Effect of Human Capital Formation on Agricultural Productivity in Southeast, Nigeria

O. R. Iheke, J. C. Nwaru, U. R. Oke, G. Daniel-Igwe, T. A. Amusa, F. A. Nse-Nelson

Department of Agricultural Economics Michael Okpara University of Agriculture, Umudike, Nigeria

DOI: https://doi.org/10.47772/IJRISS.2026.1015EC00035

Received: 02 November 2025; Accepted: 08 November 2025; Published: 25 April 2026

ABSTRACT

Health capital is critical in achieving increased agricultural productivity and the health status of farmers affect their use of and control of other factors of production. The study examined the effect of human capital formation on agricultural productivity in Southeast Nigeria. A multi-stage random sampling technique was used in choosing the sample. Data were collected using structured questionnaires. Data collected were analyzd using simple descriptive statistical tools such as means, frequency tables, percentages, and m multiple regression analysis. were used for data analysis. Results showed that majority (57.03%) of the respondents were males while the remaining 42.97% are females. The average age of the farmers was 52 years. Majority (67%) farmers were married. On educational qualification, secondary school education was the highest level of qualification of 57% of the farmers. The average year of farming experience of the farmers was 18 years. The average household size of the farmers was 6 persons per household. The average farm size cultivated was 1.7 hectares. The result in showed that 15.66% of the farmers belong to no single farmers' association. Meanwhile, 52.21% of the farmers indicate being members of at least one farmers' association, while 17.27%, 13.65% and 1.20% of the farmers indicate being members of 2, 3, and 4 farmers' associations respectively. The result on access to extension visits showed that the majority (66.67%) of the farmers had no contact with extension agents in the last cropping season. Majority (51.41%) of the crop farmers had no access to credit. About 47.79% of the farmers sourced their funds for farm business from personal savings, 41.37% of them sourced their funds from farmers' associations, 14.46% of the farmers indicated intervention programmes as their sources of funds for farming, while 6.43%, 5.62% and 1.65% of the arable crop farmers sourced their funds for farming from thrift/esusu, friends/relatives and Microfinance banks respectively. The significant determinants of productivity were farm size ($P<0.01$), labour ($P<0.05$), expenditure on health ($P<0.01$), expenditure on education ($P<0.05$), and variable inputs ($P<0.01$). Increase in human capital formation increases agricultural productivity. Therefore, it was recommended that policies that enhance the health status of the farmer as well as improve access to education should be implemented for increased agricultural productivity. This will include but not limited to provision of functional and affordable care facilities and training of the farmers. In the vain, the extension service delivery system should be strengthened since it serves for the education of the farmers on improved farming techniques and innovations for enhanced productivity.

Keywords: Human Capital, Formation, Productivity

INTRODUCTION

Human capital is a crucial driver of economic outcomes and its importance in fostering growth and development cannot be over-emphasized. Previously, investment in education and training were seen as the only means of developing human resource for better economic performance. Little or no attention was paid to health; but there is no doubt that health as a component of human capital is very vital for growth and development. Studies have shown that a strong correlation exists between health status and individual's level of productivity. Dauda (2011) noted that good health increases labour force participation which invariably would translate into higher productivity and Gross Domestic Product (GDP) growth. According to Kurt (2015), Piabuo and Tieguhong (2017) and Raghupathi and Raghupathi (2020), the increased expenditure in healthcare increases the productivity of human capital, thus making a positive contribution to economic growth.

Iheke and Ukaegbu (2015) noted that the role of health capital on agricultural productivity manifests in the incalculable opportunity cost incurred when the farmer is impaired; given the preponderance of health challenges faced by Nigerian farmers such as malaria, malnutrition, waterbone diseases and HIV/ AIDS which are not only massive killers but systemic wasters, the linkage between agriculture and the health sector must be addressed for some significant policy interventions.The strong association between good health and economic prosperity is easily appreciated and appears in the context of agricultural productivity as well as in contexts such as income, wages, and other wealth measures. Good health is essential in order to raise agricultural productivity, to relieve the poverty and hunger of rural people and to increase food production that will tend to bring down the cost of food to benefit the growing numbers of urban poor who buy food. According to Ajani and Ugwu (2008) health enhances work effectiveness and the productivity of an individual through increase in physical and mental capacities. McNamara *et al.* (2010) noted higher levels of agricultural value added with better health status or health system measures.

