggest the author should rewrite the Introduction session to focus on the research topics. Don't need to talk too much on the importance of agriculture to Baubau City.

In the "2. Materials and Methods", Additional information is required to let the reader be clear on how the research was conducted. Currently, the introduction is too simple.

In "4. Conclusion", no discription on the the effectiveness of agricultural extension services.

In reference section, some literatures lack of standardization.

Submission Date 03 January 2023  
 Date of this review 12 Jan 2023 07:04:21

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1 Article

# 2 Effectiveness of Agricultural Extension on Paddy Rice 3 Farmer's Baubau City, Southeast Sulawesi, Indonesia

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13  
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15 **Abstract:** Agricultural extension workers play an essential role in the productivity of  
16 agricultural systems. Based on the actual conditions in the field, it can be seen that the level of  
17 extension services still needs to be higher due to a lack of human resources in the field of  
18 extension services. This research was conducted to determine the effectiveness of agricultural  
19 extension services and determine the factors that influence the effectiveness of agricultural  
20 extension to farmers in Baubau City, Indonesia. The analytical method includes exogenous latent  
21 variables: human resources, technological progress, farming capital, farmer age, education, and  
22 farming experience. The effectiveness of agricultural extension are used as endogenous latent  
23 variables. The research sample consisted of 110 rice farmers in Baubau City, and the Slovin  
24 formula was used to calculate the sample. The data collection for this research was carried out by  
25 distributing questionnaires to respondents, in-depth interviews, and direct observation in the  
26 city of Baubau. Using the AMOS application, quantitative analysis was carried out through  
27 Structural Equation Modeling (SEM). The study results show that: 1) The factors that influence  
28 the effectiveness of agricultural extension in Baubau City are farming capital, farmer age,  
29 education, farming experience, and human resources, and 2) the influence of these factors on  
30 effectiveness agricultural extension is as follows: if the farming capital is high, human resources  
31 can be increased. In addition, the higher the farmer's age, the lower the need for human  
32 resources. It is also noted that higher farmer education contributes to increased human capital,  
33 and increased experience in farming is associated with increased human capital. Thus, an  
34 increase in human resources will increase the effectiveness of agricultural extension. Significant  
35 factors that influence the effectiveness of agricultural extension in Baubau City, Southeast  
36 Sulawesi, are farming capital, farmer age, education, farming experience, and human resources.

33 **Citation:** To be added by editorial  
34 staff during production.

35 Academic Editor: Firstname  
36 Lastname

37 Received: date

38 Revised: date

Accepted: date

Published: date



39  
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**Keywords:** effectiveness, agricultural extension, paddy rice, Indonesia.

## 1. Introduction

Southeast Sulawesi has sufficient competence to support the Indonesian food development program because of the high availability of land and the potential for land productivity. Based on data on rice fields area in the rice planting season, Southeast Sulawesi has an area of 82,382 ha of raw rice fields (Central Bureau of Statistic, 2020). The area of rice fields in Baubau city is 1,375 ha, this indicates that the agricultural sector is one of the sectors with high priority in Baubau City (Abadi, 2019). Rice production domestically is dominated by lowland rice production. Hence, the

3  
1 extension workers should increase their effectiveness in extension services for the  
2 lowland ricer farmers.

3 Extension workers can contribute to the regulatory process by providing expertise  
4 and content for proposed, adopted, and restructured agriculture-related regulations.  
5 As Extension agents have direct interaction with clients in the field, they can  
6 communicate the needs of stakeholder groups. Therefore, they should be involved in  
7 the regulatory process. An evidence-based approach involving input from target  
8 groups and practitioners seems to be an inevitable strategy for the success of a  
9 sustainable land grant project (Fouladkhah, A., 2017).

10 Extension agents are one of the supporting elements in the agribusiness sub-  
11 system. In principle, the agricultural extension supports all sub-systems in  
12 agribusiness. Specifically, in this study, extension workers play a role in supporting the  
13 *on-farm* to increase the productivity of lowland rice. Hence, to increase the productivity  
14 of rice farming, extension workers are needed. The role of the extension worker is to  
15 provide guidance and knowledge in the form of the latest information or innovation to  
16 improve their farming system, ultimately increasing their crop yields. In addition, the  
17 purpose of agricultural extension is to change the behavior of farmers, for instance,  
18 their ability to adapt to situations and conditions that keep changing. Thus, they can  
19 improve their farming systems, increase production, and reduce the possibility of crop  
20 failure. While simultaneously improving their living standards.

21 However, there are some significant issues, such as a lack of active participation  
22 from agricultural extension workers and the difference in the extension worker to  
23 farmer ratio, leading to fewer extension workers to many farmers. This problem causes  
24 the workload of each extension worker to be quite large because either the extension  
25 area or the number of assisted farmer groups is quite large. The current condition is  
26 forcing agricultural extension workers to work hard despite a limited number of  
27 workers, and they must be able to perform optimally to increase their work  
28 productivity.

29 The role of extension workers can increase sustainable agricultural productivity  
30 and food security (Olorunfemi, T. O., et al. 2020). One of the most crucial things is to  
31 ensure that leaving agricultural extension and education programs has a positive  
32 impact on farmers (Salehi, M., et al. 2021). Consequently, the crucial role of extension  
33 workers is to create awareness among farmers to apply guidelines for food needs (Fiaz,  
34 S., et al. 2018). The findings of the study (Jamil, M.H., 2017) show that the development  
35 of agricultural extension workers has a positive effect on the agricultural extension  
36 program.

37 Agricultural extension programs and policies can play an important role in  
38 achieving production (Mahir, M. E. A. E., & Abdelaziz, H. H. 2011). Additionally, this  
39 agricultural policy discussed by (Baloch, M. A., & Thapa, G. B., 2019) who said that  
40 agricultural policies must be implemented effectively to the needs of farmers and the  
41 problems they face. One example is that the Government of Pakistan has adopted a  
42 policy of providing agricultural services to promote agricultural production by  
43 disseminating appropriate knowledge and technology to farmers (Baloch, M. A., &  
44 Thapa, G. B., 2018).

45 The agricultural industrial revolution has had an impact on efficiency and  
46 productivity in agricultural extension services in the agricultural sector (Nyarko, D. A.,  
47 & Kozári, J. 2021). The effects of community-based strategies on food security has a  
48 positive impact (Wellard, K., et al. 2013). It is suggested that extension services provide  
49 information and communication technology training ( ICT) for agricultural extension  
50 workers to improve extension services. In addition, according to (Umbara, D.S.,  
51 Sulistyowati, L., Noor, T.I., and Setiawan, 2021) The dissemination of agricultural  
52 technology information by utilizing the internet network is very helpful for  
53 agricultural extension workers in carrying out their main tasks. Information and  
54 communication Technology are also can be used to facilitate the delivery of  
55 information and knowledge sharing between farmers, extension workers, and other  
56 stakeholders. (Annor-Frempong, F., et al. (2006). In the article (Haghighi, N. F., et al.  
57 2008) stated the perspective on the application of information and communication  
58 technology in agriculture, some issues with using ICT in organizations, however, in  
59 contrast, in accordance (Diaz, R. T., et al. (2021). It was found that services Extension  
60 services in the study area are not sufficient when farmers face difficulties.

61 From the literature, it can be gathered that an agricultural extension worker plays  
62 an essential role in the productivity of a farming system. Based on the actual conditions

3  
1 in the field, it can be acknowledged that the extension service rate is low due to a lack  
2 of human resources in the extension field. Therefore, to solve the problems that arose  
3 from the current predicament, this study was conducted to determine the effectiveness  
4 of agricultural extension services. The primary purpose of this study is to determine  
5 the factors that influence the effectiveness of agricultural extension services to lowland  
6 rice farmers in Baubau City and to find out how these factors can affect the  
7 effectiveness of agricultural extension services.

8 **2. Research Hypothesis**

- 9 a. It is suspected that the variables of technological progress (X1), farming capital (X2),  
10 farmer age (X3), farmer education (X4), and farmer experience (X5) have a  
11 significant relationship and have a direct influence on human resources (Y1).  
12 b. Allegedly, the variables of technological progress (X1), farming capital (X2), farmer  
13 age (X3), farmer education (X4), and farmer experience (X5) have a significant  
14 relationship and give an indirect effect but are thought to influence the variable  
15 effectiveness of agricultural extension ( Y2).  
16 c. It is suspected that the variable human resources (Y1) have a significant relationship  
17 with the variable effectiveness of agricultural extension (Y2).

18 **3. Research methods**

19 **3.1 Place and time**

20 This research is located in Bau-bau City, Southeast Sulawesi, and was carried out  
21 in January-July 2022.

22 **3.2 Data Collection**

23 Data collection techniques in this study were carried out using interviews,  
24 questionnaires, and observation.

25 **3.3 Population and Sample**

26 The population of this study were all farmers in Baubau City. The population of  
27 this study was 1257 people (Data from the Baubau City Agriculture Office, 2021). In  
28 addition, the population of agricultural extension workers in Baubau City is 26 people.

29 A simple random sampling was used. The sample measurements were calculated  
30 using the Slovin formula.

31  
32 
$$n = \frac{N}{1+N(E)^2} \dots\dots\dots$$
  
33 (1)

34  
35 
$$n_i = \frac{N_i}{N} \times n \dots\dots\dots$$
  
36 (2)

- 37 Description :  
38 n = Number of samples  
39 N = Population  
40 e<sup>2</sup> = Precession set (5%)  
41 n<sub>i</sub> = Standard sample size i  
42 N<sub>i</sub> = Population size i

43 This sample size was determined with an error rate of 10% or based on the desired  
44 level of confidence (precision) of 90%, and the sample size based on the Slovin formula  
45 amounted to 110 respondents. The study sample for extension agents was based on the  
46 population of extension workers in Baubau City, which amounted to 26 personnel.  
47 From which 30% of the total were sampled, resulting in 8 extension workers.

48 The data collection techniques used to carry out the study were questionnaires,  
49 direct interviews and observations to determine the characteristics and behavior of the

research object. The data obtained were analyzed descriptively and quantitatively using the SEM method (*Structural Equation Modeling*) – Software Amos (*Analysis of Moment Structure*) .

### 3.4 Analysis Method

#### 3.4.1 Descriptive Statistical Analysis

Descriptive statistical data was interpreted using the TCR criteria (Respondent Achievement Level), and the following formula was used:

$$TCR = \frac{Mean}{Skor Max} \times 100 \dots\dots\dots (3)$$

**Table 1.** TCR criteria

No.	Scale Range	TCR
1	90% - 100%	Very good
2	80% - 89,99%	Good
3	65% - 79,99%	Enough
4	55% - 64,99%	Not good
5	0% - 54,99%	Not good

The percentage formula used in this study is:

$$P = \frac{f}{N} \times 100 \% \dots\dots\dots (4)$$

Description:

P = Percentage Number

f =The number of frequencies of each answer that has become the respondent's choice

N=The number of frequencies or the number of individuals

To determine the level of criteria with a descriptive analysis of the percentage, which is divided into five indicators, namely:

**Table 2.** Percentage Descriptive Analysis Criteria

Number	Percentage	Criteria
1.	0 % – 20%	Very low
2.	21% – 40%	Low
3.	41% – 60%	Moderate
4.	61 % – 80 %	High
5.	81%– 100%	Very high

### 3.4.2 Quantitative Analysis

SEM (Structural Equation Modeling) analysis in this study was carried out using Amos 24 software to answer problems related to variables that influence the effectiveness of agricultural extension in Baubau City.

The formula used in this study is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e \dots\dots\dots(5)$$

Description:

Y1 = Effectiveness of Agricultural Extension

Y2 = Human Resources

$\beta$  = Constant

E = Standard error

X1 = Technology advances

X2 = Capital

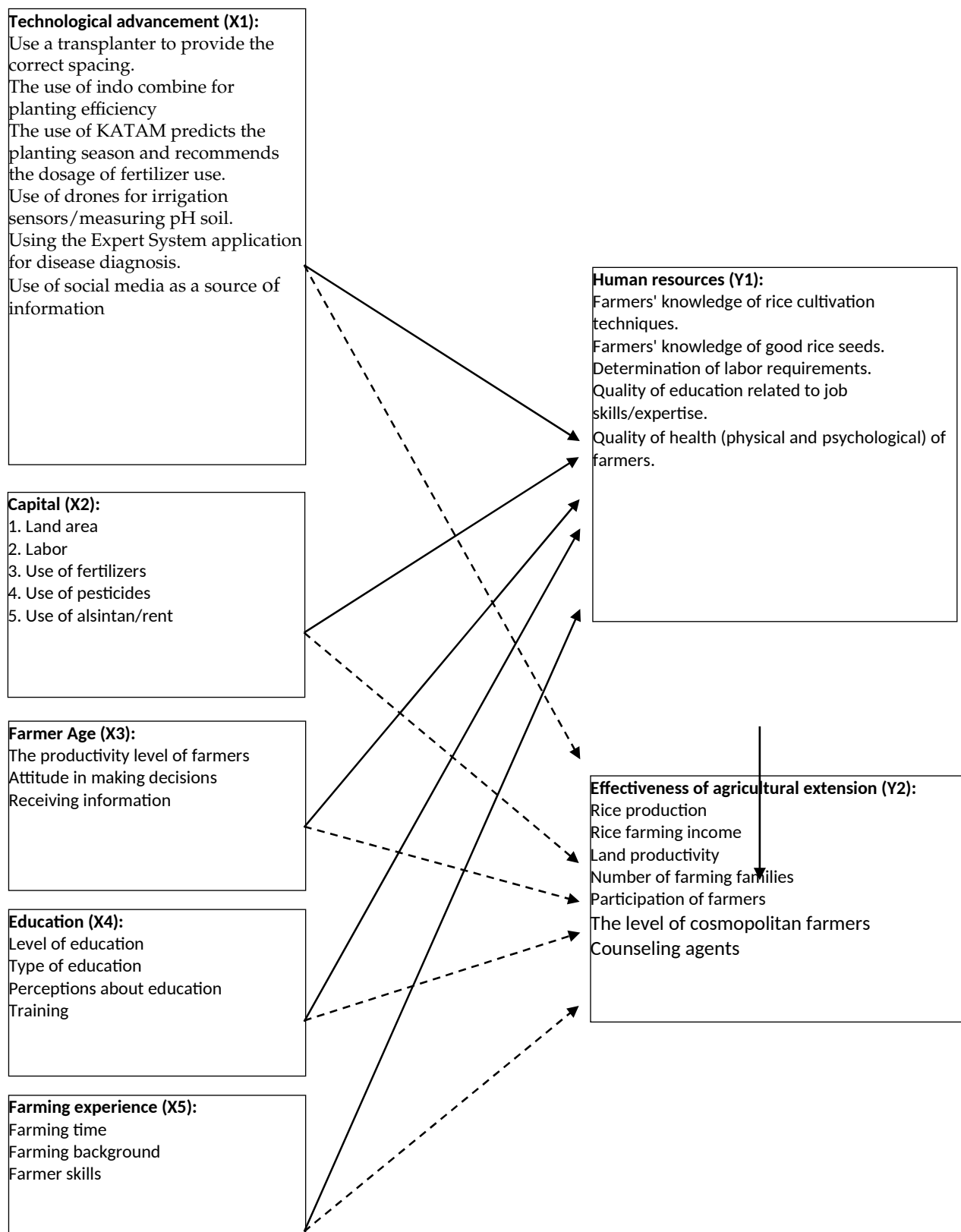
X3 = Farmer Age

X4 = Education

X5 = Farming experience

### 3.4.3 Constructs, Indicator, and code variable

3



1

2

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#### 4. Results

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6

The demographic characteristic of the farming communities involves 96% of male and 4% of female farmers (table 1). There is a division of household tasks between husband and wife. Based on in-depth interviews with several respondents, they stated

3  
1 that working in the fields is the husband's duty while the wife takes care of the  
2 household. Results based on age indicated that 34% of farmers were 36-45 years old,  
3 and 6% were under 25 years old. Farmers who work at productive age will be better  
4 and more optimal than non-productive age (Productive age 15-64). In addition, age can  
5 also be used as a benchmark to see the activities of farmers at work (Hasyim, 2006).

6 It was revealed that the respondents with non-educational levels were 10%.  
7 Respondents with the last education at the elementary, junior school, and senior high  
8 school levels were 41%, 13%, 31%, respectively, and at the tertiary level added to 5%;  
9 according to (Soehardjo and Patong, D. 1999) higher levels of education results to more  
10 straightforward implementation of innovations. Farmer education is not only oriented  
11 toward increasing production but the social life of the farming community farmers  
12 with a high education level will be relatively faster in implementing technology  
13 adoption and innovation. Farmers who have low education may have difficulty  
14 implementing the adoption of innovation quickly. The level of education possessed by  
15 farmers depicts the knowledge and insight a farmer has in applying technology and  
16 innovation to increase farming activities (Lubis, 2000). Demographic characteristics  
17 based on the main occupation of farmers show that farming is the respondents' main  
18 occupation, totaling 97%. In comparison, the remaining 3% of the main occupation are  
19 civil servants and farming as their side employment.

20 Based on the study's results, farmers with a land area of less than 1 ha was 16%, 1  
21 to 5 ha was 82%, and more than 5 ha was 2%. The number of farmers that own their  
22 land is 93%, and 6% of the farmers are tenants, while the remaining 1% amounts to  
23 farmers being landowners and tenants. It is important to note that more land  
24 ownership means more potential to increase productivity and efficiency by adopting  
25 modern technology. Land tenure is vital in spreading and adopting modern  
26 agricultural practices among farming communities (Aldosari et al., 2019).

27 Next, the results show that a significant percentage of the farmers had more than  
28 10 years of experience resulting in a total of 76%, followed by farmers with 5-10 years  
29 with 14% and farmers with less than 5 years of experience with 10%. The farming  
30 experience significantly affects farming activities, as evident from the production  
31 results. Farmers who have been farming for a long time have high knowledge,  
32 experience, and skills in running a farm. Farming experience is divided into three  
33 categories, namely less experienced (< 5 years), moderately experienced (5-10 years),  
34 and experienced (10 years). Farmers have different farming experiences or lengths of  
35 farming (Soehardjo and Patong, D. 1999) Furthermore, it can be seen that respondents  
36 have chosen "hereditary" as their farming background surmounting 90% or as many as  
37 99 people from the total number of respondents, and none of the respondents chose the  
38 "has the farming ability" as a farming background and in this case the respondent's last  
39 education determines the farming background. The remaining percentage were  
40 recorded for farming backgrounds are as follows "economic need, availability of  
41 adequate land, the ability to farm and willingness based on agriculture as a promising  
42 field." The percentage for each are as followed 3%, 4%, 1% & 2% respectively.

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46 **Table 3.** Demographic Characteristics Data of Rice Farmers in Baubau City, Southeast  
47 Sulawesi

Gender	n	%	Age ( years)	n	%
Male	106	96	Less than 25	7	6
Female	4	4	25 – 35	25	23
Total	110	100	36 – 45	17	15
			46 – 55	37	34
			More than 55	24	22
			Total	110	100
Last Education	n	%	Main occupation	n	%

3

No Education	11	10	Farmers	107	97
Elementary school	45	41	Other than farmers (PNS)	3	3
Junior high school	14	13	Total	110	100
Senior high school	34	31			
Higher education	6	5			
Total	110	100			
Land Area (ha)	n	%	Land Ownership Status	n	%
Less than 1	18	16	Owner	102	93
1 – 5	90	82	Tenant/tenant	7	6
More than 5	2	2	Owner and tenant	1	1
Total	110	100	Total	110	100
Time of farming (years)	n	%	Farming background	n	%
Less than 5	11	10	Hereditary	99	90
5 – 10	15	14	Economic needs	3	3
More than 10	84	76	Availability of adequate land	5	4
Total	110	100	Has the ability to farm	1	1
			Willingness from within because farming is a promising field	2	2
			Total	110	100

1 n = Total; % = Percentage

2

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**Table 4.** Data on Demographic Characteristics of Agricultural Extension Respondents based on Working Area and Distance from Work Area Baubau City, Southeast Sulawesi

No.	Working Area	Distance from Working Area
		(Km)
1	Lea-lea Subdistrict	15
2	Tampuna Subdistrict	21
3	Liabuku Subdistrict	9
4	Bungi Subdistrict and Lea-Lea Subdistrict	10
5	Ngkaring-ngkaring Subdistrict	5
6	Waliabuku Subdistrict	13

7	Lowu-lowu	15
8	Subdistrict Kalia-lia	15

An extension work area is a place or an area that becomes the territory of authority in carrying out its duties as an extension worker, whether within the ward, sub-district, district/city, or wider area. The extension worker's work area can affect productivity in carrying out his duties as an extension worker. Meanwhile, the distance from the working area is the distance from the instructor's residence to the extension location. In Table 2, it can be seen that each respondent has a different work area and length from the work area. The distance from the farthest working area is 21km, and the closest is 5 km.

**Table 5.** Data on Demographic Characteristics of Agricultural Instructor Respondents in Baubau City, Southeast Sulawesi

Duration as an Extension (years)	n	%	Status	n	%
Less than 5	1	12	Civil Servants	5	63
5 – 10	2	25	Honorary Employee	1	12
More than 10	5	63	THL- TBPL	2	25
Total	8	100	Total	8	100

THL- TBPL: Agricultural extension workers

Duration as an extension refers to this study, each respondent has been an extension worker from the time of appointment until this research is carried out, expressed in units of years. The length of time an extension worker determines the level of experience each agent has. In this case, the duration of an extension worker is divided into three categories: less experienced (<5 years), moderately experienced (5-10 years), and experienced (>10 years). Table 5 shows the highest percentage (63%) 5 out of 8 agents have experience of more than 10 years as an extension worker. While extension agents with moderate experience equal to 2 out of 8 (25%), and extension agents with less than 5 years of experience totaled to 1 out of 8 (12%).

The status of the extension workers refers to the position an agent holds, which corresponds to their employment descriptions. Table 5 displays that of the 8 surveyed workers, 63% (5 agents) are Civil Servants, 12 % are honorary employee, and 25% are THL-TBPL position holders.

### 3.1. Descriptive Statistical Analysis

#### 3.1.1. Technological Progress Variables

**Table 6.** Frequency Distribution of Technological Progress Variables (X1) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming Businesses in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
-----	-----------	---	------	------	-----	----------

1	Use of <i>transplanter</i>	110	52	27.22	52.3	Not good
2	Use of <i>indo combine harvester</i>	110	52	23.68	45.5	Not good
3	Use of KATAM (predicted planting season)	110	50	38.22	76.4	Enough
4	Use of KATAM (fertilizer dose)	110	50	35.51	71.02	Enough
5	Use of <i>drones</i> (irrigation sensor/measuring soil pH)	110	16	12.94	80.9	Good
6	Use of expert system applications	110	17	13.35	78.5	Enough
7	Use of social media	110	50	23.57	47.1	Not good
Average				24.91	64.53	Not good

Based on Table 6 above, the average technological progress variable is 24.91 with a respondent's level of achievement is 64.53% which favors the not good category. Thus, it can be said that technological advances have less than the desired effect on agricultural extension. The indicator with the lowest TCR value in the table above is the use of *indo combine harvester* with an average score of 23.68, gravitating in the bad category. While the indicator with the lowest average score is for the use of *drones* (irrigation sensor/measuring soil pH) which is 12.94, and the TCR value is 80.9 falling into the good category.

The impact of the extension approach on the use of technology, food security was found to be positive (Wellard, K., et al. (2013). Dissemination of agricultural technology information is helpful for agricultural extension workers in carrying out their main tasks. Agriculture (Umbara, D.S et al., 2021 ). In recent years, the agricultural industry has experienced an increase in the application of information and communication technology globally. This new revolution is said to have an impact on efficiency and productivity in agricultural extension services in the agricultural sector (Daniel et al., 2021). Information and Communication Technology can be used in a cost-effective and practical way to facilitate information sharing and knowledge sharing among farmers, extension workers and other stakeholders (Joseph Kwarteng, 2006). This new revolution is said to have an impact on efficiency and productivity in agricultural extension services in the agricultural sector (Daniel Ayisi Nyarko and József Kozári, 2021). Attitudes towards the application of information and communication technology in agricultural extension, the extent of the problems faced by extension organizations to use ICT, Knowledge of ICT and personal characteristics (Negin Fallah Haghighi et al., 2008).

### 3.1.2 Farming Capital Variable

**Table 7.** Frequency Distribution of Farming Capital Variables (X2) in Research on Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
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1	Land area	110	54	39.60	73.3	Sufficient
2	Labor	110	51	23.03	45.1	Not good
3	Fertilizer use	110	52	42.85	82.4	Good
4	Pesticide use	110	56	42.36	75.7	Enough
5	Agricultural machinery use	110	67	42.98	64.1	Poor
Average				38.16	68.12	Enough

Based on Table 7 above, the average farming capital variable is 38.16 with a TCR value of 68.12, portraying the sufficiency of the indicator. In other words, the influence of the farming capital variable on the effectiveness of agricultural extension is satisfactory. The labor indicator in the table above has the lowest TCR value of 45.1, and the average score is 23.03, which is the indicator value with the lowest score; hence, it is portrayed in the bad category. In comparison, the indicator with the highest TCR value is the use of fertilizer, which is 82.4 with an average value of 42.85 and is present in the Good category.

### 3.1.3 Farmer Age Variable

**Table 8.** Frequency Distribution of Farmer Age Variable (X3) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Rice Field Farming in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Farmer Productivity Level	110	57	38.82	68.1	Enough
2	Attitude in Making Decisions	110	57	41.33	72.5	Enough
3	Acceptance of Information	110	57	36.05	63.2	Low
Average				38.73	67.93	Adequate

In table above, the average farmer age variable is 38.73 with a TCR value of 67.93 and is in the Adequate category. It can be stated that the influence of the age variable of farmers on the effectiveness of agricultural extension is reasonably influential. The attitude indicator in decision making has the highest average value of 41.33 and the TCR value of 72.5; hence, classified in enough sections. While the indicator with the lowest average value, namely the acceptance of information, is 36.05 with a TCR value of 63.2, which falls in the designated section of Poor.

### 3.1.4 Farmer Education Variable

**Table 9.** Frequency Distribution of Farmer Education Variables (X4) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
-----	-----------	---	------	------	-----	----------

1	Education Level	110	57	18.25	32.01	Not good
2	Type of Education	110	51	15.58	30.6	Not good
3	Perception about Education	110	54	13.95	25.8	Not good
4	Training	110	58	18.48	32.4	Not good
Average				14.56	30.20	Not good

Based on Table 9, the average farmer education variable is 14.56 with a TCR value of 30.20 which is Not good. In other terms, the influence of farmers education on the effectiveness of agricultural extension is not present. The Perception Indicator of Education has the lowest average score of 13.95 and the TCR value of 25.8, indicating that the variable component is in a bad category. Likewise, the other three indicators fall in the not good category, as evident in the table above.

### 3.1.5 Farming Experience Variable

**Table 10.** Frequency Distribution of Farming Experience Variables (X5) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Farming time	110	60	40.51	67.5	Enough
2	Farming background	110	56	28.13	50.2	Not good
3	Farmers skills	110	57	43.72	76.7	Enough
Average				37.45	64.8	Poor

Referring to table 10, the average farming experience variable was 37.45 with a TCR value of 64.8, indicating that the experience variable categorizes in the poor section. From the three indicators, it shows that the farming background indicator has an average value of 28.13 and a TCR value of 50.2, while being categorized as not good; however, the indicators of the farming time and farmer skills are in the sufficient category with TCR values of 67.5 and 76.7 respectively.

### 3.1.6 Extension Problem Variables

Table 11 shows the average variable of extension problems is 35.28 with a TCR value of 83.26, indicating that these variables are in a good category. The indicator of the number of assisted farmers has an average value of 44.00 and shows a TCR value of 78.6 which means it is in the sufficient category. The extension media indicator has an average value of 25.63 and shows its TCR value of 91.5, presenting as Very Good, followed by indicators of the experience of the extension worker, the frequency of extension, the amount of working time of the agricultural instructor, the extension method, and the extension material, which were both in the good category. The indicator of the distance of the extension location is in the enough category.

3  
1 **Table 11.** Frequency Distribution of Extension Problems Variables (X6) in the study of  
2 Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in  
3 Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Number of Assisted Farmers	8	56	44.00	78.6	Enough
2	Distance of Extension Locations	8	21	15.00	71.4	Enough
3	Total Working Time of Agricultural Instructor	8	23	19.88	86.4	Good
4	Extension Media	8	28	25.63	91.5	Very good
5	Extension Methods	8	31	25.38	81.9	Good
6	Extension Frequency	8	44	38.13	86.7	Good
7	Extension Materials	8	46	37.13	80.7	Good
8	Extension Experience	8	53	47.13	88.9	Good
Average				35.28	83.26	Good

#### 4 3.1.7 Extension Materials

1 Based on table 12, the average of the Extension Materials variable is 3.53 with a  
2 TCR value of 83.94, indicating that this variable is in a good category. The table's  
3 fertilization, harvesting, and post-harvest indicators have the same average value of  
4 3.63 and the same TCR value of 90.75, indicating that the three indicators are in the very  
5 good category. Then followed by indicators of good planting time, seed sowing, and  
6 planting, which all have the same average value of 3.50 and the same TCR value of 87.5,  
7 indicating that the variable components are in a good category. While the nursery and  
8 maintenance indicators are in the enough category.

9 **Table 12.** Frequency Distribution of Extension Material Variables (X7) in the study of  
10 Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in  
11 Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Good Planting Time	8	4	3.50	87.5	Good
2	Tillage	8	5	4.00	80	Good
3	Nurseries	8	4	2.63	65.75	Enough
4	Nurseries	8	4	3.50	87.5	Good
5	Planting	8	4	3.50	87.5	Good
6	Maintenance	8	5	3.75	75	Enough
7	Fertilizing	8	4	3.63	90.75	Very good
8	Harvesting	8	4	3.63	90.75	Very good
9	Post-harvest	8	4	3.63	90.75	Very good

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Average 3.53 83.94 Good

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### 3.1.8 Human Resources

Table 13 shows that the average score of the Human Resources variable is 4.20, and the TCR value is 84.12, hence, summarizing the variable in the Good category. In the five indicators below, one indicator is in the bad category, namely the quality of education related to work skills/expertise, with an average value of 1.80 and a TCR value of 36. In contrast, the other four indicators are in the very good category.

**Table 13.** Frequency Distribution of Human Resources Variables (Y1) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Farmers' knowledge of rice cultivation techniques	110	5	4.90	98	Very good
2	Farmers' knowledge of good rice seeds	110	5	4.92	98.4	Very good
3	Determination of labor needs	110	5	4.65	93	Very good
4	Quality of education related to Skills/work skills	110	5	1.80	36	Not good
5	Health quality (physical and psychological) of farmers	110	5	4.76	95.2	Very good
<b>Average</b>				4.20	84.12	Good

### 3.1.9 Effectiveness of Agricultural Extension

The results of table 14 show that the average variable of Extension Effectiveness Agriculture is 3.73 and has a TCR value of 74.76 which means that the variable is in the sufficient category. This Agricultural Extension Effectiveness variable has six indicators, of which one indicator is in a bad category, that is, the number of farming families. Then two indicators are in the very good category: farmer participation and the level of cosmopolitan farmers with TCR values of 97 and 92.6. Then followed by indicators of rice farming income in the good category, and indicators of rice production and land productivity in the sufficient category.

**Table 14.** Frequency Distribution of Extension Problems Variables (X6) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Rice Field Farming in Baubau City, Southeast Sulawesi, 2022

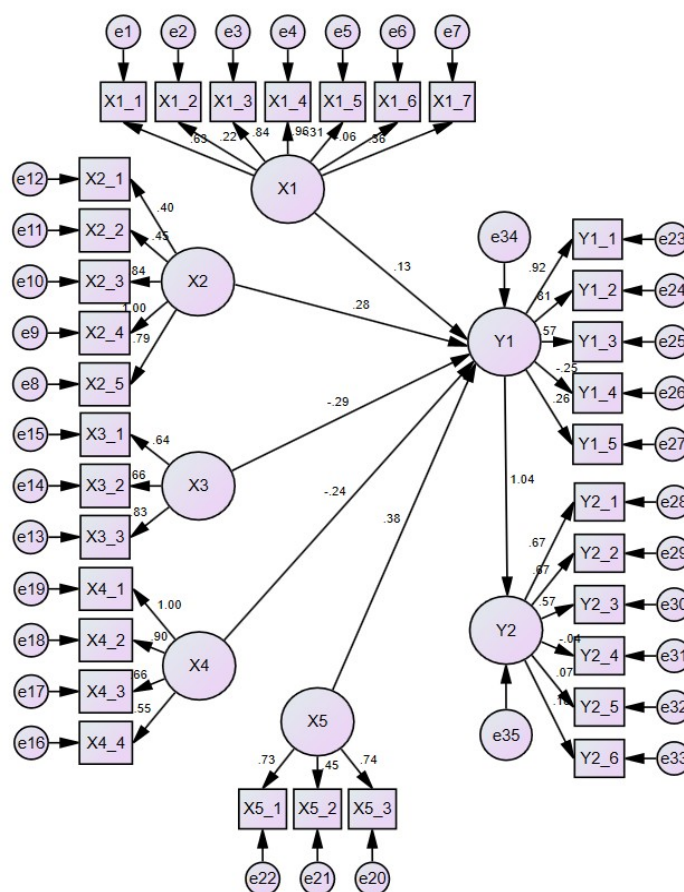
No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Rice Production	110	5	3.65	73	Enough
2	Rice Farming Income	110	5	4.20	84	Good
3	Land Productivity	110	5	3.65	73	Enough

4	Number of Farmer Families	110	5	1.45	29	Not good
5	Farmer Participation	110	5	4.85	97	Very good
6	Cosmopolitan Level Farmers	110	5	4.63	92.6	Very good
Average				3.73	74.76	Fair

### 3.2 Analysis of Structural Equation Modeling (SEM)

#### 3.2.1 Evaluation of Measurement Model

This research model consists of 7 (seven) constructs, including the variables of Technological Progress (X1), Capital (X2), Farmer Age (X3), Education (X4), Farming Experience (X5), Human Resources (Y1), and Effectiveness of Agricultural Extension (Y2). Evaluation of the measurement model is a stage to test the validity and reliability of a construct.



#### 1. Validity Testing

Construct validity testing is intended to determine whether the indicators used in measuring latent variables are valid. The validity of each indicator in measuring the latent variable is indicated by the size of the loading factor (Standardized Weights). An indicator is declared valid if an indicator's loading factor is positive and greater than 0.5. The results of the validity test are presented in table 13.

Table 15 shows that the question indicators X1\_2, X1\_5, X1\_6, and X1\_7, which measure the Technological Progress variable (X1), are declared invalid because they

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 1 produce a loading factor value of less than 0.5. Then the question indicators X2\_1 and  
 2 X2\_2 which measure the Modal variable (X2), are declared invalid. Furthermore, the  
 3 question indicators X5\_2, Y1\_4, and Y1\_5 which measure the variables of Farming  
 4 Experience (X5) and Counseling Problems (Y1), are declared invalid because they  
 5 produce a loading factor value of less than 0.5. Then the question indicators Y2\_4, Y2\_5,  
 6 and Y2\_6 which measure the Agricultural Extension Effectiveness variable (Y2), are  
 7 declared invalid because they produce a loading factor value of less than 0.5.

8 When viewed from the strength of the loading factor (Standardized Weights) on  
 9 each variable, the X1\_4 indicator has the highest contribution to the Technological  
 10 Progress variable (X1) of 95.6%. Then on, the Capital variable (X2), it is dominated by  
 11 the X2\_4 indicator of 99.6%. Furthermore, the X3\_3 indicator has the highest  
 12 contribution to the Farmer Age variable (X3) at 82.9%. Then the Education variable (X4)  
 13 is dominated by the X2\_4 indicator of 90.5%. Then the X5\_3 indicator has the highest  
 14 contribution to the variable Age of Farming Experience (X5) at 73.6%. Furthermore, the  
 15 Human Resources variable (Y1) is dominated by the Y1\_1 indicator of 91.8.0%. The  
 16 variable of Agricultural Extension Effectiveness (Y2), is dominated by the Y2\_1  
 17 indicator of 67.1%.

18 Validity can not only be seen through the loading factor but also through the  
 19 Average Variance Extracted (AVE). An instrument is said to meet the validity test if it  
 20 has an Average Variance Extracted (AVE) above 0.5. The results of the convergent  
 21 validity test are presented in table 14:

22 **Table 15.** Construct and Validity Test

Variable	Indicator	Loading Factor	Criteria	AVE
Technology advances (X1)	X1_1	0.626	0.5	0.326
	X1_2	0.220	0.5	
	X1_3	0.837	0.5	
	X1_4	0.956	0.5	
	X1_5	-0.306	0.5	
	X1_6	-0.058	0.5	
	X1_7	0.362	0.5	
Capital (X2)	X2_1	0.398	0.5	0.535
	X2_2	0.451	0.5	
	X2_3	0.839	0.5	
	X2_4	0.996	0.5	
	X2_5	0.786	0.5	
Farmer Age (X3)	X3_1	0.644	0.5	0.512
	X3_2	0.659	0.5	
	X3_3	0.829	0.5	
Education (X4)	X4_1	1.002	0.5	0.639
	X4_2	0.905	0.5	
	X4_3	0.658	0.5	
	X4_4	0.548	0.5	

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Farming Experience (X5)	X5_1	0.732	0.5	0.425
	X5_2	0.445	0.5	
	X5_3	0.736	0.5	
Human resources (Y1)	Y1_1	0.918	0.5	0.393
	Y1_2	0.813	0.5	
	Y1_3	0.573	0.5	
	Y1_4	-0.248	0.5	
	Y1_5	0.263	0.5	
Effectiveness of Agricultural Extension (Y2)	Y2_1	0.671	0.5	0.210
	Y2_2	0.668	0.5	
	Y2_3	0.567	0.5	
	Y2_4	-0.043	0.5	
	Y2_5	0.074	0.5	
	Y2_6	0.179	0.5	

1

Based on table 15, it can be seen that overall, the indicators on the variables of Technological Advance (X1), Farming Experience (X5), Human Resource (Y1), and Effectiveness of Agricultural Extension (Y2) are declared valid in measuring the variables because they have fewer AVE values of 0.5. Cronbach's Alpha was used for reliability. This value reflects the reliability of all indicators in the model. The minimum value is 0.7. In addition to Cronbach's Alpha, composite reliability values are also used, interpreted he same as Cronbach's Alpha values.

