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Analyzing the Role of Commercialization and Farmer's Literacy on Agriculture Extension Services in Indonesia

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The current study aimed to assess the role of commercialization and farmer literacy rate on the "agricultural extension services" (AES) in Indonesia. This study was performed in Indonesia where the impact of farmer's literacy and commercialization was analyzed on the AES and macroeconomic data has been collected about Indonesia for a period of 30 years. Time series analysis was applied on the data to see the relationship over these past thirty years. The current study is based on secondary data because the databases and archival references were accessed to obtain desired data. The data was analyzed in terms of descriptive statistics, unit root test, co-integration and heteroscedasticity before running regression. The regression results showed that commercialization has significant impact on AES at level and at first lag however, the impact is negative. The results further proved that farmer literacy has significant impact on AES at level as well as first lag. The results of long-run equation and short-run equation are showing that there is a significant and positive impact of commercialization as well as farmer's literacy on the AES in the long-run while the commercialization has no significant short-term impact on AES. However, the farmer's literacy has a significant positive impact on AES in the short-run. The current study and findings have important implications in theory and practice because the researchers and policymakers will know, through the findings of this study, how they can enhance or discourage the country AES by focusing on farmer's literacy and commercialization.

Key words: Commercialization, Farmer's Literacy, Agriculture Extension Services, Indonesia.