The core of human capital formation is acquisition of new knowledge and skills. Since knowledge and skills are embodied in human beings, it is hard to separate them from human health, which also determines labor productivity (Strauss and Thomas 1995). Iheke *et al.* (2024) and Amusa, *et al* (2024) reported education positively influence productivity of arable crop farmers. According to Schultz (1999) and Strauss and Thomas (1998), there is a positive relationship between health and productivity of skilled and unskilled labour. Good health as related to labour output or better production organization (since people of good health generally have better intellectual capacities), can enhance farmer`s/household income and economic growth.

In spite of Nigeria's robust endowment in natural and human resources, the level of poverty of her people stands in contrast to the country's enormous wealth. According to the National Bureau of Statistics (NBS) (2011), 61.2% of the Nigerian population live in poverty, while in South Eastern Nigeria, 59.2% of the population live in poverty. Although hunger results from poverty rather than any absolute scarcity of food, both poverty and hunger are predominantly rural; and for most rural Africans, agriculture is the main source of livelihoods, primary source of food and income (World Bank 2008; APP, 2010). Yet, for much of Africa progress in raising agricultural productivity over last three decades has been disappointing. The problem of low productivity is exacerbated by poor health conditions of the farmers. Given that most members of the communities are farmers themselves, absent workers cannot be replaced, so that short-term morbidity mechanically translates into lower production input. The consequences of these morbidity related labor losses are usually large. There is lack of health institutions especially in the rural areas and where available, they suffer neglect and lack modern health care facilities. This increases the cost of health care and time in assessing it, with the resultant loss in physical performance and equally impacts negatively on the farm profit levels (Iheke *et al*., 2011). According to Hawkes and Ruel (2006a), agricultural income influences households' ability to purchase health-related goods and services that determine their overall health status.

Thus, health status of farmers are affected by a number of factors such as inadequate health goods as medical services (primary care or hospital care) and the technology for producing improvements in health status which may change over time due to new medicines or treatments, and the inability of the farmer to purchase health goods. Good health and productive agriculture are important in the economy of any nation especially in the fight against poverty (Ajani and Ugwu, 2008). Empirical evidence abounds in the literature that health, as a form of human capital is one of the factors which affect arable crop productivity (Akpan *et al.,* 2011). Health enhances work effectiveness and the productivity of an individual through increase in physical and mental capacities.

As pointed out by Hawkes and Ruel (2006b), poor health reduces producers' ability to innovate, experiment with different farming practices, and capitalize on farm-specific knowledge. This impinges on the productivity potentials of the farmers. In addition, agricultural outcomes are influenced by the quality of human capital. As noted by Iheke *et al.* (2024), Amusa *et al.* (2024), Iheke and Nwaru (2014) and Iheke *et al.* (2013), Iheke (2010; 2006) and Obasi (1991), education increases the ability of the farmers to adopt agricultural innovation and hence improve their efficiency and productivity. Hence, education as a form of human capital increases the productivity and efficiency of workers by increasing the level of cognitive stock of economically productive human capability which is a product of innate abilities and investment in human beings.

Problem statement/Justification

The literature on human capital formation abound with partial equilibrium analyses of production and cost functions of education (Shri and Chowdhury (1994), Tilak (1985) and Tilak (1988), as well as of determinants of household expenditure on education (Tilak, 2001; Tilak, 2002; and Shri and Chowdhury (1994). The health target of Sustainable Development Goals (SDGs) accentuates the relevance of human capital as a catalyst to propelling economic development as argued by the endogenous growth models (Bala *et al.,* 2021). The studies dealing with the production function of education (Sri and Chowdhury (1994) measure output in terms of 'enrolments' and inputs in terms of 'number of teachers employed' and 'value of non-teaching inputs'. Such production functions are obviously useful in determining whether the "production" of education is subject to increasing, constant or diminishing returns and the relationships between the marginal productivities of the teaching and non-teaching inputs. (The cost functions of education are essentially a 'dual' of the production function and serve the purpose of merely confirming the results obtained from the production functions). However, from these essentially technical descriptions of the 'production' of education no policy conclusion of consequence is derivable. In other words, in so far as these studies determine neither the private nor social returns to education, their policy significance is limited. The studies concerned with the determinants of household expenditure on education (Tilak (2002) also treated education as an end in itself and fall short of explaining expenditure on education in terms of the expected private returns on education. Using step-wise regression for cross-sectional state level data, Tilak (2002) explains household expenditure on education in terms of household incomes, and other household characteristics such as educational level of the head of the household, occupation, caste, religion. Differences in the quality of education, government, health, and other institutions across countries, in human capital, or in the level of technology can induce correlated movements in health and income (Wang, 2015).