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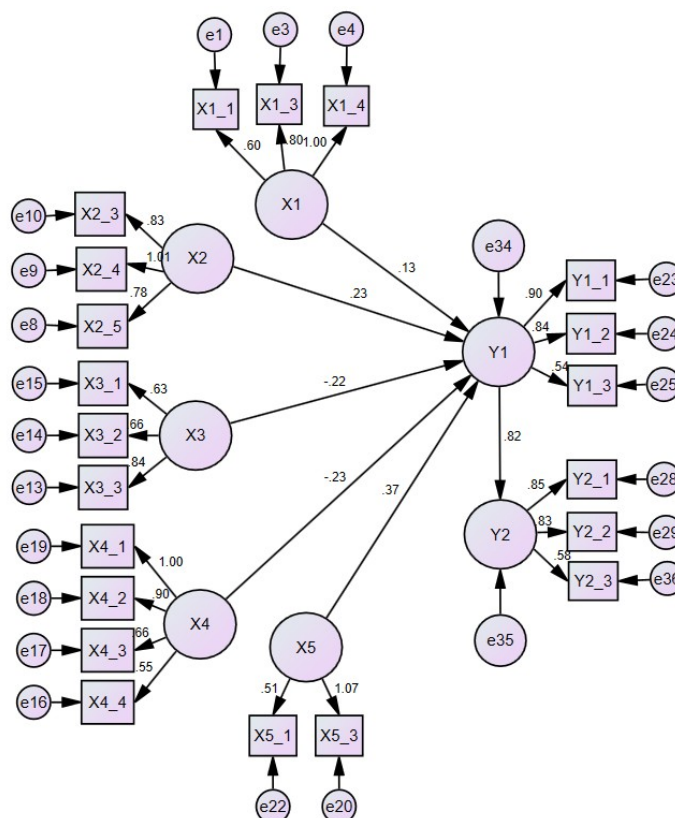
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**Figure 2.** Path Diagram After Invalid Indicator Drop

The validity of each indicator in measuring the latent variable is indicated by the size of the loading factor (Standardized Weights). An indicator is declared valid if the loading factor of an indicator is positive and is greater than 0.5. The results of the validity test and the loading factor, the Average Variance Extracted (AVE) value is obtained, which is presented in table 15.

## 2. Construct Reliability Test

The construct reliability test was carried out using the Construct Reliability (CR) technique. The test criteria state that the coefficient of Construct Reliability (CR) and Cronbach's alpha 0.6 means that it can be stated that the construct is reliable or the indicator is consistent in measuring the variables it measures. The summary of the reliability test results is presented in table 18.

Based on table 18, it can be seen that the value of Construct Reliability and Cronbach's alpha on all variables is greater than 0.6. Thus, based on the calculation of Construct Reliability and Cronbach's alpha, the variable is declared reliable.

### 3.2.2 SEM Model Evaluation

#### 1. Model Fit Test

Testing the feasibility/fitness of the model (construct) is intended to determine whether the construct formed is appropriate (feasible) or not. There are several test indices in SEM analysis, namely CMIN/DF, RMSEA, TLI, and CFI. The test criteria use CMIN/DF; if the CMIN/DF value is the cut-off value (2.00), then the construct formed is appropriate (feasible). The criteria using RMSEA state that if the RMSEA value is the cut-off value (0.08), then the construct formed is appropriate (feasible). The criteria using TLI and CFI state that if the goodness of fit value is the cut-off value (by 0.90), then the model formed is appropriate (feasible). The results of the model feasibility test are summarized in table 18:

**Table 16.** Construct Validity Test After Drop Invalid Indicator

Variable	Indicator	Loading Factor	Criteria	Description
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	X1_1	0.600	0.5	Valid
Technology advances (X1)	X1_3	0.805	0.5	Valid
	X1_4	0.999	0.5	Valid
	X2_3	0.830	0.5	Valid
Capital (X2)	X2_4	1.008	0.5	Valid
	X2_5	0.776	0.5	Valid
	X3_1	0.633	0.5	Valid
Farmer Age (X3)	X3_2	0.659	0.5	Valid
	X3_3	0.838	0.5	Valid
	X4_1	1.004	0.5	Valid
	X4_2	0.903	0.5	Valid
Education (X4)	X4_3	0.656	0.5	Valid
	X4_4	0.548	0.5	Valid
	X5_1	0.510	0.5	Valid
Farming Experience (X5)	X5_3	1.066	0.5	Valid
	Y1_1	0.900	0.5	Valid
Human resources (Y1)	Y1_2	0.839	0.5	Valid
	Y1_3	0.544	0.5	Valid
	Y2_1	0.849	0.5	Valid
Effectiveness of Agricultural Extension (Y2)	Y2_2	0.835	0.5	Valid
	Y2_3	0.578	0.5	Valid

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**Table 17.** Validity Test After Drop Invalid Indicator

Variable	AVE	Description
Technology advances (X1)	0.669	Valid
Capital (X2)	0.769	Valid
Farmer Age (X3)	0.512	Valid
Education (X4)	0.639	Valid
Farming Experience (X5)	0.698	Valid
Human Resources (Y1)	0.757	Valid
Effectiveness of Agricultural Extension (Y2)	0.709	Valid

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**Table 18.** Reliability Test

Variable	Construct Reliability	Cronbach's Alpha	Description
Technology advances (X1)	0.814	0.807	Reliable
Capital (X2)	0.854	0.884	Reliable

Farmer Age (X3)	0.791	0.729	Reliable
Education (X4)	0.872	0.782	Reliable
Farming Experience (X5)	0.700	0.704	Reliable
Human Resources (Y1)	0.829	0.681	Reliable
Effectiveness of Agricultural Extension (Y2)	0.804	0.776	Reliable

Based on table 18, it can be seen that the Construct Reliability and Cronbach's alpha values for all variables are more significant than 0.6. Thus, these variables are declared reliable based on the calculations of Construct Reliability and Cronbach's alpha.

**Table 19.** Goodness Of Fit Model

Index	Goodness Of Fit	Cut Off Value	Description
CMIN/DF	2.709	≤ 2.00	Poor of Fit
RMSEA	0.148	≤ 0.08	Poor of Fit
TLI	0.673	≥ 0.90	Poor of Fit
CFI	0.714	≥ 0.90	Poor of Fit

Based on the summary of the goodness of fit, it can be seen that the 4 (four) indicate, namely CMIN/DF, RMSEA, TLI, and CFI do not meet the criteria. Thus the SEM model that has been formed is declared not feasible.

Because the model is not feasible, modifications to the covariance index of the model are carried out to obtain a fit model. Basically, the Structural Equation Modeling (SEM) model in Amos is a Covariance Based SEM (CB-SEM) which needs to be accommodated by the covariance element. The following is a path diagram after modification of the index covariance model (figure 3):

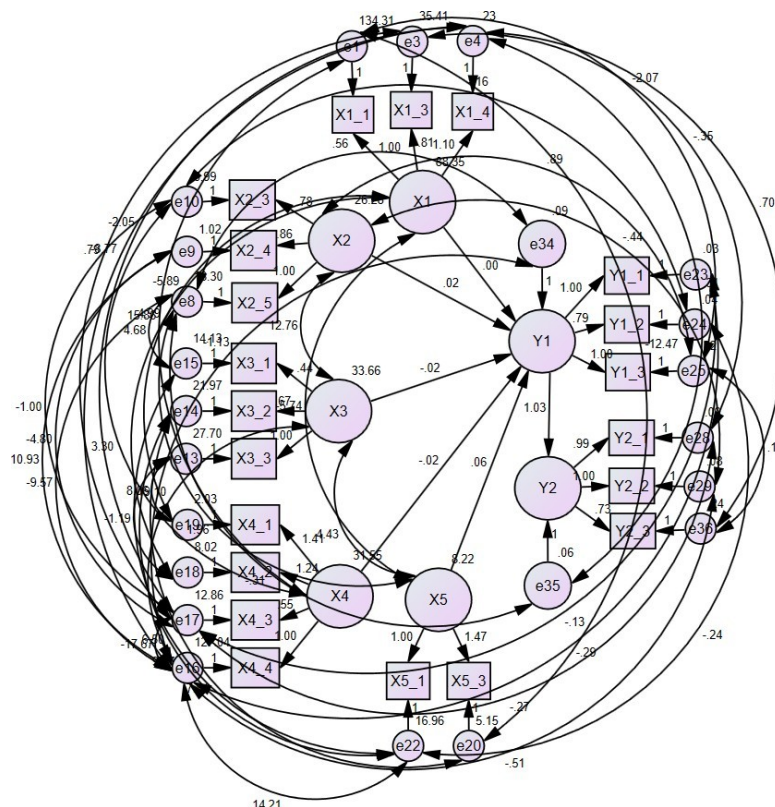


Figure 3 Path Diagram After Modifying the Covariance Index (Unstandardize)

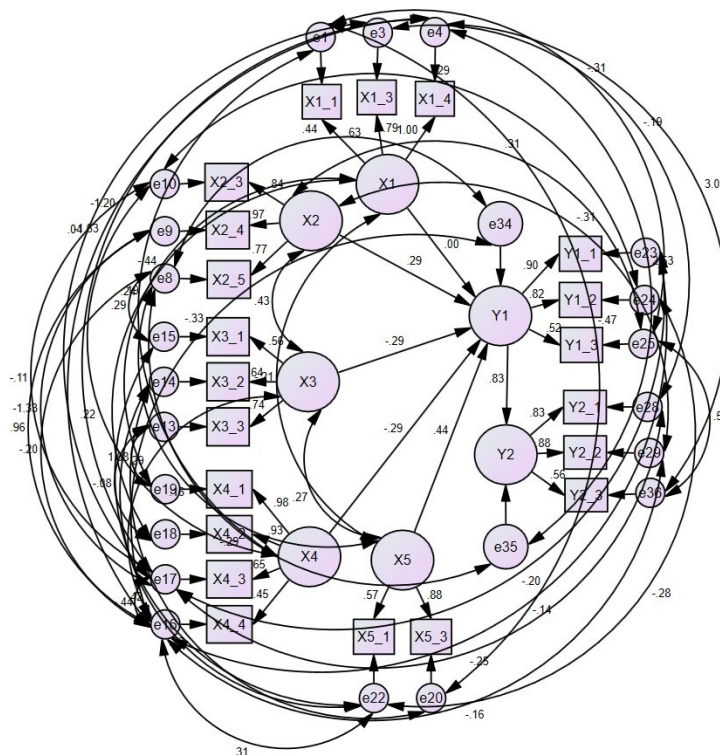


Figure 4 Path Diagram After Modification of Covariance Index (Standardize)

Table 20. Goodness Of Fit Model

Indeks	Goodness Of Fit	Cut Off Value	Description
CMIN/DF	1.400	≤ 2.00	Good of Fit
RMSEA	0.061	≤ 0.08	Good of Fit
TLI	0.945	≥ 0.90	Good of Fit
CFI	0.963	≥ 0.90	Good of Fit

The results of the model feasibility test after modification of the covariance index have been summarized in table 20. Based on the summary of the goodness of fit, it can be seen that the 4 indices, namely CMIN/DF, RMSEA, TLI, and CFI, all meet the criteria. From the results of the index criteria, it can be concluded that the SEM path diagram that has been formed is declared suitable for use.

2. Model Hypothesis Test

a. Direct Effect Test

Hypothesis testing is intended to test whether exogenous variables have a direct effect on endogenous variables. The significance test can be known through the p-value. The test criteria state that if the CR statistic is > 1.96 or if the p-value is < 0.05, it is stated

that there is a significant effect of exogenous variables on endogenous variables. The analysis results can be seen in the summary in table 20.

**Table 21.** Hypothesis test

Hypothesis	Track	Standardized Coefficient	SE	CR	p-value	Description
H1	X1 → Y1	0.001	0.003	0.019	0.985	Not significant
H2	X2 → Y1	0.289	0.006	3.255	0.001	Significant
H3	X3 → Y1	-0.287	0.008	-2.389	0.017	Significant
H4	X4 → Y1	-0.294	0.005	-3.908	***	Significant
H5	X5 → Y1	0.440	0.013	4.467	***	Significant
H6	Y1 → Y2	0.828	0.114	9.027	***	Significant

Description: \*\*\* p-value < 0.001

Based on table 21, it can be informed that:

1. Testing the effect of Technological Progress (X1) on Human Resources (Y1) produces a CR statistic of 0.019 and a p-value of 0.985. The test results show that the p-value (0.985) > alpha 0.05 meaning no significant effect of technological progress on human resources.
2. The test of the effect of Capital (X2) on Human Resources (Y1) produces a p-value of 0.001. The test results show that the statistical p-value (0.001) < alpha 0.05, which means that there is a significant effect of Capital on Extension Issues. The positive coefficient of 0.289 indicates that capital positively affects Human Resources. This means that the higher the capital, the higher the human resources.
3. Testing the effect of Farmer Age (X3) on Human Resources (Y1) produces a CR statistic of -2,389 with a p-value of 0.017. The test results show that the statistical p-value (0.017) < alpha 0.05, meaning that Farmer Age has a significant effect on Human Resources. A negative coefficient of -0.287 indicates that Farmer Age harms Resources
4. Humans. This means that the higher the farmer's age, the lower the human resources.
5. The effect of Education (X4) on Human Resources (Y1) test produces a CR statistic of -3.908 with a p-value of 0.001. The test results show that the p-value (0.001) < alpha 0.05, which means that Education has a significant effect on Human Resources. This means that the higher the education, the higher the human resources.
6. Testing the effect of Farming Experience (X5) on Human Resources (Y1) resulted in a CR statistic of 4.467 with a p-value of 0.001. The test results show that the statistical p-value (0.001) < alpha 0.05 meaning that farming experience has a significant effect on human resources. A positive coefficient of 0.440 indicates that the farming experience positively affects human resources. This means that the better the farming experience, the better human resources.
7. The test of the influence of Human Resources (Y1) on the Effectiveness of Agricultural Extension (Y2) resulted in a CR statistic of 9.027 and a p-value of 0.001. The test results show that the statistical p-value (0.001) < alpha 0.05, which means that Human Resources has a significant influence on the Effectiveness of Agricultural Extension. The positive coefficient of 0.828 indicates that Human Resources positively affect the

Effectiveness of Agricultural Extension. This means that better Human Resources can increase the Effectiveness of Agricultural Extension.

### b. Indirect Effect Test

Hypothesis testing is intended to test whether exogenous variables have an indirect effect on endogenous variables through mediating variables (intervening). Mediation testing can be known through the Sobel test. The test criteria state that if the z statistic > z table (1.96) or p-value < alpha 0.05, it is stated that there is a significant indirect effect of exogenous variables on endogenous variables through mediating variables (intervening). The analysis results can be seen in the summary in table 21.

**Table 22.** Hypothesis test

Hypothesis	Track	Indirect Coefficient	Std. Error	p-value	Description
H7	X1 → Y1 → Y2	0.001	0.002	0.739	Not Significant
H8	X2 → Y1 → Y2	0.239	0.033	0.000	Not Significant
H9	X3 → Y1 → Y2	-0.238	0.034	0.000	Not Significant
H10	X4 → Y1 → Y2	-0.243	0.034	0.000	Not Significant
H11	X5 → Y1 → Y2	0.364	0.051	0.000	Not Significant

Based on table 22, it can be stated that the test of the effect of Capital (X2), Farmer's Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2) through the mediation of Human Resources (Y1) produces a statistical p-value < alpha 5% which means that there is an indirect effect of Capital Progress (X2), Farmer Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2) through the mediation of Human Resources (Y1) or by. In other words, the Human Resources variable (Y1) can mediate the effect of Capital (X2), Farmer Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2).

While the test of the effect of technological progress (X1) on the effectiveness of agricultural extension (Y2) through the mediation of human resources (Y1) resulted in a statistical p-value (0.985) > alpha 5%, which means that there is no indirect effect of technological progress (X1) on the effectiveness of extension. Agriculture (Y2) through the mediation of Human Resources (Y1) or, in other words, the Human Resources variable (Y1) is not able to mediate the effect of Technological Progress (X1) on the Effectiveness of Agricultural Extension (Y2).

### 3. Convert Path Diagrams to Structural Equations

The conversion of path diagrams into structural equations is intended to find out how the shape of the influence between constructs is based on their mathematical equations. Based on the attachment, it can be seen that the mathematical models formed are:

$$\text{Equality 1: } Y_1 = 0.001 X_1 + 0.239 X_2 - 0.287 X_3 - 0.294 X_4 + 0.440 X_5$$

$$\text{Equality 2: } Y_2 = 0.828 Y_1$$

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## 5. Conclusion

1. The factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi are farming capital, farmer's age, education, farming experience, and human resources.
2. The influence of these factors on the effectiveness of agricultural extension in Baubau city is as follows: : if farming capital is high, human resources can be increased. Moreover, the higher the farmers' age, the lower the need for human resources. It was additionally noted that higher education of farmers contributes to improvement in human resources, and the increased experience in farming corresponded to an increase in human resources. Hence, increasing human resources will increase the effectiveness of agricultural extension.
3. Extension issues and materials are factors that affect the effectiveness of agricultural extension in Baubau City, where in this case the influence can be categorized as good or influential.
4. Farming capital is land area, labor, use of fertilizers, pesticides, and use of agricultural tools and machines. There is an influence of farming capital variables on the effectiveness of agricultural extension. According to research by (Kusnadi, N., et al, 2011)., the wider the land owned, the higher the farming income.

Human resources describe the knowledge possessed by education, training, experience, and information received. Activities that must be carried out by agricultural extension workers in the city of Bau Bau are optimizing socialization and training related to agricultural land, for example, making demonstration plots so that farmers can see directly and have no doubts about the theory provided. In addition, one way to achieve extension effectiveness is to increase human resources (agricultural extension workers) as program implementers so that the programs that have been designed can be implemented. The lack of extension workers resulted in a significant workload for each extension agent because the extension area assisted by the extension worker was large, and the number of assisted farmer groups was significant. Currently, there are 44,890 agricultural extension workers. These agricultural extension workers serve 71,479 villages, so they still need as many as 26,589 agricultural extension workers (agricultural extension center Indonesia, 2022). Many agricultural extension workers can supervise the assistance funds given to farmers so that they are appropriately managed to realize farmer welfare, distribute farmers' knowledge about the latest agricultural technologies, and develop rice farming. For example, they help to provide production facilities, distribute fertilizer and seed aid, and provide cooperative institutions to assist farmers in procuring farming capital. Agricultural extension agents have roles as facilitators, communicators, motivators, and consultants. Indonesian government regulation no. 16 of 2006 concerning the Agricultural Extension System, one of the critical points in this law is the need to build extension institutions in the regions at the provincial and district/city levels.

Age affects productivity level, making decisions, and receiving information. The dominant number of respondents is 46 – 55 years old. This shows that the productive age in this study is in the age range of 46-55 years. At a productive age,

3  
1 it will be easier to get new ideas and quickly understand the use of technology.  
2 Information obtained by farmers, especially from agricultural extension workers,  
3 will increase their paddy rice production. This follows the research results (Hasyim,  
4 2006) that those who work at productive age will be better and maximal than non-  
5 productive age.

6 Education is influential in taking action in making programs for agricultural  
7 development. The low level of education in this study indicates that the quality of  
8 human resources needs to be improved in efforts to develop farming performance.  
9 Improving the skills and knowledge of farming will encourage the achievement of  
10 planned production targets. According to (Lubis, 2000), having a high level of  
11 education will be relatively faster in implementing technology and innovation  
12 adoption, having low education is usually challenging to implement innovation  
13 adoption quickly.

14 The indicators included in the Technological Progress variable are the use of  
15 transplanters, the use of indo combine harvesters, the use of KATAM (planting  
16 season prediction), the use of KATAM (fertilizer dose), the use of drones (irrigation  
17 sensors/measuring soil pH), the use of expert system applications, and the use  
18 social media. The average variable of technological progress is 24.91, with an  
19 achievement level of 64.53% in the Less Good category. Farmers should optimize  
20 information technology, such as using the internet to find the latest information.  
21 Advances in technology play a role in supporting the availability of relevant and  
22 timely agricultural information. Information on the results of research and  
23 technological innovations in agriculture helps efforts to increase the production of  
24 agricultural commodities. According to research results (Prayoga, K. 2017), the use  
25 of technology is considered less optimized by the Indonesian Ministry of  
26 Agriculture. Extension activities that utilize social media must continue to be  
27 optimized because the number of users continues to increase.

28 5. Matters related to extension include the number of assisted farmers, the  
29 distance to extension locations, the amount of agricultural extension work time,  
30 extension media, methods, frequency, materials, and the instructor's experience.  
31 Extension media has the most significant contribution to the problem variables of  
32 extension agents. Through extension media, it can attract farmers to attend  
33 training. Agricultural extension agents use various media that are adjusted to the  
34 farmer's age. Then followed by indicators of instructor experience, frequency of  
35 extension, amount of working time of agricultural extension workers, extension  
36 methods, and extension materials. Extension material is everything that extension  
37 agents propose to farmers, including the suitability of the material with the needs  
38 and benefits. Based on the assessment of the extension workers in the field, it was  
39 assessed that the absorption of the material and the most suitable application were  
40 in fertilization, harvesting, and post-harvest materials. This is followed by good  
41 planting time, nurseries, planting, nursery, and maintenance indicators. Agriculture  
42 is a critical sector in national development. In national development, it is necessary  
43 to support human resources, who have the capacity, who can produce solutions to  
44 answer the challenges. It is necessary to carry out an agricultural extension to

3  
1 develop agriculture. Agricultural extension is also one of the efforts to produce  
2 quality human resources. Agricultural extension is an empowerment effort or an  
3 effort to motivate and change the behavior of farmers and their families so that  
4 they have the will and can solve the problems they face in doing their farming.  
5 Therefore the role of extension is crucial and becomes a strategic matter in national  
6 development.

7 The Ministry of Agriculture is targeting Indonesia to become a world food barn  
8 by 2045. To achieve this mission, the Ministry of Agriculture places farmers as the  
9 main actors in agricultural development. Attention is needed to farmers through  
10 agricultural extension workers. In general, the knowledge farmers have to lack in  
11 renewal and the existence of agricultural extension can help agricultural  
12 development.

### 13 Acknowledgments

14 The author would like to express his gratitude to all parties who have helped and  
15 participated in this research. Especially to the Hasanuddin University, Faculty of  
16 Agriculture, especially the Agribusiness Study Program. And also to the supervising  
17 lecturers who helped and guided me from the beginning to the completion of this  
18 research.  
19

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# REVIEW 2

## Cover Letter

January 03, 2023

Department of Socio-Economic, Agribusiness study program.

Universitas Hasanuddin

Perintis Kemerdekaan KM 10 Kota Makassar 90245 Indonesia

Dear Editor Journal of the Saudi Society of Agricultural Sciences

I am submitting a manuscript for consideration of publication in the journal of Sustainability The manuscript is entitled “Effectiveness of Agricultural Extension on Paddy Rice Farmer's Baubau City, Southeast Sulawesi, Indonesia”. **It has not been published elsewhere and that it has not been submitted simultaneously for publication elsewhere.**

The result from the study has depicted that: 1) The factors that influence the effectiveness of agricultural extension in Baubau City are farming capital, farmer age, education, farming experience, and human resources, and 2) the influence of these factors on the effectiveness of agricultural extension is as follows: if farming capital is high, human resources can be increased. Moreover, the higher the farmers' age, the lower the need for human resources. It was additionally noted that higher education of farmers contributes to improvement in human resources, and the increased experience in farming corresponded to an increase in human resources. Hence, increasing human resources will increase the effectiveness of agricultural extension.

Thank you very much for your consideration.

Yours Sincerely,

Dr. Muh. Hatta Jamil, S.P., M.Si

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# Response to Reviewer 2 Comments

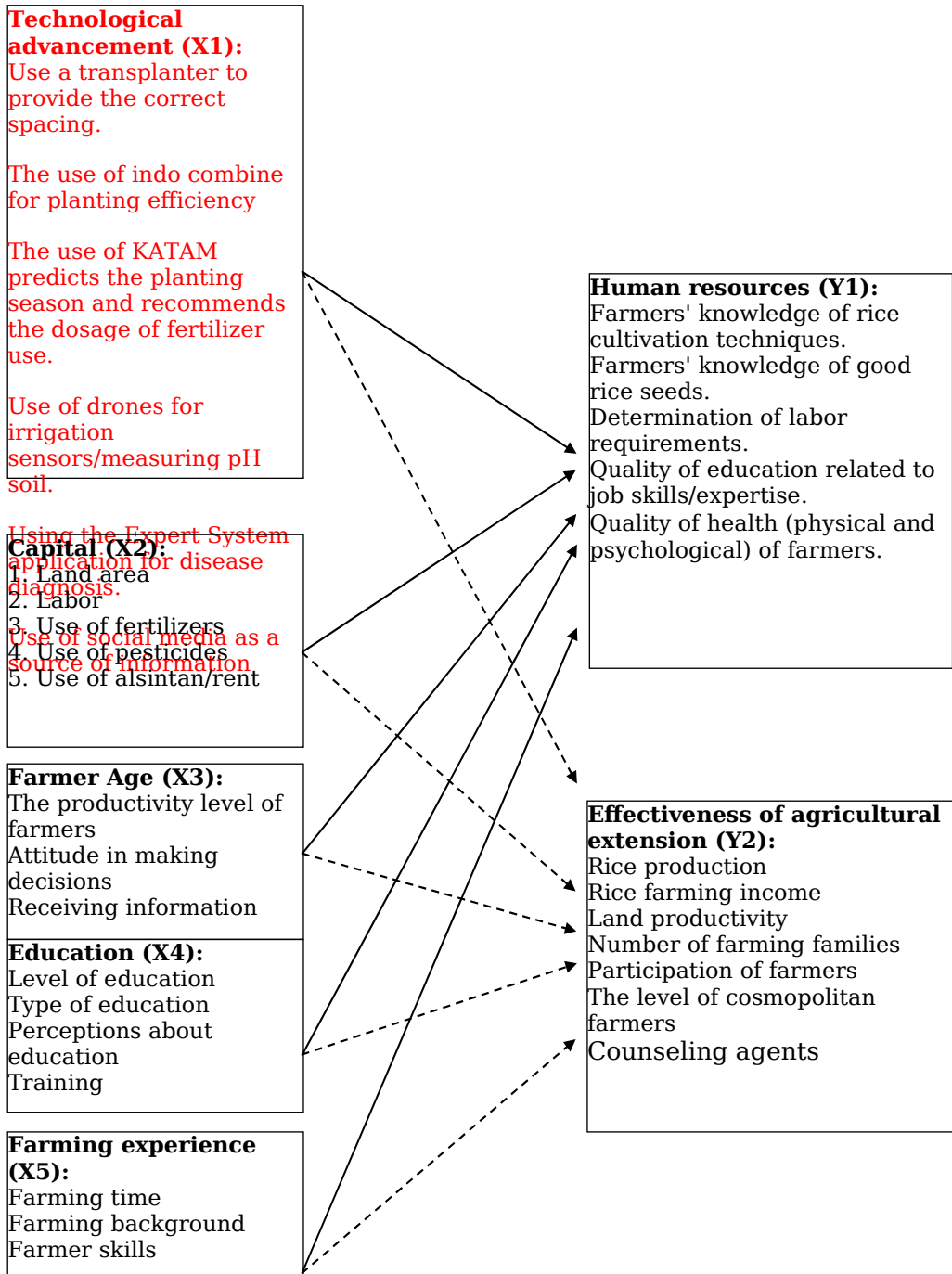
Point 1: I think the Authors for having restructured and enlarged the manuscript based on my comments. I have just two further requests that should make the manuscript suitable for publication.

Section 3.2 (Data collection): here the Authors should list all the measured variables (in reference to research hypotheses). Otherwise, the model specification (equation 5) would refer to undefined measurements. Therefore, I suggest to move Section 3.4.3 and the graphic at page 7 inside Section 3.2.

## **Response 1:**

Data collection techniques in this study were carried out using interviews, questionnaires, and observation. The measured variable is technological progress (X1), Farming Capital (X2), Farmer Age (X3), Farmer Education (X4), Farmer Experience (X5), Human Resources (Y1), and Effectiveness of Agricultural Extension (Y2).

Constructs, Indicator, and code variable



Point 2:

Equation 5: this is not the formulation of the structural equation model actually employed by the Authors. As I can see from Figure 1 and the following figures, variable Y does not exist, rather there are two variables: Y1 and Y2, with the following structure:

\* equation 1, where Y1 depends on X1, ..., X5

\* equation 2, where Y2 depends on Y1

Please fix.

**Response 2:** The conversion of path diagrams into structural equations is intended to find out how the shape of the influence between constructs is based on their mathematical equations. Based on the attachment, it can be seen that the mathematical models formed are:

SEM (Structural Equation Modeling) analysis in this study was carried out using Amos 24 software to answer problems related to variables that influence the effectiveness of agricultural extension in Baubau City.

The formula used in this study is:

**Equality 1**  $Y_1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e \dots\dots\dots(5)$

**Equality 2**  $Y_2 = \beta_0 + \beta_1 Y_1 + e \dots\dots\dots(6)$

Description:

- Y1 = Human Resources
- Y2 = Effectiveness of Agricultural Extension
- β = Constant
- E = Standard error
- X1 = Technology advances
- X2 = Capital
- X3 = Farmer Age
- X4 = Education
- X5 = Farming experience

**Equality 1:**  $\beta_0 = 0.001$ ,  $\beta_1 = 0.239$ ,  $\beta_2 = -0.2873$ ,  $\beta_3 = -0.294$ ,  $\beta_4 = 0.440$ ,  $\beta_5 = 0.440$

**Equality 2:**  $\beta_0 = 0.828$ ,  $\beta_1 = 0.828$

# Response to Reviewer 1 Comments

Point 1: I consider that the modifications introduced by the authors in the text of the article have improved the original manuscript and allow said paper to be published in its current state

**Response 1:** Thank you very much for the cooperation.

# REVISI KE 2

This screenshot shows the 'Manuscript Revision' page for a paper titled 'Effectiveness of Agricultural Extension on Paddy Rice Farmer's Baubau City, Southeast Sulawesi, Indonesia'. The manuscript ID is sustainability-2171108. The assigned editor is Natalsawas Soonthornwiphat. The status is 'Pending minor revisions'. The authors listed are MH Jamil, Nadine Tika, L Fudjaja, AN Tenriawaru, M Salam, Muhammad Ridwan, Ahmad Imam Muslim, and Nividita Varund Chand. The page includes a sidebar with navigation menus for users and reviewers, and a table of author contributions.

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Ms. Nadine Tika	nadinetikaagri@gmail.com	ID Agribusiness, Fa...	
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Ms. Nividita Varund Chand	nividita.chand@fmu.ac.fj	FJ College of Agricu...	

This screenshot shows the 'Reply to Reviewers' section of the manuscript submission page. It includes a summary of submission statistics: Number of Words (9677), Submission Received (03 January 2023), QC passed (Yes), and Submission Revision Date (23 January 2023). The main section is titled 'Reply to Reviewers' and contains a message: 'Please download the latest version of the manuscript for revision. Your original submission may have been changed.' Below this, there are links to 'Download Manuscript' and 'Submit Revised Manuscript'. A table lists the review reports for three reviewers, each with links for Round 1 and Round 2. A note at the bottom states: 'Options to upload a new version of your manuscript will be available once all the reviewer comments have been received.'

Reviewer	Review Report (Round 1)	Review Report (Round 2)
Reviewer 1	You replied to the comments.	Click here to upload your response to reviewer.
Reviewer 2	You replied to the comments.	Click here to upload your response to reviewer.
Reviewer 3	You replied to the comments.	

Revisions

Reviewer 1 [Review Report \(Round 1\)](#) You replied to the comments.  
[Review Report \(Round 2\)](#) Click [here](#) to upload your response to reviewer.

Reviewer 2 [Review Report \(Round 1\)](#) You replied to the comments.  
[Review Report \(Round 2\)](#) Click [here](#) to upload your response to reviewer.

Reviewer 3 [Review Report \(Round 1\)](#) You replied to the comments.

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## RIEWER 1

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Journal [Sustainability](#) (ISSN 2071-1050)  
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 Type Article  
 Title [Effectiveness of Agricultural Extension on Paddy Rice Farmer's Baubau City, Southeast Sulawesi, Indonesia](#)  
 Authors [MH Jamil \\*](#), [Nadine Tika](#), [L Fudjaja](#), [AN Tenriawaru](#), [M Salam](#), [Muhammad Ridwan](#), [Ahmad Imam Muslim](#), [Nividita Varund Chand](#)

**Abstract**  
 Agricultural extension workers play an essential role in the productivity of agricultural systems. Based on the actual conditions in the field, it can be seen that the level of extension services still needs to be higher due to a lack of human resources in the field of extension services. This research was conducted to determine the effectiveness of agricultural extension services. This study aimed to determine the factors that influence the effectiveness of agricultural extension to farmers in Baubau City, Indonesia. The analytical method includes exogenous latent variables: technological progress, farming capital, farmer age, education, and farming experience. Human resources and the effectiveness of agricultural extension are used as endogenous latent variables. The research sample consisted of 110 rice farmers in Baubau City, and the Slovin formula was used to calculate the sample. The data collection for this research was carried out by distributing questionnaires to respondents, in-depth interviews, and direct observation in the city of Baubau. Using the AMOS application, quantitative analysis was carried out through Structural Equation Modeling (SEM). The study results show that: 1) The factors that influence the effectiveness of agricultural extension in Baubau City are farming capital, farmer age, education, farming experience, and human resources, and 2) the influence of these factors on effectiveness. Agricultural extension is as follows: if the farming capital is high, human resources can be increased. In addition, the higher the farmer's age, the lower the need for human resources. It is also noted that higher farmer education contributes to increased human capital, and increased experience in farming is associated with increased human capital. Thus, an increase in human resources will increase the effectiveness of agricultural extension. Significant factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi, are farming capital, farmer age, education, farming experience, and human resources.

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high, human resources can be increased. In addition, the higher the farmer's age, the lower the need for human resources. It is also noted that higher farmer education contributes to increased human capital, and increased experience in farming is associated with increased human capital. Thus, an increase in human resources will increase the effectiveness of agricultural extension. Significant factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi, are farming capital, farmer age, education, farming experience, and human resources.