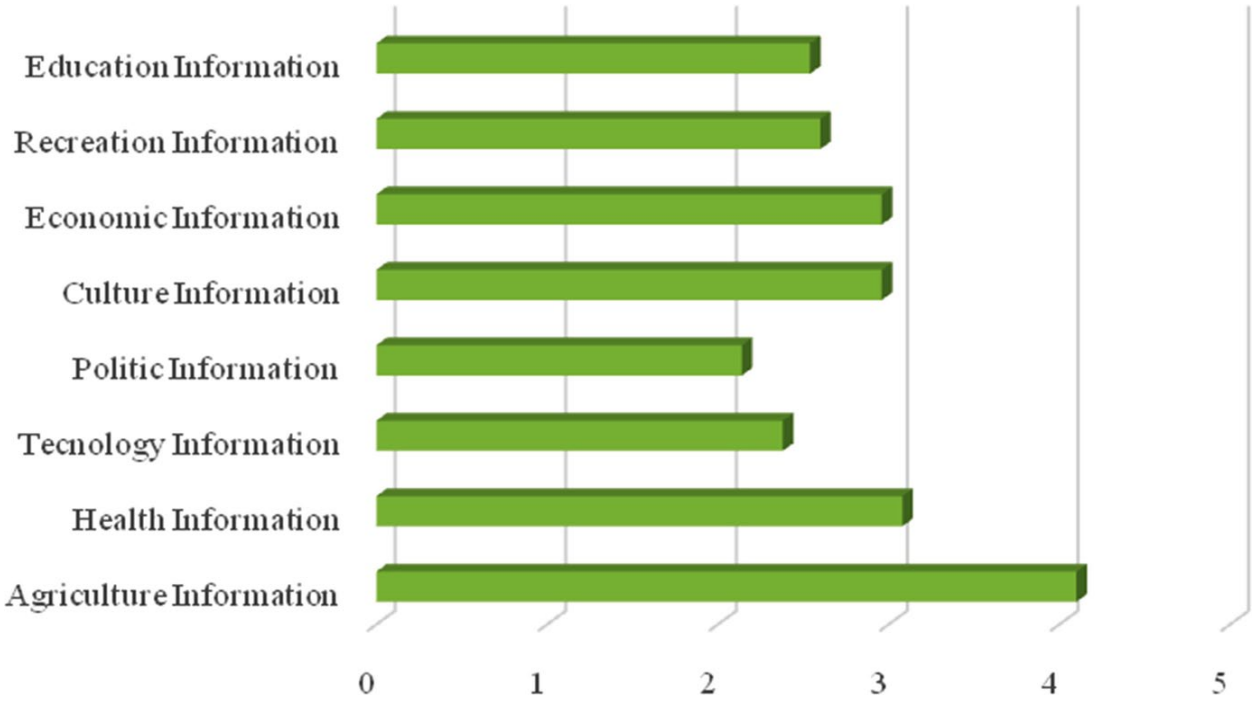
Introduction

Agricultural extension services play a chief part in the agriculture sector. Agricultural extension services, as an essential component of agrarian expansion, have been in effect since Indonesia embraced its independence (Maryudi et al., 2017). After gaining independence, agriculture extension services strategy in Indonesia was integrated with a close-fitting synchronization between connected establishments from the midpoint to the areas (Abate & Bernard, 2017). After 2006, Indonesia enforced law number 16/2006 for its Agriculture, Forestry, as well as Extension Services. The determination of this new covenant was to provide commands for agriculturalist liberation and capability construction by giving non-formal teaching to mature farmers with the aim of increasing their affluence (Azadi et al., 2016).

Today, commercialization in the agriculture sector is a predictable realism in the whole realm. Commercialization in farming is not an innovative occurrence, plus it is not a new disclosure to the agricultural domain (Munir & Davidson, 2017). Ever since the 1950s, most agriculturalists in Indonesia have been headed for commercialization. Their chief aim was excess yield to achieve market vision. In commercialized agriculture, the role of extension services are mainly deliberated on the inventive and successful agriculturalists, who demonstrate satisfactory ecological circumstances and sophisticated socio-economic rank (Sabastian et al., 2019). The aim of commercialized agriculture is to reduce the number of agriculturalists, as well as enlarge the size of farmed land. However, commercialized livestock agribusiness does not depend on the size of farm, except in the case of dairy agribusiness (Abate & Bernard, 2017).

One of the chief difficulties confronting agricultural efficiency in Indonesia is the illiteracy of farmers. Due to this, agricultural development and the crop yield have faced significant challenges over the years. The degree of farmers' literacy in Indonesia has generally disturbed agricultural, particularly in the rural regions (Martini, Roshetko, & Paramita, 2017). Extension services are most affected and more wearisome when farmers have little education and information. While farmers typically have opulent understanding of local environments and valued applied information or knowledge of how to greatly and effectively make use of their situation, they need advanced information produced from exploration and progression to increase their production (Talib, Ashraf, Agunga, & Chaudhary, 2018). Hence, the effect of education on the life of rural agrarians cannot be overlooked. Agricultural expansion comprises an arrangement of improvements and modifications, which progressively request a more refined and well-educated agriculturalist (Munir & Davidson, 2017) see Figure 1 below.

Figure 1. Farmer's Literacy in Indonesia



In Indonesia, agriculture is an important sector for the crop yield however, prominence is not given to farmer's literacy nor the commercialization aspect. Since both these factors affect the implementation of extension services by rural farmers, it is significant that farmers commercialize and acquire knowledge. This is vital for the economic stability of the entire country since literacy and commercialization has, to date, lagged behind in Indonesia (Martini, Roshetko, & Paramita, 2017). The issue is persistent in Indonesia as well as other international republics for example Pakistan, ASEAN countries, Bangkok, Brazil, India, South Africa etc. as all these countries are constantly aiming to implement new technologies in their farming practices. Therefore, the role of education, literacy and commercialization is a necessary field to research (Abate & Bernard, 2017).

Through a literature review, gaps were identified in the available literature. However, while studies were found researching the role of commercialization on extension services in Indonesia, no past studies focused on the role on farmer's literacy on extension services in Indonesia (Sabastian et al., 2019). Mostly, studies were conducted in other countries and therefore, the factors of literacy and commercialization affecting agricultural extension services of Indonesia was not researched in any study (Ragasa & Mazunda, 2018). Hence, as exploration is requisite in this area, the present study will assess the role of commercialization and farmer's literacy on agricultural extension services in Indonesia The research questions formulated for the current study are: (1) What the role of commercialization on agricultural extension services in Indonesia? and (2) What is the role of farmer's literacy on agricultural extension services in Indonesia?

Commercialization in Indonesia greatly affects the acquisition of modern knowledge and it contributes to the ongoing practice of extension services by providing suitable conditions of farming (Ozoya, Edewor, Iruonagbe, & Chiazor, 2018). Under endangered agriculture, agriculturalists trail notions of commercialization. Increased farming efficiency through extension services likewise is determined by the literacy level of farmers, in that they can comprehend and assent to the composite technical variations which are problematic for uneducated farmers to understand (Talib, Ashraf, Agunga, & Chaudhary, 2018). Therefore, agricultural extension services provide significant benefits incontrolling the level of literacy and commercialization, in reducing the poverty of rural population and improving the incomes of rural families while also rising general contributions to overseas exchange incomes through exports (Hariyanto & Anwar, 2019).