Objectives of the study

The objective of this research is to examine the effect of human capital formation on agricultural productivity.

METHODOLOGY

This study was conducted in South East Nigeria, which comprises of five states namely: Abia, Anambra, Ebonyi, Enugu and Imo. The area lies between latitudes 4^0 20^1 and 7^0 25^1 North and longitudes 5^0 25^1 and 8^0 51^1 East. It covers a land area of about 109, 524KM2 or 11.86 percent of the total land area of Nigeria. The area lies mainly on plains under 200M above sea level (Obi and Salako, 1995; Monanu, 1975). The population of the area is 22,012,828 (NPC, 2019).

Farming is the predominant occupation of the rural inhabitants. Almost all the families in the area farm either as a primary occupation or as a secondary occupation. The region is blessed with favourable warm climate and sufficient moisture ideal for agricultural production. These factors account for the choice of South Eastern Nigeria for this study. According to Nwajiuba (2005), four states in Southeast Nigeria (Anambra, Imo, Abia and Enugu) are among the seven most densely populated states of Nigeria, implying that the southeast is the most densely populated area in Nigeria.

A multi-stage random sampling technique was used in choosing the sample. In the first stage, 3 States were randomly selected from the 5 states in South Eastern Nigeria. Secondly, from each State, 4 Local Government Areas (LGAs) were randomly selected and from each L.G.A, 3 communities were randomly selected. The list of arable crop farmers formed the sampling frame in each community from which 10 households were randomly selected. In all, 360 respondents were used for the study.

Data were collected using structured questionnaires, which served as and interview schedules, because most of the respondents were not educated. The instruments were pre-tested to standardize them and to ensure their validity and reliability. Data collected included those on socio-economic characteristics of the respondents, expenditure on health care, education, farm inputs like fertilizer, labour use; farm size, capital assets; credit and extension services; costs and returns (input and output) arising from arable crop production in the study area.

Simple descriptive statistical tools such as means, frequency tables, percentages, and multiple regression analysis were used for data analysis. A Cobb-Douglas production function was modelled to examine the impact of human capital formation on agricultural productivity. The model is specified as:

$$InY = In\alpha_o + \alpha_1 InX_1 + \alpha_2 InX_2 + \alpha_3 InX_3 + \alpha_4 InX_4 + \alpha_5 InX_5 + \alpha_6 InX_6 + \mu \quad (1)$$

Where in equation (2), Y = productivity, measured as the value of output produced in naira divided by value of inputs employed in naira; X_1 = farm size (hectares); X_2 = labour inputs (mandays); X_3 = health expenditure (naira) (proxy for human capital); X_4 = expenditure on education (naira) (another proxy for human capital); X_5 = other variable inputs such as planting materials, fertilizer, pesticides, etc. (naira); X_6 = capital (naira) (depreciation charges on farm machinery, implements and tools, interest on loan, land rent); μ = stochastic disturbance term; α_0 = intercept of the model, $\alpha_1 .... \alpha_6$ = the slopes of the regression or behavioural parameters.

A priori, it is expected that $\alpha_1, \alpha_2, \alpha_3 ... \alpha_6 > 0$. This implies that the above variables are expected to have a positive relationship with productivity. This means that an increase in any of the variables should increase or impart positively on the level of productivity of the farm households.

RESULTS AND DISCUSSION

Socio-economic characteristics of the respondents

The socio-economic characteristic distribution of the respondents is presented in Table 1a and Ib. The result in Table 1a shows that majority (57.03%) of the respondents are males while the remaining 42.97% are females. This indicates that male farmers slightly dominate small scale crop farming in southeast Nigeria. The result corroborates that of Alhassan, *et al.* (2019) who reported 86.3% male dominance over female farmers in a similar study. The result of age distribution of the respondents shows that greater proportion of 34.94% of the respondents were between the age range of 41 - 50 years, followed by those within the age range of 51 – 60 years who constitutes 27.71% while respondents within 61 – 70 age bracket were 14.86%. Only 12.45% of the respondents have their age ranged between 31 – 40 years while those within 71 – 80 and 21 – 30 age brackets constitute 5.62% and 4.42% respectively.