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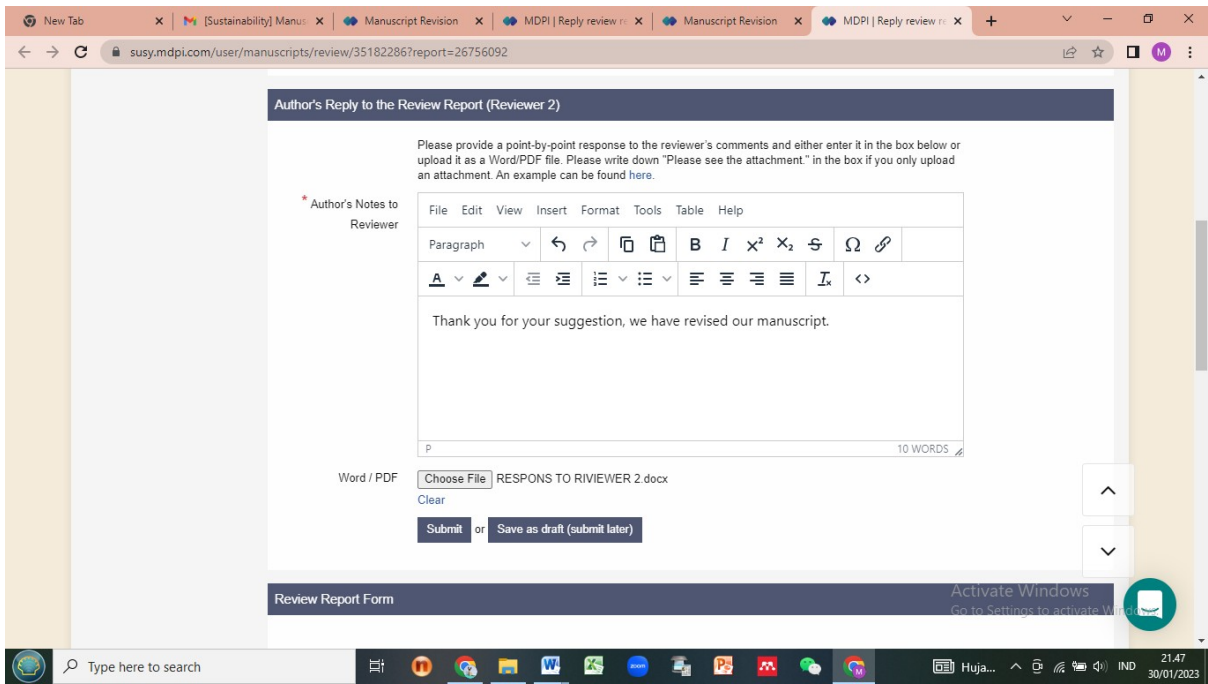
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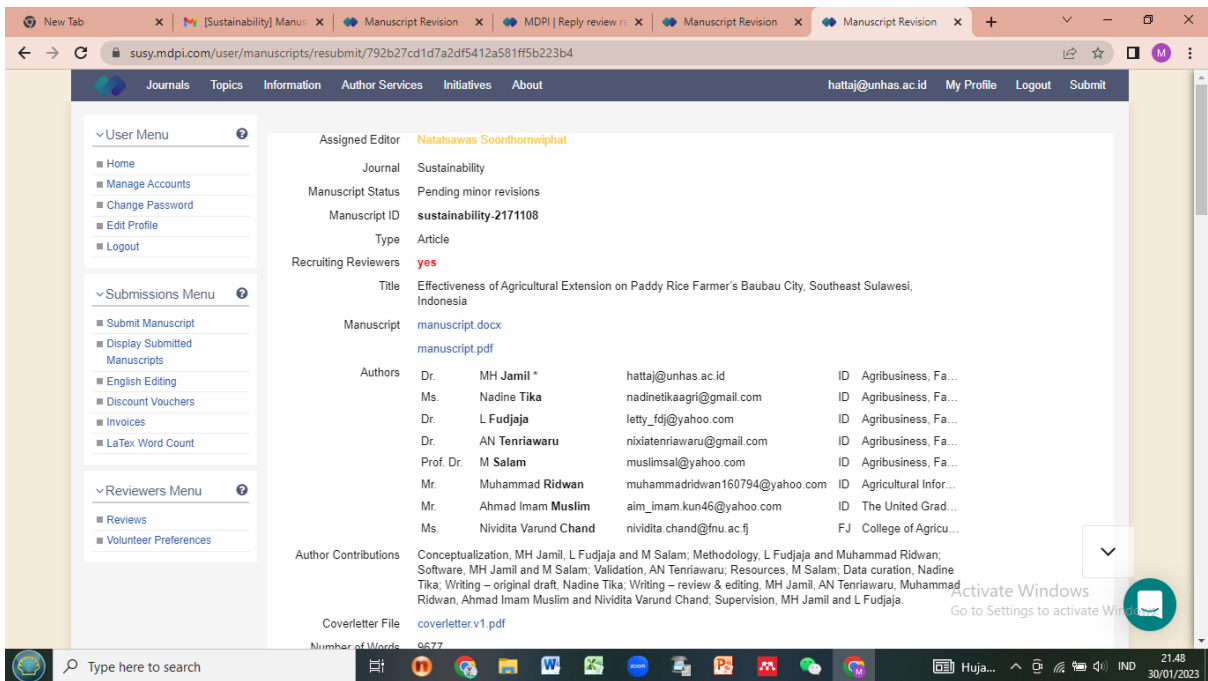
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# Effectiveness of Agricultural Extension on Paddy Rice Farmer's Baubau City, Southeast Sulawesi, Indonesia

MH Jamil <sup>1,\*</sup>, Nadine Tika <sup>1</sup>, L Fudjaja <sup>1</sup>, AN Tenriawaru <sup>1</sup>, M Salam <sup>1</sup>, Muhammad Ridwan <sup>2</sup>, Ahmad Imam Muslim <sup>3</sup> and Nividita Varun Chand <sup>†</sup>

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**Abstract:** Agricultural extension workers play an essential role in the productivity of agricultural systems. Based on the actual conditions in the field, it can be seen that the level of extension services still needs to be higher due to a lack of human resources in the field of extension services. This research was conducted to determine the effectiveness of agricultural extension services and the factors that influence the effectiveness of agricultural extension to farmers in Baubau City, Indonesia. The analytical method includes exogenous latent variables: human resources, technological progress, farming capital, farmer age, education, and farming experience. The effectiveness of agricultural extension is used as an endogenous latent variable. The research sample consisted of 110 rice farmers in Baubau City, and the Slovin formula was used to calculate the sample. The data collection for this research was carried out by distributing questionnaires to respondents, in-depth interviews, and direct observation in the city of Baubau. Using the AMOS application, quantitative analysis was carried out through structural equation modeling (SEM). The study results show that: (1) The factors that influence the effectiveness of agricultural extension in Baubau City are farming capital, farmer age, education, farming experience, and human resources, and (2) the influence of these factors on the effectiveness of agricultural extension is as follows: if the farming capital is high, human resources can be increased. In addition, the higher the farmer's age, the lower the need for human resources. It is also noted that higher farmer education contributes to increased human capital, and increased experience in farming is associated with increased human capital. Thus, an increase in human resources will increase the effectiveness of agricultural extension. Significant factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi, are farming capital, farmer age, education, farming experience, and human resources.

**Keywords:** effectiveness; agricultural extension; paddy rice; Indonesia

## 1. Introduction

Southeast Sulawesi has sufficient competence to support the Indonesian food development program because of the high availability of land and the potential for land productivity. Based on data on rice field areas in the rice planting season, Southeast Sulawesi has an area of 82,382 ha of raw rice fields (Central Bureau of Statistics, 2020). The size of rice fields in Baubau city is 1375 ha; this indicates that the agricultural sector is one of the sectors with high priority in Baubau City (Abadi, 2019). However, rice production domestically is dominated by lowland rice production. Hence, the extension

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workers should increase their effectiveness in extension services for the lowland [rice](#) farmers.

Extension workers can contribute to the regulatory process by providing expertise and content for proposed, adopted, and restructured agriculture-related regulations. As [extension](#) agents [directly interact](#) with clients in the field, they can communicate the needs of stakeholder groups. Therefore, they should be involved in the regulatory process. An evidence-based approach involving input from target groups and practitioners seems to be an inevitable strategy for the success of a sustainable land grant project ([Fouladkhah, A., 2017](#)).

Extension agents are one of the supporting elements in the agribusiness sub-system. In principle, the agricultural extension supports all sub-systems in agribusiness. Specifically, in this study, extension workers play a role in supporting to increase the productivity of lowland rice. Hence, to increase the productivity of rice farming, extension workers are needed. The role of the extension worker is to provide guidance and knowledge in the form of the latest information or innovation to improve their farming system, ultimately increasing their crop yields. In addition, the purpose of agricultural extension is to change the behavior of farmers, for instance, their ability to adapt to situations and conditions that keep changing. Thus, they can improve their farming systems, increase production, and reduce the possibility of crop failure. While simultaneously improving their living standards.

However, there are some significant issues, such as a lack of active participation from agricultural extension workers and the difference in the extension worker-to-farmer ratio, leading to fewer extension workers [for](#) many farmers. This problem causes the workload of each extension worker to be quite [heavy](#) because either the extension area or the number of assisted farmer groups is quite large. [Therefore, the](#) current condition is forcing agricultural extension workers to work hard despite a limited number of workers, and they must be able to perform optimally to increase their work productivity.

The role of extension workers can increase sustainable agricultural productivity and food security ([Olorunfemi, T. O., et al. 2020](#)). One of the most crucial things is to ensure that [using the](#) agricultural extension and education programs has a positive impact on farmers ([Salehi, M., et al. 2021](#)). Consequently, the crucial role of extension workers is to create awareness among farmers to apply guidelines for food needs ([Fiaz, S., et al. 2018](#)). The findings of the study ([Jamil, M.H., 2017](#)) show that the development of agricultural extension workers has a positive effect on the agricultural extension program.

Agricultural extension programs and policies can play an important role in achieving production ([Mahir, M. E. A. E., & Abdelaziz, H. H. 2011](#)). Additionally, this agricultural policy [was](#) discussed by ([Baloch, M. A., & Thapa, G. B, 2019](#)), who said that agricultural policies must be implemented effectively to [address](#) the needs of farmers and the problems they face. One example is that the Government of Pakistan has adopted a policy of providing agricultural services to promote agricultural production by disseminating appropriate knowledge and technology to farmers ([Baloch, M. A., & Thapa, G. B., 2018](#)).

The agricultural, industrial revolution has had an impact on efficiency and productivity in agricultural extension services in the agricultural sector ([Nyarko, D. A., & Kozári, J. 2021](#)). [Furthermore, the](#) effects of community-based strategies on food security [have](#) a positive impact ([Wellard, K., et al. 2013](#)). [Therefore,](#) it is suggested that extension services provide [Information](#) and [Communication Technology](#) training (ICT) for agricultural extension workers to improve extension services. In addition, according to ([Umbara, D.S., Sulistyowati, L., Noor, T.I., and Setiawan, 2021](#)), [the](#) dissemination of agricultural technology information by utilizing the internet network is very helpful for agricultural extension workers in carrying out their main tasks. Information and [Communication](#) Technology [can](#) also facilitate the delivery of information and knowledge sharing between farmers, extension workers, and other stakeholders- ([Annor-Frempong, F., et al. \(2006\)](#)). [The](#) article ([Haghighi, N. F., et al. 2008](#)) stated the perspective on the ap-

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plication of [Information](#) and [Communication Technology](#) in agriculture, and some issues with using ICT in organizations; however, [this is in contrast to](#) (Diaz, R. T., et al. (2021). [Furthermore, it](#) was found that [extension](#) services in the study area are not sufficient when farmers face difficulties.

From the literature, it can be gathered that an agricultural extension worker plays an essential role in the productivity of a farming system. Based on the actual conditions in the field, it can be acknowledged that the extension service rate is low due to a lack of human resources in the extension field. Therefore, to solve the problems that arose from the current predicament, this study was conducted to determine the effectiveness of agricultural extension services. The primary purpose of this study is to determine the factors that influence the effectiveness of agricultural extension services to lowland rice farmers in Baubau City and to find out how these factors can affect the effectiveness of agricultural extension services.

## 2. Research Hypothesis

- a. It is suspected that the variables of technological progress (X1), farming capital (X2), farmer age (X3), farmer education (X4), and farmer experience (X5) have a significant relationship and have a direct influence on human resources (Y1).
- b. Allegedly, the variables of technological progress (X1), farming capital (X2), farmer age (X3), farmer education (X4), and farmer experience (X5) have a significant relationship and give an indirect effect but are thought to influence the variable effectiveness of agricultural extension (Y2).
- c. It is suspected that the variable human resources (Y1) have a significant relationship with the variable effectiveness of agricultural extension (Y2).

## 3. Research Methods

### 3.1. Place and Time

This research is located in [Baubau](#) City, Southeast Sulawesi, and was carried out [from](#) January–July 2022.

### 3.2. Data Collection

Data collection techniques in this study were carried out using interviews, questionnaires, and observation. The measured variable is technological progress (X1), [farming capital](#) (X2), [farmer age](#) (X3), [farmer education](#) (X4), [farmer experience](#) (X5), [human resources](#) (Y1), and [effectiveness of agricultural extension](#) (Y2).

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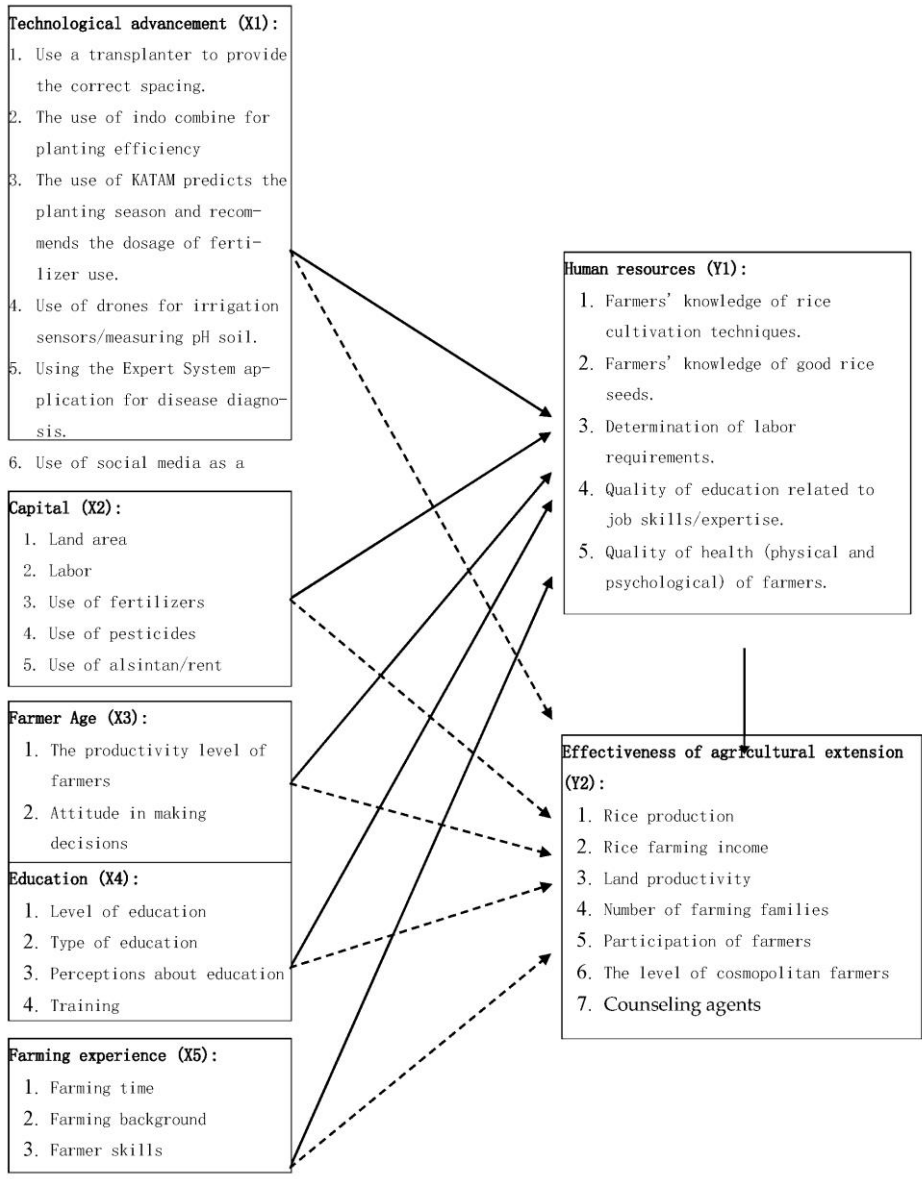


Figure 1. Constructs, Indicator, and Code Variable

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### 3.3. Population and Sample

The population of this study was [all farmers in Baubau City](#); 1257 people (Data from the Baubau City Agriculture Office, 2021). In addition, the population of agricultural extension workers in Baubau City is 26.

[Simple](#) random sampling was used. The sample measurements were calculated using the Slovin formula:

$$n = \frac{N}{1+N(E)^2} \quad (1)$$

$$n_i = \frac{N_i}{N} \times n \quad (2)$$

Description:

$n$  = Number of samples

$N$  = Population

$e^2$  = Precision set (5%)

$n_i$  = Standard sample size  $i$

$N_i$  = Population size  $i$

The sample size was determined with an error rate of 10% or based on the desired level of confidence (precision) of 90%, and the sample size based on the Slovin formula amounted to 110 respondents. The study sample for extension agents was based on the population of extension workers in Baubau City, which amounted to 26 personnel, [from](#) which 30% of the total [was](#) sampled, resulting in 8 extension workers.

The data collection techniques used to carry out the study were questionnaires, direct interviews, and observations to determine the characteristics and behavior of the research object. The data obtained were analyzed descriptively and quantitatively using the SEM method ([structural equation modeling](#))—Software [AMOS](#) (*Analysis of Moment Structure*).

### 3.4. Analysis Method

#### 3.4.1. Descriptive Statistical Analysis

Descriptive statistical data was interpreted using the TCR criteria (Respondent Achievement Level), and the following formula was used:

$$TCR = \frac{Mean}{Skor Max} \times 100 \quad (3)$$

The percentage formula used in this study is [as follows](#):

$$P = \frac{f}{N} \times 100\% \quad (4)$$

Description:

$P$  = Percentage Number

$f$  = The number of frequencies of each answer that has become the respondent's choice

$N$  = The number of frequencies or the number of individuals

To determine the level of criteria with a descriptive analysis of the percentage, which is divided into five indicators, namely:

#### 3.4.2. Quantitative Analysis

SEM ([structural equation modeling](#)) analysis in this study was carried out using [AMOS](#) 24 software to answer problems related to variables that influence the effectiveness of agricultural extension in Baubau City.

The formula used in this study is [as follows](#):

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$$\text{Equality 1 } Y1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e \quad (5)$$

$$\text{Equality 2 } Y1 = \beta_0 + \beta_1 Y_1 + e \quad (6)$$

Description:

Y1 = Human Resources

Y2 = Effectiveness of Agricultural Extension

$\beta$  = Constant

E = Standard error

X1 = Technology advances

X2 = Capital

X3 = Farmer Age

X4 = Education

X5 = Farming experience

#### 4. Results

The demographic characteristic of the farming communities involves 96% of male and 4% of female farmers (Table 1). There is a division of household tasks between husband and wife. Based on in-depth interviews with several respondents, they stated that working in the fields is the husband's duty while the wife takes care of the household. Results based on age indicated that 34% of farmers were 36–45 years old, and 6% were under 25 years old. Farmers who work at the productive age will be better and more optimal than non-productive age (Productive age 15–64). In addition, age can also be used as a benchmark to see the activities of farmers at work (Hasyim, 2006).

Table 1. TCR criteria.

No.	Scale Range	TCR
1	90–100%	Very good
2	80–89.99%	Good
3	65–79.99%	Enough
4	55–64.99%	Not good
5	0–54.99%	Not good

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It was revealed that the respondents with non-educational levels were 10%. Respondents with their last education at the elementary, junior, and senior high school levels were 41%, 13%, and 31%, respectively; at the tertiary level added, 5% (Soehardjo and Patong, D. 1999). Higher levels of education result in a more straightforward implementation of innovations. Farmer education is not only oriented toward increasing production but the social life of the farming community. On the other hand, farmers with a high education level will be relatively faster in implementing technology adoption and innovation. Farmers who have low education may have difficulty implementing the adoption of innovation quickly. The level of education possessed by farmers depicts the knowledge and insight a farmer has in applying technology and innovation to increase farming activities (Lubis, 2000). Demographic characteristics based on the main occupation of farmers show that farming is the respondents' main occupation, totaling 97%. In comparison, the remaining 3% of the main occupation are civil servants, and farming is their side employment.

Based on the study results, farmers with a land area of less than 1 ha was 16%, 1 to 5 ha was 82%, and more than 5 ha was 2%. The number of farmers that own their land is 93%, and 6% of the farmers are tenants, while the remaining 1% amounts to farmers being landowners and tenants. It is important to note that more land ownership means more potential to increase productivity and efficiency by adopting modern technology.

Land tenure is vital in spreading and adopting modern agricultural practices among farming communities (Aldosari et al., 2019).

Next, the results show that a significant percentage of the farmers had more than 10 years of experience resulting in a total of 76%, followed by farmers with 5–10 years with 14% and farmers with less than 5 years of experience with 10%. The farming experience significantly affects farming activities, as evident in the production results. Farmers who have been farming for a long time have high knowledge, experience, and skills in running a farm. Farming experience is divided into three categories, namely less experienced (<5 years), moderately experienced (5–10 years), and experienced (10 years). Farmers have different farming experiences or lengths of farming (Soehardjo and Patong, D. 1999)

Furthermore, it can be seen that respondents have chosen “hereditary” as their farming background surmounting 90% or as many as 99 people from the total number of respondents. None of the respondents chose “has the farming ability” as a farming background; in this case, the respondent’s last education determines the farming background. The remaining percentages recorded for farming backgrounds are “economic need, availability of adequate land, the ability to farm and willingness based on agriculture as a promising field.” The percentages for each are as follows: 3%, 4%, 1%, and 2%, respectively.

An extension work area is a place or an area that becomes the territory of authority in carrying out its duties as an extension worker, whether within the ward, sub-district, district/city, or wider area. The extension worker’s work area can affect productivity in carrying out his duties. Meanwhile, the distance from the working area is the distance from the instructor’s residence to the extension location. In Table 2, it can be seen that each respondent has a different work area and distance from the work area. The distance from the farthest working area is 21 km, and the closest is 5 km.

**Table 2.** Percentage Descriptive Analysis Criteria.

Number	Percentage	Criteria
1.	0–20%	Very low
2.	21–40%	Low
3.	41–60%	Moderate
4.	61–80%	High
5.	81–100%	Very high

**Table 3.** Demographic Characteristics Data of Rice Farmers in Baubau City, Southeast Sulawesi.

Gender	n	%	Age (Years)	n	%
Male	106	96	Less than 25	7	6
Female	4	4	25–35	25	23
Total	110	100	36–45	17	15
			46–55	37	34
			More than 55	24	22
			Total	110	100
Last Education	n	%	Main Occupation	n	%
No Education	11	10	Farmers	107	97
Elementary school	45	41	Other than farmers (PNS)	3	3
Junior High school	14	13	Total	110	100
Senior High school	34	31			
Higher Education	6	5			
Total	110	100			
Land Area (ha)	n	%	Land Ownership Status	n	%
Less than 1	18	16	Owner	102	93

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1–5	90	82	Tenant/tenant	7	6
More than 5	2	2	Owner and tenant	1	1
Total	110	100	Total	110	100
Time of farming (years)	n	%	Farming background	n	%
Less than 5	11	10	Hereditary	99	90
5–10	15	14	Economic needs	3	3
More than 10	84	76	Availability of adequate land	5	4
Total	110	100	Has the ability to farm	1	1
			Willingness from within because farming is a promising field	2	2
			Total	110	100

n = Total; % = Percentage.

**Table 4.** Data on Demographic Characteristics of Agricultural Extension Respondents based on Working Area and Distance from Work Area Baubau City, Southeast Sulawesi.

No.	Working Area	Distance from Working Area (Km)
1	Lea-lea Subdistrict	15
2	Tampuna Subdistrict	21
3	Liabuku Subdistrict	9
4	Bungi Subdistrict and Lea-Lea Subdistrict	10
5	Ngkaring-ngkaring Subdistrict	5
6	Waliabuku Subdistrict	13
7	Lowu-lowu	15
8	Subdistrict Kalia-lia	15

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Duration as an **Extension** refers to this study; each respondent has been an extension worker from the time of appointment until this research is carried out, expressed in units of years. The length of time **as** an extension worker determines the level of experience each agent has. In this case, the duration of an extension worker is divided into three categories: less experienced (<5 years), moderately experienced (5–10 years), and experienced (>10 years). **Table 5** shows the highest percentage (63%); **five** out of **eight** agents have more than 10 years **of experience** as an extension worker. While extension agents **have** moderate experience, equal to **two** out of **eight** (25%), and extension agents with less than **five** years of experience totaled **one** out of **eight** (12%).

**Table 5.** Data on Demographic Characteristics of Agricultural Instructor Respondents in Baubau City, Southeast Sulawesi.

Duration as an Extension (Years)	n	%	Status	n	%
Less than 5	1	12	Civil Servants	5	63
5–10	2	25	Honorary Employee	1	12
More than 10	5	63	THL-TBPL	2	25
Total	8	100	Total	8	100

THL-TBPL: Agricultural extension workers.

The status of the extension workers refers to the position an agent holds, which corresponds to their employment descriptions. Table 5 displays that of the **eight** surveyed workers, 63% (**five** agents) are Civil Servants, 12% are honorary **employees**, and 25% are THL-TBPL position holders.

#### 4.1. Descriptive Statistical Analysis

##### 4.1.1. Technological Progress Variables

Based on Table 6, the average **Technological Progress Variable** is 24.91, with a respondent's level of achievement, 64.5%, which favors the **Not good** category. Thus, it can be said that technological advances have less than the desired effect on agricultural extension. The indicator with the lowest TCR value in the table **below** is the use of *indo combine harvester*, with an average score of 23.68, gravitating to the **Not good** category. While the indicator with the lowest average score is for the use of *drones* (irrigation sensor/measuring soil pH) which is 12.94, and the TCR value is 80.9 falling into the **Good** category.

**Table 6.** Frequency Distribution of Technological Progress Variables (X1) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming Businesses in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Use of <i>transplanter</i>	110	52	27.22	52.3	Not good
2	Use of <i>indo combine harvester</i>	110	52	23.68	45.5	Not good
3	Use of KATAM (predicted planting season)	110	50	38.22	76.4	Enough
4	Use of KATAM (fertilizer dose)	110	50	35.51	71.02	Enough
5	Use of <i>drones</i> (irrigation sensor/measuring soil pH)	110	16	12.94	80.9	Good
6	Use of expert system applications	110	17	13.35	78.5	Enough
7	Use of social media	110	50	23.57	47.1	Not good
Average				24.91	64.53	Not good

The impact of the extension approach on the use of technology, and food security was found to be positive (Wellard, K., et al. (2013). Dissemination of agricultural technology information is helpful for agricultural extension workers in carrying out their main tasks. (Umbara, D.S et al., 2021). In recent years, the agricultural industry has experienced an increase in the application of **Information** and **Communication Technology** globally. This new revolution is said to have **had** an impact on efficiency and productivity in agricultural extension services in the agricultural sector (Daniel et al., 2021). **Furthermore**, Information and Communication Technology can be used in a cost-effective and practical way to facilitate information sharing and knowledge sharing among farmers, extension workers, and other stakeholders (Joseph Kwarteng, 2006). This new revolution is said to have **impacted** efficiency and productivity in agricultural extension services in the agricultural sector (Daniel Ayisi Nyarko and József Kozári, 2021) **and attitudes** towards the application of **Information and Communication Technology** in agricultural extension, the extent of the problems faced by extension organizations to **the use of ICT**, **knowledge** of ICT, and personal characteristics (Negin Fallah Haghighi et al., 2008).

#### 4.1.2. Farming Capital Variable

Based on Table 7, the average **Farming Capital** variable is 38.16 with a TCR value of 68.12, portraying the sufficiency of the indicator. In other words, the influence of the farming capital variable on the effectiveness of agricultural extension is satisfactory. **On the other hand, the** labor indicator has the lowest TCR value of 45.1, and the average score is 23.03, which is the indicator value with the lowest score; hence, it is portrayed in the **Not good** category. In comparison, the indicator with the highest TCR value is the use of fertilizer, which is 82.4 with an average value of 42.85 and is present in the Good category.

**Table 7.** Frequency Distribution of Farming Capital Variables (X2) in Research on Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

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No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Land area	110	54	39.60	73.3	Sufficient
2	Labor	110	51	23.03	45.1	Not good
3	Fertilizer use	110	52	42.85	82.4	Good
4	Pesticide use	110	56	42.36	75.7	Enough
5	Agricultural machinery use	110	67	42.98	64.1	Poor
	Average			38.16	68.12	Enough

#### 4.1.3. Farmer Age Variable

In [Table 8](#), the average [Farmer Age](#) variable is 38.73 with a TCR value of 67.93 and is in the [adequate](#) category. [Therefore, it](#) can be stated that the influence of the age variable of farmers on the effectiveness of agricultural extension is reasonably influential. The attitude indicator in decision-making has the highest average value of 41.33 and the TCR value of 72.5; hence, classified [into the Enough Category](#). While the indicator with the lowest average value, namely the acceptance of information, is 36.05 with a TCR value of 63.2, which falls in the designated [category](#) of Poor.

**Table 8.** Frequency Distribution of Farmer Age Variable (X3) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Rice Field Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Farmer Productivity Level	110	57	38.82	68.1	Enough
2	Attitude in Making Decisions	110	57	41.33	72.5	Enough
3	Acceptance of Information	110	57	36.05	63.2	Low
Average				38.73	67.93	Adequate

#### 4.1.4. Farmer Education Variable

In [Table 9](#), the average [Farmer Education](#) variable is 14.56 with a TCR value of 30.20 which is Not good. In other terms, the influence of [farmers'](#) education on the effectiveness of agricultural extension is not present. The Perception [indicator](#) of Education has the lowest average score of 13.95 and the TCR value of 25.8, indicating that the variable component is in a [Not good](#) category. Likewise, the other three indicators [also fall into](#) the [Not good](#) category.

**Table 9.** Frequency Distribution of Farmer Education Variables (X4) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Education Level	110	57	18.25	32.01	Not good
2	Type of Education	110	51	15.58	30.6	Not good
3	Perception about Education	110	54	13.95	25.8	Not good
4	Training	110	58	18.48	32.4	Not good
Average				14.56	30.20	Not good

#### 4.1.5. Farming Experience Variable

Referring to [Table 10](#), the average [Farming Experience](#) variable was 37.45 with a TCR value of 64.8, indicating that the experience variable categorizes in the [Poor](#) section. From the three indicators, it shows that the farming background indicator has an average value of 28.13 and a TCR value of 50.2, while being categorized as [Not good](#); however, the indicators of the farming time and farmer skills are in the [Enough](#) category with TCR values of 67.5 and 76.7, respectively.

**Table 10.** Frequency Distribution of Farming Experience Variables (X5) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Farming time	110	60	40.51	67.5	Enough
2	Farming background	110	56	28.13	50.2	Not good
3	Farmers skills	110	57	43.72	76.7	Enough

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Average	37.45	64.8	Poor
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#### 4.1.6. Extension Problem Variables

Table 11 shows that the average variable of **Extension Problems** is 35.28 with a TCR value of 83.26, indicating that these variables are in a **Good** category. The indicator of the number of assisted farmers has an average value of 44.00 and shows a TCR value of 78.6 which means it is in the **Enough** category. The extension media indicator has an average value of 25.63. It shows its TCR value of 91.5, presenting as Very Good, followed by indicators of the experience of the extension worker, the frequency of extension, the amount of working time of the agricultural instructor, the extension method, and the extension material, which were all in the **Good** category. Finally, the indicator of the distance of the extension location is in the **Enough** category.

**Table 11.** Frequency Distribution of Extension Problems Variables (X6) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Number of Assisted Farmers	8	56	44.00	78.6	Enough
2	Distance of Extension Locations	8	21	15.00	71.4	Enough
3	Total Working Time of Agricultural Instructor	8	23	19.88	86.4	Good
4	Extension Media	8	28	25.63	91.5	Very <b>Good</b>
5	Extension Methods	8	31	25.38	81.9	Good
6	Extension Frequency	8	44	38.13	86.7	Good
7	Extension Materials	8	46	37.13	80.7	Good
8	Extension Experience	8	53	47.13	88.9	Good
Average				35.28	83.26	Good

#### 4.1.7. Extension Materials

Based on Table 12, the average of the Extension Materials variable is 3.53, with a TCR value of 83.94, indicating that this variable is in the **Good** category. The fertilization, harvesting, and post-harvest indicators have the same average value of 3.63 and the same TCR value of 90.75, indicating that the three indicators are in the **Very Good** category. They are then followed by indicators of good planting time, seed sowing, and planting, which all have the same average value of 3.50 and the same TCR value of 87.5, indicating that the variable components are in the **Good** category. At the same time, the nursery and maintenance indicators are in the **Enough** category.

**Table 12.** Frequency Distribution of Extension Material Variables (X7) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Good Planting Time	8	4	3.50	87.5	Good
2	Tillage	8	5	4.00	80	Good
3	Nurseries	8	4	2.63	65.75	Enough
4	Nurseries	8	4	3.50	87.5	Good
5	Planting	8	4	3.50	87.5	Good
6	Maintenance	8	5	3.75	75	Enough
7	Fertilizing	8	4	3.63	90.75	Very good
8	Harvesting	8	4	3.63	90.75	Very good
9	Post-harvest	8	4	3.63	90.75	Very good
Average				3.53	83.94	Good

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#### 4.1.8. Human Resources

Table 13 shows that the average score of the Human Resources variable is 4.20, and the TCR value is 84.12, hence, summarizing the variable in the Good category. Of the five indicators below, one indicator is in the **Not good** category, namely the quality of education related to work skills/expertise, with an average value of 1.80 and a TCR value of 36. In contrast, the other four indicators are in the **Very good** category.

**Table 13.** Frequency Distribution of Human Resources Variables (Y1) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Farmers' knowledge of rice cultivation techniques	110	5	4.90	98	Very good
2	Farmers' knowledge of good rice seeds	110	5	4.92	98.4	Very good
3	Determination of labor needs	110	5	4.65	93	Very good
4	Quality of education related to Skills/work skills	110	5	1.80	36	Not good
5	Health quality (physical and psychological) of farmers	110	5	4.76	95.2	Very good
<b>Average</b>				4.20	84.12	Good

#### 4.1.9. Effectiveness of Agricultural Extension

The results of Table 14 show that the average variable of Extension Effectiveness Agriculture is 3.73 and has a TCR value of 74.76 which means that the variable is in the **Fair** category. This Agricultural Extension Effectiveness variable has six indicators, of which one indicator is in the **Not good** category; the number of farming families. Then two indicators are in the **Very good** category: farmer participation and the level of cosmopolitan farmers with TCR values of 97 and 92.6. **They were then** followed by indicators of rice farming income in the **Good** category, and rice production and land productivity in the **Enough** category.

**Table 14.** Frequency Distribution of Extension Problems Variables (X6) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Rice Field Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Rice Production	110	5	3.65	73	Enough
2	Rice Farming Income	110	5	4.20	84	Good
3	Land Productivity	110	5	3.65	73	Enough
4	Number of Farmer Families	110	5	1.45	29	Not good
5	Farmer Participation	110	5	4.85	97	Very good
6	Cosmopolitan Level Farmers	110	5	4.63	92.6	Very good
<b>Average</b>				3.73	74.76	Fair

## 4.2. Analysis of Structural Equation Modeling (SEM)

### 4.2.1. Evaluation of Measurement Model

This research model consists of 7 (seven) constructs, including the variables of Technological Progress (X1), Capital (X2), Farmer Age (X3), Education (X4), Farming Experience (X5), Human Resources (Y1), and Effectiveness of Agricultural Extension (Y2). Evaluation of the measurement model is a stage to test the validity and reliability of a construct.

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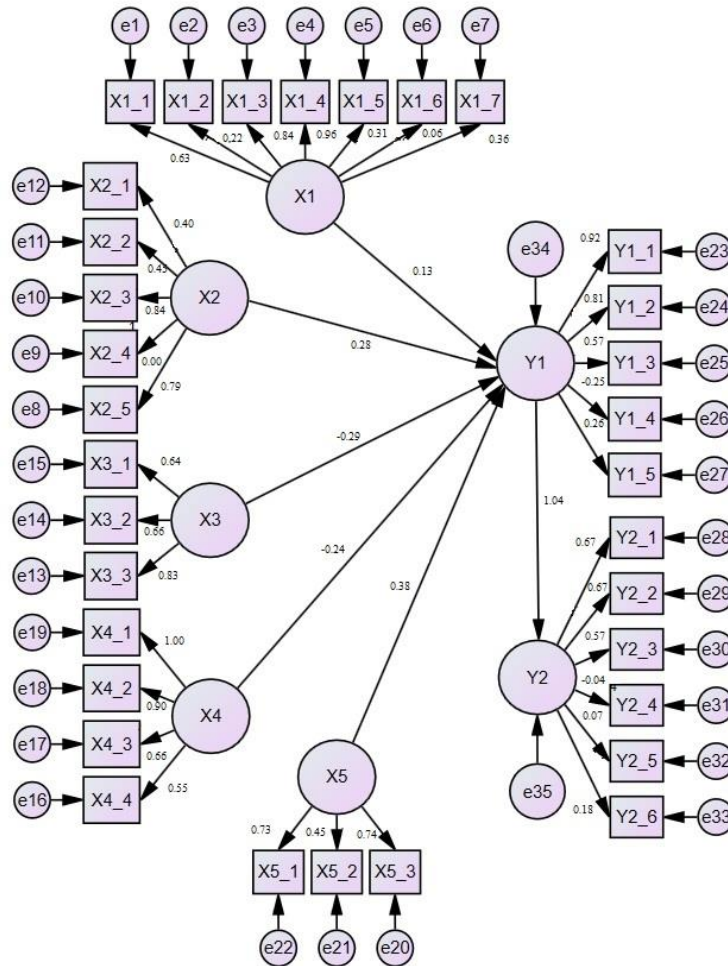


Figure 2. Path Diagram.

### 1. Validity Testing

Construct validity testing is intended to determine whether the indicators used in measuring latent variables are valid. The validity of each indicator in measuring the latent variable is indicated by the size of the loading factor (Standardized Weights). An indicator is declared valid if *the indicator's loading factor is positive and greater than 0.5*. The results of the validity test are presented in Table 13.

Table 15 shows that the question indicators X1\_2, X1\_5, X1\_6, and X1\_7, which measure the Technological Progress variable (X1), are declared invalid because they produce a loading factor value of less than 0.5. Then the question indicators X2\_1 and X2\_2, which measure the Modal variable (X2), are declared invalid. Furthermore, the question indicators X5\_2, Y1\_4, and Y1\_5, which measure the variables of Farming Ex-

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perience (X5) and Counseling Problems (Y1), are declared invalid because they produce a loading factor value of less than 0.5. Then the question indicators Y2\_4, Y2\_5, and Y2\_6, which measure the Agricultural Extension Effectiveness variable (Y2), are declared invalid because they produce a loading factor value of less than 0.5.

When viewed from the strength of the loading factor (Standardized Weights) on each variable, the X1\_4 indicator has the highest contribution to the Technological Progress variable (X1) of 95.6%. Then, the Capital variable (X2) is dominated by the X2\_4 indicator of 99.6%. Furthermore, the X3\_3 indicator has the highest contribution to the Farmer Age variable (X3) at 82.9%. Then the Education variable (X4) is dominated by the X2\_4 indicator of 90.5%. Then the X5\_3 indicator has the highest contribution to the variable Age of Farming Experience (X5) at 73.6%. Furthermore, the Human Resources variable (Y1) is dominated by the Y1\_1 indicator of 91.8.0%. Finally, the Agricultural Extension Effectiveness (Y2) variable is dominated by the Y2\_1 indicator of 67.1%.