Literature Review

Commercialization is arguably one of the unavoidable realities prevailing throughout the entire world and different factors are rapidly affecting the process of commercialization both in developed and developing countries. Some of these factors are quick expansion of global economies, development and adoption of new technologies, rapid expansion of trade markets, decrease in limitations by government in economic transactions for the active participation of non-government and private entities, excessive shift of population to urban area from the rural areas, day by day increasing demand for goods, bilateral trade agreements between countries and comparatively more liberal trade policies and the development of infrastructure. Generally various parties in Indonesia collaborate for commercialization especially in the private sector.

Commercialization is one of the most operative and widely accepted methods to cope with the problem of poverty (Carletto, Corral, & Guelfi, 2017). Commercialization in the agricultural sector is an old phenomenon and since the 1950's, farmers around the globe have been moving towards the commercialization of agriculture with the aim to produce surplus and protect independent market factors. Farmer's literacy and agriculture extension services (AES) play a vital role in agricultural production. The extension services in commercialized agriculture tend to focus on the more resourceful large scale farmer working in the more favorable environment and with high social and economic status (Alwarritzi, Nanseki, & Chomei, 2015).

A higher amount of agricultural lend and a lower number of farmers is considered favorable in commercialization. The Indonesian government also takes part in and monitors the extension system but studies suggest that removal of arbitrators and a gradual decrease in the amount off allocated financial resources has created an argumentative negative impact on the extension services (Koh & Ghazoul, 2010). While on the other hand, studies have proved that there is a directly proportional relation between literacy rate and the efficiency in utilizing the cultivated

land. Alternate studies also show that Indonesian lands tend to be farmed in more of an old-style where there is low literacy rate. (Siahaya, Hutauruk, Aponno, Hatulesila, & Mardhanie, 2016).

Commercialization and extension services

Commercialization in agriculture has created a positive relationship between commercialization itself and the extension services as proven by several research studies (Nkegbe et al., 2018). In the commercialized system of agriculture there is a different role for agriculture extension services (AES) than in the traditional system. Farmers, in order to produce surplus of their own needs, even the small households with small land, and move toward the commercial agriculture essentially requiring the use of better technologies and adoption of the extension programs. It would be hard for farmers to survive in the agriculture business while producing crops only for their own consumption requirements, therefore the intent is to meet the needs and demands of the market too. In order to meet these demands farmers need to produce marketable surplus of their crops.

On the basis of marketable surplus produced by the framers, this can be divided into three different categories. The farmers producing only 25% crops surplus of their own needs are termed subsistence farmers. Nexr, are the farmers that produce 25% to 50% crops in surplus of their own needs who are considered the transition farmers. Those farmers for whom more than 50% of the total production is in surplus of their own needs are termed commercial farmers (Fukai, Xangsayasane, Manikham, & Mitchell, 2019). The objectives of commercialization of the agriculture production are to produce crops for sales and profit maximization, meet the needs and demands of both the non-farming population and provision of raw material for processing and manufacturing originations and leading farmers toward entrepreneurial outcomes through implementation of the concepts of business management (Gabrielli et al., 2018).

Productivity plays the most vital role to achieve these objectives and several research studies have proven that there is a positive relation between higher productivity and AES (Elias, Nohmi, Yasunobu, & Ishida, 2013). AES is continuous, informal educational process distributed over a period of time which provides the opportunity to improve standard of living through gaining profitability by increasing farm productivity. It helps in increasing the skills and knowledge of the farmer which consequently changes their attitude toward adoption of new technologies, farming practices and marketing of their commodities. Currently AES is expected to further expand its scope and guide and assist with not only farming activities but also in other activities which can enhance the net income and overall wellbeing of farmers. As commercialization essentially requires successful AES programs to effectively and accurately guide the farmer, commercialization has become a commodity itself which comes with a price.