Table 1a: Socio-economic characteristics of the respondents

Gender	**Frequency (n = 249)**	**Percentage**
Male	142	57.03
Female	107	42.97
Age		
21-30	11	4.42
31-40	31	12.45
41-50	87	34.94
51-60	69	27.71
61-70	37	14.86
71-80	14	5.62
Mean	**51.89**	
Marital status		
Single	23	9.24
Married	171	68.67
Divorced	25	10.04
Widowed	30	12.05
Educational level		
No formal education	17	6.83
Primary	30	12.05
Secondary	142	57.03
Tertiary	60	24.10
Years of farming experience		
1-10	80	32.13

11-20	84	33.73
21-30	49	19.68
31-40	32	12.85
41-50	2	0.80
51-60	2	0.80
Mean	**18**	
Household size		
1-3	25	10.04
4-6	147	59.04
7-9	60	24.10
10-12	17	6.82
Mean	**6**	

Source: Field Survey, 2024.

The average age of the farmers was computed as 52 years indicating that the farmers are still relatively agile. The trend of age distribution of arable crop farmers as shown in the study conformed with the findings of Anyanwu, *et al.* (2025) where the authors found the average age of value chain development programme participant and non-participants rice farmers in Anambra State to be 40 and 51 years respectively.

Vast majority of about 67% of the farmers are married, 12% are widows/widowers, 10% are divorced/separated while only 9.24% of them were single. This finding is consistent with that of several recent studies. For instance, Obianefo, *et al.* (2019) in a study on cassava farmers in Southeast Nigeria found that majority (70%) of their respondents were married. Similarly, Anyanwu, *et al.* (2025) found that majority of about 65% and 67% of participants and non-participants farmers in Anambra southeast Nigeria are married.

On educational qualification, secondary school education was the highest level of qualification of 57% of the farmers, 24.1% of the farmers had tertiary education, about 12.1% of the farmers had primary education while 6.83% had no formal education. Therefore, the farmers are relatively lettered with a total of about 81% of the farmers having secondary school education and above. This result slightly corroborates that of Ayinla, *et al* (2024) and Ahmadu and Ewansiha (2023) who also found total majority of about 67% and 78% respectively of arable crop farmers had secondary school education and above.

As presented in Table 1a, about 34% of the farmers had between 11-20 years of farming experience. This was closely followed by 32.1% of the farmers who had between 1-10 years of experience. Moreover, 19.68% of the farmers had years of farming experience of between 21 to 30 years, those that had experiencing ranging from 31-40 years constitutes 12.85% while 0.80% and 0.80% of the farmers had 41-50 years and 51-60 years of farming experience respectively. The average year of farming experience of the farmers was 18 years; which indicates that an average arable farmer in the study area had been in operation for quite some years. This finding aligned with the result of the study of Anyanwu, *et al.* (2025) that the average years of farming experience for participating rice farmers in southeast Nigeria is about 19 years. The result is also in agreement with the findings of Ahmadu and Ewansiha (2023) who established an average years of farming experience of about 20 years for arable crop farmers in southern Nigeria.

Majority (59.04%) of the farmers were within the household size of 4 to 6 persons, 24.1% of the farmers had household size that ranged from 7 to 9 persons. About 10% of the farmers had household size of 1 to 3 persons while only 6.8% of the farmers had about 10 to 12 persons in their farm households. The average household size of the farmers was 6 persons. This is in line with the findings of Henri-Ukoha *et al.,* (2015) who asserted that majority of arable crop farm households in Imo State, south-east Nigeria has about 6 to 10 persons. In affirmation, Baddianaaha, *et al.* (2021) equally found that the average household size for smallholder farmers was 7 persons per farm household. Although, the trend of the result of this study disagreed with that of Abah (2011) who found out that majority of tomato farmers in FCT Abuja fell within household size of 1–5 persons. Differences in demographic attributes between the two locations could be responsible for the variance in the results.