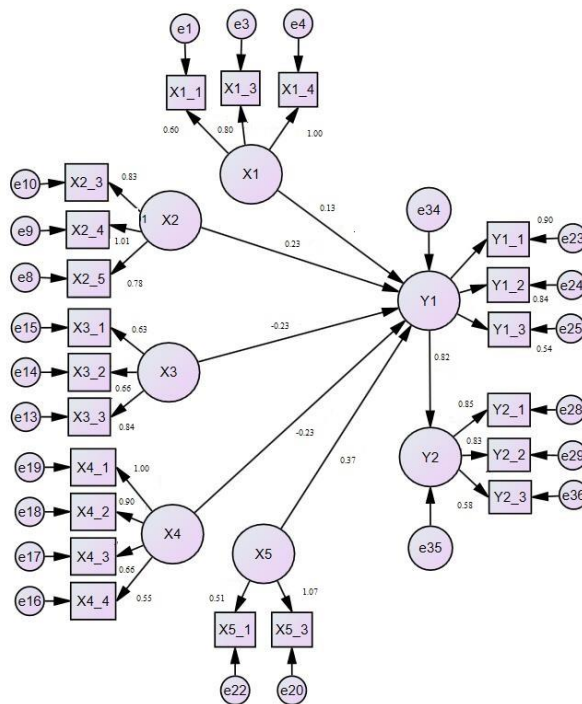
Validity can be seen through the loading factor and the Average Variance Extracted (AVE). An instrument is said to meet the validity test if it has an Average Variance Extracted (AVE) above 0.5. The results of the convergent validity test are presented in Table 14:

**Table 15.** Construct and Validity Test.

Variable	Indicator	Loading Factor	Criteria	AVE
Technology Advances (X1)	X1_1	0.626	0.5	0.326
	X1_2	0.220	0.5	
	X1_3	0.837	0.5	
	X1_4	0.956	0.5	
	X1_5	-0.306	0.5	
	X1_6	-0.058	0.5	
	X1_7	0.362	0.5	
Capital (X2)	X2_1	0.398	0.5	0.535
	X2_2	0.451	0.5	
	X2_3	0.839	0.5	
	X2_4	0.996	0.5	
	X2_5	0.786	0.5	
Farmer Age (X3)	X3_1	0.644	0.5	0.512
	X3_2	0.659	0.5	
	X3_3	0.829	0.5	
Education (X4)	X4_1	1.002	0.5	0.639
	X4_2	0.905	0.5	
	X4_3	0.658	0.5	
	X4_4	0.548	0.5	
Farming Experience (X5)	X5_1	0.732	0.5	0.425
	X5_2	0.445	0.5	
	X5_3	0.736	0.5	
Human Resources (Y1)	Y1_1	0.918	0.5	0.393
	Y1_2	0.813	0.5	
	Y1_3	0.573	0.5	
	Y1_4	-0.248	0.5	
	Y1_5	0.263	0.5	
Effectiveness of Agricultural Extension (Y2)	Y2_1	0.671	0.5	0.210
	Y2_2	0.668	0.5	
	Y2_3	0.567	0.5	
	Y2_4	-0.043	0.5	

Y2_5	0.074	0.5
Y2_6	0.179	0.5

Based on Table 15, it can be seen that overall, the indicators on the variables of Technological Advance (X1), Farming Experience (X5), Human Resource (Y1), and Effectiveness of Agricultural Extension (Y2) are declared valid in measuring the variables because they have fewer AVE values of 0.5. Cronbach's [alpha](#) was used for reliability. This value reflects the reliability of all indicators in the model. The minimum value is 0.7. In addition to Cronbach's [alpha](#), composite reliability values are also used, interpreted the same as Cronbach's [alpha](#) values.



**Figure 3.** Path Diagram After Invalid Indicator Drop.

The validity of each indicator in measuring the latent variable is indicated by the size of the loading factor (Standardized Weights). An indicator is declared valid if the loading factor of an indicator is positive and is greater than 0.5. The results of the validity test and the loading factor, the Average Variance Extracted (AVE) value, are obtained, which is presented in Table 15.

## 2. Construct Reliability Test

The construct reliability test was carried out using the [construct reliability](#) (CR) technique. The test criteria state that the coefficient of [construct reliability](#) (CR) and Cronbach's alpha 0.6 means that it can be stated that the construct is reliable or the indicator is consistent in measuring the variables it measures.

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#### 4.2.2. SEM Model Evaluation

##### 1. Model Fit Test

Testing the feasibility/fitness of the model (construct) is intended to determine whether the construct formed is appropriate (feasible). There are several test indices in SEM analysis, namely CMIN/DF, RMSEA, TLI, and CFI. The test criteria use CMIN/DF; if the CMIN/DF value is the cut-off value (2.00), then the construct formed is appropriate (feasible). The criteria using RMSEA state that if the RMSEA value is the cut-off value (0.08), then the construct formed is appropriate (feasible). The criteria using TLI and CFI state that if the goodness of fit value is the cut-off value (by 0.90), then the model formed is appropriate (feasible).

**Table 16.** Construct Validity Test After Drop Invalid Indicator.

Variable	Indicator	Loading Factor	Criteria	Description
Technology <b>Advances</b> (X1)	X1_1	0.600	0.5	Valid
	X1_3	0.805	0.5	Valid
	X1_4	0.999	0.5	Valid
Capital (X2)	X2_3	0.830	0.5	Valid
	X2_4	1.008	0.5	Valid
	X2_5	0.776	0.5	Valid
Farmer Age (X3)	X3_1	0.633	0.5	Valid
	X3_2	0.659	0.5	Valid
	X3_3	0.838	0.5	Valid
Education (X4)	X4_1	1.004	0.5	Valid
	X4_2	0.903	0.5	Valid
	X4_3	0.656	0.5	Valid
	X4_4	0.548	0.5	Valid
Farming Experience (X5)	X5_1	0.510	0.5	Valid
	X5_3	1.066	0.5	Valid
	Human <b>Resources</b> (Y1)	Y1_1	0.900	0.5
Y1_2		0.839	0.5	Valid
Y1_3		0.544	0.5	Valid
Y2_1		0.849	0.5	Valid
Effectiveness of Agricultural Extension (Y2)	Y2_2	0.835	0.5	Valid
	Y2_3	0.578	0.5	Valid

**Table 17.** Validity Test After Drop Invalid Indicator.

Variable	AVE	Description
Technology <b>Advances</b> (X1)	0.669	Valid
Capital (X2)	0.769	Valid
Farmer Age (X3)	0.512	Valid
Education (X4)	0.639	Valid
Farming Experience (X5)	0.698	Valid
Human Resources (Y1)	0.757	Valid
Effectiveness of Agricultural Extension (Y2)	0.709	Valid

**Table 18.** Reliability Test.

Technology <b>Advances</b> (X1)	0.814	0.807	Reliable
Capital (X2)	0.854	0.884	Reliable
Farmer Age (X3)	0.791	0.729	Reliable
Education (X4)	0.872	0.782	Reliable

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Farming Experience (X5)	0.700	0.704	Reliable
Human Resources (Y1)	0.829	0.681	Reliable
Effectiveness of Agricultural Extension (Y2)	0.804	0.776	Reliable

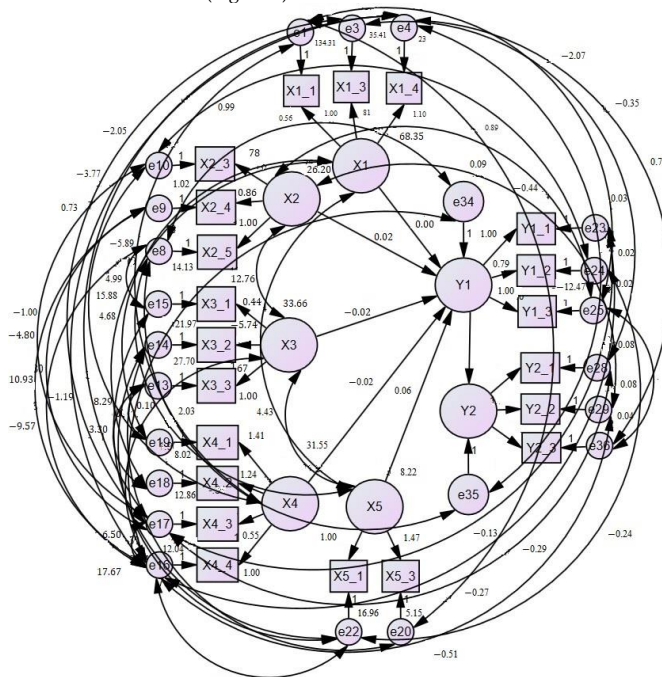
Based on Table 18, it can be seen that the **construct reliability** and Cronbach's alpha values for all variables are more significant than 0.6. Thus, these variables are declared reliable based on the calculations of **construct reliability** and Cronbach's alpha.

**Table 19.** Goodness of Fit Model.

Index	Goodness of Fit	Cut Off Value	Description
CMIN/DF	2.709	≤ 2.00	Poor of Fit
RMSEA	0.148	≤ 0.08	Poor of Fit
TLI	0.673	≥ 0.90	Poor of Fit
CFI	0.714	≥ 0.90	Poor of Fit

Based on the goodness of fit **summary**, it can be seen that the four **indications**, namely CMIN/DF, RMSEA, TLI, and CFI, do not meet the criteria. Thus, the SEM model that has been formed is declared not feasible.

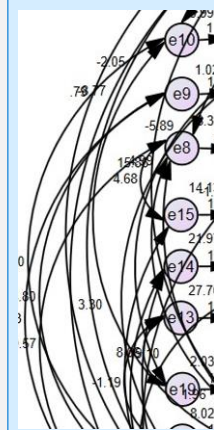
Because the model is not feasible, modifications to the covariance index are carried out to obtain a fit model. Basically, the **structural equation modeling (SEM) method** in **AMOS** is a **covariance-based SEM (CB-SEM)** which needs to be accommodated by the covariance element. **For example, the** following is a path diagram after modification of the index covariance model (Figure 4):



**Figure 4.** Path Diagram After Modifying the Covariance Index (**Unstandardized**).

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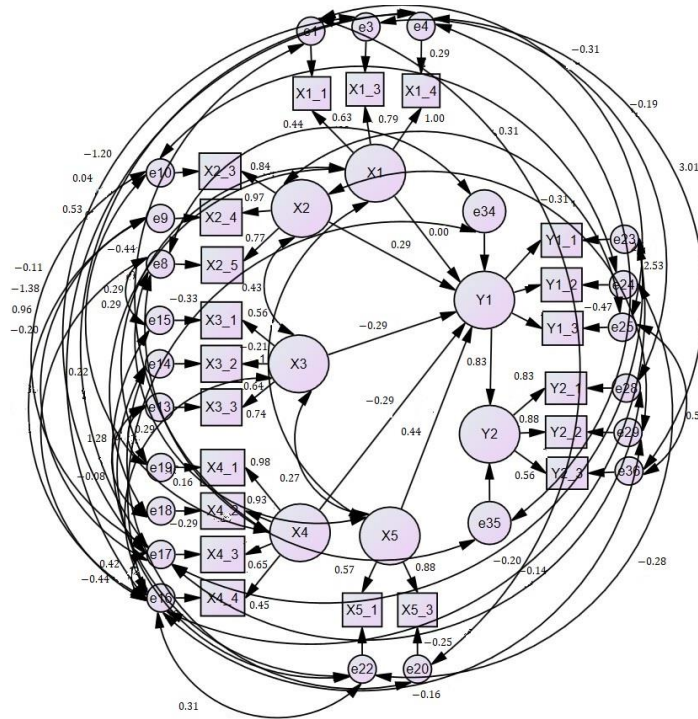


Figure 5. Path Diagram After Modification of Covariance Index (Standardized).

The results of the model feasibility test after modification of the covariance index have been summarized in Table 20. Based on the summary of the goodness of fit, it can be seen that the **four** indices, namely CMIN/DF, RMSEA, TLI, and CFI, all meet the criteria. **Therefore, from** the results of the index criteria, it can be concluded that the SEM path diagram that has been formed is declared suitable for use.

Table 20. Goodness of Fit Model (After Modification of the covariance).

Indeks	Goodness of Fit	Cut Off Value	Description
CMIN/DF	1.400	≤2.00	Good of Fit
RMSEA	0.061	≤0.08	Good of Fit
TLI	0.945	≥0.90	Good of Fit
CFI	0.963	≥0.90	Good of Fit

2. Model Hypothesis Test  
 a. Direct Effect Test

Hypothesis testing is intended to test whether exogenous variables have a direct effect on endogenous variables. The significance test can be known through the *p*-value. The test criteria state that if the CR statistic is >1.96 or if the *p*-value is <0.05, there is a significant effect of exogenous variables on endogenous variables. The analysis results can be seen in the summary in Table 20.

The following can be inferred from Table 21:

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Table 21. Hypothesis test.

Hypothesis	Track	Standardized Coefficient	SE	CR	p-Value	Description
H1	X1→Y1	0.001	0.003	0.019	0.985	Not significant
H2	X2→Y1	0.289	0.006	3.255	0.001	Significant
H3	X3→Y1	-0.287	0.008	-2.389	0.017	Significant
H4	X4→Y1	-0.294	0.005	-3.908	***	Significant
H5	X5→Y1	0.440	0.013	4.467	***	Significant
H6	Y1→Y2	0.828	0.114	9.027	***	Significant

Description: \*\*\*  $p$ -value < 0.001.

1. Testing the effect of Technological Progress (X1) on Human Resources (Y1) produces a CR statistic of 0.019 and a  $p$ -value of 0.985. The test results show that the  $p$ -value (0.985) > alpha 0.05, meaning no significant effect of technological progress on [Human Resources](#).
2. The test of the effect of Capital (X2) on Human Resources (Y1) produces a  $p$ -value of 0.001. The test results show that the statistical  $p$ -value (0.001) < alpha 0.05, which means that there is a significant effect of Capital on Extension Issues. The positive coefficient of 0.289 indicates that [Capital](#) positively affects Human Resources. This means that the higher the [Capital](#), the higher the [Human Resources](#).
3. Testing the effect of Farmer Age (X3) on Human Resources (Y1) produces a CR statistic of -2389 with a  $p$ -value of 0.017. The test results show that the statistical  $p$ -value (0.017) < alpha 0.05, meaning that [Farmer's Age](#) has a significant effect on Human Resources. A negative coefficient of -0.287 indicates that Farmer Age harms [Human Resources](#). This means that the higher the [Farmer's Age](#), the lower the [Human Resources](#).
4. The effect of Education (X4) on [the Human Resources \(Y1\)](#) test produces a CR statistic of -3.908 with a  $p$ -value of 0.001. The test results show that the  $p$ -value (0.001) < alpha 0.05 means that Education has a significant effect on Human Resources. This means that the higher the [Education](#), the higher the [Human Resources](#).
5. Testing the effect of Farming Experience (X5) on Human Resources (Y1) resulted in a CR statistic of 4.467 with a  $p$ -value of 0.001. The test results show that the statistical  $p$ -value (0.001) < alpha 0.05 means that [Farming Experience](#) has a significant effect on [Human Resources](#). A positive coefficient of 0.440 indicates that the [Farming Experience](#) positively affects [Human Resources](#). This means that the better the [Farming Experience](#), the better [the Human Resources](#).
6. The test of the influence of Human Resources (Y1) on the Effectiveness of Agricultural Extension (Y2) resulted in a CR statistic of 9.027 and a  $p$ -value of 0.001. The test results show that the statistical  $p$ -value (0.001) < alpha 0.05, which means that Human Resources has a significant influence on the Effectiveness of Agricultural Extension. The positive coefficient of 0.828 indicates that Human Resources positively affect the Effectiveness of Agricultural Extension. This means that better Human Resources can increase the Effectiveness of Agricultural Extension.

#### b. Indirect Effect Test

Hypothesis testing is intended to test whether exogenous variables have an indirect effect on endogenous variables through mediating variables (intervening). Mediation testing can be known through the Sobel test. The test criteria state that if the  $z$  statistic >  $z$  table (1.96) or  $p$ -value < alpha 0.05, it is stated that there is a significant indirect effect of exogenous variables on endogenous variables through mediating variables (intervening). The analysis results can be seen in the summary in Table 21.

Based on Table 22, it can be stated that the test of the effect of Capital (X2), Farmer's Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricul-

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tural Extension (Y2) through the mediation of Human Resources (Y1) produces a statistical  $p$ -value  $<$  alpha 5% which means that there is an indirect effect of Capital Progress (X2), Farmer Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2) through the mediation of Human Resources (Y1). In other words, the Human Resources variable (Y1) can mediate the effect of Capital (X2), Farmer Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2).

**Table 22.** Hypothesis test.

Hypothesis	Track	Indirect Coefficient	Std. Error	$p$ -Value	Description
H7	X1→Y1→Y2	0.001	0.002	0.739	Not Significant
H8	X2→Y1→Y2	0.239	0.033	0.000	Not Significant
H9	X3→Y1→Y2	−0.238	0.034	0.000	Not Significant
H10	X4→Y1→Y2	−0.243	0.034	0.000	Not Significant
H11	X5→Y1→Y2	0.364	0.051	0.000	Not Significant

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While the test of the effect of **Technological Progress** (X1) on the **Effectiveness of Agricultural Extension** (Y2) through the mediation of **Human Resources** (Y1) resulted in a statistical  $p$ -value (0.985)  $>$  alpha 5%, which means that there is no indirect effect of **Technological Progress** (X1) on the **Effectiveness of Agriculture Extension** (Y2) through the mediation of Human Resources (Y1) or, in other words, the Human Resources variable (Y1) is not able to mediate the effect of Technological Progress (X1) on the Effectiveness of Agricultural Extension (Y2).

### 3. Convert Path Diagrams to Structural Equations

The conversion of path diagrams into structural equations is intended to find out how the shape of the influence between constructs is based on their mathematical equations. Based on the attachment, it can be seen that the mathematical models formed are [as follows](#):

$$\text{Equality 1: } Y_1 = 0.001 X_1 + 0.239 X_2 - 0.2873 X_3 - 0.294 X_4 + 0.440 X_5$$

$$\text{Equality 2: } Y_2 = 0.828 Y_1$$

## 5. Conclusions

1. The factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi, are farming capital, farmer's age, education, farming experience, and human resources.
2. The influence of these factors on the effectiveness of agricultural extension in Baubau city is as follows: if farming capital is high, human resources can be increased. Moreover, the higher the farmers' age, the lower the need for human resources. It was additionally noted that higher education of farmers contributes to improvement in human resources, and the increased experience in farming corresponded to an increase in human resources. Hence, increasing human resources will increase the effectiveness of agricultural extension.
3. Extension issues and materials affect the effectiveness of agricultural extension in Baubau City, where the influence can be categorized as **Good** or **Influential**.
4. Farming capital is land area, labor, use of fertilizers, pesticides, agricultural tools, and machines. There is an influence of farming capital variables on the effectiveness of agricultural extension.

Human resources describe the knowledge possessed by education, training, experience, and information received. Activities that must be carried out by agricultural

extension workers in the city of [Baubau](#) are optimizing socialization and training related to agricultural land, for example, making demonstration plots so that farmers can see directly and have no doubts about the theory provided. In addition, one way to achieve extension effectiveness is to increase human resources (agricultural extension workers) as program implementers so that the programs that have been designed can be implemented. The lack of extension workers resulted in a significant workload for each extension agent because the extension area assisted by the extension worker was large, and the number of assisted farmer groups was significant. Currently, there are 44,890 agricultural extension workers. These agricultural extension workers serve 71,479 villages, so they still need as many as 26,589 agricultural extension workers (agricultural extension center Indonesia, 2022). Many agricultural extension workers can supervise the assistance funds given to farmers so that they are appropriately managed to realize farmer welfare, distribute farmers' knowledge about the latest agricultural technologies, and develop rice farming. For example, they help to provide production facilities, distribute fertilizer and seed aid, and provide cooperative institutions to assist farmers in procuring farming capital. [In addition, agricultural](#) extension agents have roles as facilitators, communicators, motivators, and consultants. Indonesian [Government Regulation](#) no. 16 of 2006 concerning the Agricultural Extension System, one of the critical points in this law is the need to build extension institutions in the regions at the provincial and district/city levels.

Age affects productivity level, making decisions, and receiving information. The dominant number of respondents is 46–55 years old. This shows that the productive age in this study is in the age range of 46–55 years. At a productive age, it will be easier to get new ideas and quickly understand the use of technology. Information obtained by farmers, especially from agricultural extension workers, will increase their paddy rice production. This follows the research results (Hasyim, 2006) that those who work at productive age will be better and maximal than non-productive age.

Education is influential in taking action in making programs for agricultural development. The low level of education in this study indicates that the quality of human resources needs to be improved in efforts to develop farming performance. Improving the skills and knowledge of farming will encourage the achievement of planned production targets. According to (Lubis, 2000), having a high level of education will be relatively faster in implementing technology and innovation adoption; having low education usually [makes it](#) challenging to implement innovation adoption quickly.

The indicators included in the Technological Progress variable are the use of transplanters, the use of indo combine harvesters, the use of KATAM (planting season prediction), the use of KATAM (fertilizer dose), the use of drones (irrigation sensors/measuring soil pH), the use of expert system applications, and the use [of](#) social media. The average variable of [Technological Progress](#) is 24.91, with an achievement level of 64.53% in the [less good](#) category. Farmers should optimize information technology, such as using the internet to find the latest information. Advances in technology play a role in supporting the availability of relevant and timely agricultural information. Information on the results of research and technological innovations in agriculture helps efforts to increase the production of agricultural commodities. According to research results (Prayoga, K. 2017), the use of technology is considered less optimized by the Indonesian Ministry of Agriculture. Extension activities that utilize social media must continue to be optimized because the number of users continues to increase.

5. Matters related to extension include the number of assisted farmers, the distance to extension locations, the amount of agricultural extension work time, extension media, methods, frequency, materials, and the instructor's experience. Extension media has the most significant contribution to the problem variables of extension agents. Through extension media, it can attract farmers to attend training. Agricultural extension agents use various media that are adjusted to the farmer's

age—then, followed by indicators of instructor experience, frequency of extension, amount of working time of agricultural extension workers, extension methods, and extension materials. Extension material is everything that extension agents propose to farmers, including the suitability of the material with the needs and benefits. Based on the assessment of the extension workers in the field, it was assessed that the absorption of the material and the most suitable application were in fertilization, harvesting, and post-harvest materials. This is followed by good planting time, nurseries, planting, nursery, and maintenance indicators. Agriculture is a critical sector in national development. In national development, it is necessary to support human resources, who have the capacity, who can produce solutions to answer the challenges. **Therefore, it** is necessary to carry out an agricultural extension to develop agriculture. Agricultural extension is also one of the efforts to produce quality human resources. Agricultural extension is an empowerment effort or an effort to motivate and change the behavior of farmers and their families so that they have the will and can solve the problems they face in doing their farming. Therefore the role of extension is crucial and becomes a strategic matter in national development.

The Ministry of Agriculture is targeting Indonesia to become a world food barn by 2045. To achieve this mission, the Ministry of Agriculture places farmers as the main actors in agricultural development. **Therefore, attention** is needed **from** farmers through agricultural extension workers. In general, the knowledge farmers have to lack in renewal, and the existence of agricultural extension can help agricultural development.

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**Institutional Review Board Statement:** The study was conducted in accordance with the Declaration of Helsinki, and approved by the institutional Review Board (or ethics Committee) of Hasanuddin University.

**Informed Consent Statement:** **Informed consent was obtained from all subjects involved in the study**

**Data Availability Statement:** data is unavailable due to privacy or ethical restrictions

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**Conflicts of Interest:** The authors declare no conflict of interest

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Type: Article

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Title: Effectiveness of Agricultural Extension on Paddy Rice Farmer's Baubau City, Southeast Sulawesi, Indonesia

Manuscript: manuscript.docx, manuscript.pdf, manuscript-english.pdf

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Author Contributions: Conceptualization, MH Jamil, L Fudjaja and M Salam; Methodology, L Fudjaja and Muhammad Ridwan; Software, MH Jamil and M Salam; Validation, AN Tenriawaru; Resources, M Salam; Data curation, Nadine Tika; Writing – original draft, Nadine Tika; Writing – review & editing, MH Jamil, AN Tenriawaru, Muhammad Ridwan, Ahmad Imam Muslim and Nividita Varund Chand; Supervision, MH Jamil and L Fudjaja.

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## Cover Letter

January 03, 2023

Department of Socio-Economic, Agribusiness study program.

Universitas Hasanuddin

Perintis Kemerdekaan KM 10 Kota Makassar 90245 Indonesia

Dear Editor Journal of the Saudi Society of Agricultural Sciences

I am submitting a manuscript for consideration of publication in the journal of Sustainability The manuscript is entitled “Effectiveness of Agricultural Extension on Paddy Rice Farmer's Baubau City, Southeast Sulawesi, Indonesia”. **It has not been published elsewhere and that it has not been submitted simultaneously for publication elsewhere.**

The result from the study has depicted that: 1) The factors that influence the effectiveness of agricultural extension in Baubau City are farming capital, farmer age, education, farming experience, and human resources, and 2) the influence of these factors on the effectiveness of agricultural extension is as follows: if farming capital is high, human resources can be increased. Moreover, the higher the farmers' age, the lower the need for human resources. It was additionally noted that higher education of farmers contributes to improvement in human resources, and the increased experience in farming corresponded to an increase in human resources. Hence, increasing human resources will increase the effectiveness of agricultural extension.

Thank you very much for your consideration.

Yours Sincerely,

Dr. Muh. Hatta Jamil, S.P., M.Si

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Article

# Effectiveness of Agricultural Extension on Paddy Rice Farmer's Baubau City, Southeast Sulawesi, Indonesia

MH Jamil <sup>1,\*</sup>, Nadine Tika <sup>1</sup>, L Fudjaja <sup>1</sup>, AN Tenriawaru <sup>1</sup>, M Salam <sup>1</sup>, Muhammad Ridwan <sup>2</sup>, Ahmad Imam Muslim <sup>3</sup> and Nividita Varun Chand <sup>4</sup>

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Abstract: Agricultural extension workers play an essential role in the productivity of agricultural systems. Based on the actual conditions in the field, it can be seen that the level of extension services still needs to be higher due to a lack of human resources in the field of extension services. This research was conducted to determine the effectiveness of agricultural extension services and determine the factors that influence the effectiveness of agricultural extension to farmers in Baubau City, Indonesia. The analytical method includes exogenous latent variables: human resources, technological progress, farming capital, farmer age, education, and farming experience. The effectiveness of agricultural extension are is used as an endogenous latent variables. The research sample consisted of 110 rice farmers in Baubau City, and the Slovin formula was used to calculate the sample. The data collection for this research was carried out by distributing questionnaires to respondents, in-depth interviews, and direct observation in the city of Baubau. Using the AMOS application, quantitative analysis was carried out through structural equation modeling (SEM). The study results show that: 1) The factors that influence the effectiveness of agricultural extension in Baubau City are farming capital, farmer age, education, farming experience, and human resources; and 2) the influence of these factors on the effectiveness of agricultural extension is as follows: if the farming capital is high, human resources can be increased. In addition, the higher the farmer's age, the lower the need for human resources. It is also noted that higher farmer education contributes to increased human capital, and increased experience in farming is associated with increased human capital. Thus, an increase in human resources will increase the effectiveness of agricultural extension. Significant factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi, are farming capital, farmer age, education, farming experience, and human resources.

**Keywords:** effectiveness; agricultural extension; paddy rice; Indonesia

**Citation:** Jamil, M.; Tika, N.; Fudjaja, L.; Tenriawaru, A.; Salam, M.; Ridwan, M.; Muslim, A.I.; Chand, N.V. Effectiveness of Agricultural Extension on Paddy Rice Farmer's Baubau City, Southeast Sulawesi, Indonesia. *Sustainability* **2023**, *15*, x. <https://doi.org/10.3390/sxxxx>

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## 1. Introduction

Southeast Sulawesi has sufficient competence to support the Indonesian food development program because of the high availability of land and the potential for land productivity. Based on data on rice fields area in the rice planting season, Southeast Sulawesi has an area of 82,382 ha of raw rice fields (Central Bureau of Statistics, 2020). The area-size of rice fields in Baubau city is 1375 ha; this indicates that the agricultural sector is one of the sectors with high priority in Baubau City (Abadi, 2019). Rice-However, rice production domestically is dominated by lowland rice production. Hence, the extension

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workers should increase their effectiveness in extension services for the lowland rice farmers.

Extension workers can contribute to the regulatory process by providing expertise and content for proposed, adopted, and restructured agriculture-related regulations. As extension agents ~~have direct interaction~~ **directly interact** with clients in the field, they can communicate the needs of stakeholder groups. Therefore, they should be involved in the regulatory process. An evidence-based approach involving input from target groups and practitioners seems to be an inevitable strategy for the success of a sustainable land grant project (Fouladkhah, A., 2017).

Extension agents are one of the supporting elements in the agribusiness sub-system. In principle, the agricultural extension supports all sub-systems in agribusiness. Specifically, in this study, extension workers play a role in supporting the *on-farm* to increase the productivity of lowland rice. Hence, to increase the productivity of rice farming, extension workers are needed. The role of the extension worker is to provide guidance and knowledge in the form of the latest information or innovation to improve their farming system, ultimately increasing their crop yields. In addition, the purpose of agricultural extension is to change the behavior of farmers, for instance, their ability to adapt to situations and conditions that keep changing. Thus, they can improve their farming systems, increase production, and reduce the possibility of crop failure. While simultaneously improving their living standards.

However, there are some significant issues, such as a lack of active participation from agricultural extension workers and the difference in the extension worker-to-farmer ratio, leading to fewer extension workers ~~to for~~ many farmers. This problem causes the workload of each extension worker to be quite ~~heavy~~ **large** because either the extension area or the number of assisted farmer groups is quite large. ~~Therefore,~~ ~~¶~~ The current condition is forcing agricultural extension workers to work hard despite a limited number of workers, and they must be able to perform optimally to increase their work productivity.

The role of extension workers can increase sustainable agricultural productivity and food security (Olorunfemi, T. O., et al. 2020). One of the most crucial things is to ensure that ~~leaving using the~~ agricultural extension and education programs has a positive impact on farmers (Salehi, M., et al. 2021). Consequently, the crucial role of extension workers is to create awareness among farmers to apply guidelines for food needs (Fiaz, S., et al. 2018). The findings of the study (Jamil, M.H., 2017) show that the development of agricultural extension workers has a positive effect on the agricultural extension program.

Agricultural extension programs and policies can play an important role in achieving production (Mahir, M. E. A. E., & Abdelaziz, H. H. 2011). Additionally, this agricultural policy ~~was~~ discussed by (Baloch, M. A., & Thapa, G. B, 2019), who said that agricultural policies must be implemented effectively to **address** the needs of farmers and the problems they face. One example is that the Government of Pakistan has adopted a policy of providing agricultural services to promote agricultural production by disseminating appropriate knowledge and technology to farmers (Baloch, M. A., & Thapa, G. B., 2018).

The agricultural, industrial revolution has had an impact on efficiency and productivity in agricultural extension services in the agricultural sector (Nyarko, D. A., & Kozári, J. 2021). ~~The Furthermore, the~~ effects of community-based strategies on food security ~~has have~~ a positive impact (Wellard, K., et al. 2013). ~~¶¶~~ ~~Therefore, it~~ is suggested that extension services provide ~~information and~~ **communication** ~~technology~~ training (ICT) for agricultural extension workers to improve extension services. In addition, according to (Umbara, D.S., Sulistyowati, L., Noor, T.I., and Setiawan, 2021), ~~¶~~ the dissemination of agricultural technology information by utilizing the internet network is very helpful for agricultural extension workers in carrying out their main tasks. Information and **communication** Technology ~~are also can also be used to~~ facilitate the delivery of information and knowledge sharing between farmers, extension workers, and other stakeholders. (Annor-Frempong, F., et al. (2006). ~~¶~~ ~~In~~ the article (Haghighi, N. F., et

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a. 2008) stated the perspective on the application of **I**nformation and **C**ommunication **T**echnology in agriculture **and**, some issues with using ICT in organizations; **however**, **this is in contrast, in accordance to** (Diaz, R. T., et al. (2021). **Furthermore, it** was found that **services e**xtension services in the study area are not sufficient when farmers face difficulties.

From the literature, it can be gathered that an agricultural extension worker plays an essential role in the productivity of a farming system. Based on the actual conditions in the field, it can be acknowledged that the extension service rate is low due to a lack of human resources in the extension field. Therefore, to solve the problems that arose from the current predicament, this study was conducted to determine the effectiveness of agricultural extension services. The primary purpose of this study is to determine the factors that influence the effectiveness of agricultural extension services to lowland rice farmers in Baubau City and to find out how these factors can affect the effectiveness of agricultural extension services.

## 2. Research Hypothesis

- a. It is suspected that the variables of technological progress (X1), farming capital (X2), farmer age (X3), farmer education (X4), and farmer experience (X5) have a significant relationship and have a direct influence on human resources (Y1).
- b. Allegedly, the variables of technological progress (X1), farming capital (X2), farmer age (X3), farmer education (X4), and farmer experience (X5) have a significant relationship and give an indirect effect but are thought to influence the variable effectiveness of agricultural extension (Y2).
- c. It is suspected that the variable human resources (Y1) have a significant relationship with the variable effectiveness of agricultural extension (Y2).

## 3. Research Methods

### 3.1. Place and Time

This research is located in Bau-bau City, Southeast Sulawesi, and was carried out **in** **from** January–July 2022.

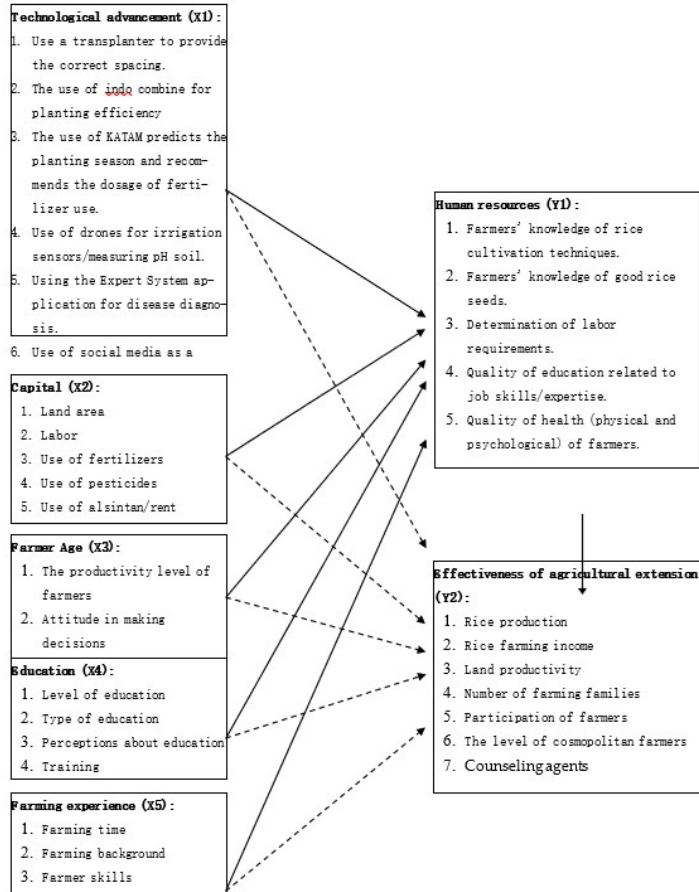
### 3.2. Data Collection

Data collection techniques in this study were carried out using interviews, questionnaires, and observation. The measured variable is technological progress (X1), **F**arming **c**apital (X2), **f**armer **a**ge (X3), **f**armer **e**ducation (X4), **f**armer **e**xperience (X5), **h**uman **r**esources (Y1), and **e**ffectiveness of **a**gricultural **e**xtension (Y2).

Constructs, Indicator, and **C**ode **V**ariable

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### 3.3. Population and Sample

The population of this study ~~were was~~ all farmers in Baubau City. ~~The population of this study was~~ 1257 people (Data from the Baubau City Agriculture Office, 2021). In addition, the population of agricultural extension workers in Baubau City is 26 ~~people~~.

A ~~simpleSimple~~ random sampling was used. The sample measurements were calculated using the Slovin formula:

$$n = \frac{N}{1 + N(E)^2} \quad (1)$$

$$n_i = \frac{N_i}{N} \times n \quad (2)$$

Description:

n = Number of samples

N = Population

e<sup>2</sup> = Precession set (5%)

$n_i$  = Standard sample size  $i$

$N_i$  = Population size  $i$

The sample size was determined with an error rate of 10% or based on the desired level of confidence (precision) of 90%, and the sample size based on the Slovin formula amounted to 110 respondents. The study sample for extension agents was based on the population of extension workers in Baubau City, which amounted to 26 personnel. From which 30% of the total were sampled, resulting in 8 extension workers.

The data collection techniques used to carry out the study were questionnaires, direct interviews, and observations to determine the characteristics and behavior of the research object. The data obtained were analyzed descriptively and quantitatively using the SEM method (Structural Equation Modeling)—Software AMOS (Analysis of Moment Structure).

### 3.4. Analysis Method

#### 3.4.1. Descriptive Statistical Analysis

Descriptive statistical data was interpreted using the TCR criteria (Respondent Achievement Level), and the following formula was used:

$$TCR = \frac{Mean}{Skor Max} \times 100 \quad (3)$$

The percentage formula used in this study is as follows:

$$P = \frac{f}{N} \times 100\% \quad (4)$$

Description:

$P$  = Percentage Number

$f$  = The number of frequencies of each answer that has become the respondent's choice

$N$  = The number of frequencies or the number of individuals

To determine the level of criteria with a descriptive analysis of the percentage, which is divided into five indicators, namely:

#### 3.4.2. Quantitative Analysis

SEM (Structural Equation Modeling) analysis in this study was carried out using AMOS 24 software to answer problems related to variables that influence the effectiveness of agricultural extension in Baubau City.

The formula used in this study is as follows:

$$\text{Equality 1 } Y_1 = \beta_0 + \beta_1 X_2 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e \quad (5)$$

$$\text{Equality 2 } Y_1 = \beta_0 + \beta_1 Y_1 + e \quad (6)$$

Description:

$Y_1$  = Human Resources

$Y_2$  = Effectiveness of Agricultural Extension

$\beta$  = Constant

$E$  = Standard error

$X_1$  = Technology advances

$X_2$  = Capital

$X_3$  = Farmer Age

$X_4$  = Education

$X_5$  = Farming experience

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#### 4. Results

The demographic characteristic of the farming communities involves 96% of male and 4% of female farmers (Table 1). There is a division of household tasks between husband and wife. Based on in-depth interviews with several respondents, they stated that working in the fields is the husband's duty while the wife takes care of the household. Results based on age indicated that 34% of farmers were 36–45 years old, and 6% were under 25 years old. Farmers who work at the productive age will be better and more optimal than non-productive age (Productive age 15–64). In addition, age can also be used as a benchmark to see the activities of farmers at work (Hasyim, 2006).