Commercialization has revolutionized the public sector AES and the business of the technology firms (Muyanga & Jayne, 2008). It would not have been possible without the commercialization of AES itself. So under this conceptualization, agriculture extension can be considered a product or a service which is exchanged between two parties by obtaining a certain amount in return. Agriculture extension service providers act as sellers while farmers act as buyer of the service and the price of the service is decided as any other economic activity in which the price is determined, by market forces, keeping in view supply and demand.

Therefore like quality seeds, fertilizers, pesticides and preparation of land AES can also be considered as fine input which can positively affect crop productivity. So paying for these services may also be considered as paying for any other essential input. Also the AES provider doesn't have to be essentially a non-government organization, as it could also be semi-government or entirely a public extension agency (Adetayo & Eunice, 2013). It has been observed that profit centered extension agencies sometimes neglect environmental concerns though the situation has improved in developed countries with the passage of time, where community pays attention to environmental protection (Nugraha & Osman, 2018, 2019). The presence of both private and public AES can provide more competent programs as observed in many south Asian countries. Moreover private agencies mostly focus on the resource-rich farmers neglecting the smaller households because of the commercialization and profitability factors therefore the public or not-for-profit organizations need to concern themselves with the smaller resource-deficient farmers to improve productivity from the basic scale.

H1: Commercialization has significant impact on AES.

Farmer literacy and extension services

Studies suggest that several effective AES programs have failed to show a reasonable increase in productivity because the farmers lack formal education and are reluctant to participate in the change process because of this. Therefore the researchers suggest that farmer literacy has a positive impact on the AES and in order to understand the effect of famer literacy on AES the conceptual frame work of farmer literacy needs to be elaborated first. Farmer literacy in terms of possessing essential information required in agricultural business is defined as the ability of a farmer to recognize when the information is required and how to access, evaluate and effectually use that information when needed (Ademola & Olatokun, 2018). This concept is termed Agricultural Information Literacy (AIL).

AIL is directly proportional to critical thinking skills and highlights several activities like selection of relevant information using the right information tools, organization of information in an understandable manner, evaluation and rejection of useless information and using the

right information to enhance agricultural productivity . Living in the information age, farmers must have the potential to actively participate in meeting the needs of rapidly developing information community. The second perspective of defining the farmer literacy is the ability of a farmer to read and write (Akoto, Appiah, & Turkson, 2017).

Farmer literacy plays a vital role in the growth of the farmer by promoting efficiency. Increased efficiency boosts net income which results in economic growth and better living standards. In contrast, incompatibility of the farmer with the current information age can badly effect productivity. It is self-evident that progressive market economies are led by the information and information resources considered to be more crucial than energy or material resources. It is a fact that whoever has timely access to information can capture greater markets and earn more (Erumban & Das, 2016).Timely access to the right information plays a very crucial role in the knowledge management of agriculture organization. In order to provide this information, extension services providers use extension messages to solve the agricultural problems of the farmers. Extension services are a system which facilitate the farmers and other agricultural stakeholders access to timely information, necessary education and modern technologies to help them interact and enhance their technical and managerial skills (Danso-Abbeam, Ehiakpor, & Aidoo, 2018).

Several research studies prove that extension and research payoff in terms of higher productivity in the long term (Elias et al., 2013). Extension services provide information about technologies and new techniques to the agricultural communities which, when adopted and implemented properly, can enhance productivity which consequently increase income. As a result of these improved economic activities, the standard of living is enhanced (Bonye, Alfred, & Jasaw, 2012). Extension service providers, after creating a new technology regarding the agricultural field, make efforts to profligate its rate of adoption and closely monitor the process to eliminate any hindrance. It is ensured that the farmers fully understand the process of using the latest techniques by giving demos where required.

In many countries, extension workers use print media for transfer of knowledge and reinforcement of latest information because of cost effectiveness, easy accessibility and distribution. Thus to take advantage of the information disseminated in the form of print media, the farmers need to be literate or else the effectiveness of the messages is limited due to lack of understanding (Kassem, Abdel-magieed, El-Gamal, & Aldosari, 2017). Studies suggest that in many countries where there is high farmer literacy, the extension agencies have tried to shift the farmers toward the use of latest equipment, seeds, fertilizers and irrigation systems to enhance productivity and the results have been favorable (Lee, An, & Kim, 2017).