Land is a major input in agricultural production. Majority of about 55% of the farmers cultivate between 1 – 2

hectares, 31.33% cultivate between 2.1 – 4.0 hectares, 9.64% of the farmers cultivates between 4.1 – 6.0 hectares while only 4.42% have farm size that range from 6.1 – 8 hectares (Table Ib). The average farm size of the farmers was 1.7 hectares which is considerably low. The result conformed with that of other related studies such as Ashagidigbi, Yusuf and Agboola (2019) who found the average farm size cultivated by arable crop farmers in Nigeria to be 1.62. Similarly, Abuludea, Kolawole and Ajala (2023) found that about 78% of Nigerian farmers cultivate farm size ranging from 1 – 5 hectares. The findings of Anyanwu, *et al* (2025) also showed that the average farm size of crop farmers in Anambra state southeast Nigeria is 1.88 hectares. The result in Table 1b showed that 15.66% of the farmers belong to no single farmers' association. Meanwhile, 52.21% of the farmers indicate being members of at least one farmers' association, while 17.27%, 13.65% and 1.20% of the farmers indicate being members of 2, 3, and 4 farmers' associations respectively.

Table 1b: Socio-economic characteristics of the respondents (Cont'd)

Farm size	**Frequency (n = 249)**	**Percentage**
0.1-2.0	136	54.62
2.1-4.0	78	31.33
4.1-6.0	24	9.64
6.1-8.0	11	4.42
Mean	**1.7**	
Number of farm associations		
0	39	15.66
1	130	52.21
2	43	17.27
3	34	13.65
4	3	1.20
Extension visit		
Yes	83	33.33
No	166	66.67
Access to credit		
Access	121	48.59
No access	128	51.41
Source of fund *		
Personal savings	119	47.79
Friends/relatives	14	5.62
Associations	103	41.37
Intervention programmes	36	14.46
Microfinance banks	29	1.65
Thrift/Esusu	16	6.43

Source: Field Survey, 2024, * multiple responses

The result on access to extension visits showed that the majority (66.67%) of the farmers had no contact with extension agents in the last cropping season while only 33.33% of them had varying number of extension visits in the last cropping session. Hence, extension service to meet farmers' need in the area is considerably weak. Izuogu, *et al.* (2024), Nkosi, *et al.,* (2022) and Nigus, *et al* (2022) recognized the obvious ineffectiveness in performance of extension delivery to farmers in Nigeria and Africa at large due to declining rate in the number of extension workers and their visits to meet the needs of the farmers. The findings of this study is in consonance with the report of Odjebor, *et al* (2024) who also established low extension service delivery to farmers and then recommended more funding and training for extension agents with frequent visits to farmers.

Despite the significance of finance to farm business, majority (51.41%) of the crop farmers had no access to credit while the remaining 48.59% had access to one form of formal credit or the other to support their farming activities. This showed that the farmers have very low access to farm credit probably due to low awareness of the sources, lack of collateral or administrative bottleneck. This finding aligned with existing report of Pealore (2022) who identified limited access to farm credit and social structure as one of the major challenges against

smallholder farmers. Ashagidigbi, *et al* (2019) in their study equally found that majority of about 83% of smallholder farmers had no access to credit which aligns with the findings of current study.

The result of multiple responses on sources of fund for farm activities in Table 1b showed that 47.79% of the farmers sourced their funds for farm business from personal savings, 41.37% of them sourced their funds from farmers' associations, 14.46% of the farmers indicated intervention programmes as their sources of funds for farming, while 6.43%, 5.62% and 1.65% of the arable crop farmers sourced their funds for farming from thrift/esusu, friends/relatives and Microfinance banks respectively. This further buttress the fact that smallholder farmers in southeast Nigeria have very limited access to formal credit for farming. Some of the reasons for poor access of smallholder farmers to formal credit were identified by Ikenga, Oyita and Gbigbi (2024) to include poor access to banking services in rural communities where smallholder farmers are domiciled, unfriendly collateral/security, high agricultural risk, lack of access to credit information, high cost of credit administration among others.

Determinants of productivity

The estimated determinants of productivity is presented in Table 2. The double log functional form was chosen as the lead equation based on its fitness as shown in the R^2 of 0.8595 which implies that 85.95% of the variations in the productivity of the crop farmers were accounted for by the independent variables included in the model. The F-ration value of 23.85 was high and significant at 1% level indicating the significance of the entire model. Out of the six independent variables indicates in the model, five (farm size, labour, health expenditure, education expenditure and variable inputs) significantly influenced farmers' productivity at 1 and 5%.