**Table 1.** TCR criteria.

No.	Scale Range	TCR
1	90%–100%	Very good
2	80%–89, 99%	Good
3	65%–79, 99%	Enough
4	55%–64, 99%	Not good
5	0%–54, 99%	Not good

It was revealed that the respondents with non-educational levels were 10%. Respondents with their last education at the elementary, junior school, and senior high school levels were 41%, 13%, and 31%, respectively, and at the tertiary level added to 5%; according to (Soehardjo and Patong, D. 1999). Higher levels of education results in a more straightforward implementation of innovations. Farmer education is not only oriented toward increasing production but the social life of the farming community. On the other hand, farmers with a high education level will be relatively faster in implementing technology adoption and innovation. Farmers who have low education may have difficulty implementing the adoption of innovation quickly. The level of education possessed by farmers depicts the knowledge and insight a farmer has in applying technology and innovation to increase farming activities (Lubis, 2000). Demographic characteristics based on the main occupation of farmers show that farming is the respondents' main occupation, totaling 97%. In comparison, the remaining 3% of the main occupation are civil servants, and farming is their side employment.

Based on the study's results, farmers with a land area of less than 1 ha was 16%, 1 to 5 ha was 82%, and more than 5 ha was 2%. The number of farmers that own their land is 93%, and 6% of the farmers are tenants, while the remaining 1% amounts to farmers being landowners and tenants. It is important to note that more land ownership means more potential to increase productivity and efficiency by adopting modern technology. Land tenure is vital in spreading and adopting modern agricultural practices among farming communities (Aldosari et al., 2019).

Next, the results show that a significant percentage of the farmers had more than 10 years of experience resulting in a total of 76%, followed by farmers with 5–10 years with 14% and farmers with less than 5 years of experience with 10%. The farming experience significantly affects farming activities, as evident in from the production results. Farmers who have been farming for a long time have high knowledge, experience, and skills in running a farm. Farming experience is divided into three categories, namely less experienced (<5 years), moderately experienced (5–10 years), and experienced (10 years). Farmers have different farming experiences or lengths of farming (Soehardjo and Patong, D. 1999).

Furthermore, it can be seen that respondents have chosen "hereditary" as their farming background surmounting 90% or as many as 99 people from the total number of respondents. None of the respondents chose the "has the farming ability" as a farming background; and in this case, the respondent's last education determines the farming background. The remaining percentages were recorded for farming backgrounds

are as follows—“economic need, availability of adequate land, the ability to farm and willingness based on agriculture as a promising field.” The percentage for each are as follows: 3%, 4%, 1%, and 2%, respectively.

An extension work area is a place or an area that becomes the territory of authority in carrying out its duties as an extension worker, whether within the ward, sub-district, district/city, or wider area. The extension worker’s work area can affect productivity in carrying out his duties as an extension worker. Meanwhile, the distance from the working area is the distance from the instructor’s residence to the extension location. In Table 2, it can be seen that each respondent has a different work area and length-distance from the work area. The distance from the farthest working area is 21 km, and the closest is 5 km.

**Table 2.** Percentage Descriptive Analysis Criteria.

Number	Percentage	Criteria
1.	0–20%	Very low
2.	21–40%	Low
3.	41–60%	Moderate
4.	61–80%	High
5.	81–100%	Very high

**Table 3.** Demographic Characteristics Data of Rice Farmers in Baubau City, Southeast Sulawesi.

Gender	n	%	Age (Years)	n	%
Male	106	96	Less than 25	7	6
Female	4	4	25–35	25	23
Total	110	100	36–45	17	15
			46–55	37	34
			More than 55	24	22
			Total	110	100
Last Education	n	%	Main Occupation	n	%
No Education	11	10	Farmers	107	97
Elementary school	45	41	Other than farmers (PNS)	3	3
Junior High school	14	13	Total	110	100
Senior High school	34	31			
Higher Education	6	5			
Total	110	100			
Land Area (ha)	n	%	Land Ownership Status	n	%
Less than 1	18	16	Owner	102	93
1–5	90	82	Tenant/tenant	7	6
More than 5	2	2	Owner and tenant	1	1
Total	110	100	Total	110	100
Time of farming (years)	n	%	Farming background	n	%
Less than 5	11	10	Hereditary	99	90
5–10	15	14	Economic needs	3	3
More than 10	84	76	Availability of adequate land	5	4
Total	110	100	Has the ability to farm	1	1
			Willingness from within because farming is a promising field	2	2
			Total	110	100

n = Total; % = Percentage.

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**Table 4.** Data on Demographic Characteristics of Agricultural Extension Respondents based on Working Area and Distance from Work Area Baubau City, Southeast Sulawesi.

No.	Working Area	Distance from Working Area (Km)
1	Lea-lea Subdistrict	15
2	Tampuna Subdistrict	21
3	Liabuku Subdistrict	9
4	Bungi Subdistrict and Lea-Lea Subdistrict	10
5	Ngkaring-ngkaring Subdistrict	5
6	Waliabuku Subdistrict	13
7	Lowu-lowu	15
8	Subdistrict Kalia-lia	15

Duration as an Extension refers to this study; each respondent has been an extension worker from the time of appointment until this research is carried out, expressed in units of years. The length of time as an extension worker determines the level of experience each agent has. In this case, the duration of an extension worker is divided into three categories: less experienced (<5 years), moderately experienced (5–10 years), and experienced (>10 years). Table 5 shows the highest percentage (63%); five out of eight agents have experience of more than 10 years of experience as an extension worker. While extension agents have moderate experience, equal to two out of eight (25%), and extension agents with less than five years of experience totaled one out of eight (12%).

**Table 5.** Data on Demographic Characteristics of Agricultural Instructor Respondents in Baubau City, Southeast Sulawesi.

Duration as an Extension (Years)	n	%	Status	n	%
Less than 5	1	12	Civil Servants	5	63
5–10	2	25	Honorary Employee	1	12
More than 10	5	63	THL- TBPL	2	25
Total	8	100	Total	8	100

THL- TBPL: Agricultural extension workers.

The status of the extension workers refers to the position an agent holds, which corresponds to their employment descriptions. Table 5 displays that of the eight surveyed workers, 63% (five agents) are Civil Servants, 12% are honorary employees, and 25% are THL-TBPL position holders.

#### 4.1. Descriptive Statistical Analysis

##### 4.1.1. Technological Progress Variables

Based on Table 6 above, the average Technological Progress variable is 24.91, with a respondent's level of achievement is 64.53%, which favors the Not good category. Thus, it can be said that technological advances have less than the desired effect on agricultural extension. The indicator with the lowest TCR value in the table below is the use of *indo combine harvester*, with an average score of 23.68, gravitating to the Not good category. While the indicator with the lowest average score is for the use of *drones* (irrigation sensor/measuring soil pH) which is 12.94, and the TCR value is 80.9 falling into the Good category.

**Table 6.** Frequency Distribution of Technological Progress Variables (X1) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming Businesses in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
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1	Use of <i>transplanter</i>	110	52	27.22	52.3	Not good
2	Use of <i>indo combine harvester</i>	110	52	23.68	45.5	Not good
3	Use of KATAM (predicted planting season)	110	50	38.22	76.4	Enough
4	Use of KATAM (fertilizer dose)	110	50	35.51	71.02	Enough
5	Use of <i>drones</i> (irrigation sensor/measuring soil pH)	110	16	12.94	80.9	Good
6	Use of expert system applications	110	17	13.35	78.5	Enough
7	Use of social media	110	50	23.57	47.1	Not good
Average				24.91	64.53	Not good

The impact of the extension approach on the use of technology, and food security was found to be positive (Wellard, K., et al. (2013). Dissemination of agricultural technology information is helpful for agricultural extension workers in carrying out their main tasks. *Agriculture* (Umbara, D.S et al., 2021). In recent years, the agricultural industry has experienced an increase in the application of Information and Communication Technology globally. This new revolution is said to have had an impact on efficiency and productivity in agricultural extension services in the agricultural sector (Daniel et al., 2021). *Information—Furthermore, Information* and Communication Technology can be used in a cost-effective and practical way to facilitate information sharing and knowledge sharing among farmers, extension workers, and other stakeholders (Joseph Kwarteng, 2006). This new revolution is said to have an impact on impacted efficiency and productivity in agricultural extension services in the agricultural sector (Daniel Ayisi Nyarko and József Kozári, 2021). and on a Attitudes towards the application of Information and Communication Technology in agricultural extension, the extent of the problems faced by extension organizations to the use of ICT, knowledge of ICT, and personal characteristics (Negin Fallah Haghighi et al., 2008).

#### 4.1.2. Farming Capital Variable

Based on Table 7 above, the average Farming Capital variable is 38.16 with a TCR value of 68.12, portraying the sufficiency of the indicator. In other words, the influence of the farming capital variable on the effectiveness of agricultural extension is satisfactory. *The On the other hand, the* labor indicator in the table above has the lowest TCR value of 45.1, and the average score is 23.03, which is the indicator value with the lowest score; hence, it is portrayed in the *bad Not good* category. In comparison, the indicator with the highest TCR value is the use of fertilizer, which is 82.4 with an average value of 42.85 and is present in the Good category.

**Table 7.** Frequency Distribution of Farming Capital Variables (X2) in Research on Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Land area	110	54	39.60	73.3	Sufficient
2	Labor	110	51	23.03	45.1	Not good
3	Fertilizer use	110	52	42.85	82.4	Good
4	Pesticide use	110	56	42.36	75.7	Enough
5	Agricultural machinery use	110	67	42.98	64.1	Poor
Average				38.16	68.12	Enough

#### 4.1.3. Farmer Age Variable

**Table 8.** Frequency Distribution of Farmer Age Variable (X3) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Rice Field Farming in Baubau City, Southeast Sulawesi, 2022.

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No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Farmer Productivity Level	110	57	38.82	68.1	Enough
2	Attitude in Making Decisions	110	57	41.33	72.5	Enough
3	Acceptance of Information	110	57	36.05	63.2	Low
Average				38.73	67.93	Adequate

In [table above Table 8](#), the average [Farmer Age](#) variable is 38.73 with a TCR value of 67.93 and is in the [adequate](#) category. [Therefore, it](#) can be stated that the influence of the age variable of farmers on the effectiveness of agricultural extension is reasonably influential. The attitude indicator in decision-making has the highest average value of 41.33 and the TCR value of 72.5; hence, classified into [the Enough sections Category](#). While the indicator with the lowest average value, namely the acceptance of information, is 36.05 with a TCR value of 63.2, which falls in the designated [section-category](#) of Poor.

#### 4.1.4. Farmer Education Variable

On [Table 9](#), the average [Farmer Education](#) variable is 14.56 with a TCR value of 30.20 which is [Not](#) good. In other terms, the influence of farmers' education on the effectiveness of agricultural extension is not present. The Perception [indicator](#) of Education has the lowest average score of 13.95 and the TCR value of 25.8, indicating that the variable component is in a [bad-Not good](#) category. Likewise, the other three indicators [also fall into](#) the [Not good](#) category, [as evident in the table above](#).

**Table 9.** Frequency Distribution of Farmer Education Variables (X4) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Education Level	110	57	18.25	32.01	Not good
2	Type of Education	110	51	15.58	30.6	Not good
3	Perception about Education	110	54	13.95	25.8	Not good
4	Training	110	58	18.48	32.4	Not good
Average				14.56	30.20	Not good

#### 4.1.5. Farming Experience Variable

Referring to [Table 10](#), the average [Farming Experience](#) variable was 37.45 with a TCR value of 64.8, indicating that the experience variable categorizes in the [Poor](#) section. From the three indicators, it shows that the farming background indicator has an average value of 28.13 and a TCR value of 50.2; while being categorized as [Not](#) good; however, the indicators of the farming time and farmer skills are in the [sufficient-Enough](#) category with TCR values of 67.5 and 76.7, respectively.

**Table 10.** Frequency Distribution of Farming Experience Variables (X5) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Farming time	110	60	40.51	67.5	Enough
2	Farming background	110	56	28.13	50.2	Not good
3	Farmers skills	110	57	43.72	76.7	Enough
Average				37.45	64.8	Poor

#### 4.1.6. Extension Problem Variables

[Table 11](#) shows [that](#) the average variable of [Extension Problems](#) is 35.28 with a TCR value of 83.26, indicating that these variables are in a [Good](#) category. The indicator of the

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number of assisted farmers has an average value of 44.00 and shows a TCR value of 78.6 which means it is in the ~~sufficient~~ Enough category. The extension media indicator has an average value of 25.63 ~~and shows. It shows~~ its TCR value of 91.5, presenting as ~~Vy~~Very ~~Cg~~Good, followed by indicators of the experience of the extension worker, the frequency of extension, the amount of working time of the agricultural instructor, the extension method, and the extension material, which were ~~allboth~~ in the ~~Cg~~Good category. ~~The~~ Finally, the indicator of the distance of the extension location is in the ~~E~~Enough category.

**Table 11.** Frequency Distribution of Extension Problems Variables (X6) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Number of Assisted Farmers	8	56	44.00	78.6	Enough
2	Distance of Extension Locations	8	21	15.00	71.4	Enough
3	Total Working Time of Agricultural Instructor	8	23	19.88	86.4	Good
4	Extension Media	8	28	25.63	91.5	Very <del>Cg</del> good
5	Extension Methods	8	31	25.38	81.9	Good
6	Extension Frequency	8	44	38.13	86.7	Good
7	Extension Materials	8	46	37.13	80.7	Good
8	Extension Experience	8	53	47.13	88.9	Good
Average				35.28	83.26	Good

#### 4.1.7. Extension Materials

Based on Table 12, the average of the Extension Materials variable is 3.53, with a TCR value of 83.94, indicating that this variable is in ~~the a~~ ~~Cg~~Good category. The ~~table's~~ fertilization, harvesting, and post-harvest indicators have the same average value of 3.63 and the same TCR value of 90.75, indicating that the three indicators are in the ~~Vy~~Very ~~Cg~~Good category. ~~They are t~~Then followed by indicators of good planting time, seed sowing, and planting, which all have the same average value of 3.50 and the same TCR value of 87.5, indicating that the variable components are in ~~thea~~ ~~Cg~~Good category. ~~While~~ ~~At the same time~~, the nursery and maintenance indicators are in the ~~E~~Enough category.

**Table 12.** Frequency Distribution of Extension Material Variables (X7) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Good Planting Time	8	4	3.50	87.5	Good
2	Tillage	8	5	4.00	80	Good
3	Nurseries	8	4	2.63	65.75	Enough
4	Nurseries	8	4	3.50	87.5	Good
5	Planting	8	4	3.50	87.5	Good
6	Maintenance	8	5	3.75	75	Enough
7	Fertilizing	8	4	3.63	90.75	Very good
8	Harvesting	8	4	3.63	90.75	Very good
9	Post-harvest	8	4	3.63	90.75	Very good
Average				3.53	83.94	Good

#### 4.1.8. Human Resources

Table 13 shows that the average score of the Human Resources variable is 4.20, and the TCR value is 84.12, hence, summarizing the variable in the Good category. ~~In~~ Of the five indicators below, one indicator is in the ~~bad~~ ~~Not good~~ category, namely the quality

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of education related to work skills/expertise, with an average value of 1.80 and a TCR value of 36. In contrast, the other four indicators are in the **Very good** category.

**Table 13.** Frequency Distribution of Human Resources Variables (Y1) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Farmers' knowledge of rice cultivation techniques	110	5	4.90	98	Very good
2	Farmers' knowledge of good rice seeds	110	5	4.92	98.4	Very good
3	Determination of labor needs	110	5	4.65	93	Very good
4	Quality of education related to Skills/work skills	110	5	1.80	36	Not good
5	Health quality (physical and psychological) of farmers	110	5	4.76	95.2	Very good
<b>Average</b>				4.20	84.12	Good

#### 4.1.9. Effectiveness of Agricultural Extension

The results of Table 14 show that the average variable of Extension Effectiveness Agriculture is 3.73 and has a TCR value of 74.76 which means that the variable is in the **sufficient-Fair** category. This Agricultural Extension Effectiveness variable has six indicators, of which one indicator is in a **bad** the **Not good** category, that is, the number of farming families. Then two indicators are in the **Very good** category: farmer participation and the level of cosmopolitan farmers with TCR values of 97 and 92.6. **Then They were then** followed by indicators of rice farming income in the **Good** category, and indicators of rice production and land productivity in the **sufficient-Enough** category.

**Table 14.** Frequency Distribution of Extension Problems Variables (X6) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Rice Field Farming in Baubau City, Southeast Sulawesi, 2022.

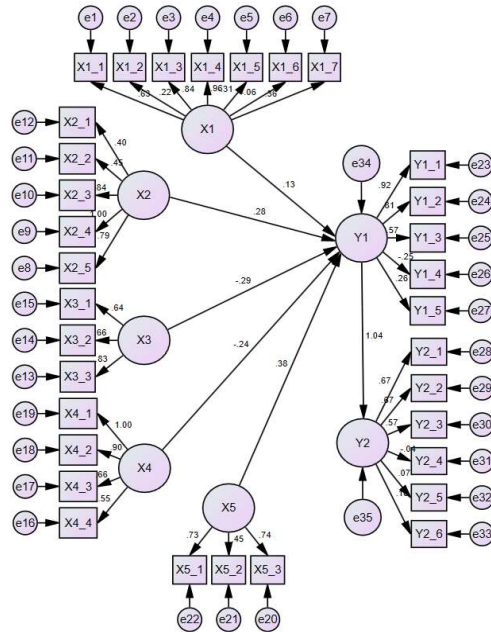
No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Rice Production	110	5	3.65	73	Enough
2	Rice Farming Income	110	5	4.20	84	Good
3	Land Productivity	110	5	3.65	73	Enough
4	Number of Farmer Families	110	5	1.45	29	Not good
5	Farmer Participation	110	5	4.85	97	Very good
6	Cosmopolitan Level Farmers	110	5	4.63	92.6	Very good
<b>Average</b>				3.73	74.76	Fair

## 4.2. Analysis of Structural Equation Modeling (SEM)

### 4.2.1. Evaluation of Measurement Model

This research model consists of 7 (seven) constructs, including the variables of Technological Progress (X1), Capital (X2), Farmer Age (X3), Education (X4), Farming Experience (X5), Human Resources (Y1), and Effectiveness of Agricultural Extension (Y2). Evaluation of the measurement model is a stage to test the validity and reliability of a construct.

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**Figure 1.** Path Diagram

### 1. Validity Testing

Construct validity testing is intended to determine whether the indicators used in measuring latent variables are valid. The validity of each indicator in measuring the latent variable is indicated by the size of the loading factor (Standardized Weights). An indicator is declared valid if ~~the~~ *the indicator's loading factor is positive and greater than 0.5*. The results of the validity test are presented in Table 13.

Table 15 shows that the question indicators X1\_2, X1\_5, X1\_6, and X1\_7, which measure the Technological Progress variable (X1), are declared invalid because they produce a loading factor value of less than 0.5. Then the question indicators X2\_1 and X2\_2, which measure the Modal variable (X2), are declared invalid. Furthermore, the question indicators X5\_2, Y1\_4, and Y1\_5, which measure the variables of Farming Experience (X5) and Counseling Problems (Y1), are declared invalid because they produce a loading factor value of less than 0.5. Then the question indicators Y2\_4, Y2\_5, and Y2\_6, which measure the Agricultural Extension Effectiveness variable (Y2), are declared invalid because they produce a loading factor value of less than 0.5.

When viewed from the strength of the loading factor (Standardized Weights) on each variable, the X1\_4 indicator has the highest contribution to the Technological Progress variable (X1) of 95.6%. Then ~~the~~ *the Capital variable (X2)* is dominated by the X2\_4 indicator of 99.6%. Furthermore, the X3\_3 indicator has the highest contribution to the Farmer Age variable (X3) at 82.9%. Then the Education variable (X4) is dominated by the X2\_4 indicator of 90.5%. Then the X5\_3 indicator has the highest contribution to the variable Age of Farming Experience (X5) at 73.6%. Furthermore, the Human Resources variable (Y1) is dominated by the Y1\_1 indicator of 91.8.0%. ~~The Finally, the Agricultural Extension Effectiveness (Y2) variable variable of Agricultural Extension Effectiveness (Y2)~~ *is dominated by the Y2\_1 indicator of 67.1%.*

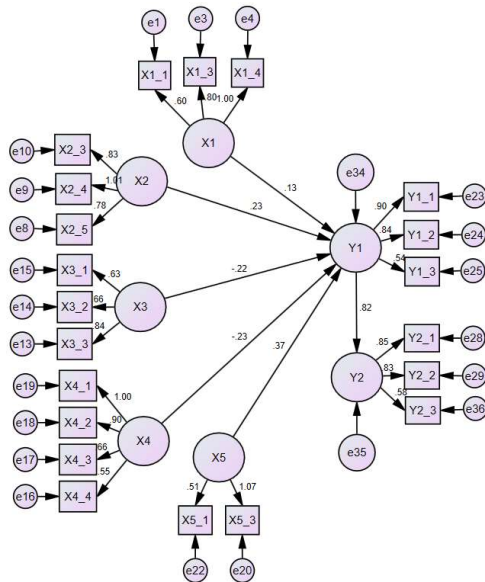
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Validity can ~~not only be seen through the loading factor and seen through the loading factor but also through~~ the Average Variance Extracted (AVE). An instrument is said to meet the validity test if it has an Average Variance Extracted (AVE) above 0.5. The results of the convergent validity test are presented in Table 14:

**Table 15.** Construct and Validity Test.

Variable	Indicator	Loading Factor	Criteria	AVE
Technology Advances (X1)	X1_1	0.626	0.5	0.326
	X1_2	0.220	0.5	
	X1_3	0.837	0.5	
	X1_4	0.956	0.5	
	X1_5	-0.306	0.5	
	X1_6	-0.058	0.5	
	X1_7	0.362	0.5	
Capital (X2)	X2_1	0.398	0.5	0.535
	X2_2	0.451	0.5	
	X2_3	0.839	0.5	
	X2_4	0.996	0.5	
	X2_5	0.786	0.5	
Farmer Age (X3)	X3_1	0.644	0.5	0.512
	X3_2	0.659	0.5	
	X3_3	0.829	0.5	
Education (X4)	X4_1	1.002	0.5	0.639
	X4_2	0.905	0.5	
	X4_3	0.658	0.5	
	X4_4	0.548	0.5	
Farming Experience (X5)	X5_1	0.732	0.5	0.425
	X5_2	0.445	0.5	
	X5_3	0.736	0.5	
Human Resources (Y1)	Y1_1	0.918	0.5	0.393
	Y1_2	0.813	0.5	
	Y1_3	0.573	0.5	
	Y1_4	-0.248	0.5	
	Y1_5	0.263	0.5	
Effectiveness of Agricultural Extension (Y2)	Y2_1	0.671	0.5	0.210
	Y2_2	0.668	0.5	
	Y2_3	0.567	0.5	
	Y2_4	-0.043	0.5	
	Y2_5	0.074	0.5	
	Y2_6	0.179	0.5	

Based on Table 15, it can be seen that overall, the indicators on the variables of Technological Advance (X1), Farming Experience (X5), Human Resource (Y1), and Effectiveness of Agricultural Extension (Y2) are declared valid in measuring the variables because they have fewer AVE values of 0.5. Cronbach's  $\alpha$  was used for reliability. This value reflects the reliability of all indicators in the model. The minimum value is 0.7. In addition to Cronbach's  $\alpha$ , composite reliability values are also used, interpreted the same as Cronbach's  $\alpha$  values.



**Figure 2.** Path Diagram After Invalid Indicator Drop.

The validity of each indicator in measuring the latent variable is indicated by the size of the loading factor (Standardized Weights). An indicator is declared valid if the loading factor of an indicator is positive and is greater than 0.5. The results of the validity test and the loading factor, the Average Variance Extracted (AVE) value, ~~is-are~~ obtained, which is presented in Table 15.

## 2. Construct Reliability Test

The construct reliability test was carried out using the ~~c~~Construct ~~r~~Reliability (CR) technique. The test criteria state that the coefficient of ~~c~~Construct ~~r~~Reliability (CR) and Cronbach's alpha 0.6 means that it can be stated that the construct is reliable or the indicator is consistent in measuring the variables it measures. The summary of the reliability test results is presented in Table 18.

Based on Table 18, it can be seen that the value of ~~c~~Construct ~~r~~Reliability and Cronbach's alpha on all variables is greater than 0.6. Thus, based on the calculation of ~~c~~Construct ~~r~~Reliability and Cronbach's alpha, the variable is declared reliable.

### 4.2.2. SEM Model Evaluation

#### 1. Model Fit Test

Testing the feasibility/fitness of the model (construct) is intended to determine whether the construct formed is appropriate (feasible) ~~or not~~. There are several test indices in SEM analysis, namely CMIN/DF, RMSEA, TLI, and CFI. The test criteria use CMIN/DF; if the CMIN/DF value is the cut-off value (2.00), then the construct formed is appropriate (feasible). The criteria using RMSEA state that if the RMSEA value is the cut-off value (0.08), then the construct formed is appropriate (feasible). The criteria using TLI and CFI state that if the goodness of fit value is the cut-off value (by 0.90), then the model formed is appropriate (feasible). The results of the model feasibility test are summarized in Table 18.

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Please revise the citations and make sure the Tables are mentioned in numerical order.

**Table 16.** Construct Validity Test After Drop Invalid Indicator.

Variable	Indicator	Loading Factor	Criteria	Description
Technology Advances (X1)	X1_1	0.600	0.5	Valid
	X1_3	0.805	0.5	Valid
	X1_4	0.999	0.5	Valid
Capital (X2)	X2_3	0.830	0.5	Valid
	X2_4	1.008	0.5	Valid
	X2_5	0.776	0.5	Valid
Farmer Age (X3)	X3_1	0.633	0.5	Valid
	X3_2	0.659	0.5	Valid
	X3_3	0.838	0.5	Valid
Education (X4)	X4_1	1.004	0.5	Valid
	X4_2	0.903	0.5	Valid
	X4_3	0.656	0.5	Valid
Farming Experience (X5)	X4_4	0.548	0.5	Valid
	X5_1	0.510	0.5	Valid
	X5_3	1.066	0.5	Valid
Human Resources (Y1)	Y1_1	0.900	0.5	Valid
	Y1_2	0.839	0.5	Valid
	Y1_3	0.544	0.5	Valid
Effectiveness of Agricultural Extension (Y2)	Y2_1	0.849	0.5	Valid
	Y2_2	0.835	0.5	Valid
	Y2_3	0.578	0.5	Valid

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**Table 17.** Validity Test After Drop Invalid Indicator.

Variable	AVE	Description
Technology Advances (X1)	0.669	Valid
Capital (X2)	0.769	Valid
Farmer Age (X3)	0.512	Valid
Education (X4)	0.639	Valid
Farming Experience (X5)	0.698	Valid
Human Resources (Y1)	0.757	Valid
Effectiveness of Agricultural Extension (Y2)	0.709	Valid

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**Table 18.** Reliability Test.

Technology Advances (X1)	0.814	0.807	Reliable
Capital (X2)	0.854	0.884	Reliable
Farmer Age (X3)	0.791	0.729	Reliable
Education (X4)	0.872	0.782	Reliable
Farming Experience (X5)	0.700	0.704	Reliable
Human Resources (Y1)	0.829	0.681	Reliable
Effectiveness of Agricultural Extension (Y2)	0.804	0.776	Reliable

Based on Table 18, it can be seen that the Construct Reliability and Cronbach's alpha values for all variables are more significant than 0.6. Thus, these variables are declared reliable based on the calculations of Construct Reliability and Cronbach's alpha.

**Table 19.** Goodness of Fit Model.

Index	Goodness of Fit	Cut Off Value	Description
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CMIN/DF	2.709	$\leq 2.00$	Poor of Fit
RMSEA	0.148	$\leq 0.08$	Poor of Fit
TLI	0.673	$\geq 0.90$	Poor of Fit
CFI	0.714	$\geq 0.90$	Poor of Fit

Based on the summary of the goodness of fit, it can be seen that the 4 (four) indicators, namely CMIN/DF, RMSEA, TLI, and CFI, do not meet the criteria. Thus, the SEM model that has been formed is declared not feasible.

Because the model is not feasible, modifications to the covariance index of the model are carried out to obtain a fit model. Basically, the structural equation modeling (SEM) model method in AMOS is a covariance-based SEM (CB-SEM) which needs to be accommodated by the covariance element. For example, the following is a path diagram after modification of the index covariance model (Figure 3):

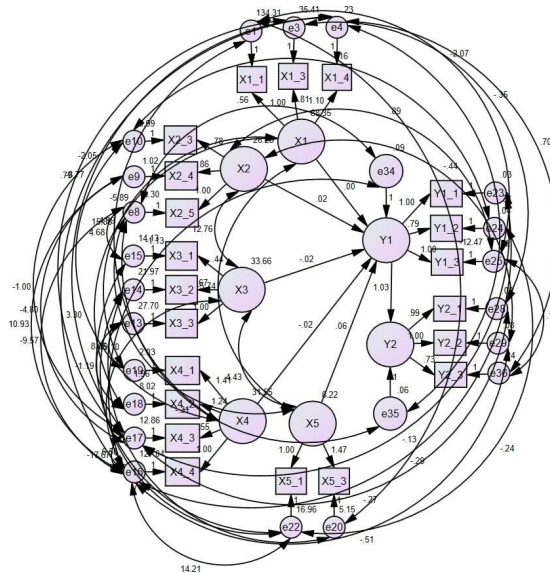


Figure 3. Path Diagram After Modifying the Covariance Index (Unstandardized).

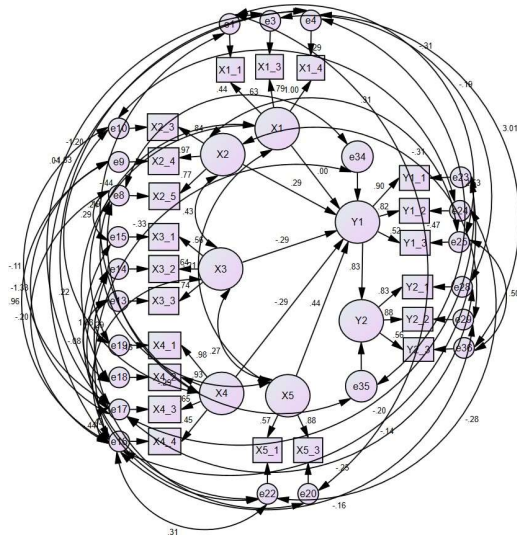


Figure 4. Path Diagram After Modification of Covariance Index (Standardized).

The results of the model feasibility test after modification of the covariance index have been summarized in Table 20. Based on the summary of the goodness of fit, it can be seen that the *four* indices, namely CMIN/DF, RMSEA, TLI, and CFI, all meet the criteria. ~~From~~ *Therefore, from* the results of the index criteria, it can be concluded that the SEM path diagram that has been formed is declared suitable for use.

Table 20. Goodness of Fit Model.

Indeks	Goodness of Fit	Cut Off Value	Description
CMIN/DF	1.400	≤2.00	<i>Good of Fit</i>
RMSEA	0.061	≤0.08	<i>Good of Fit</i>
TLI	0.945	≥0.90	<i>Good of Fit</i>
CFI	0.963	≥0.90	<i>Good of Fit</i>

2. Model Hypothesis Test

a. Direct Effect Test

Hypothesis testing is intended to test whether exogenous variables have a direct effect on endogenous variables. The significance test can be known through the *p*-value. The test criteria state that if the CR statistic is >1.96 or if the *p*-value is <0.05, *it is stated that* there is a significant effect of exogenous variables on endogenous variables. The analysis results can be seen in the summary in Table 20.

*The following can be inferred from* Based on Table 21, *it can be informed that:*

Table 21. Hypothesis test.

Hypothesis	Track	Standardized Coefficient	SE	CR	<i>p</i> -Value	Description
H1	X1→Y1	0.001	0.003	0.019	0.985	Not significant
H2	X2→Y1	0.289	0.006	3.255	0.001	Significant
H3	X3→Y1	-0.287	0.008	-2.389	0.017	Significant

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H4	X4→Y1	-0.294	0.005	-3.908	***	Significant
H5	X5→Y1	0.440	0.013	4.467	***	Significant
H6	Y1→Y2	0.828	0.114	9.027	***	Significant

Description: \*\*\*  $p$ -value < 0.001.

1. Testing the effect of Technological Progress (X1) on Human Resources (Y1) produces a CR statistic of 0.019 and a  $p$ -value of 0.985. The test results show that the  $p$ -value (0.985) > alpha 0.05, meaning no significant effect of technological progress on Human Resources.
2. The test of the effect of Capital (X2) on Human Resources (Y1) produces a  $p$ -value of 0.001. The test results show that the statistical  $p$ -value (0.001) < alpha 0.05, which means that there is a significant effect of Capital on Extension Issues. The positive coefficient of 0.289 indicates that Capital positively affects Human Resources. This means that the higher the Capital, the higher the Human Resources.
3. Testing the effect of Farmer Age (X3) on Human Resources (Y1) produces a CR statistic of -2389 with a  $p$ -value of 0.017. The test results show that the statistical  $p$ -value (0.017) < alpha 0.05, meaning that Farmer's Age has a significant effect on Human Resources. A negative coefficient of -0.287 indicates that Farmer Age harms Resources.
4. Humans Resources. This means that the higher the Farmer's Age, the lower the Human Resources.
5. The effect of Education (X4) on the Human Resources (Y1) test produces a CR statistic of -3.908 with a  $p$ -value of 0.001. The test results show that the  $p$ -value (0.001) < alpha 0.05, which means that Education has a significant effect on Human Resources. This means that the higher the Education, the higher the Human Resources.
6. Testing the effect of Farming Experience (X5) on Human Resources (Y1) resulted in a CR statistic of 4.467 with a  $p$ -value of 0.001. The test results show that the statistical  $p$ -value (0.001) < alpha 0.05 meaning means that Farming Experience has a significant effect on Human Resources. A positive coefficient of 0.440 indicates that the Farming Experience positively affects Human Resources. This means that the better the Farming Experience, the better the Human Resources.
7. The test of the influence of Human Resources (Y1) on the Effectiveness of Agricultural Extension (Y2) resulted in a CR statistic of 9.027 and a  $p$ -value of 0.001. The test results show that the statistical  $p$ -value (0.001) < alpha 0.05, which means that Human Resources has a significant influence on the Effectiveness of Agricultural Extension. The positive coefficient of 0.828 indicates that Human Resources positively affect the Effectiveness of Agricultural Extension. This means that better Human Resources can increase the Effectiveness of Agricultural Extension.

#### b. Indirect Effect Test

Hypothesis testing is intended to test whether exogenous variables have an indirect effect on endogenous variables through mediating variables (intervening). Mediation testing can be known through the Sobel test. The test criteria state that if the  $z$  statistic >  $z$  table (1.96) or  $p$ -value < alpha 0.05, it is stated that there is a significant indirect effect of exogenous variables on endogenous variables through mediating variables (intervening). The analysis results can be seen in the summary in Table 21.

Based on Table 22, it can be stated that the test of the effect of Capital (X2), Farmer's Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2) through the mediation of Human Resources (Y1) produces a statistical  $p$ -value < alpha 5% which means that there is an indirect effect of Capital Progress (X2), Farmer Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2) through the mediation of Human Resources (Y1) ~~or by~~. In other words, the Human Resources variable (Y1) can mediate the effect of

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Capital (X2), Farmer Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2).

**Table 22.** Hypothesis test.

Hypothesis	Track	Indirect Coefficient	Std. Error	p-Value	Description
H7	X1→Y1→Y2	0.001	0.002	0.739	Not Significant
H8	X2→Y1→Y2	0.239	0.033	0.000	Not Significant
H9	X3→Y1→Y2	-0.238	0.034	0.000	Not Significant
H10	X4→Y1→Y2	-0.243	0.034	0.000	Not Significant
H11	X5→Y1→Y2	0.364	0.051	0.000	Not Significant

While the test of the effect of **T**echnological **P**rogress (X1) on the **E**ffectiveness of **A**gricultural **E**xtension (Y2) through the mediation of **H**uman **R**esources (Y1) resulted in a statistical  $p$ -value (0.985) > alpha 5%, which means that there is no indirect effect of **T**echnological **P**rogress (X1) on the **E**ffectiveness of **A**griculture **E**xtension-**A**griculture (Y2) through the mediation of Human Resources (Y1) or, in other words, the Human Resources variable (Y1) is not able to mediate the effect of Technological Progress (X1) on the Effectiveness of Agricultural Extension (Y2).

### 3. Convert Path Diagrams to Structural Equations

The conversion of path diagrams into structural equations is intended to find out how the shape of the influence between constructs is based on their mathematical equations. Based on the attachment, it can be seen that the mathematical models formed are [as follows](#):

$$\text{Equality 1: } Y_1 = 0.001 X_1 + 0.239 X_2 - 0.2873 X_3 - 0.294 X_4 + 0.440 X_5$$

$$\text{Equality 2: } Y_2 = 0.828 Y_1$$

## 5. Conclusions

1. The factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi, are farming capital, farmer's age, education, farming experience, and human resources.
2. The influence of these factors on the effectiveness of agricultural extension in Baubau city is as follows: if farming capital is high, human resources can be increased. Moreover, the higher the farmers' age, the lower the need for human resources. It was additionally noted that higher education of farmers contributes to improvement in human resources, and the increased experience in farming corresponded to an increase in human resources. Hence, increasing human resources will increase the effectiveness of agricultural extension.
3. Extension issues and materials [affect the effectiveness of agricultural extension in Baubau City, where are factors that affect the effectiveness of agricultural extension in Baubau City, where in this case](#) the influence can be categorized as **C**good or **I**nfluential.
4. Farming capital is land area, labor, use of fertilizers, pesticides, ~~and use of~~ agricultural tools, and machines. There is an influence of farming capital variables on the effectiveness of agricultural extension. According to research by (Kusnadi, N., et al., 2011), the wider the land owned, the higher the farming income.