H2: Farmer's literacy has significant impact on AES.

Research Methodology

Data Collection and Sampling

The current study is about the impact of commercialization and literacy of farmers on Agricultural extension services (AES). The research methodology adopted to fulfil this purpose was totally based on secondary data extracted from databases and archival refrences. The population of this study consists of time series data about AES, farmers' literacy and commercialization in Indonesia for the past 30 years. The 30 year data set was collected mainly from the website of "World Bank Group".

Variables Definition

The present study involves the following variables that are measured through suitable proxies.

- **Dependent variables.** The dependent variable of the current study is "agricultural extension service" (AES) which was measured as a dummy variable based on its existence in Indonesia in the respective year. The value of 2 or 1 was assigned to the variable if there is AES in Indonesia or if there is no AES in Indonesia respectively.
- **Independent variables**. The current study involves two independent variables that are commercialization and farmer's literacy. The commercialization is a dummy variable which was assigned value of '1' if there was no commercialization, 2 if there was private commercialization, 2 if there was public commercialization, and 3 if there were both private and public commercialization in Indonesia in respective year. The farmer's literacy was measured by taking the literacy rate in Indonesia.
- **Control Variables.** There are four control variables in the current study named as "Arable land" (ARL), "economic growth", "Carrier Yield" (CY) and "labour Force" (LF). The ARL was measured by taking proportion of arable land of the total land in Indonesia. Carrier yield was measured in Kgs per hectare. Economic growth was measured as the GDP of Indonesia and the data about the labour force was available from the official databases of the country.

Modelling and Methodological Approach

In the present research, the impact of farmer's literacy and commercialization on the AES has been examined through ARDL time series analysis. The thirty year data set was analysed through EViews. This time series analysis is a great approach to determine the lags at which a relationship is significant. Through time series analysis, the lags were identified at which the farmers' literacy and commercialization significantly influenced the AES. The mathematical representation of the econometric model studied in the current study is as follow:

$$\mathrm{AES}_t = \beta_0 + \beta_1 FLR_{t-1} + \beta_2 \mathrm{COM}_{t-1} + \beta_3 \mathrm{DP}_{t-1} + \beta_4 \mathrm{ARL}_{t-1} \beta_5 \mathrm{CY}_{t-1} + \beta_6 \mathrm{LF}_{t-1} + u_{it} \quad (1)$$

Unit Root Test

The unit root test is used to check if the data is stationery or not. The unit root test is particularly important in the analysis of macroeconomic and financial data. Since the current variables are macroeconomic and financial therefore, the "unit root test" was applied on the data. In "unit root test" the current study adopted the "ADF Fisher Chi-square (ADF Fisher) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS)" in which "Bartlett Kernel estimation method" with "Newey–west bandwidth" was applied in the test of KPSS.

$$\Delta Y_1 = \beta_1 + \beta_2 \, t + \alpha Y_{t-l} + \sum_{t=1}^{r} \rho_i \, \Delta Y_{t-i} + \mu_t \qquad (2)$$

Here, "ΔY_{t-i}" shows the "lag difference", the "β_1" denotes the "constant term" and "t" indicates the "time trend". The "unit root test" was used in the current time series analysis to confirm that "error term" is serially independent by including "lag difference terms". The null and alternative hypotheses for "unit root test" are as follow.

$$H_o: \boldsymbol{\alpha = 0}$$
$$H_1: \boldsymbol{\alpha \neq 0}$$

Results

The secondary time series data was put into analysis through EViews in which "descriptive statistics, unit root, heteroscedasticity, co-integration and regression tests" were applied on the data to complete the analysis.

Descriptive Statistics

The data was analyzed in terms of its normality and adequacy for which the values of "skewness, kurtosis, mean value and std. deviation" were mainly considered. Table 1 below presents the descriptive characteristics of the data.