Table 2: Determinants of productivity

Variable	Linear	Exponential	Double log +	Semi log
Intercept	51.008	3.246	11.493	31.513
	(3.61)***	(12.43)***	(3.75)***	(1.83)*
Farm size (X_1)	2.223	0.089	0.501	-12.483
	(2.30)**	(4.99)***	(6.18)***	(-2.75)***
Labour (X_2)	0.109	0.002	0.671	21.574
	(1.03)	(1.16)	(2.65)**	(1.52)
Health expenditure (X_3)	0.052	4.96e-06	-0.085	-1.901
	(0.91)	(1.19)	(3.79)***	(-0.31)
Expenditure on education (X_4)	-0.006	-1.81e-06	0.741	-23.871
	(-0.89)	(-1.34)	(2.54)**	(-1.46)
Other variable inputs (X_5)	-1.12e-07	-1.292-08	0.376	-10.189
	(-0.67)	(-4.17)***	(5.85)***	(-2.82)***
Capital (X_6)	-0.003	2.27e-5	0.145	8.156
	(-0.67)	(2.15)**	(1.52)	(1.52)
R^2	0.2316	0.7629	0.8595	0.6799
R^{-2}	0.1976	0.7242	0.8111	0.6157
F – ratio	2.79***	16.44***	23.85***	12.79***

Source: Field Survey, 2024.

The coefficient of farm size was statistically significant at $p<0.01$ and positively related to productivity of the farmers. This result implies that productivity of farmers increased with an increase in their farm size which suggests that farmers with larger farm size are more productive than farmers with smaller farm size. Amusa, Efedua and Okeke (2024) examined the productivity of cassava farmers in soil erosion prone areas of Anambra State, Nigeria and found that farm size is one of the key factors influencing farmers' productivity. The coefficient of labour was significant at $p<0.05$ and positively related with productivity of the farmers. The implication of the positive and significant relationship is that, increase availability of farm labour leads to increase in the level of productivity the farmers. This is expected because cost effective farm labour constitutes major input in boosting farm output and productivity.

Expenditure on health had a significant ($p<0.01$) but negative relationship with productivity. This implies that increase in expenditure on health issues lead to decrease in the level of productivity the farmers. This is expected because farmers who spend huge amount of farm income in healthcare will have less to spend on farm activities and expansion, hence diminishing the productivity. This finding aligned with the findings of Adewuyi, *et al* (2021) that cost to health care and disease treatment significantly and negatively influence efficiency and productivity of farmers. The coefficient of expenditure on education was significant at $p<0.05$ and positively related with productivity. This suggests that an increase in farmers spending in educational pursuit leads to an increase in productivity and vice versa. By implication, the more the expenditure farmers commit to education, the more educated they become which may translate to more skills and expertise in farming that will increase their productivity. The result corroborates with that of Iheke *et al.* (2024) and and Amusa, *et al* (2024) whose findings affirmed that education positively influence productivity of arable crop farmers.

Variable inputs was highly significant at $p<0.01$ and positively influenced productivity. This shows that as variable inputs in crop production of the farmers increase, there is also increase in their productivity. This is expected most especially when the variables inputs are efficiently combined to produce output at minimum cost. Variable inputs such as seeds and seedlings, fertilizers, cuttings, agrochemicals among others significantly and positively influence farmers' productivity. In affirmation, Ojo, Diye, Coker and Ojo (2021) found that fertilizer used, agrochemical and seed significantly market access and productivity of crop farmers. Also in agreement with the findings of this study, Osuji, Maduike, Oguegbuchulam and Eze (2014) examined the effects of farm inputs on productivity of farmers in Imo state and found that farm inputs such as organic manure, inorganic manure, labour, planting materials, agro-chemicals and farm capital used significantly influence farmers productivity. In a similar study by Mahmud (2023) variable inputs factors that significantly affects agricultural productivity are fertilizers, chemicals, labour, loan and interest rates.

CONCLUSION

It could be concluded from this study that human capital formation has positive and significant effect on agricultural productivity. Increase in human capital formation increases agricultural productivity. Hence, health status of the farmer and his level of education influences his productivity. Therefor, it was recommended that policies that enhance the health status of the farmer as well as improve access to education should be implemented for increased agricultural productivity. This will include but not limited to provision of functional and affordable care facilities and training of the farmers. In the vain, the extension service delivery system should be strengthened since it serves for the education of the farmers on improved farming techniques and innovations for enhanced productivity.

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