Human resources describe the knowledge possessed by education, training, experience, and information received. Activities that must be carried out by agricultural extension workers in the city of Baubau are optimizing socialization and training related to agricultural land, for example, making demonstration plots so that farmers can see

directly and have no doubts about the theory provided. In addition, one way to achieve extension effectiveness is to increase human resources (agricultural extension workers) as program implementers so that the programs that have been designed can be implemented. The lack of extension workers resulted in a significant workload for each extension agent because the extension area assisted by the extension worker was large, and the number of assisted farmer groups was significant. Currently, there are 44,890 agricultural extension workers. These agricultural extension workers serve 71,479 villages, so they still need as many as 26,589 agricultural extension workers (agricultural extension center Indonesia, 2022). Many agricultural extension workers can supervise the assistance funds given to farmers so that they are appropriately managed to realize farmer welfare, distribute farmers' knowledge about the latest agricultural technologies, and develop rice farming. For example, they help to provide production facilities, distribute fertilizer and seed aid, and provide cooperative institutions to assist farmers in procuring farming capital. [Agricultural-In addition, agricultural](#) extension agents have roles as facilitators, communicators, motivators, and consultants. Indonesian [G](#)overnment [R](#)egulation no. 16 of 2006 concerning the Agricultural Extension System, one of the critical points in this law is the need to build extension institutions in the regions at the provincial and district/city levels.

Age affects productivity level, making decisions, and receiving information. The dominant number of respondents is 46–55 years old. This shows that the productive age in this study is in the age range of 46–55 years. At a productive age, it will be easier to get new ideas and quickly understand the use of technology. Information obtained by farmers, especially from agricultural extension workers, will increase their paddy rice production. This follows the research results (Hasyim, 2006) that those who work at productive age will be better and maximal than non-productive age.

Education is influential in taking action in making programs for agricultural development. The low level of education in this study indicates that the quality of human resources needs to be improved in efforts to develop farming performance. Improving the skills and knowledge of farming will encourage the achievement of planned production targets. According to (Lubis, 2000), having a high level of education will be relatively faster in implementing technology and innovation adoption; having low education [is](#) usually [makes it](#) challenging to implement innovation adoption quickly.

The indicators included in the Technological Progress variable are the use of transplanters, the use of indo combine harvesters, the use of KATAM (planting season prediction), the use of KATAM (fertilizer dose), the use of drones (irrigation sensors/measuring soil pH), the use of expert system applications, and the use [of](#) social media. The average variable of [T](#)echnological [P](#)rogress is 24.91, with an achievement level of 64.53% in the [L](#)ess [g](#)ood category. Farmers should optimize information technology, such as using the internet to find the latest information. Advances in technology play a role in supporting the availability of relevant and timely agricultural information. Information on the results of research and technological innovations in agriculture helps efforts to increase the production of agricultural commodities. According to research results (Prayoga, K. 2017), the use of technology is considered less optimized by the Indonesian Ministry of Agriculture. Extension activities that utilize social media must continue to be optimized because the number of users continues to increase.

5. Matters related to extension include the number of assisted farmers, the distance to extension locations, the amount of agricultural extension work time, extension media, methods, frequency, materials, and the instructor's experience. Extension media has the most significant contribution to the problem variables of extension agents. Through extension media, it can attract farmers to attend training. Agricultural extension agents use various media that are adjusted to the farmer's [age](#). [Then—then](#), followed by indicators of instructor experience, frequency of extension, amount of working time of agricultural extension workers, extension methods, and

extension materials. Extension material is everything that extension agents propose to farmers, including the suitability of the material with the needs and benefits. Based on the assessment of the extension workers in the field, it was assessed that the absorption of the material and the most suitable application were in fertilization, harvesting, and post-harvest materials. This is followed by good planting time, nurseries, planting, nursery, and maintenance indicators. Agriculture is a critical sector in national development. In national development, it is necessary to support human resources, who have the capacity, who can produce solutions to answer the challenges. ~~It~~ **Therefore, it** is necessary to carry out an agricultural extension to develop agriculture. Agricultural extension is also one of the efforts to produce quality human resources. Agricultural extension is an empowerment effort or an effort to motivate and change the behavior of farmers and their families so that they have the will and can solve the problems they face in doing their farming. Therefore the role of extension is crucial and becomes a strategic matter in national development.

The Ministry of Agriculture is targeting Indonesia to become a world food barn by 2045. To achieve this mission, the Ministry of Agriculture places farmers as the main actors in agricultural development. ~~Attention~~ **Therefore, attention** is needed ~~to~~ **from** farmers through agricultural extension workers. In general, the knowledge farmers have to lack in renewal, and the existence of agricultural extension can help agricultural development.

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**Conflicts of Interest:**

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## Article

# Effectiveness of Agricultural Extension on Paddy Rice Farmer's Baubau City, Southeast Sulawesi, Indonesia

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**Abstract:** Agricultural extension workers play an essential role in the productivity of agricultural systems. Based on the actual conditions in the field, it can be seen that the level of extension services still needs to be higher due to a lack of human resources in the field of extension services. This research was conducted to determine the effectiveness of agricultural extension services and the factors that influence the effectiveness of agricultural extension to farmers in Baubau City, Indonesia. The analytical method includes exogenous latent variables: human resources, technological progress, farming capital, farmer age, education, and farming experience. The effectiveness of agricultural extension is used as an endogenous latent variable. The research sample consisted of 110 rice farmers in Baubau City, and the Slovin formula was used to calculate the sample. The data collection for this research was carried out by distributing questionnaires to respondents, in-depth interviews, and direct observation in the city of Baubau. Using the AMOS application, quantitative analysis was carried out through structural equation modeling (SEM). The study results show that: (1) The factors that influence the effectiveness of agricultural extension in Baubau City are farming capital, farmer age, education, farming experience, and human resources, and (2) the influence of these factors on the effectiveness of agricultural extension is as follows: if the farming capital is high, human resources can be increased. In addition, the higher the farmer's age, the lower the need for human resources. It is also noted that higher farmer education contributes to increased human capital, and increased experience in farming is associated with increased human capital. Thus, an increase in human resources will increase the effectiveness of agricultural extension. Significant factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi, are farming capital, farmer age, education, farming experience, and human resources.

**Keywords:** effectiveness; agricultural extension; paddy rice; Indonesia

## 1. Introduction

Southeast Sulawesi has sufficient competence to support the Indonesian food development program because of the high availability of land and the potential for land productivity. Based on data on rice field areas in the rice planting season, Southeast Sulawesi has an area of 82,382 ha of raw rice fields (Central Bureau of Statistics, 2020). The size of rice fields in Baubau city is 1375 ha; this indicates that the agricultural sector is one of the sectors with high priority in Baubau City (Abadi, 2019) [1]. However, rice produc-

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tion domestically is dominated by lowland rice production. Hence, the extension workers should increase their effectiveness in extension services for the lowland rice farmers.

Extension workers can contribute to the regulatory process by providing expertise and content for proposed, adopted, and restructured agriculture-related regulations. As extension agents directly interact with clients in the field, they can communicate the needs of stakeholder groups. Therefore, they should be involved in the regulatory process. An evidence-based approach involving input from target groups and practitioners seems to be an inevitable strategy for the success of a sustainable land grant project (Fouladkhah, A., 2017) [8].

Extension agents are one of the supporting elements in the agribusiness sub-system. In principle, the agricultural extension supports all sub-systems in agribusiness. Specifically, in this study, extension workers play a role in supporting to increase the productivity of lowland rice. Hence, to increase the productivity of rice farming, extension workers are needed. The role of the extension worker is to provide guidance and knowledge in the form of the latest information or innovation to improve their farming system, ultimately increasing their crop yields. In addition, the purpose of agricultural extension is to change the behavior of farmers, for instance, their ability to adapt to situations and conditions that keep changing. Thus, they can improve their farming systems, increase production, and reduce the possibility of crop failure. While simultaneously improving their living standards.

However, there are some significant issues, such as a lack of active participation from agricultural extension workers and the difference in the extension worker-to-farmer ratio, leading to fewer extension workers for many farmers. This problem causes the workload of each extension worker to be quite heavy because either the extension area or the number of assisted farmer groups is quite large. Therefore, the current condition is forcing agricultural extension workers to work hard despite a limited number of workers, and they must be able to perform optimally to increase their work productivity.

The role of extension workers can increase sustainable agricultural productivity and food security (Olorunfemi, T. O., et al. 2020) [16]. One of the most crucial things is to ensure that using the agricultural extension and education programs has a positive impact on farmers (Salehi, M., et al. 2021) [19]. Consequently, the crucial role of extension workers is to create awareness among farmers to apply guidelines for food needs (Fiaz, S., et al. 2018) [7]. The findings of the study (Jamil, M.H., 2017) [11] show that the development of agricultural extension workers has a positive effect on the agricultural extension program.

Agricultural extension programs and policies can play an important role in achieving production (Mahir, M. E. A. E., & Abdelaziz, H. H. 2011) [14]. Additionally, this agricultural policy was discussed by (Baloch, M. A., & Thapa, G. B, 2019) [4], who said that agricultural policies must be implemented effectively to address the needs of farmers and the problems they face. One example is that the Government of Pakistan has adopted a policy of providing agricultural services to promote agricultural production by disseminating appropriate knowledge and technology to farmers (Baloch, M. A., & Thapa, G. B., 2018) [5].

The agricultural, industrial revolution has had an impact on efficiency and productivity in agricultural extension services in the agricultural sector (Nyarko, D. A., & Kozári, J. 2021) [15]. Furthermore, the effects of community-based strategies on food security have a positive impact (Wellard, K., et al. 2013) [23]. Therefore, it is suggested that extension services provide Information and Communication Technology training (ICT) for agricultural extension workers to improve extension services. In addition, according to (Umbara, D.S., Sulistyowati, L., Noor, T.I., and Setiawan, 2021) [22], the dissemination of agricultural technology information by utilizing the internet network is very helpful for agricultural extension workers in carrying out their main tasks. Information and Communication Technology can also facilitate the delivery of information and knowledge sharing between farmers, extension workers, and other stakeholders (An-

nor-Frempong, F., et al. (2006) [3]. The article (Haghighi, N. F., et al. 2008) [9] stated the perspective on the application of Information and Communication Technology in agriculture and some issues with using ICT in organizations; however, this is in contrast to (Diaz, R. T., et al. (2021) [6]). Furthermore, it was found that extension services in the study area are not sufficient when farmers face difficulties.

From the literature, it can be gathered that an agricultural extension worker plays an essential role in the productivity of a farming system. Based on the actual conditions in the field, it can be acknowledged that the extension service rate is low due to a lack of human resources in the extension field. Therefore, to solve the problems that arose from the current predicament, this study was conducted to determine the effectiveness of agricultural extension services. The primary purpose of this study is to determine the factors that influence the effectiveness of agricultural extension services to lowland rice farmers in Baubau City and to find out how these factors can affect the effectiveness of agricultural extension services.

## 2. Research Hypothesis

- a. It is suspected that the variables of technological progress (X1), farming capital (X2), farmer age (X3), farmer education (X4), and farmer experience (X5) have a significant relationship and have a direct influence on human resources (Y1).
- b. Allegedly, the variables of technological progress (X1), farming capital (X2), farmer age (X3), farmer education (X4), and farmer experience (X5) have a significant relationship and give an indirect effect but are thought to influence the variable effectiveness of agricultural extension (Y2).
- c. It is suspected that the variable human resources (Y1) have a significant relationship with the variable effectiveness of agricultural extension (Y2).

## 3. Research Methods

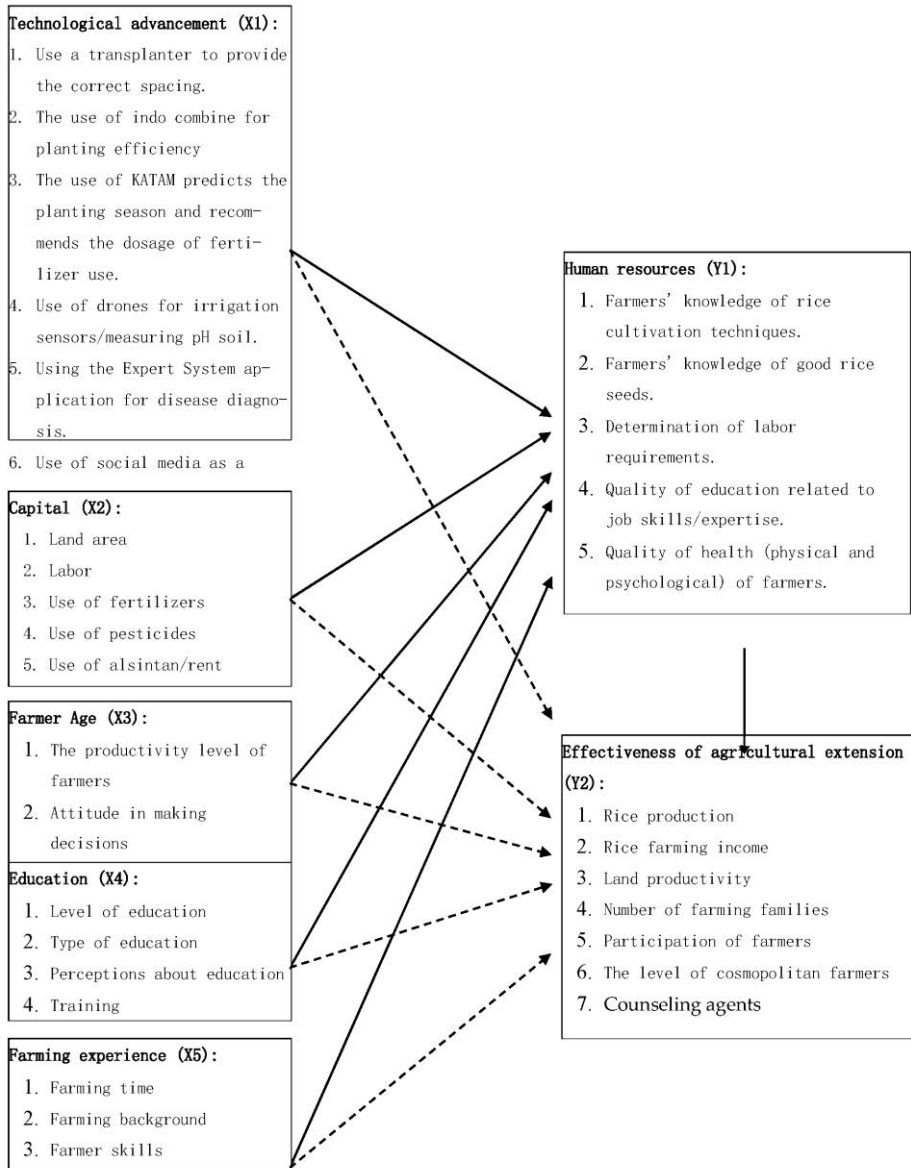
### 3.1. Place and Time

This research is located in Baubau City, Southeast Sulawesi, and was carried out from January–July 2022.

### 3.2. Data Collection

Data collection techniques in this study were carried out using interviews, questionnaires, and observation. The measured variable is technological progress (X1), farming capital (X2), farmer age (X3) farmer education (X4), farmer experience (X5) human resources (Y1), and effectiveness of agricultural extension (Y2) (Figure 1).

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**Figure 1.** Constructs, Indicator, and Code Variable.

### 3.3. Population and Sample

The population of this study was all farmers in Baubau City; 1257 people (Data from the Baubau City Agriculture Office, 2021). In addition, the population of agricultural extension workers in Baubau City is 26.

Simple random sampling was used. The sample measurements were calculated using the Slovin formula:

$$n = \frac{N}{1+N(E)^2} \quad (1)$$

$$n_i = \frac{N_i}{N} \times n \quad (2)$$

Description:

$n$  = Number of samples

$N$  = Population

$e^2$  = Precession set (5%)

$n_i$  = Standard sample size  $i$

$N_i$  = Population size  $i$

The sample size was determined with an error rate of 10% or based on the desired level of confidence (precision) of 90%, and the sample size based on the Slovin formula amounted to 110 respondents. The study sample for extension agents was based on the population of extension workers in Baubau City, which amounted to 26 personnel, from which 30% of the total was sampled, resulting in 8 extension workers.

The data collection techniques used to carry out the study were questionnaires, direct interviews, and observations to determine the characteristics and behavior of the research object. The data obtained were analyzed descriptively and quantitatively using the SEM method (*structural equation modeling*)—Software AMOS (*Analysis of Moment Structure*).

### 3.4. Analysis Method

#### 3.4.1. Descriptive Statistical Analysis

Descriptive statistical data was interpreted using the TCR criteria (Respondent Achievement Level), and the following formula was used:

$$TCR = \frac{Mean}{Skor Max} \times 100 \quad (3)$$

The percentage formula used in this study is as follows:

$$P = \frac{f}{N} \times 100\% \quad (4)$$

Description:

$P$  = Percentage Number

$f$  = The number of frequencies of each answer that has become the respondent's choice

$N$  = The number of frequencies or the number of individuals

To determine the level of criteria with a descriptive analysis of the percentage, which is divided into five indicators, namely,

#### 3.4.2. Quantitative Analysis

SEM (structural equation modeling) analysis in this study was carried out using AMOS 24 software to answer problems related to variables that influence the effectiveness of agricultural extension in Baubau City.

The formula used in this study is as follows:

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$$\text{Equality 1 } Y1 = \beta_0 + \beta_1X_2 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + e \quad (5)$$

$$\text{Equality 2 } Y1 = \beta_0 + \beta_1Y1 + e \quad (6)$$

Description:

Y1 = Human Resources

Y2 = Effectiveness of Agricultural Extension

$\beta$  = Constant

E = Standard error

X1 = Technology advances

X2 = Capital

X3 = Farmer Age

X4 = Education

X5 = Farming experience

#### 4. Results

The demographic characteristic of the farming communities involves 96% of male and 4% of female farmers (Table 1). There is a division of household tasks between husband and wife. Based on in-depth interviews with several respondents, they stated that working in the fields is the husband's duty while the wife takes care of the household. Results based on age indicated that 34% of farmers were 36–45 years old, and 6% were under 25 years old. Farmers who work at the productive age will be better and more optimal than non-productive age (Productive age 15–64). In addition, age can also be used as a benchmark to see the activities of farmers at work (Hasyim, 2006) [10].

**Table 1.** TCR criteria.

No.	Scale Range	TCR
1	90–100%	Very good
2	80–89.99%	Good
3	65–79.99%	Enough
4	55–64.99%	Not good
5	0–54.99%	Not good

It was revealed that the respondents with non-educational levels were 10%. Respondents with their last education at the elementary, junior, and senior high school levels were 41%, 13%, and 31%, respectively; at the tertiary level added, 5% (Soehardjo and Patong, D. 1999) [20]. Higher levels of education result in a more straightforward implementation of innovations. Farmer education is not only oriented toward increasing production but the social life of the farming community. On the other hand, farmers with a high education level will be relatively faster in implementing technology adoption and innovation. Farmers who have low education may have difficulty implementing the adoption of innovation quickly. The level of education possessed by farmers depicts the knowledge and insight a farmer has in applying technology and innovation to increase farming activities (Lubis, 2000) [12,13]. Demographic characteristics based on the main occupation of farmers show that farming is the respondents' main occupation, totaling 97%. In comparison, the remaining 3% of the main occupation are civil servants, and farming is their side employment.

Based on the study results, farmers with a land area of less than 1 ha was 16%, 1 to 5 ha was 82%, and more than 5 ha was 2%. The number of farmers that own their land is 93%, and 6% of the farmers are tenants, while the remaining 1% amounts to farmers being landowners and tenants. It is important to note that more land ownership means more potential to increase productivity and efficiency by adopting modern technology.

Land tenure is vital in spreading and adopting modern agricultural practices among farming communities (Aldosari et al., 2019) [2].

Next, the results show that a significant percentage of the farmers had more than 10 years of experience resulting in a total of 76%, followed by farmers with 5–10 years with 14% and farmers with less than 5 years of experience with 10%. The farming experience significantly affects farming activities, as evident in the production results. Farmers who have been farming for a long time have high knowledge, experience, and skills in running a farm. Farming experience is divided into three categories, namely less experienced (<5 years), moderately experienced (5–10 years), and experienced (10 years). Farmers have different farming experiences or lengths of farming (Soehardjo and Patong, D. 1999) [20].

Furthermore, it can be seen that respondents have chosen “hereditary” as their farming background surmounting 90% or as many as 99 people from the total number of respondents. None of the respondents chose “has the farming ability” as a farming background; in this case, the respondent’s last education determines the farming background. The remaining percentages recorded for farming backgrounds are “economic need, availability of adequate land, the ability to farm and willingness based on agriculture as a promising field.” The percentages for each are as follows: 3%, 4%, 1%, and 2%, respectively.

An extension work area is a place or an area that becomes the territory of authority in carrying out its duties as an extension worker, whether within the ward, sub-district, district/city, or wider area. The extension worker’s work area can affect productivity in carrying out his duties. Meanwhile, the distance from the working area is the distance from the instructor’s residence to the extension location. In Table 2, it can be seen that each respondent has a different work area and distance from the work area. The distance from the farthest working area is 21 km, and the closest is 5 km.

**Table 2.** Percentage Descriptive Analysis Criteria.

Number	Percentage	Criteria
1.	0–20%	Very low
2.	21–40%	Low
3.	41–60%	Moderate
4.	61–80%	High
5.	81–100%	Very high

**Table 3.** Demographic Characteristics Data of Rice Farmers in Baubau City, Southeast Sulawesi.

Gender	n	%	Age (Years)	n	%
Male	106	96	Less than 25	7	6
Female	4	4	25–35	25	23
Total	110	100	36–45	17	15
			46–55	37	34
			More than 55	24	22
			Total	110	100
Last Education	n	%	Main Occupation	n	%
No Education	11	10	Farmers	107	97
Elementary school	45	41	Other than farmers (PNS)	3	3
Junior High school	14	13	Total	110	100
Senior High school	34	31			
Higher Education	6	5			
Total	110	100			
Land Area (ha)	n	%	Land Ownership Status	n	%
Less than 1	18	16	Owner	102	93

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1–5	90	82	Tenant/tenant	7	6
More than 5	2	2	Owner and tenant	1	1
Total	110	100	Total	110	100
Time of farming (years)	n	%	Farming background	n	%
Less than 5	11	10	Hereditary	99	90
5–10	15	14	Economic needs	3	3
More than 10	84	76	Availability of adequate land	5	4
Total	110	100	Has the ability to farm	1	1
			Willingness from within because farming is a promising field	2	2
			Total	110	100

n = Total; % = Percentage.

**Table 4.** Data on Demographic Characteristics of Agricultural Extension Respondents based on Working Area and Distance from Work Area Baubau City, Southeast Sulawesi.

No.	Working Area	Distance from Working Area (Km)
1	Lea-lea Subdistrict	15
2	Tampuna Subdistrict	21
3	Liabuku Subdistrict	9
4	Bungi Subdistrict and Lea-Lea Subdistrict	10
5	Ngkaring-ngkaring Subdistrict	5
6	Waliabuku Subdistrict	13
7	Lowu-lowu	15
8	Subdistrict Kalia-lia	15

Duration as an Extension refers to this study; each respondent has been an extension worker from the time of appointment until this research is carried out, expressed in units of years. The length of time as an extension worker determines the level of experience each agent has. In this case, the duration of an extension worker is divided into three categories: less experienced (<5 years), moderately experienced (5–10 years), and experienced (>10 years). Table 5 shows the highest percentage (63%); five out of eight agents have more than 10 years of experience as an extension worker. While extension agents have moderate experience, equal to two out of eight (25%), and extension agents with less than five years of experience totaled one out of eight (12%).

**Table 5.** Data on Demographic Characteristics of Agricultural Instructor Respondents in Baubau City, Southeast Sulawesi.

Duration as an Extension (Years)	n	%	Status	n	%
Less than 5	1	12	Civil Servants	5	63
5–10	2	25	Honorary Employee	1	12
More than 10	5	63	THL-TBPL	2	25
Total	8	100	Total	8	100

THL-TBPL: Agricultural extension workers.

The status of the extension workers refers to the position an agent holds, which corresponds to their employment descriptions. Table 5 displays that of the eight surveyed workers, 63% (five agents) are Civil Servants, 12% are honorary employees, and 25% are THL-TBPL position holders.

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#### 4.1. Descriptive Statistical Analysis

##### 4.1.1. Technological Progress Variables

Based on Table 6, the average Technological Progress Variable is 24.91, with a respondent's level of achievement, 64.5%, which favors the Not good category. Thus, it can be said that technological advances have less than the desired effect on agricultural extension. The indicator with the lowest TCR value in the table below is the use of *indo combine harvester*, with an average score of 23.68, gravitating to the Not good category. While the indicator with the lowest average score is for the use of *drones* (irrigation sensor/measuring soil pH) which is 12.94, and the TCR value is 80.9 falling into the Good category.

**Table 6.** Frequency Distribution of Technological Progress Variables (X1) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming Businesses in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Use of transplanter	110	52	27.22	52.3	Not good
2	Use of <i>indo combine harvester</i>	110	52	23.68	45.5	Not good
3	Use of KATAM (predicted planting season)	110	50	38.22	76.4	Enough
4	Use of KATAM (fertilizer dose)	110	50	35.51	71.02	Enough
5	Use of <i>drones</i> (irrigation sensor/measuring soil pH)	110	16	12.94	80.9	Good
6	Use of expert system applications	110	17	13.35	78.5	Enough
7	Use of social media	110	50	23.57	47.1	Not good
	Average			24.91	64.53	Not good

The impact of the extension approach on the use of technology and food security was found to be positive (Wellard, K., et al. (2013) [23]). Dissemination of agricultural technology information is helpful for agricultural extension workers in carrying out their main tasks. (Umbara, D.S et al., 2021) [22]. In recent years, the agricultural industry has experienced an increase in the application of Information and Communication Technology globally. This new revolution is said to have had an impact on efficiency and productivity in agricultural extension services in the agricultural sector (Daniel et al., 2021) [15]. Furthermore, Information and Communication Technology can be used in a cost-effective and practical way to facilitate information sharing and knowledge sharing among farmers, extension workers, and other stakeholders (Joseph Kwarteng, 2006) [3]. This new revolution is said to have impacted efficiency and productivity in agricultural extension services in the agricultural sector (Daniel Ayisi Nyarko and József Kozári, 2021) [15] and attitudes towards the application of Information and Communication Technology in agricultural extension, the extent of the problems faced by extension organizations to the use of ICT, knowledge of ICT, and personal characteristics (Negin Fallah Haghighi et al., 2008) [9].

##### 4.1.2. Farming Capital Variable

Based on Table 7, the average Farming Capital variable is 38.16 with a TCR value of 68.12, portraying the sufficiency of the indicator. In other words, the influence of the farming capital variable on the effectiveness of agricultural extension is satisfactory. On the other hand, the labor indicator has the lowest TCR value of 45.1, and the average score is 23.03, which is the indicator value with the lowest score; hence, it is portrayed in the Not good category. In comparison, the indicator with the highest TCR value is the use of fertilizer, which is 82.4 with an average value of 42.85 and is present in the Good category.

**Table 7.** Frequency Distribution of Farming Capital Variables (X2) in Research on Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Land area	110	54	39.60	73.3	Sufficient
2	Labor	110	51	23.03	45.1	Not good
3	Fertilizer use	110	52	42.85	82.4	Good
4	Pesticide use	110	56	42.36	75.7	Enough
5	Agricultural machinery use	110	67	42.98	64.1	Poor
Average				38.16	68.12	Enough

#### 4.1.3. Farmer Age Variable

In Table 8, the average Farmer Age variable is 38.73 with a TCR value of 67.93 and is in the adequate category. Therefore, it can be stated that the influence of the age variable of farmers on the effectiveness of agricultural extension is reasonably influential. The attitude indicator in decision-making has the highest average value of 41.33 and the TCR value of 72.5; hence, classified into the Enough Category. While the indicator with the lowest average value, namely the acceptance of information, is 36.05 with a TCR value of 63.2, which falls in the designated category of Poor.

**Table 8.** Frequency Distribution of Farmer Age Variable (X3) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Rice Field Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Farmer Productivity Level	110	57	38.82	68.1	Enough
2	Attitude in Making Decisions	110	57	41.33	72.5	Enough
3	Acceptance of Information	110	57	36.05	63.2	Low
Average				38.73	67.93	Adequate

#### 4.1.4. Farmer Education Variable

In Table 9, the average Farmer Education variable is 14.56 with a TCR value of 30.20 which is Not good. In other terms, the influence of farmers' education on the effectiveness of agricultural extension is not present. The Perception indicator of Education has the lowest average score of 13.95 and the TCR value of 25.8, indicating that the variable component is in a Not good category. Likewise, the other three indicators also fall into the Not good category.

**Table 9.** Frequency Distribution of Farmer Education Variables (X4) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Education Level	110	57	18.25	32.01	Not good
2	Type of Education	110	51	15.58	30.6	Not good
3	Perception about Education	110	54	13.95	25.8	Not good
4	Training	110	58	18.48	32.4	Not good
Average				14.56	30.20	Not good

#### 4.1.5. Farming Experience Variable

Referring to Table 10, the average Farming Experience variable was 37.45 with a TCR value of 64.8, indicating that the experience variable categorizes in the Poor section. From the three indicators, it shows that the farming background indicator has an average

value of 28.13 and a TCR value of 50.2 while being categorized as Not good; however, the indicators of the farming time and farmer skills are in the Enough category with TCR values of 67.5 and 76.7, respectively.

**Table 10.** Frequency Distribution of Farming Experience Variables (X5) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Farming time	110	60	40.51	67.5	Enough
2	Farming background	110	56	28.13	50.2	Not good
3	Farmers skills	110	57	43.72	76.7	Enough
Average				37.45	64.8	Poor

#### 4.1.6. Extension Problem Variables

Table 11 shows that the average variable of Extension Problems is 35.28 with a TCR value of 83.26, indicating that these variables are in a Good category. The indicator of the number of assisted farmers has an average value of 44.00 and shows a TCR value of 78.6 which means it is in the Enough category. The extension media indicator has an average value of 25.63. It shows its TCR value of 91.5, presenting as Very Good, followed by indicators of the experience of the extension worker, the frequency of extension, the amount of working time of the agricultural instructor, the extension method, and the extension material, which were all in the Good category. Finally, the indicator of the distance of the extension location is in the Enough category.

**Table 11.** Frequency Distribution of Extension Problems Variables (X6) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Number of Assisted Farmers	8	56	44.00	78.6	Enough
2	Distance of Extension Locations	8	21	15.00	71.4	Enough
3	Total Working Time of Agricultural Instructor	8	23	19.88	86.4	Good
4	Extension Media	8	28	25.63	91.5	Very Good
5	Extension Methods	8	31	25.38	81.9	Good
6	Extension Frequency	8	44	38.13	86.7	Good
7	Extension Materials	8	46	37.13	80.7	Good
8	Extension Experience	8	53	47.13	88.9	Good
Average				35.28	83.26	Good

#### 4.1.7. Extension Materials

Based on Table 12, the average of the Extension Materials variable is 3.53, with a TCR value of 83.94, indicating that this variable is in the Good category. The fertilization, harvesting, and post-harvest indicators have the same average value of 3.63 and the same TCR value of 90.75, indicating that the three indicators are in the Very Good category. They are then followed by indicators of good planting time, seed sowing, and planting, which all have the same average value of 3.50 and the same TCR value of 87.5, indicating that the variable components are in the Good category. At the same time, the nursery and maintenance indicators are in the Enough category.

**Table 12.** Frequency Distribution of Extension Material Variables (X7) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Good Planting Time	8	4	3.50	87.5	Good
2	Tillage	8	5	4.00	80	Good
3	Nurseries	8	4	2.63	65.75	Enough
4	Nurseries	8	4	3.50	87.5	Good
5	Planting	8	4	3.50	87.5	Good
6	Maintenance	8	5	3.75	75	Enough
7	Fertilizing	8	4	3.63	90.75	Very good
8	Harvesting	8	4	3.63	90.75	Very good
9	Post-harvest	8	4	3.63	90.75	Very good
Average				3.53	83.94	Good

#### 4.1.8. Human Resources

Table 13 shows that the average score of the Human Resources variable is 4.20, and the TCR value is 84.12, hence, summarizing the variable in the Good category. Of the five indicators below, one indicator is in the Not good category, namely the quality of education related to work skills/expertise, with an average value of 1.80 and a TCR value of 36. In contrast, the other four indicators are in the Very good category.

**Table 13.** Frequency Distribution of Human Resources Variables (Y1) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Farmers' knowledge of rice cultivation techniques	110	5	4.90	98	Very good
2	Farmers' knowledge of good rice seeds	110	5	4.92	98.4	Very good
3	Determination of labor needs	110	5	4.65	93	Very good
4	Quality of education related to Skills/work skills	110	5	1.80	36	Not good
5	Health quality (physical and psychological) of farmers	110	5	4.76	95.2	Very good
Average				4.20	84.12	Good

#### 4.1.9. Effectiveness of Agricultural Extension

The results of Table 14 show that the average variable of Extension Effectiveness Agriculture is 3.73 and has a TCR value of 74.76 which means that the variable is in the Fair category. This Agricultural Extension Effectiveness variable has six indicators, of which one indicator is in the Not good category: the number of farming families. Then two indicators are in the Very good category: farmer participation and the level of cosmopolitan farmers with TCR values of 97 and 92.6. They were then followed by indicators of rice farming income in the Good category and rice production and land productivity in the Enough category.

**Table 14.** Frequency Distribution of Extension Problems Variables (X6) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Rice Field Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Rice Production	110	5	3.65	73	Enough
2	Rice Farming Income	110	5	4.20	84	Good
3	Land Productivity	110	5	3.65	73	Enough
4	Number of Farmer Families	110	5	1.45	29	Not good

5	Farmer Participation	110	5	4.85	97	Very good
6	Cosmopolitan Level Farmers	110	5	4.63	92.6	Very good
Average				3.73	74.76	Fair

4.2. Analysis of Structural Equation Modeling (SEM)

4.2.1. Evaluation of Measurement Model

This research model consists of 7 (seven) constructs, including the variables of Technological Progress (X1), Capital (X2), Farmer Age (X3), Education (X4), Farming Experience (X5), Human Resources (Y1), and Effectiveness of Agricultural Extension (Y2). Evaluation of the measurement model is a stage to test the validity and reliability of a construct (Figure 2).

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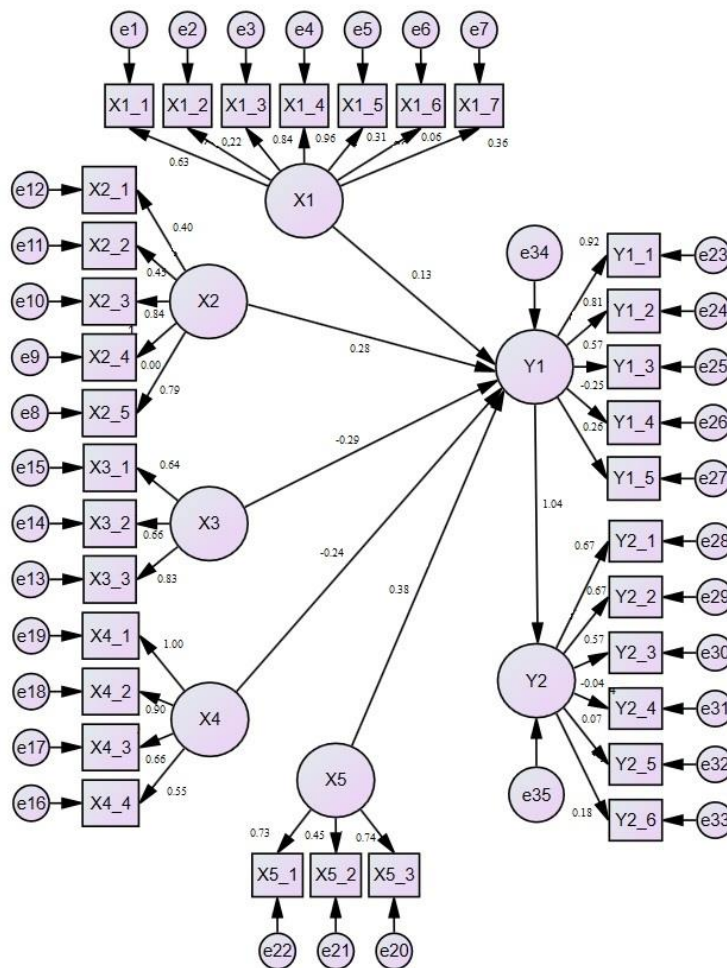


Figure 2. Path Diagram.

### 1. Validity Testing

Construct validity testing is intended to determine whether the indicators used in measuring latent variables are valid. The validity of each indicator in measuring the latent variable is indicated by the size of the loading factor (*Standardized Weights*). An indicator is declared valid if the indicator's loading factor is positive and greater than 0.5. The results of the validity test are presented in Table 13.

Table 15 shows that the question indicators X1\_2, X1\_5, X1\_6, and X1\_7, which measure the Technological Progress variable (X1), are declared invalid because they produce a loading factor value of less than 0.5. Then the question indicators X2\_1 and X2\_2, which measure the Modal variable (X2), are declared invalid. Furthermore, the question indicators X5\_2, Y1\_4, and Y1\_5, which measure the variables of Farming Experience (X5) and Counseling Problems (Y1), are declared invalid because they produce a loading factor value of less than 0.5. Then the question indicators Y2\_4, Y2\_5, and Y2\_6, which measure the Agricultural Extension Effectiveness variable (Y2), are declared invalid because they produce a loading factor value of less than 0.5.

When viewed from the strength of the loading factor (*Standardized Weights*) on each variable, the X1\_4 indicator has the highest contribution to the Technological Progress variable (X1) of 95.6%. Then, the Capital variable (X2) is dominated by the X2\_4 indicator of 99.6%. Furthermore, the X3\_3 indicator has the highest contribution to the Farmer Age variable (X3) at 82.9%. Then the Education variable (X4) is dominated by the X2\_4 indicator of 90.5%. Then the X5\_3 indicator has the highest contribution to the variable Age of Farming Experience (X5) at 73.6%. Furthermore, the Human Resources variable (Y1) is dominated by the Y1\_1 indicator of 91.8.0%. Finally, the Agricultural Extension Effectiveness (Y2) variable is dominated by the Y2\_1 indicator of 67.1%.