Table 1: Descriptive Statistics

Statistics	AES	ARL	CY	COM	FLR	GDP	LF
Mean	1.4000	13.089	4508.30	2.040	17.249	7.0913	2.9167
Median	1.0000	13.07	4365.80	2.000	17.730	6.91090	2.9151
Maximum	2.0000	13.27	5306.600	3.000	26.325	11.9438	2.9280
Minimum	1.000	12.97	3816.900	0.000	5.9330	3.0586	2.9036
Std. Dev.	0.5000	0.1058	519.9653	0.934	6.1200	2.4311	0.0071
Skewness	0.408	0.2967	0.150860	-0.704	-0.2639	0.1509	-0.0928
Kurtosis	1.166	1.696	1.481168	2.6723	1.9411	2.1931	1.91412

The descriptive statistics presented in Table 1 show that the mean value of AES, FLR, commercialization, GDP, labour force, arable land and carrier yield fall between their minimum and maximum values. This means that there was no extreme value in the data of any variable. The normality of data was mainly ensured through values of skewness and kurtosis for all variables that ranged from -1 to +1 and 1 to 3 respectively. The std. deviation of all variables also meets the threshold standard therefore, it can be stated that there is acceptable variation in the data and there is no outlier so the data is normal.

Unit Root Test

The errors related to the "fallacious regression" were carefully avoided by running Unit root test on the data. The ARDL approach allows the estimation of "co-integrating vector" in case of series I(1) and series I(0) therefore, these condition must be fulfilled for ARDL modelling. The results of "unit root test" are presented in tables 2 and 3 below.

Table 2: Unit Root Test at the levels of the variables

Variables	ADF (null: variables has a unit root)		KPSS (null: variable is stationery)	
	Test Statistic	Critical value at .05 level	Test Statistic	Critical value at .05 level
AES	-0.13	-3.01*	0.88	0.52**
ARL	0.55		0.86	
CY	1.09		0.79	
COM	1.19		0.84	
FLR	1.16		0.41	
GDP	1.18		0.42	
LF	1.09		0.39	

Table 3: Unit root test at first differences of variables

Variables	ADF (null: variables has a unit root)		KPSS (null: variable is stationery)	
	Test Statistic	Critical value at .05 level	Test Statistic	Critical value at .05 level
AES	-5.99	-3.01	0.07	0.52
ARL	-7.23		0.18	
CY	-5.99		0.08	
COM	-6.01		0.13	
FLR	-5.87		0.19	
GDP	-6.04		0.07	
LF	-5.87		0.05	

Table 2 and 3 indicate the unit root test at level and at first differences. Since the results of both tests are the same, it is found that the series AES, ARL, CY, COM, FLR, GDP and LF are I(1). This means that the condition for ARDL approach has been fulfilled so the data is able to be processes for ARDL analysis.

Co-integration test

The results of "unit root test" show that the data is stationary. The stationary residuals of variables suggest that there must be co-integration among variables. The co-integration test was applied on the data to test the null hypothesis which stated that "there is no co-integration" and the alternative hypothesis suggested that "there is co-integration" (Nugraha & Osman, 2018). Table 4 below provides the summary of results of co-integration. The key indicators of "F-statistics, Akaike information criteria (AIC), or Schwarz information criteria (SIC)" are used in the co-integration test. The F-statistics should be higher than the "upper critical value" in order to accept the alternative hypothesis. The minimum AIC and SIC determine the "optimal lag value".

Table 4: Co-integration Test

Lag	Intercept			Intercept and trend		
	AIC	SIC	F	AIC	SIC	F
1	-2.099	-1.532	2.90	-2.013	-1.510	2.89
2	-2.130	-1.488	3.78	-2.013	-1.423	3.42
3	-2.109	-1.385	3.98	-2.001	-1.341	3.89
4	-2.109	-1.283	2.89	-2.101	-1.241	2.76

5	-2.392	-1.563	3.54	-2.134	-1.478	3.43
6	**-3.182**	**-1.867**	**6.03****	**-3.164**	**-1.834**	**6.39****
7	-2.466	-1.294	0.76	-2.321	-1.210	0.79

The F-statistic is greater than "upper critical value" at minimum AIC and SIC so the null hypothesis is rejected and the alternative hypothesis is accepted which suggests that there is co-integration. The confirmation of co-integration was followed by the estimation of long-run ARDL equation which is as follow:

$$AES_t = \beta_0 + \sum_{i=0}^{p}\beta_{1i}FLR_{t-i} + \sum_{i=0}^{q}\beta_{2i}COM_{t-i} + \sum_{i=0}^{r}\beta_{3i}GDP_{t-i} + \sum_{i=0}^{s}\beta_{4i}ARL_{t-i} + \sum_{i=0}^{t}\beta_{5i}CY_{t-i} + \sum_{i=0}^{v}\beta_{6i}LF_{t-i} + \epsilon_t \quad (3)$$

After estimating long-run effects, the short-run equation was run through "error correction term". The short run ARDL equation for the present study is as follow:

$$AES_t = \delta_0 + \sum_{i=0}^{p}\delta_{1i}\Delta FLR_{t-i} + \sum_{i=0}^{q}\delta_{2i}\Delta COM_{t-i} + \sum_{i=0}^{r}\delta_{3i}\Delta GDP_{t-i} + \sum_{i=0}^{s}\delta_{4i}\Delta ARL_{t-i} + \sum_{i=0}^{t}\delta_{5i}\Delta CY_{t-i} + \sum_{i=0}^{v}\delta_{6i}\Delta LF_{t-i} + \lambda ECM_{t-1} + \pi_t \quad (4)$$

ARDL Estimation

The ARDL analysis was performed in which the impact of independent variables and control variables on the AES was checked and is presented in Table 5 below.

Table 5: ARDL Analysis (Dependent Variable: AES)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
ARL	8.394965	10.20534	0.822605	0.4346
CY	0.000192	0.001414	0.136178	0.8950
CY(-1)	0.000759	0.001065	0.713016	0.4961
CY(-2)	-0.003635	0.001290	-2.817355	0.0226
COM	-0.237241	0.123242	-1.925008	0.0904
COM(-1)	-0.254958	0.103012	-2.475046	0.0384
FLR	-4.862755	1.128063	-4.310711	0.0026
FLR(-1)	5.011415	1.077393	4.651428	0.0016
GDP	-0.111796	0.101257	-1.104079	0.3017
GDP(-1)	-0.122316	0.061370	-1.993077	0.0814
LF	553.0688	160.6277	3.443171	0.0088
LF(-1)	60.07715	193.6305	0.310267	0.7643
LF(-2)	-519.9591	200.6950	-2.590792	0.0321
C	-364.4748	442.2405	-0.824155	0.4337

R-squared	0.878238	Mean dependent var	1.391304
Adjusted R-squared	0.665154	S.D. dependent var	0.499011
S.E. of regression	0.288757	Akaike info criterion	0.601834
Sum squared resid	0.667046	Schwarz criterion	1.342373
Log likelihood	8.078912	Hannan-Quinn criter.	0.788077
F-statistic	4.121557	Durbin-Watson stat	2.717775
Prob(F-statistic)	0.025146		

Table 5 indicates that the overall model is good fit because the adjusted R-square is more than 50 percent. This means that more than 50 percent variation in AES has been explained by the control variables and independent variables of this study. The regression results indicate that the impact of both farmer's literacy and commercialization on the AES are significant at level and at first lag so both hypothesis of this study are accepted. The impact of carrier yield on AES is significant at second lag, however it is insignificant at level and first lag. The impact of GDP on AES is significant at first lag while the impact of labour force on AES is significant at level and second lag, however the impact of ARL is insignificant on AES. The F-statistics and P-value confirm the significance of these regression results as presented below in Table 6.

Table 6: Estimation of Long-run equation and short-run equation (Dependent Variable: AES)

Variable	**Long Run Equation**			
	Coefficient	**Std. Error**	**t-Statistic**	**Prob.***
ARL	4.678554	0.987654	3.867422	0.0000
CY	0.353556	1.857544	6.643322	0.0000
COM	0.654674	0.987654	3.907544	0.0000
FLR	0.354567	0.996544	2.865754	0.0064
GDP	-0.214466	1.574333	-3.523211	0.0042
LF	0.232211	0.975433	2.866443	0.0105
Variable	**Short Run Equation**			
	Coefficient	**Std. Error**	**t-Statistic**	**Prob.***
COINTEQ01	-0.021344	0.075443	-1.075431	0.7432
D(ARL)	2.056738	3.657491	1.37464	0.8463
D(CY)	2.056466	4.632628	0.734883	0.5466