Validity can be seen through the loading factor and the Average Variance Extracted (AVE). An instrument is said to meet the validity test if it has an Average Variance Extracted (AVE) above 0.5. The results of the convergent validity test are presented in Table 15.

**Table 15.** Construct and Validity Test.

Variable	Indicator	Loading Factor	Criteria	AVE
Technology Advances (X1)	X1_1	0.626	0.5	0.326
	X1_2	0.220	0.5	
	X1_3	0.837	0.5	
	X1_4	0.956	0.5	
	X1_5	-0.306	0.5	
	X1_6	-0.058	0.5	
	X1_7	0.362	0.5	
Capital (X2)	X2_1	0.398	0.5	0.535
	X2_2	0.451	0.5	
	X2_3	0.839	0.5	
	X2_4	0.996	0.5	
	X2_5	0.786	0.5	
Farmer Age (X3)	X3_1	0.644	0.5	0.512
	X3_2	0.659	0.5	
	X3_3	0.829	0.5	
Education (X4)	X4_1	1.002	0.5	0.639
	X4_2	0.905	0.5	
	X4_3	0.658	0.5	
	X4_4	0.548	0.5	
Farming Experience (X5)	X5_1	0.732	0.5	0.425
	X5_2	0.445	0.5	

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	X5_3	0.736	0.5	
Human Resources (Y1)	Y1_1	0.918	0.5	
	Y1_2	0.813	0.5	
	Y1_3	0.573	0.5	0.393
	Y1_4	-0.248	0.5	
	Y1_5	0.263	0.5	
Effectiveness of Agricultural Extension (Y2)	Y2_1	0.671	0.5	
	Y2_2	0.668	0.5	
	Y2_3	0.567	0.5	0.210
	Y2_4	-0.043	0.5	
	Y2_5	0.074	0.5	
	Y2_6	0.179	0.5	

Based on Table 15, it can be seen that overall, the indicators on the variables of Technological Advance (X1), Farming Experience (X5), Human Resource (Y1), and Effectiveness of Agricultural Extension (Y2) are declared valid in measuring the variables because they have fewer AVE values of 0.5. Cronbach's alpha was used for reliability. This value reflects the reliability of all indicators in the model. The minimum value is 0.7. In addition to Cronbach's alpha, composite reliability values are also used, interpreted the same as Cronbach's alpha values (Figure 3).

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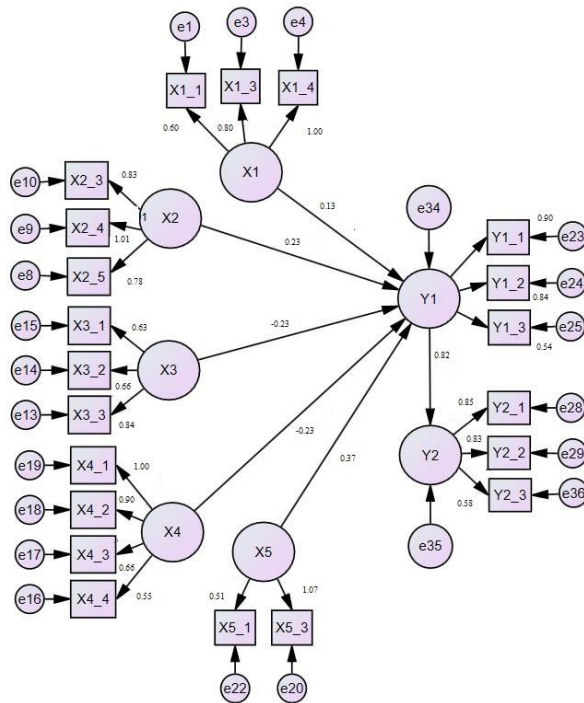


Figure 3. Path Diagram After Invalid Indicator Drop.

The validity of each indicator in measuring the latent variable is indicated by the size of the loading factor (Standardized Weights). An indicator is declared valid if the loading factor of an indicator is positive and is greater than 0.5. The results of the validity test and the loading factor, the Average Variance Extracted (AVE) value, are obtained, which is presented in Table 15.

## 2. Construct Reliability Test

The construct reliability test was carried out using the construct reliability (CR) technique. The test criteria state that the coefficient of construct reliability (CR) and Cronbach's alpha 0.6 means that it can be stated that the construct is reliable or the indicator is consistent in measuring the variables it measures.

### 4.2.2. SEM Model Evaluation

#### 1. Model Fit Test

Testing the feasibility/fitness of the model (construct) is intended to determine whether the construct formed is appropriate (feasible). There are several test indices in SEM analysis, namely CMIN/DF, RMSEA, TLI, and CFI. The test criteria use CMIN/DF; if the CMIN/DF value is the cut-off value (2.00), then the construct formed is appropriate (feasible). The criteria using RMSEA state that if the RMSEA value is the cut-off value (0.08), then the construct formed is appropriate (feasible). The criteria using TLI and CFI state that if the goodness of fit value is the cut-off value (by 0.90), then the model formed is appropriate (feasible).

**Table 16.** Construct Validity Test After Drop Invalid Indicator.

Variable	Indicator	Loading Factor	Criteria	Description
Technology Advances (X1)	X1_1	0.600	0.5	Valid
	X1_3	0.805	0.5	Valid
	X1_4	0.999	0.5	Valid
Capital (X2)	X2_3	0.830	0.5	Valid
	X2_4	1.008	0.5	Valid
	X2_5	0.776	0.5	Valid
Farmer Age (X3)	X3_1	0.633	0.5	Valid
	X3_2	0.659	0.5	Valid
	X3_3	0.838	0.5	Valid
Education (X4)	X4_1	1.004	0.5	Valid
	X4_2	0.903	0.5	Valid
	X4_3	0.656	0.5	Valid
Farming Experience (X5)	X4_4	0.548	0.5	Valid
	X5_1	0.510	0.5	Valid
	X5_3	1.066	0.5	Valid
Human Resources (Y1)	Y1_1	0.900	0.5	Valid
	Y1_2	0.839	0.5	Valid
	Y1_3	0.544	0.5	Valid
Effectiveness of Agricultural Extension (Y2)	Y2_1	0.849	0.5	Valid
	Y2_2	0.835	0.5	Valid
	Y2_3	0.578	0.5	Valid

**Table 17.** Validity Test After Drop Invalid Indicator.

Variable	AVE	Description
Technology Advances (X1)	0.669	Valid
Capital (X2)	0.769	Valid
Farmer Age (X3)	0.512	Valid

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Education (X4)	0.639	Valid
Farming Experience (X5)	0.698	Valid
Human Resources (Y1)	0.757	Valid
Effectiveness of Agricultural Extension (Y2)	0.709	Valid

Based on Table 18, it can be seen that the construct reliability and Cronbach's alpha values for all variables are more significant than 0.6. Thus, these variables are declared reliable based on the calculations of construct reliability and Cronbach's alpha.

**Table 18.** Reliability Test.

Technology Advances (X1)	0.814	0.807	Reliable
Capital (X2)	0.854	0.884	Reliable
Farmer Age (X3)	0.791	0.729	Reliable
Education (X4)	0.872	0.782	Reliable
Farming Experience (X5)	0.700	0.704	Reliable
Human Resources (Y1)	0.829	0.681	Reliable
Effectiveness of Agricultural Extension (Y2)	0.804	0.776	Reliable

**Table 19.** Goodness of Fit Model.

Index	Goodness of Fit	Cut Off Value	Description
CMIN/DF	2.709	$\leq 2.00$	Poor of Fit
RMSEA	0.148	$\leq 0.08$	Poor of Fit
TLI	0.673	$\geq 0.90$	Poor of Fit
CFI	0.714	$\geq 0.90$	Poor of Fit

Based on the goodness of fit summary, it can be seen that the four indications, namely CMIN/DF, RMSEA, TLI, and CFI, do not meet the criteria. Thus, the SEM model that has been formed is declared not feasible.

Because the model is not feasible, modifications to the covariance index are carried out to obtain a fit model. Basically, the structural equation modeling (SEM) method in AMOS is a covariance-based SEM (CB-SEM) which needs to be accommodated by the covariance element. For example, the following is a path diagram after modification of the index covariance model (Figure 4 and Figure 5):

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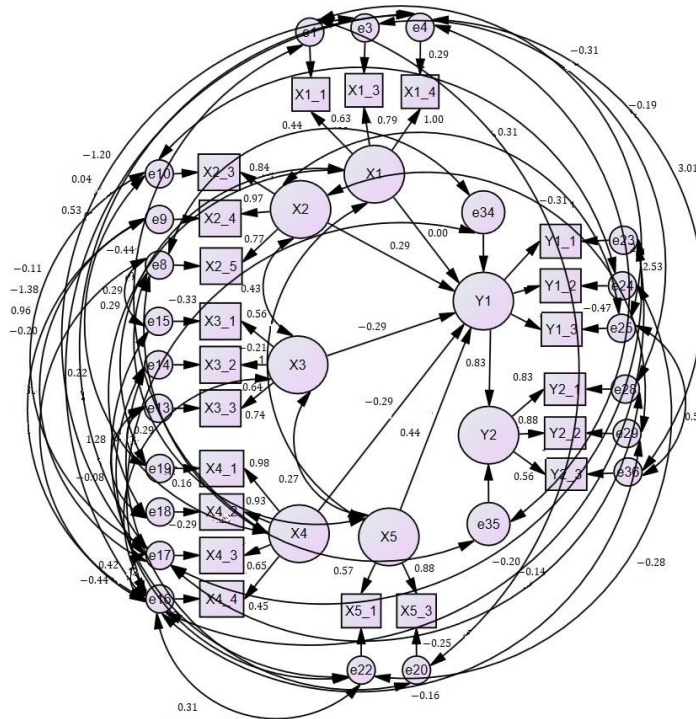


Figure 5. Path Diagram After Modification of Covariance Index (Standardized).

The results of the model feasibility test after modification of the covariance index have been summarized in Table 20. Based on the summary of the goodness of fit, it can be seen that the four indices, namely CMIN/DF, RMSEA, TLI, and CFI, all meet the criteria. Therefore, from the results of the index criteria, it can be concluded that the SEM path diagram that has been formed is declared suitable for use.

Table 20. Goodness of Fit Model (After Modification of the covariance).

Indeks	Goodness of Fit	Cut Off Value	Description
CMIN/DF	1.400	≤2.00	Good of Fit
RMSEA	0.061	≤0.08	Good of Fit
TLI	0.945	≥0.90	Good of Fit
CFI	0.963	≥0.90	Good of Fit

2. Model Hypothesis Test

a. Direct Effect Test

Hypothesis testing is intended to test whether exogenous variables have a direct effect on endogenous variables. The significance test can be known through the *p*-value. The test criteria state that if the CR statistic is >1.96 or if the *p*-value is <0.05, there is a significant effect of exogenous variables on endogenous variables. The analysis results can be seen in the summary in Table 20.

The following can be inferred from Table 21:

Table 21. Hypothesis test.

Hypothesis	Track	Standardized Coefficient	SE	CR	<i>p</i> -Value	Description
H1	X1→Y1	0.001	0.003	0.019	0.985	Not significant
H2	X2→Y1	0.289	0.006	3.255	0.001	Significant
H3	X3→Y1	-0.287	0.008	-2.389	0.017	Significant
H4	X4→Y1	-0.294	0.005	-3.908	***	Significant
H5	X5→Y1	0.440	0.013	4.467	***	Significant
H6	Y1→Y2	0.828	0.114	9.027	***	Significant

Description: \*\*\* *p*-value < 0.001.

1. Testing the effect of Technological Progress (X1) on Human Resources (Y1) produces a CR statistic of 0.019 and a *p*-value of 0.985. The test results show that the *p*-value (0.985) > alpha 0.05, meaning no significant effect of technological progress on Human Resources.
2. The test of the effect of Capital (X2) on Human Resources (Y1) produces a *p*-value of 0.001. The test results show that the statistical *p*-value (0.001) < alpha 0.05, which means that there is a significant effect of Capital on Extension Issues. The positive coefficient of 0.289 indicates that Capital positively affects Human Resources. This means that the higher the Capital, the higher the Human Resources.
3. Testing the effect of Farmer Age (X3) on Human Resources (Y1) produces a CR statistic of -2389 with a *p*-value of 0.017. The test results show that the statistical *p*-value (0.017) < alpha 0.05, meaning that Farmer's Age has a significant effect on Human Resources. A negative coefficient of -0.287 indicates that Farmer Age harms Human Resources. This means that the higher the Farmer's Age, the lower the Human Resources.
4. The effect of Education (X4) on the Human Resources (Y1) test produces a CR statistic of -3.908 with a *p*-value of 0.001. The test results show that the *p*-value (0.001) < alpha 0.05 means that Education has a significant effect on Human Resources. This means that the higher the Education, the higher the Human Resources.
5. Testing the effect of Farming Experience (X5) on Human Resources (Y1) resulted in a CR statistic of 4.467 with a *p*-value of 0.001. The test results show that the statistical *p*-value (0.001) < alpha 0.05 means that Farming Experience has a significant effect on Human Resources. A positive coefficient of 0.440 indicates that the Farming Experience positively affects Human Resources. This means that the better the Farming Experience, the better the Human Resources.
6. The test of the influence of Human Resources (Y1) on the Effectiveness of Agricultural Extension (Y2) resulted in a CR statistic of 9.027 and a *p*-value of 0.001. The test results show that the statistical *p*-value (0.001) < alpha 0.05, which means that Human Resources has a significant influence on the Effectiveness of Agricultural Extension. The positive coefficient of 0.828 indicates that Human Resources positively affect the Effectiveness of Agricultural Extension. This means that better Human Resources can increase the Effectiveness of Agricultural Extension.

b. Indirect Effect Test

Hypothesis testing is intended to test whether exogenous variables have an indirect effect on endogenous variables through mediating variables (intervening). Mediation testing can be known through the Sobel test. The test criteria state that if the *z* statistic > *z* table (1.96) or *p*-value < alpha 0.05, it is stated that there is a significant indirect effect of exogenous variables on endogenous variables through mediating variables (intervening). The analysis results can be seen in the summary in Table 21.

Based on Table 22, it can be stated that the test of the effect of Capital (X2), Farmer's Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricul-

tural Extension (Y2) through the mediation of Human Resources (Y1) produces a statistical  $p$ -value  $<$  alpha 5% which means that there is an indirect effect of Capital Progress (X2), Farmer Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2) through the mediation of Human Resources (Y1). In other words, the Human Resources variable (Y1) can mediate the effect of Capital (X2), Farmer Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2).

**Table 22.** Hypothesis test.

Hypothesis	Track	Indirect Coefficient	Std. Error	$p$ -Value	Description
H7	X1→Y1→Y2	0.001	0.002	0.739	Not Significant
H8	X2→Y1→Y2	0.239	0.033	0.000	Not Significant
H9	X3→Y1→Y2	−0.238	0.034	0.000	Not Significant
H10	X4→Y1→Y2	−0.243	0.034	0.000	Not Significant
H11	X5→Y1→Y2	0.364	0.051	0.000	Not Significant

While the test of the effect of Technological Progress (X1) on the Effectiveness of Agricultural Extension (Y2) through the mediation of Human Resources (Y1) resulted in a statistical  $p$ -value (0.985)  $>$  alpha 5%, which means that there is no indirect effect of Technological Progress (X1) on the Effectiveness of Agriculture Extension (Y2) through the mediation of Human Resources (Y1) or, in other words, the Human Resources variable (Y1) is not able to mediate the effect of Technological Progress (X1) on the Effectiveness of Agricultural Extension (Y2).

### 3. Convert Path Diagrams to Structural Equations

The conversion of path diagrams into structural equations is intended to find out how the shape of the influence between constructs is based on their mathematical equations. Based on the attachment, it can be seen that the mathematical models formed are as follows:

$$\text{Equality 1: } Y_1 = 0.001 X_1 + 0.239 X_2 - 0.2873 X_3 - 0.294 X_4 + 0.440 X_5$$

$$\text{Equality 2: } Y_2 = 0.828 Y_1$$

## 5. Conclusions

1. The factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi, are farming capital, farmer's age, education, farming experience, and human resources.
2. The influence of these factors on the effectiveness of agricultural extension in Baubau city is as follows: if farming capital is high, human resources can be increased. Moreover, the higher the farmers' age, the lower the need for human resources. It was additionally noted that higher education of farmers contributes to improvement in human resources, and the increased experience in farming corresponded to an increase in human resources. Hence, increasing human resources will increase the effectiveness of agricultural extension.
3. Extension issues and materials affect the effectiveness of agricultural extension in Baubau City, where the influence can be categorized as Good or Influential.
4. Farming capital is land area, labor, use of fertilizers, pesticides, agricultural tools, and machines. There is an influence of farming capital variables on the effectiveness of agricultural extension.

Human resources describe the knowledge possessed by education, training, experience, and information received. Activities that must be carried out by agricultural

extension workers in the city of Baubau are optimizing socialization and training related to agricultural land, for example, making demonstration plots so that farmers can see directly and have no doubts about the theory provided. In addition, one way to achieve extension effectiveness is to increase human resources (agricultural extension workers) as program implementers so that the programs that have been designed can be implemented. The lack of extension workers resulted in a significant workload for each extension agent because the extension area assisted by the extension worker was large, and the number of assisted farmer groups was significant. Currently, there are 44,890 agricultural extension workers. These agricultural extension workers serve 71,479 villages, so they still need as many as 26,589 agricultural extension workers (agricultural extension center Indonesia, 2022) [18]. Many agricultural extension workers can supervise the assistance funds given to farmers so that they are appropriately managed to realize farmer welfare, distribute farmers' knowledge about the latest agricultural technologies, and develop rice farming. For example, they help to provide production facilities, distribute fertilizer and seed aid, and provide cooperative institutions to assist farmers in procuring farming capital. In addition, agricultural extension agents have roles as facilitators, communicators, motivators, and consultants. Indonesian Government Regulation no. 16 of 2006 concerning the Agricultural Extension System, one of the critical points in this law is the need to build extension institutions in the regions at the provincial and district/city levels.

Age affects productivity level, making decisions, and receiving information. The dominant number of respondents is 46–55 years old. This shows that the productive age in this study is in the age range of 46–55 years. At a productive age, it will be easier to get new ideas and quickly understand the use of technology. Information obtained by farmers, especially from agricultural extension workers, will increase their paddy rice production. This follows the research results (Hasyim, 2006) [10] that those who work at productive age will be better and maximal than non-productive age.

Education is influential in taking action in making programs for agricultural development. The low level of education in this study indicates that the quality of human resources needs to be improved in efforts to develop farming performance. Improving the skills and knowledge of farming will encourage the achievement of planned production targets. According to (Lubis, 2000) [12,13], having a high level of education will be relatively faster in implementing technology and innovation adoption; having low education usually makes it challenging to implement innovation adoption quickly.

The indicators included in the Technological Progress variable are the use of transplanters, the use of indo combine harvesters, the use of KATAM (planting season prediction), the use of KATAM (fertilizer dose), the use of drones (irrigation sensors/measuring soil pH), the use of expert system applications, and the use of social media. The average variable of Technological Progress is 24.91, with an achievement level of 64.53% in the less good category. Farmers should optimize information technology, such as using the internet to find the latest information. Advances in technology play a role in supporting the availability of relevant and timely agricultural information. Information on the results of research and technological innovations in agriculture helps efforts to increase the production of agricultural commodities. According to research results (Prayoga, K. 2017) [17], the use of technology is considered less optimized by the Indonesian Ministry of Agriculture. Extension activities that utilize social media must continue to be optimized because the number of users continues to increase.

5. Matters related to extension include the number of assisted farmers, the distance to extension locations, the amount of agricultural extension work time, extension media, methods, frequency, materials, and the instructor's experience. Extension media has the most significant contribution to the problem variables of extension agents. Through extension media, it can attract farmers to attend training. Agricultural extension agents use various media that are adjusted to the farmer's

age—then, followed by indicators of instructor experience, frequency of extension, amount of working time of agricultural extension workers, extension methods, and extension materials. Extension material is everything that extension agents propose to farmers, including the suitability of the material with the needs and benefits. Based on the assessment of the extension workers in the field, it was assessed that the absorption of the material and the most suitable application were in fertilization, harvesting, and post-harvest materials. This is followed by good planting time, nurseries, planting, nursery, and maintenance indicators. Agriculture is a critical sector in national development. In national development, it is necessary to support human resources, who have the capacity, who can produce solutions to answer the challenges. Therefore, it is necessary to carry out an agricultural extension to develop agriculture. Agricultural extension is also one of the efforts to produce quality human resources. Agricultural extension is an empowerment effort or an effort to motivate and change the behavior of farmers and their families so that they have the will and can solve the problems they face in doing their farming. Therefore the role of extension is crucial and becomes a strategic matter in national development.

The Ministry of Agriculture is targeting Indonesia to become a world food barn by 2045. To achieve this mission, the Ministry of Agriculture places farmers as the main actors in agricultural development. Therefore, attention is needed from farmers through agricultural extension workers. In general, the knowledge farmers have to lack in renewal, and the existence of agricultural extension can help agricultural development.

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## Article

# Effectiveness of Agricultural Extension on Paddy Rice Farmer's Baubau City, Southeast Sulawesi, Indonesia

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**Abstract:** Agricultural extension workers play an essential role in the productivity of agricultural systems. Based on the actual conditions in the field, it can be seen that the level of extension services still needs to be higher due to a lack of human resources in the field of extension services. This research was conducted to determine the effectiveness of agricultural extension services and the factors that influence the effectiveness of agricultural extension to farmers in Baubau City, Indonesia. The analytical method includes exogenous latent variables: human resources, technological progress, farming capital, farmer age, education, and farming experience. The effectiveness of agricultural extension is used as an endogenous latent variable. The research sample consisted of 110 rice farmers in Baubau City, and the Slovin formula was used to calculate the sample. The data collection for this research was carried out by distributing questionnaires to respondents, in-depth interviews, and direct observation in the city of Baubau. Using the AMOS application, quantitative analysis was carried out through structural equation modeling (SEM). The study results show that: (1) The factors that influence the effectiveness of agricultural extension in Baubau City are farming capital, farmer age, education, farming experience, and human resources, and (2) the influence of these factors on the effectiveness of agricultural extension is as follows: if the farming capital is high, human resources can be increased. In addition, the higher the farmer's age, the lower the need for human resources. It is also noted that higher farmer education contributes to increased human capital, and increased experience in farming is associated with increased human capital. Thus, an increase in human resources will increase the effectiveness of agricultural extension. Significant factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi, are farming capital, farmer age, education, farming experience, and human resources.

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**Keywords:** effectiveness; agricultural extension; paddy rice; Indonesia

## 1. Introduction

Southeast Sulawesi has sufficient competence to support the Indonesian food development program because of the high availability of land and the potential for land productivity. Based on data on rice field areas in the rice planting season, Southeast Sulawesi has an area of 82,382 ha of raw rice fields (Data Landsat 8, 2021). The size of rice fields in Baubau city is 1375 ha; this indicates that the agricultural sector is one of the sectors with high priority in Baubau City (Abadi, 2019) [1]. However, rice production

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domestically is dominated by lowland rice production. Hence, the extension workers should increase their effectiveness in extension services for the lowland rice farmers.

Extension workers can contribute to the regulatory process by providing expertise and content for proposed, adopted, and restructured agriculture-related regulations. As extension agents directly interact with clients in the field, they can communicate the needs of stakeholder groups. Therefore, they should be involved in the regulatory process. An evidence-based approach involving input from target groups and practitioners seems to be an inevitable strategy for the success of a sustainable land grant project (Fouladkhah, A., 2017) [2].

Extension agents are one of the supporting elements in the agribusiness sub-system. In principle, the agricultural extension supports all sub-systems in agribusiness. Specifically, in this study, extension workers play a role in supporting to increase the productivity of lowland rice. Hence, to increase the productivity of rice farming, extension workers are needed. The role of the extension worker is to provide guidance and knowledge in the form of the latest information or innovation to improve their farming system, ultimately increasing their crop yields. In addition, the purpose of agricultural extension is to change the behavior of farmers, for instance, their ability to adapt to situations and conditions that keep changing. Thus, they can improve their farming systems, increase production, and reduce the possibility of crop failure. While simultaneously improving their living standards.

However, there are some significant issues, such as a lack of active participation from agricultural extension workers and the difference in the extension worker-to-farmer ratio, leading to fewer extension workers for many farmers. This problem causes the workload of each extension worker to be quite heavy because either the extension area or the number of assisted farmer groups is quite large. Therefore, the current condition is forcing agricultural extension workers to work hard despite a limited number of workers, and they must be able to perform optimally to increase their work productivity.

The role of extension workers can increase sustainable agricultural productivity and food security (Olorunfemi, T. O., et al., 2020) [3]. One of the most crucial things is to ensure that using the agricultural extension and education programs has a positive impact on farmers (Salehi, M., et al., 2021) [4]. Consequently, the crucial role of extension workers is to create awareness among farmers to apply guidelines for food needs (Fiaz, S., et al., 2018) [5]. The findings of the study (Jamil, M.H., 2017) [6] show that the development of agricultural extension workers has a positive effect on the agricultural extension program.

Agricultural extension programs and policies can play an important role in achieving production (Mahir, M. E. A. E., & Abdelaziz, H. H. 2011) [7]. Additionally, this agricultural policy was discussed by (Baloch, M. A., & Thapa, G. B, 2019) [8], who said that agricultural policies must be implemented effectively to address the needs of farmers and the problems they face. One example is that the Government of Pakistan has adopted a policy of providing agricultural services to promote agricultural production by disseminating appropriate knowledge and technology to farmers (Baloch, M. A., & Thapa, G. B., 2018) [9].

The agricultural, industrial revolution has had an impact on efficiency and productivity in agricultural extension services in the agricultural sector (Nyarko, D. A., & Kozári, J. 2021) [10]. Furthermore, the effects of community-based strategies on food security have a positive impact (Wellard, K., et al., 2013) [11]. Therefore, it is suggested that extension services provide Information and Communication Technology training (ICT) for agricultural extension workers to improve extension services. In addition, according to (Umbara, D.S., Sulistyowati, L., Noor, T.I., and Setiawan, 2021) [12,13], the dissemination of agricultural technology information by utilizing the internet network is very helpful for agricultural extension workers in carrying out their main tasks. Information and Communication Technology can also facilitate the delivery of information and knowledge sharing between farmers, extension workers, and other stakeholders (An-

nor-Frempong, F., et al. (2006) [14]. The article (Haghighi, N. F., et al., 2008) [15] stated the perspective on the application of Information and Communication Technology in agriculture and some issues with using ICT in organizations; however, this is in contrast to (Diaz, R. T., et al. (2021) [16]). Furthermore, it was found that extension services in the study area are not sufficient when farmers face difficulties.

From the literature, it can be gathered that an agricultural extension worker plays an essential role in the productivity of a farming system. Based on the actual conditions in the field, it can be acknowledged that the extension service rate is low due to a lack of human resources in the extension field. Therefore, to solve the problems that arose from the current predicament, this study was conducted to determine the effectiveness of agricultural extension services. The primary purpose of this study is to determine the factors that influence the effectiveness of agricultural extension services to lowland rice farmers in Baubau City and to find out how these factors can affect the effectiveness of agricultural extension services.

## 2. Research Hypothesis

- a. It is suspected that the variables of technological progress (X1), farming capital (X2), farmer age (X3), farmer education (X4), and farmer experience (X5) have a significant relationship and have a direct influence on human resources (Y1).
- b. Allegedly, the variables of technological progress (X1), farming capital (X2), farmer age (X3), farmer education (X4), and farmer experience (X5) have a significant relationship and give an indirect effect but are thought to influence the variable effectiveness of agricultural extension (Y2).
- c. It is suspected that the variable human resources (Y1) have a significant relationship with the variable effectiveness of agricultural extension (Y2).

## 3. Research Methods

### 3.1. Place and Time

This research is located in Baubau City, Southeast Sulawesi, and was carried out from January–July 2022.

### 3.2. Data Collection

Data collection techniques in this study were carried out using interviews, questionnaires, and observation. The measured variable is technological progress (X1), farming capital (X2), farmer age (X3) farmer education (X4), farmer experience (X5) human resources (Y1), and effectiveness of agricultural extension (Y2) (Figure 1).

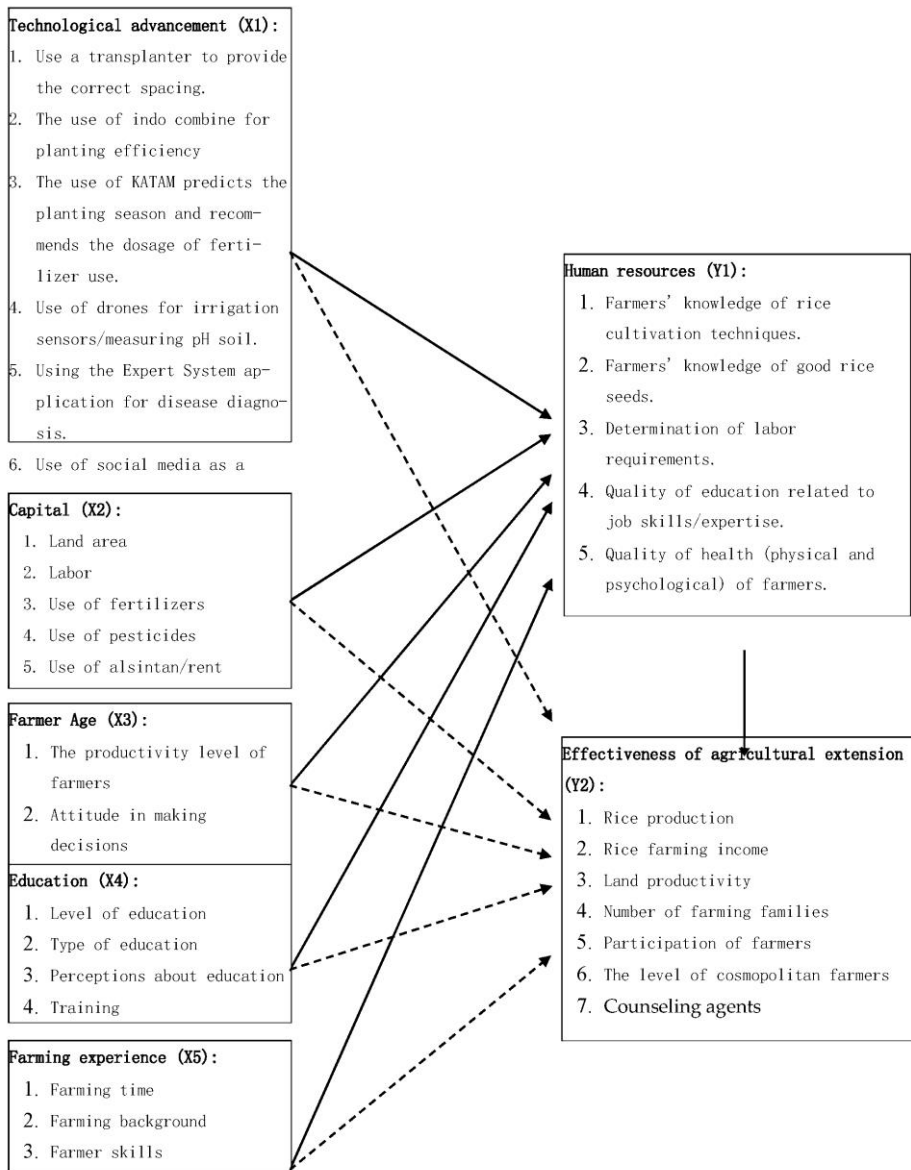


Figure 1. Constructs, Indicator, and Code Variable.

### 3.3. Population and Sample

The population of this study was all farmers in Baubau City; 1257 people (Data from the Baubau City Agriculture Office, 2021). In addition, the population of agricultural extension workers in Baubau City is 26.

Simple random sampling was used. The sample measurements were calculated using the Slovin formula:

$$n = \frac{N}{1 + N (E)^2} \quad (1)$$

$$n_i = \frac{N_i}{N} \times n \quad (2)$$

Description:

$n$  = Number of samples

$N$  = Population

$e^2$  = Precession set (5%)

$n_i$  = Standard sample size  $i$

$N_i$  = Population size  $i$

The sample size was determined with an error rate of 10% or based on the desired level of confidence (precision) of 90%, and the sample size based on the Slovin formula amounted to 110 respondents. The study sample for extension agents was based on the population of extension workers in Baubau City, which amounted to 26 personnel, from which 30% of the total was sampled, resulting in 8 extension workers.

The data collection techniques used to carry out the study were questionnaires, direct interviews, and observations to determine the characteristics and behavior of the research object. The data obtained were analyzed descriptively and quantitatively using the SEM method (*structural equation modeling*)—Software AMOS (*Analysis of Moment Structure*).

### 3.4. Analysis Method

#### 3.4.1. Descriptive Statistical Analysis

Descriptive statistical data was interpreted using the TCR criteria (Respondent Achievement Level), and the following formula was used:

$$TCR = \frac{Mean}{Skor Max} \times 100 \quad (3)$$

The percentage formula used in this study is as follows:

$$P = \frac{f}{N} \times 100\% \quad (4)$$

Description:

$P$  = Percentage Number

$f$  = The number of frequencies of each answer that has become the respondent's choice

$N$  = The number of frequencies or the number of individuals

To determine the level of criteria with a descriptive analysis of the percentage, which is divided into five indicators, namely,

#### 3.4.2. Quantitative Analysis

SEM (structural equation modeling) analysis in this study was carried out using AMOS 24 software to answer problems related to variables that influence the effectiveness of agricultural extension in Baubau City.

The formula used in this study is as follows:

$$\text{Equality 1 } Y1 = \beta_0 + \beta_1X_2 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + e \quad (5)$$

$$\text{Equality 2 } Y1 = \beta_0 + \beta_1Y1 + e \quad (6)$$

Description:

Y1 = Human Resources

Y2 = Effectiveness of Agricultural Extension

$\beta$  = Constant

E = Standard error

X1 = Technology advances

X2 = Capital

X3 = Farmer Age

X4 = Education

X5 = Farming experience

#### 4. Results

The demographic characteristic of the farming communities involves 96% of male and 4% of female farmers (Table 1). There is a division of household tasks between husband and wife. Based on in-depth interviews with several respondents, they stated that working in the fields is the husband's duty while the wife takes care of the household. Results based on age indicated that 34% of farmers were 36–45 years old, and 6% were under 25 years old. Farmers who work at the productive age will be better and more optimal than non-productive age (Productive age 15–64). In addition, age can also be used as a benchmark to see the activities of farmers at work (Hasyim, 2006) [17].

**Table 1.** TCR criteria.

No.	Scale Range	TCR
1	90–100%	Very good
2	80–89.99%	Good
3	65–79.99%	Enough
4	55–64.99%	Not good
5	0–54.99%	Not good

It was revealed that the respondents with non-educational levels were 10%. Respondents with their last education at the elementary, junior, and senior high school levels were 41%, 13%, and 31%, respectively; at the tertiary level added, 5% (Soehardjo and Patong, D. 1999) [12]. Higher levels of education result in a more straightforward implementation of innovations. Farmer education is not only oriented toward increasing production but the social life of the farming community. On the other hand, farmers with a high education level will be relatively faster in implementing technology adoption and innovation. Farmers who have low education may have difficulty implementing the adoption of innovation quickly. The level of education possessed by farmers depicts the knowledge and insight a farmer has in applying technology and innovation to increase farming activities (Lubis, 2000) [18]. Demographic characteristics based on the main occupation of farmers show that farming is the respondents' main occupation, totaling 97%. In comparison, the remaining 3% of the main occupation are civil servants, and farming is their side employment.

Based on the study results, farmers with a land area of less than 1 ha was 16%, 1 to 5 ha was 82%, and more than 5 ha was 2%. The number of farmers that own their land is 93%, and 6% of the farmers are tenants, while the remaining 1% amounts to farmers being landowners and tenants. It is important to note that more land ownership means more potential to increase productivity and efficiency by adopting modern technology.

Land tenure is vital in spreading and adopting modern agricultural practices among farming communities (Aldosari et al., 2019) [19].

Next, the results show that a significant percentage of the farmers had more than 10 years of experience resulting in a total of 76%, followed by farmers with 5–10 years with 14% and farmers with less than 5 years of experience with 10%. The farming experience significantly affects farming activities, as evident in the production results. Farmers who have been farming for a long time have high knowledge, experience, and skills in running a farm. Farming experience is divided into three categories, namely less experienced (<5 years), moderately experienced (5–10 years), and experienced (10 years). Farmers have different farming experiences or lengths of farming (Soehardjo and Patong, D. 1999) [12].

Furthermore, it can be seen that respondents have chosen “hereditary” as their farming background surmounting 90% or as many as 99 people from the total number of respondents. None of the respondents chose “has the farming ability” as a farming background; in this case, the respondent’s last education determines the farming background. The remaining percentages recorded for farming backgrounds are “economic need, availability of adequate land, the ability to farm and willingness based on agriculture as a promising field.” The percentages for each are as follows: 3%, 4%, 1%, and 2%, respectively.

An extension work area is a place or an area that becomes the territory of authority in carrying out its duties as an extension worker, whether within the ward, sub-district, district/city, or wider area. The extension worker’s work area can affect productivity in carrying out his duties. Meanwhile, the distance from the working area is the distance from the instructor’s residence to the extension location. In Table 2, it can be seen that each respondent has a different work area and distance from the work area. The distance from the farthest working area is 21 km, and the closest is 5 km.

**Table 2.** Percentage Descriptive Analysis Criteria.

Number	Percentage	Criteria
1.	0–20%	Very low
2.	21–40%	Low
3.	41–60%	Moderate
4.	61–80%	High
5.	81–100%	Very high

Duration as an Extension refers to this study; each respondent has been an extension worker from the time of appointment until this research is carried out, expressed in units of years. The length of time as an extension worker determines the level of experience each agent has. In Table 3 the duration of an extension worker is divided into three categories: less experienced (<5 years), moderately experienced (5–10 years), and experienced (>10 years). The highest percentage (63%); five out of eight agents have more than 10 years of experience as an extension worker. While extension agents have moderate experience, equal to two out of eight (25%), and extension agents with less than five years of experience totaled one out of eight (12%). Respondents who generally do farming are male (96%) and female (4%), based on interviews that work in the fields is the main task of a husband (male). In addition, the dominant number of respondents is those aged 46–55 years. During the productive age, farmers are more receptive to ideas and innovation. In addition, the level of education affects increasing the skills and knowledge of farmers. The last education of farmers is 41% in elementary schools. In addition, land area, land ownership status, time of farming, and farming background affect rice production and farmers’ income.