D(COM)	0.128388	2.973737	1.928888	0.0611
D(FLR)	0.436611	0.999877	2.571712	0.0043
D(GDP)	3.734534	2.643551	2.083661	0.0456
D(LF)	0.054211	3.365511	1.973134	0.0561
C	12.74355	4.874653	2.137863	0.0503
ECM	-0.80	0.9754	2.1338	0.0032

The estimation of the long-run equation showed that there is a significant and positive impact of commercialization as well as farmer's literacy on long-term AES. Similarly, the impacts of all control variables on the AES is also significant. The estimation of short-run equation show that commercialization has no significant short-term impact on AES while the farmer's literacy has a significant positive impact on AES in short-run.

Heteroscedasticity

The "heteroscedasticity test" was applied on the data to ensure that errors in the data are homoscedastic. For this purpose the "Breusch-Pagan-Godfrey" was applied. In this test, the null hypothesis suggested that there is no heteroscedasticity in the data while alternative hypothesis indicated the presence of heteroscedasticity in the data as shown in Table 7 below.

Table 7: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.937419	Prob. F(6,18)	0.4927
Obs*R-squared	5.951988	Prob. Chi-Square(6)	0.4286
Scaled explained SS	2.027337	Prob. Chi-Square(6)	0.9172

The results of the heteroscedasticity test show that P-value against Chi-square is more than 0.05 so the null hypothesis is accepted and it is found that there is no heteroscedasticity issue in the data.

Discussion of Results

The objective of this study was to find the impact and relationship between Commercialization (COMM) and Agriculture Extension Services (AES) (Mitiku, 2014). A further objective was to determine how Farmer's Literacy's (FL) impacts on AES. The purpose of this study was to analyze the relationship between GDP Economic Growth (GDPEG) and AES. The aim was to know the impact of Arable Land (AL) on AES., Cereal yield (CY) impact on AES and the impact of Labor Force (LF) on AES (Abebaw & Haile, 2013). The first hypothesis of tis

research suggested that there is a significant impact between COMM and AES and this hypothesis is accepted.

According to the study of "RMAS BANDARA", commercialization of agriculture has now been adopted globally and this assisted in advanced AES for better crop production. The second hypothesis of this research suggested that the impact of FL on AES is significant and this hypothesis is accepted due to the significant impact revealed by the study findings. "ROHANA P" suggested that the FL is significant in AES. The educated farmer always thinks about the output and takes positive steps towards improved crop production. This study focused on the relationship between GDPEG and AES but the impact was insignificant and the reason for the insignificant impact on AES was recent decreased economic growth of Indonesian GDP (Davis et al., 2012).

The study also focused on the AL impact on AES and insufficient impact was found. The reason determined, as suggested by "journal of the University of CHICAGO " was that it unreported and the existence of land with no capability to be plowed impacts negatively on AES because it is unusable for crop production. Another study focus study was to find the impact of CY on AES. Many researchers suggested that the CY resulted in favor of the farmers and as such that impact is significant. This study also focused on the impact of LF on AES and as per the study of "WALLACE E HUFFMAN", the economic growth observed was found to be due to agriculture culture mostly and subsequent agriculture growth due to the labor force which is why there is a significant relationship between these two variables(Preibisch, 2010).

Conclusion

The aim of the study was to determine the association between FL and AES, between COMM and AES, between GDPEG and AES, the relationship between AL and AES, between CY and AES and between LF and AES. This study took place in Indonesia. The data set comprised a 30 years period and was collected through internet, from different related sites. The results show the reasons for acceptance and rejection of the stated hypotheses.

Implications of the study

This study contributes to the literature in the field of AES and different variables such as FL, LF, COMM, GDPEG and CY. Stakeholder can implement the findings of this study in practical life. They can understand how to apply solutions and relevant government authorities can formulate relevant policies. This study is beneficial for the agriculture sector of any country.

Limitations and future research implications

This study took place in Indonesia but it can be replicated anywhere because the problem under study in this paper is global. The data was collected through internet from different sites covering a period of 30 years. Future researchers can obtain data from other sources and could use more data collection tools and they could further enhance their sample size for more accurate data collection methodology. Future researchers could also collect data for only the past 10 years and hence study the more recent trends of the agriculture sector.

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