**Table 3.** Demographic Characteristics Data of Rice Farmers in Baubau City, Southeast Sulawesi.

<b>Gender</b>			<b>Age (Years)</b>		
	<b>n</b>	<b>%</b>		<b>n</b>	<b>%</b>
Male	106	96	Less than 25	7	6
Female	4	4	25–35	25	23
Total	110	100	36–45	17	15
			46–55	37	34
			More than 55	24	22
			Total	110	100
<b>Last Education</b>			<b>Main Occupation</b>		
	<b>n</b>	<b>%</b>		<b>n</b>	<b>%</b>
No Education	11	10	Farmers	107	97
Elementary school	45	41	Other than farmers (PNS)	3	3
Junior High school	14	13	Total	110	100
Senior High school	34	31			
Higher Education	6	5			
Total	110	100			
<b>Land Area (ha)</b>			<b>Land Ownership Status</b>		
	<b>n</b>	<b>%</b>		<b>n</b>	<b>%</b>
Less than 1	18	16	Owner	102	93
1–5	90	82	Tenant/tenant	7	6
More than 5	2	2	Owner and tenant	1	1
Total	110	100	Total	110	100
<b>Time of farming (years)</b>			<b>Farming background</b>		
	<b>n</b>	<b>%</b>		<b>n</b>	<b>%</b>
Less than 5	11	10	Hereditary	99	90
5–10	15	14	Economic needs	3	3
More than 10	84	76	Availability of adequate land	5	4
Total	110	100	Has the ability to farm	1	1
			Willingness from within because farming is a promising field	2	2
			Total	110	100

n = Total; % = Percentage.

Table 4 shows the distance agricultural extension work areas. The longest working distance is 21 km, while some extension workers live in their working area.

**Table 4.** Data on Demographic Characteristics of Agricultural Extension Respondents based on Working Area and Distance from Work Area Baubau City, Southeast Sulawesi.

<b>No.</b>	<b>Working Area</b>	<b>Distance from Working Area (Km)</b>
1	Lea-lea Subdistrict	15
2	Tampuna Subdistrict	21
3	Liabuku Subdistrict	9
4	Bungi Subdistrict and Lea-Lea Subdistrict	10
5	Ngkaring-ngkaring Subdistrict	5
6	Waliabuku Subdistrict	13
7	Lowu-lowu	15
8	Subdistrict Kalia-lia	15

The status of the extension workers refers to the position an agent holds, which corresponds to their employment descriptions. Table 5 displays that of the eight surveyed workers, 63% (five agents) are Civil Servants, 12% are honorary employees, and 25% are THL-TBPL position holders.

**Table 5.** Data on Demographic Characteristics of Agricultural Instructor Respondents in Baubau City, Southeast Sulawesi.

<b>Duration as an Extension (Years)</b>	<b>n</b>	<b>%</b>	<b>Status</b>	<b>n</b>	<b>%</b>
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Less than 5	1	12	Civil Servants	5	63
5–10	2	25	Honorary Employee	1	12
More than 10	5	63	THL-TBPL	2	25
Total	8	100	Total	8	100

THL-TBPL: Agricultural extension workers.

#### 4.1. Descriptive Statistical Analysis

##### 4.1.1. Technological Progress Variables

Based on Table 6, the average Technological Progress Variable is 24.91, with a respondent's level of achievement, 64.5%, which favors the Not good category. Thus, it can be said that technological advances have less than the desired effect on agricultural extension. The indicator with the lowest TCR value in the table below is the use of *indo combine harvester*, with an average score of 23.68, gravitating to the Not good category. While the indicator with the lowest average score is for the use of *drones* (irrigation sensor/measuring soil pH) which is 12.94, and the TCR value is 80.9 falling into the Good category.

**Table 6.** Frequency Distribution of Technological Progress Variables (X1) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming Businesses in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Use of transplanter	110	52	27.22	52.3	Not good
2	Use of <i>indo combine harvester</i>	110	52	23.68	45.5	Not good
3	Use of KATAM (predicted planting season)	110	50	38.22	76.4	Enough
4	Use of KATAM (fertilizer dose)	110	50	35.51	71.02	Enough
5	Use of drones (irrigation sensor/measuring soil pH)	110	16	12.94	80.9	Good
6	Use of expert system applications	110	17	13.35	78.5	Enough
7	Use of social media	110	50	23.57	47.1	Not good
Average				24.91	64.53	Not good

The impact of the extension approach on the use of technology and food security was found to be positive (Wellard, K., et al. (2013) [11]). Dissemination of agricultural technology information is helpful for agricultural extension workers in carrying out their main tasks. (Umbara, D.S et al., 2021) [13]. In recent years, the agricultural industry has experienced an increase in the application of Information and Communication Technology globally. This new revolution is said to have had an impact on efficiency and productivity in agricultural extension services in the agricultural sector (Daniel et al., 2021) [10]. Furthermore, Information and Communication Technology can be used in a cost-effective and practical way to facilitate information sharing and knowledge sharing among farmers, extension workers, and other stakeholders (Joseph Kwarteng, 2006) [14]. This new revolution is said to have impacted efficiency and productivity in agricultural extension services in the agricultural sector (Daniel Ayisi Nyarko and József Kozári, 2021) [10] and attitudes towards the application of Information and Communication Technology in agricultural extension, the extent of the problems faced by extension organizations to the use of ICT, knowledge of ICT, and personal characteristics (Negin Fallah Haghghi et al., 2008) [15].

##### 4.1.2. Farming Capital Variable

Based on Table 7, the average Farming Capital variable is 38.16 with a TCR value of 68.12, portraying the sufficiency of the indicator. In other words, the influence of the farming capital variable on the effectiveness of agricultural extension is satisfactory. On

the other hand, the labor indicator has the lowest TCR value of 45.1, and the average score is 23.03, which is the indicator value with the lowest score; hence, it is portrayed in the Not good category. In comparison, the indicator with the highest TCR value is the use of fertilizer, which is 82.4 with an average value of 42.85 and is present in the Good category.

**Table 7.** Frequency Distribution of Farming Capital Variables (X2) in Research on Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Land area	110	54	39.60	73.3	Sufficient
2	Labor	110	51	23.03	45.1	Not good
3	Fertilizer use	110	52	42.85	82.4	Good
4	Pesticide use	110	56	42.36	75.7	Enough
5	Agricultural machinery use	110	67	42.98	64.1	Poor
Average				38.16	68.12	Enough

#### 4.1.3. Farmer Age Variable

In Table 8, the average Farmer Age variable is 38.73 with a TCR value of 67.93 and is in the adequate category. Therefore, it can be stated that the influence of the age variable of farmers on the effectiveness of agricultural extension is reasonably influential. The attitude indicator in decision-making has the highest average value of 41.33 and the TCR value of 72.5; hence, classified into the Enough Category. While the indicator with the lowest average value, namely the acceptance of information, is 36.05 with a TCR value of 63.2, which falls in the designated category of Poor.

**Table 8.** Frequency Distribution of Farmer Age Variable (X3) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Rice Field Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Farmer Productivity Level	110	57	38.82	68.1	Enough
2	Attitude in Making Decisions	110	57	41.33	72.5	Enough
3	Acceptance of Information	110	57	36.05	63.2	Low
Average				38.73	67.93	Adequate

#### 4.1.4. Farmer Education Variable

In Table 9, the average Farmer Education variable is 14.56 with a TCR value of 30.20 which is Not good. In other terms, the influence of farmers' education on the effectiveness of agricultural extension is not present. The Perception indicator of Education has the lowest average score of 13.95 and the TCR value of 25.8, indicating that the variable component is in a Not good category. Likewise, the other three indicators also fall into the Not good category.

**Table 9.** Frequency Distribution of Farmer Education Variables (X4) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORY
1	Education Level	110	57	18.25	32.01	Not good
2	Type of Education	110	51	15.58	30.6	Not good
3	Perception about Education	110	54	13.95	25.8	Not good
4	Training	110	58	18.48	32.4	Not good

Average	14.56	30.20	Not good
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#### 4.1.5. Farming Experience Variable

Referring to Table 10, the average Farming Experience variable was 37.45 with a TCR value of 64.8, indicating that the experience variable categorizes in the Poor section. From the three indicators, it shows that the farming background indicator has an average value of 28.13 and a TCR value of 50.2 while being categorized as Not good; however, the indicators of the farming time and farmer skills are in the Enough category with TCR values of 67.5 and 76.7, respectively.

**Table 10.** Frequency Distribution of Farming Experience Variables (X5) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Farming time	110	60	40.51	67.5	Enough
2	Farming background	110	56	28.13	50.2	Not good
3	Farmers skills	110	57	43.72	76.7	Enough
Average				37.45	64.8	Poor

#### 4.1.6. Extension Problem Variables

Table 11 shows that the average variable of Extension Problems is 35.28 with a TCR value of 83.26, indicating that these variables are in a Good category. The indicator of the number of assisted farmers has an average value of 44.00 and shows a TCR value of 78.6 which means it is in the Enough category. The extension media indicator has an average value of 25.63. It shows its TCR value of 91.5, presenting as Very Good, followed by indicators of the experience of the extension worker, the frequency of extension, the amount of working time of the agricultural instructor, the extension method, and the extension material, which were all in the Good category. Finally, the indicator of the distance of the extension location is in the Enough category.

**Table 11.** Frequency Distribution of Extension Problems Variables (X6) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Number of Assisted Farmers	8	56	44.00	78.6	Enough
2	Distance of Extension Locations	8	21	15.00	71.4	Enough
3	Total Working Time of Agricultural Instructor	8	23	19.88	86.4	Good
4	Extension Media	8	28	25.63	91.5	Very Good
5	Extension Methods	8	31	25.38	81.9	Good
6	Extension Frequency	8	44	38.13	86.7	Good
7	Extension Materials	8	46	37.13	80.7	Good
8	Extension Experience	8	53	47.13	88.9	Good
Average				35.28	83.26	Good

#### 4.1.7. Extension Materials

Based on Table 12, the average of the Extension Materials variable is 3.53, with a TCR value of 83.94, indicating that this variable is in the Good category. The fertilization, harvesting, and post-harvest indicators have the same average value of 3.63 and the same TCR value of 90.75, indicating that the three indicators are in the Very Good category. They are then followed by indicators of good planting time, seed sowing, and planting, which all have the same average value of 3.50 and the same TCR value of 87.5, indicating

that the variable components are in the Good category. At the same time, the nursery and maintenance indicators are in the Enough category.

**Table 12.** Frequency Distribution of Extension Material Variables (X7) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Good Planting Time	8	4	3.50	87.5	Good
2	Tillage	8	5	4.00	80	Good
3	Nurseries	8	4	2.63	65.75	Enough
4	Nurseries	8	4	3.50	87.5	Good
5	Planting	8	4	3.50	87.5	Good
6	Maintenance	8	5	3.75	75	Enough
7	Fertilizing	8	4	3.63	90.75	Very good
8	Harvesting	8	4	3.63	90.75	Very good
9	Post-harvest	8	4	3.63	90.75	Very good
Average				3.53	83.94	Good

#### 4.1.8. Human Resources

Table 13 shows that the average score of the Human Resources variable is 4.20, and the TCR value is 84.12, hence, summarizing the variable in the Good category. Of the five indicators below, one indicator is in the Not good category, namely the quality of education related to work skills/expertise, with an average value of 1.80 and a TCR value of 36. In contrast, the other four indicators are in the Very good category.

**Table 13.** Frequency Distribution of Human Resources Variables (Y1) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Paddy Rice Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Farmers' knowledge of rice cultivation techniques	110	5	4.90	98	Very good
2	Farmers' knowledge of good rice seeds	110	5	4.92	98.4	Very good
3	Determination of labor needs	110	5	4.65	93	Very good
4	Quality of education related to Skills/work skills	110	5	1.80	36	Not good
5	Health quality (physical and psychological) of farmers	110	5	4.76	95.2	Very good
Average				4.20	84.12	Good

#### 4.1.9. Effectiveness of Agricultural Extension

The results of Table 14 show that the average variable of Extension Effectiveness Agriculture is 3.73 and has a TCR value of 74.76 which means that the variable is in the Fair category. This Agricultural Extension Effectiveness variable has six indicators, of which one indicator is in the Not good category: the number of farming families. Then two indicators are in the Very good category: farmer participation and the level of cosmopolitan farmers with TCR values of 97 and 92.6. They were then followed by indicators of rice farming income in the Good category and rice production and land productivity in the Enough category.

**Table 14.** Frequency Distribution of Extension Problems Variables (X6) in the study of Factors Affecting the Effectiveness of Agricultural Extension on Rice Field Farming in Baubau City, Southeast Sulawesi, 2022.

No.	INDICATOR	N	Max.	Mean	TCR	CATEGORIES
1	Rice Production	110	5	3.65	73	Enough
2	Rice Farming Income	110	5	4.20	84	Good
3	Land Productivity	110	5	3.65	73	Enough
4	Number of Farmer Families	110	5	1.45	29	Not good

5	Farmer Participation	110	5	4.85	97	Very good
6	Cosmopolitan Level Farmers	110	5	4.63	92.6	Very good
Average				3.73	74.76	Fair

4.2. Analysis of Structural Equation Modeling (SEM)

4.2.1. Evaluation of Measurement Model

This research model consists of 7 (seven) constructs, including the variables of Technological Progress (X1), Capital (X2), Farmer Age (X3), Education (X4), Farming Experience (X5), Human Resources (Y1), and Effectiveness of Agricultural Extension (Y2). Evaluation of the measurement model is a stage to test the validity and reliability of a construct (Figure 2).

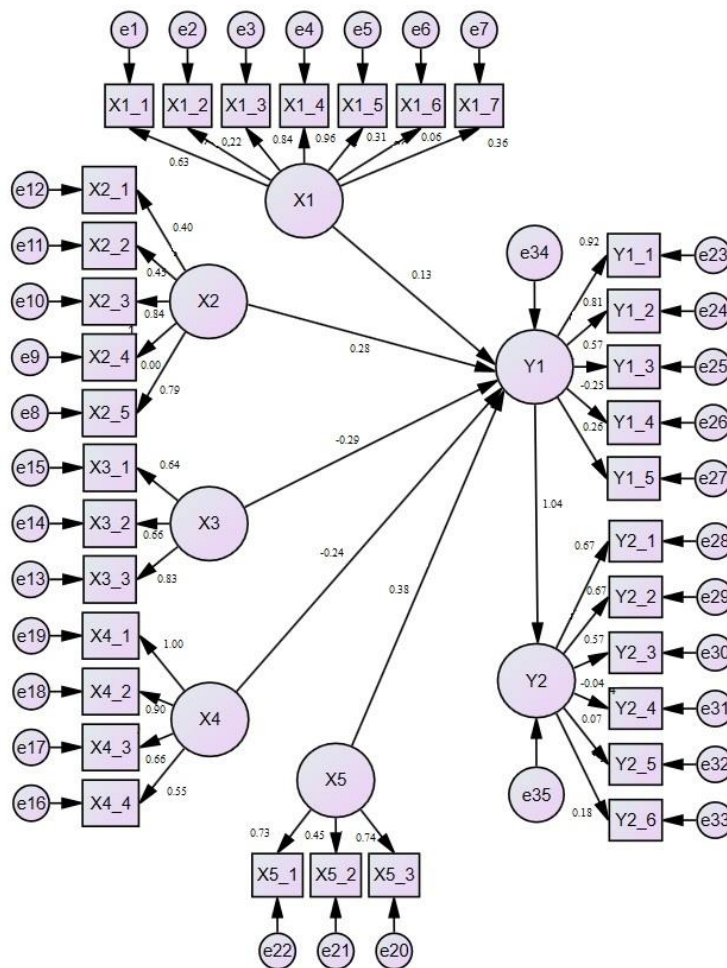


Figure 2. Path Diagram.

### 1. Validity Testing

Construct validity testing is intended to determine whether the indicators used in measuring latent variables are valid. The validity of each indicator in measuring the latent variable is indicated by the size of the loading factor (*Standardized Weights*). An indicator is declared valid if the indicator's loading factor is positive and greater than 0.5. The results of the validity test are presented in Table 13.

Table 15 shows that the question indicators X1\_2, X1\_5, X1\_6, and X1\_7, which measure the Technological Progress variable (X1), are declared invalid because they produce a loading factor value of less than 0.5. Then the question indicators X2\_1 and X2\_2, which measure the Modal variable (X2), are declared invalid. Furthermore, the question indicators X5\_2, Y1\_4, and Y1\_5, which measure the variables of Farming Experience (X5) and Counseling Problems (Y1), are declared invalid because they produce a loading factor value of less than 0.5. Then the question indicators Y2\_4, Y2\_5, and Y2\_6, which measure the Agricultural Extension Effectiveness variable (Y2), are declared invalid because they produce a loading factor value of less than 0.5.

When viewed from the strength of the loading factor (*Standardized Weights*) on each variable, the X1\_4 indicator has the highest contribution to the Technological Progress variable (X1) of 95.6%. Then, the Capital variable (X2) is dominated by the X2\_4 indicator of 99.6%. Furthermore, the X3\_3 indicator has the highest contribution to the Farmer Age variable (X3) at 82.9%. Then the Education variable (X4) is dominated by the X2\_4 indicator of 90.5%. Then the X5\_3 indicator has the highest contribution to the variable Age of Farming Experience (X5) at 73.6%. Furthermore, the Human Resources variable (Y1) is dominated by the Y1\_1 indicator of 91.8.0%. Finally, the Agricultural Extension Effectiveness (Y2) variable is dominated by the Y2\_1 indicator of 67.1%.

Validity can be seen through the loading factor and the Average Variance Extracted (AVE). An instrument is said to meet the validity test if it has an Average Variance Extracted (AVE) above 0.5. The results of the convergent validity test are presented in Table 15:

**Table 15.** Construct and Validity Test.

Variable	Indicator	Loading Factor	Criteria	AVE
Technology Advances (X1)	X1_1	0.626	0.5	0.326
	X1_2	0.220	0.5	
	X1_3	0.837	0.5	
	X1_4	0.956	0.5	
	X1_5	−0.306	0.5	
	X1_6	−0.058	0.5	
	X1_7	0.362	0.5	
Capital (X2)	X2_1	0.398	0.5	0.535
	X2_2	0.451	0.5	
	X2_3	0.839	0.5	
	X2_4	0.996	0.5	
	X2_5	0.786	0.5	
Farmer Age (X3)	X3_1	0.644	0.5	0.512
	X3_2	0.659	0.5	
	X3_3	0.829	0.5	
Education (X4)	X4_1	1.002	0.5	0.639
	X4_2	0.905	0.5	
	X4_3	0.658	0.5	
	X4_4	0.548	0.5	
Farming Experience (X5)	X5_1	0.732	0.5	0.425
	X5_2	0.445	0.5	

	X5_3	0.736	0.5	
Human Resources (Y1)	Y1_1	0.918	0.5	
	Y1_2	0.813	0.5	
	Y1_3	0.573	0.5	0.393
	Y1_4	-0.248	0.5	
	Y1_5	0.263	0.5	
Effectiveness of Agricultural Extension (Y2)	Y2_1	0.671	0.5	
	Y2_2	0.668	0.5	
	Y2_3	0.567	0.5	
	Y2_4	-0.043	0.5	0.210
	Y2_5	0.074	0.5	
	Y2_6	0.179	0.5	

Based on Table 15, it can be seen that overall, the indicators on the variables of Technological Advance (X1), Farming Experience (X5), Human Resource (Y1), and Effectiveness of Agricultural Extension (Y2) are declared valid in measuring the variables because they have fewer AVE values of 0.5. Cronbach's alpha was used for reliability. This value reflects the reliability of all indicators in the model. The minimum value is 0.7. In addition to Cronbach's alpha, composite reliability values are also used, interpreted the same as Cronbach's alpha values (Figure 3).

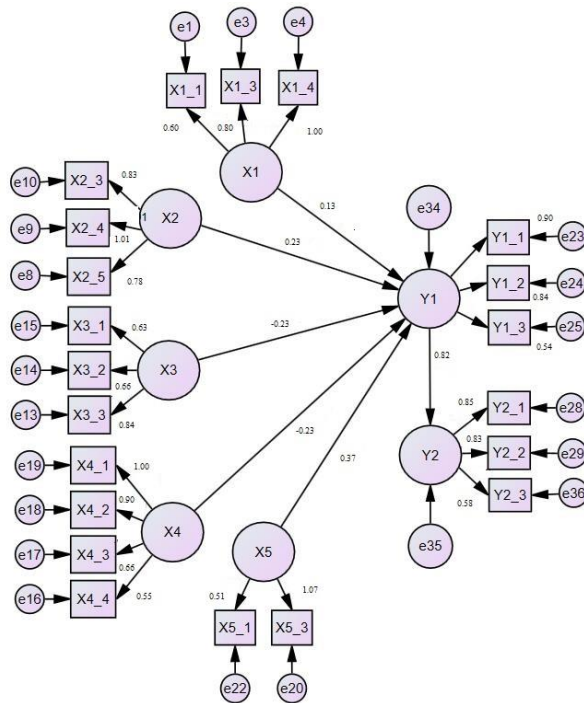


Figure 3. Path Diagram After Invalid Indicator Drop.

The validity of each indicator in measuring the latent variable is indicated by the size of the loading factor (Standardized Weights). An indicator is declared valid if the loading factor of an indicator is positive and is greater than 0.5. The results of the validity test and the loading factor, the Average Variance Extracted (AVE) value, are obtained, which is presented in Table 15.

## 2. Construct Reliability Test

The construct reliability test was carried out using the construct reliability (CR) technique. The test criteria state that the coefficient of construct reliability (CR) and Cronbach's alpha 0.6 means that it can be stated that the construct is reliable or the indicator is consistent in measuring the variables it measures.

### 4.2.2. SEM Model Evaluation

#### 1. Model Fit Test

Testing the feasibility/fitness of the model (construct) is intended to determine whether the construct formed is appropriate (feasible). There are several test indices in SEM analysis, namely CMIN/DF, RMSEA, TLI, and CFI. The test criteria use CMIN/DF; if the CMIN/DF value is the cut-off value (2.00), then the construct formed is appropriate (feasible). The criteria using RMSEA state that if the RMSEA value is the cut-off value (0.08), then the construct formed is appropriate (feasible). The criteria using TLI and CFI state that if the goodness of fit value is the cut-off value (by 0.90), then the model formed is appropriate (feasible).

Based on Table 16, it can be seen that all indicators are valid. An indicator is valid if the loading factor is positive and greater than 0.5.

**Table 16.** Construct Validity Test After Drop Invalid Indicator.

Variable	Indicator	Loading Factor	Criteria	Description
Technology Advances (X1)	X1_1	0.600	0.5	Valid
	X1_3	0.805	0.5	Valid
	X1_4	0.999	0.5	Valid
Capital (X2)	X2_3	0.830	0.5	Valid
	X2_4	1.008	0.5	Valid
	X2_5	0.776	0.5	Valid
Farmer Age (X3)	X3_1	0.633	0.5	Valid
	X3_2	0.659	0.5	Valid
	X3_3	0.838	0.5	Valid
Education (X4)	X4_1	1.004	0.5	Valid
	X4_2	0.903	0.5	Valid
	X4_3	0.656	0.5	Valid
Farming Experience (X5)	X4_4	0.548	0.5	Valid
	X5_1	0.510	0.5	Valid
	X5_3	1.066	0.5	Valid
Human Resources (Y1)	Y1_1	0.900	0.5	Valid
	Y1_2	0.839	0.5	Valid
	Y1_3	0.544	0.5	Valid
Effectiveness of Agricultural Extension (Y2)	Y2_1	0.849	0.5	Valid
	Y2_2	0.835	0.5	Valid
	Y2_3	0.578	0.5	Valid

Based on Table 17, it can be seen that the AVE for all variables are valid because AVE > 0.5.

**Table 17.** Validity Test After Drop Invalid Indicator.

Variable	AVE	Description
Technology Advances (X1)	0.669	Valid
Capital (X2)	0.769	Valid
Farmer Age (X3)	0.512	Valid
Education (X4)	0.639	Valid
Farming Experience (X5)	0.698	Valid
Human Resources (Y1)	0.757	Valid
Effectiveness of Agricultural Extension (Y2)	0.709	Valid

Based on Table 18, it can be seen that the construct reliability and Cronbach's alpha values for all variables are more significant than 0.6. Thus, these variables are declared reliable based on the calculations of construct reliability and Cronbach's alpha.

**Table 18.** Reliability Test.

Variable	Construct Reability	Cronbach's Alpha	Description
Technology Advances (X1)	0.814	0.807	Reliable
Capital (X2)	0.854	0.884	Reliable
Farmer Age (X3)	0.791	0.729	Reliable
Education (X4)	0.872	0.782	Reliable
Farming Experience (X5)	0.700	0.704	Reliable
Human Resources (Y1)	0.829	0.681	Reliable
Effectiveness of Agricultural Extension (Y2)	0.804	0.776	Reliable

Based on Table 19, it can be seen that the four indications, namely CMIN/DF, RMSEA, TLI, and CFI, do not meet the criteria. Thus, the SEM model that has been formed is declared not feasible.

**Table 19.** Goodness of Fit Model.

Index	Goodness of Fit	Cut Off Value	Description
CMIN/DF	2.709	$\leq 2.00$	Poor of Fit
RMSEA	0.148	$\leq 0.08$	Poor of Fit
TLI	0.673	$\geq 0.90$	Poor of Fit
CFI	0.714	$\geq 0.90$	Poor of Fit

Because the model is not feasible, modifications to the covariance index are carried out to obtain a fit model. Basically, the structural equation modeling (SEM) method in AMOS is a covariance-based SEM (CB-SEM) which needs to be accommodated by the covariance element. For example, the following is a path diagram after modification of the index covariance model (Figure 4 and Figure 5):

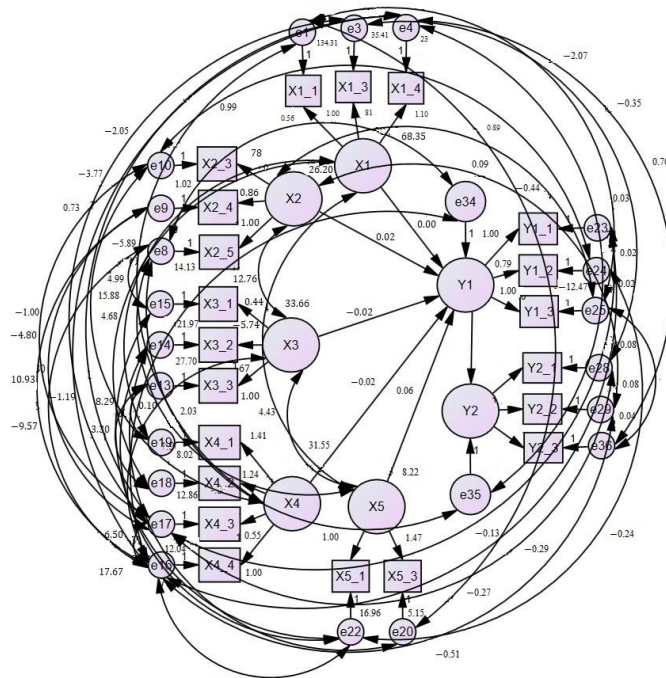


Figure 4. Path Diagram After Modifying the Covariance Index (Unstandardized).



Table 21. Hypothesis test.

Hypothesis	Track	Standardized Coefficient	SE	CR	<i>p</i> -Value	Description
H1	X1→Y1	0.001	0.003	0.019	0.985	Not significant
H2	X2→Y1	0.289	0.006	3.255	0.001	Significant
H3	X3→Y1	-0.287	0.008	-2.389	0.017	Significant
H4	X4→Y1	-0.294	0.005	-3.908	***	Significant
H5	X5→Y1	0.440	0.013	4.467	***	Significant
H6	Y1→Y2	0.828	0.114	9.027	***	Significant

Description: \*\*\* *p*-value < 0.001.

- Testing the effect of Technological Progress (X1) on Human Resources (Y1) produces a CR statistic of 0.019 and a *p*-value of 0.985. The test results show that the *p*-value (0.985) > alpha 0.05, meaning no significant effect of technological progress on Human Resources.
- The test of the effect of Capital (X2) on Human Resources (Y1) produces a *p*-value of 0.001. The test results show that the statistical *p*-value (0.001) < alpha 0.05, which means that there is a significant effect of Capital on Extension Issues. The positive coefficient of 0.289 indicates that Capital positively affects Human Resources. This means that the higher the Capital, the higher the Human Resources.
- Testing the effect of Farmer Age (X3) on Human Resources (Y1) produces a CR statistic of -2389 with a *p*-value of 0.017. The test results show that the statistical *p*-value (0.017) < alpha 0.05, meaning that Farmer's Age has a significant effect on Human Resources. A negative coefficient of -0.287 indicates that Farmer Age harms Human Resources. This means that the higher the Farmer's Age, the lower the Human Resources.
- The effect of Education (X4) on the Human Resources (Y1) test produces a CR statistic of -3.908 with a *p*-value of 0.001. The test results show that the *p*-value (0.001) < alpha 0.05 means that Education has a significant effect on Human Resources. This means that the higher the Education, the higher the Human Resources.
- Testing the effect of Farming Experience (X5) on Human Resources (Y1) resulted in a CR statistic of 4.467 with a *p*-value of 0.001. The test results show that the statistical *p*-value (0.001) < alpha 0.05 means that Farming Experience has a significant effect on Human Resources. A positive coefficient of 0.440 indicates that the Farming Experience positively affects Human Resources. This means that the better the Farming Experience, the better the Human Resources.
- The test of the influence of Human Resources (Y1) on the Effectiveness of Agricultural Extension (Y2) resulted in a CR statistic of 9.027 and a *p*-value of 0.001. The test results show that the statistical *p*-value (0.001) < alpha 0.05, which means that Human Resources has a significant influence on the Effectiveness of Agricultural Extension. The positive coefficient of 0.828 indicates that Human Resources positively affect the Effectiveness of Agricultural Extension. This means that better Human Resources can increase the Effectiveness of Agricultural Extension.

b. Indirect Effect Test

Hypothesis testing is intended to test whether exogenous variables have an indirect effect on endogenous variables through mediating variables (intervening). Mediation testing can be known through the Sobel test. The test criteria state that if the *z* statistic > *z* table (1.96) or *p*-value < alpha 0.05, it is stated that there is a significant indirect effect of exogenous variables on endogenous variables through mediating variables (intervening). The analysis results can be seen in the summary in Table 21.

Based on Table 22, it can be stated that the test of the effect of Capital (X2), Farmer's Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricul-

tural Extension (Y2) through the mediation of Human Resources (Y1) produces a statistical  $p$ -value  $< \alpha$  5% which means that there is an indirect effect of Capital Progress (X2), Farmer Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2) through the mediation of Human Resources (Y1). In other words, the Human Resources variable (Y1) can mediate the effect of Capital (X2), Farmer Age (X3), Education (X4), and Farming Experience (X5) on the Effectiveness of Agricultural Extension (Y2).

**Table 22.** Hypothesis test.

Hypothesis	Track	Indirect Coefficient	Std. Error	$p$ -Value	Description
H7	X1→Y1→Y2	0.001	0.002	0.739	Not Significant
H8	X2→Y1→Y2	0.239	0.033	0.000	Not Significant
H9	X3→Y1→Y2	−0.238	0.034	0.000	Not Significant
H10	X4→Y1→Y2	−0.243	0.034	0.000	Not Significant
H11	X5→Y1→Y2	0.364	0.051	0.000	Not Significant

While the test of the effect of Technological Progress (X1) on the Effectiveness of Agricultural Extension (Y2) through the mediation of Human Resources (Y1) resulted in a statistical  $p$ -value (0.985)  $> \alpha$  5%, which means that there is no indirect effect of Technological Progress (X1) on the Effectiveness of Agriculture Extension (Y2) through the mediation of Human Resources (Y1) or, in other words, the Human Resources variable (Y1) is not able to mediate the effect of Technological Progress (X1) on the Effectiveness of Agricultural Extension (Y2).

### 3. Convert Path Diagrams to Structural Equations

The conversion of path diagrams into structural equations is intended to find out how the shape of the influence between constructs is based on their mathematical equations. Based on the attachment, it can be seen that the mathematical models formed are as follows:

$$\text{Equality 1: } Y_1 = 0.001 X_1 + 0.239 X_2 - 0.2873 X_3 - 0.294 X_4 + 0.440 X_5$$

$$\text{Equality 2: } Y_2 = 0.828 Y_1$$

## 5. Conclusions

1. The factors that influence the effectiveness of agricultural extension in Baubau City, Southeast Sulawesi, are farming capital, farmer's age, education, farming experience, and human resources.
2. The influence of these factors on the effectiveness of agricultural extension in Baubau city is as follows: if farming capital is high, human resources can be increased. Moreover, the higher the farmers' age, the lower the need for human resources. It was additionally noted that higher education of farmers contributes to improvement in human resources, and the increased experience in farming corresponded to an increase in human resources. Hence, increasing human resources will increase the effectiveness of agricultural extension.
3. Extension issues and materials affect the effectiveness of agricultural extension in Baubau City, where the influence can be categorized as Good or Influential.
4. Farming capital is land area, labor, use of fertilizers, pesticides, agricultural tools, and machines. There is an influence of farming capital variables on the effectiveness of agricultural extension.

Human resources describe the knowledge possessed by education, training, experience, and information received. Activities that must be carried out by agricultural

extension workers in the city of Baubau are optimizing socialization and training related to agricultural land, for example, making demonstration plots so that farmers can see directly and have no doubts about the theory provided. In addition, one way to achieve extension effectiveness is to increase human resources (agricultural extension workers) as program implementers so that the programs that have been designed can be implemented. The lack of extension workers resulted in a significant workload for each extension agent because the extension area assisted by the extension worker was large, and the number of assisted farmer groups was significant. Currently, there are 44,890 agricultural extension workers. These agricultural extension workers serve 71,479 villages, so they still need as many as 26,589 agricultural extension workers (agricultural extension center Indonesia, 2022) [20]. Many agricultural extension workers can supervise the assistance funds given to farmers so that they are appropriately managed to realize farmer welfare, distribute farmers' knowledge about the latest agricultural technologies, and develop rice farming. For example, they help to provide production facilities, distribute fertilizer and seed aid, and provide cooperative institutions to assist farmers in procuring farming capital. In addition, agricultural extension agents have roles as facilitators, communicators, motivators, and consultants. Indonesian Government Regulation no. 16 of 2006 concerning the Agricultural Extension System, one of the critical points in this law is the need to build extension institutions in the regions at the provincial and district/city levels.

Age affects productivity level, making decisions, and receiving information. The dominant number of respondents is 46–55 years old. This shows that the productive age in this study is in the age range of 46–55 years. At a productive age, it will be easier to get new ideas and quickly understand the use of technology. Information obtained by farmers, especially from agricultural extension workers, will increase their paddy rice production. This follows the research results (Hasyim, 2006) [17] that those who work at productive age will be better and maximal than non-productive age.

Education is influential in taking action in making programs for agricultural development. The low level of education in this study indicates that the quality of human resources needs to be improved in efforts to develop farming performance. Improving the skills and knowledge of farming will encourage the achievement of planned production targets. According to (Lubis, 2000) [18], having a high level of education will be relatively faster in implementing technology and innovation adoption; having low education usually makes it challenging to implement innovation adoption quickly.

The indicators included in the Technological Progress variable are the use of transplanters, the use of indo combine harvesters, the use of KATAM (planting season prediction), the use of KATAM (fertilizer dose), the use of drones (irrigation sensors/measuring soil pH), the use of expert system applications, and the use of social media. The average variable of Technological Progress is 24.91, with an achievement level of 64.53% in the less good category. Farmers should optimize information technology, such as using the internet to find the latest information. Advances in technology play a role in supporting the availability of relevant and timely agricultural information. Information on the results of research and technological innovations in agriculture helps efforts to increase the production of agricultural commodities. According to research results (Prayoga, K. 2017) [21], the use of technology is considered less optimized by the Indonesian Ministry of Agriculture. Extension activities that utilize social media must continue to be optimized because the number of users continues to increase.

5. Matters related to extension include the number of assisted farmers, the distance to extension locations, the amount of agricultural extension work time, extension media, methods, frequency, materials, and the instructor's experience. Extension media has the most significant contribution to the problem variables of extension agents. Through extension media, it can attract farmers to attend training. Agricultural extension agents use various media that are adjusted to the farmer's

age—then, followed by indicators of instructor experience, frequency of extension, amount of working time of agricultural extension workers, extension methods, and extension materials. Extension material is everything that extension agents propose to farmers, including the suitability of the material with the needs and benefits. Based on the assessment of the extension workers in the field, it was assessed that the absorption of the material and the most suitable application were in fertilization, harvesting, and post-harvest materials. This is followed by good planting time, nurseries, planting, nursery, and maintenance indicators. Agriculture is a critical sector in national development. In national development, it is necessary to support human resources, who have the capacity, who can produce solutions to answer the challenges. Therefore, it is necessary to carry out an agricultural extension to develop agriculture. Agricultural extension is also one of the efforts to produce quality human resources. Agricultural extension is an empowerment effort or an effort to motivate and change the behavior of farmers and their families so that they have the will and can solve the problems they face in doing their farming. Therefore the role of extension is crucial and becomes a strategic matter in national development.

The Ministry of Agriculture is targeting Indonesia to become a world food barn by 2045. To achieve this mission, the Ministry of Agriculture places farmers as the main actors in agricultural development. Therefore, attention is needed from farmers through agricultural extension workers. In general, the knowledge farmers have to lack in renewal, and the existence of agricultural extension can help agricultural development.

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