The Role of Education on Agricultural Productivity in Sri Lanka

Rajapaksha, UG[1], Semasinghe WM[2], Silva DAC[3]

[1]*Department of Management and Finance, Kotelawala Defence University, Ratmalana, Sri Lanka*
[2]*Department of Economics, University of Kelaniya, Kelaniya, Sri Lanka*
[3]*Department of Economics, University of Colombo, Sri Lanka*
[1]ugrajapakse@yahoo.com, [2]semasinghe_wanninayake@yahoo.com, [3]suranga@cmb.ac,lk

Abstract- *Rural area is a geographic area located outside cities and towns. In order to have a long term sustainability in rural sector, education plays a major role by empowering farmers with right direction, right thinking patterns, right decision making ability and right choices. Hence the education would be a sustainable strategy to uplift the rural sector with agricultural development. However in order to enhance the productivity of the rural sector, the role of education is crucial. The pecuniary and non-pecuniary benefits of the education have impacts on farmers for their shorter and long-term pricing efficiency, scale efficiency, allocative efficiency and technical efficiency to increase the agricultural productivity. The objective of the study is to examine the relationship of education with the productivity's sample of 409 families were taken and semi structured questionnaire was used to collect the data. As a data analytical tool, Structural equation method was used with the support of SPSS AMOS (Version 21).*

However study concludes that the household with no schooling has an inverse relationship with the productivity while the educational level of primary level and secondary level have a positive influence on the Total Factor Productivity of farming and Total Factor Productivity of non-farming. In addition to that the study indicates that the extension services, social capital and other informal and non-formal education streams also influence on agricultural productivity positively.

Keywords: human development, labour productivity, agricultural productivity, education, human capital

I. INTRODUCTION

Agriculture and rural sector is inseparable; whereas education, productivity and development are also inseparable. Therefore when it turns to agricultural development, as per Bhati (1995), there is a correlation between agricultural productivity and education because, the level of education works as source of agricultural transmission or innovation. Innovation, productivity and efficiency are by-products of education of which should be used as a source to generate income aspects in the rural sector (Fuglie (2009). Not only it boosts the income level due to innovation, but also can enjoy cost advantage too due to farmer's choice of best combination of products (Hemachandra and Kodithuwakku 2006). Therefore as Education makes a man wholesome with abilities, skills and knowledge to make a man developed is of which is conceptually known as 'human development'. Human development can have a great impact on productivity. Hence this study try to elaborate how education as a source of human capital develop agricultural productivity of farming and non-farming

A Background of the study

As it was evident that Education can provide a man with Knowledge, Skill and Abilities that a man need to capitalize to enjoy the real freedom of life meaningfully in the present and the future. As education enables a human being to improve their decision making properly, promptly, accurately, broadly, proactively not reactively on sustainable manner, achieving the real freedom of life is not impossible. In order to achieve the real freedom of life as Sen Indicates, they need capabilities of which is fostered by the pecuniary and non-pecuniary benefits of the education. However, the pecuniary benefits of education plays a huge role in the short term than the non-pecuniary benefits of which plays a role in strengthening long-term benefits. Pecuniary benefits would be enhanced by the productivity as a major pillar in ensuring the maximum return to minimum efforts. However productivity is a concept which can show as the relationship of output in terms of its input. Hence education has its implication on productivity in two angles that is, as the impact of education on input

management and as impact of education on output management. Therefore at the end it meets the impact of education on productivity which comes from many perspectives such as better decision making upon; scale efficiency, pricing efficiency, allocative efficiency, pricing efficiency and finally economic efficiency.

B Research Objective

The main objective of the study is to examine the role of education as a driving force to effect on agricultural productivity in Sri Lanka.

II. EMPIRICAL REVIEWS

This section explains the empirical studies done on how education has been viewed by the empirical studies as the capability enhancement tools to ensure better agricultural productivity on farm and non-farm.

Oxaal (1997) indicates based on human capital theory that education has ability to acquire better skills in order to achieve higher productivity than those who do not have education. Hence, education can make people to be productive; to enhance their learn-by-doing ability; to enhance their productive thinking and etc. This goes faster pace than for those with less or no education. The 'learning-by-doing ability' and cognitive skills that a learner receives from a better education would have an impact on human development to bring the productivity and to develop managerial skill of which would be important in material management in agriculture, crop management, diversification management and non-agricultural production.

However regarding farmer's productivity as literature support that more than formal education, (number of year in school) the other two forms of education are important. As an example age, experience, training & etc. are in major. Although the study indicates that there is a positive relationship between education and productivity, the return to school of the study is higher than other studies. Because the study reveal that return to schooling is around 3.67% but as per Jamison & Lan (1982) (As cited by Onphandala (2009), it is around 2.87%which is below the normal trends. However, when higher education achievement reached by the farmers; the higher the return to productivity they gained. But this study does not show a higher education but still a higher return to productivity is there which need to be revisited. As Onphandala (2009) indicates that age of the farmer show the negative impact on the productivity and efficiency. But Edirisinghe et al (2008) indicates that 10% increase of age, increase the efficiency by 3.81%.

Fuglie (2009) in his study on'*Sources of growth in Indonesian agriculture',* expected see the contribution of the spread of rural education and literacy to agricultural growth. It refers both agricultural productivity and education offers growth. Usually, in the productivity concept, there are two components such as Input and Output. However, in the 'inputs' category in the productivity, formal education plays a considerable role in determining a better productivity. Because education can provides a necessary knowledge to select the best and feasible input mixture more than with no education.

In the end Fuglie (2009) articulate that there is a link between farmer education and agricultural productivity in developing countries; and hence he concludes that the contribution of improvements in farmer education/human capital has a sustained contribution to agricultural productivity growth. Even Wong (2012) in his research on 'Effects of education on Sub Saharan Africa' also supported with Fuglies (2005) views. He indicates that education is directly impact on labour quality before other factors are affected. Even Bhati (1995) too highlights that, 'agricultural productivity and use of modern inputs are positively related with educational level of farm workers'. In addition to that, Bhati (1995) concludes his study that 'there is a positive relationship between education and agricultural productivity'.

Asadullah & Rahman (2009) in their study on '*Farm productivity and efficiency in rural Bangladesh:The role of education revisited'* have aimed to see the role of education in farm production in Bangladesh. The research concludes with that the education first ensures the efficiency of the farm operation and then impact on income, output and productivity. And the impact of neighbor's education is found to be insignificant to farmer's productivity and income. However, the study focus additionally that the household head's primary and secondary education over and above zero years of education has a significant impact on productivity and household heads who complete secondary schooling also enjoy significant efficiency. But the contribution for the

productivity status for those who have completed tertiary education is minimal.

The study basically highlights that productivity is significantly influenced by primary education but not by secondary and tertiary education. This is not what Pudasaini (1983), Yang (1997), Onphanhdala, P. (2009) and Tabari & Reza (2012) have disclosed. Without taking any of such categories, they concluded that there is an impact of education on productivity or farming. Although Asadullah & Rahman (2009) articulates that secondary education and tertiary education do not show a considerable significance, Roy (1996) sees it in different angle. Because efficiency in enhancing managerial ability and efficiency in resource management and etc would come due to agricultural productivity, not due to achievement from primary level education but from higher level educational achievement. As Roy (1996) refers, the innovative ways of thinking such as 'declining soil fertility and depletion of soil micro nutrients, declining efficiency in use of fertilizer and other inputs, irrigation water efficiency, efficiency delivery system, change in the pest complex and increasing intensity of pest outbreaks, seed quality, varietal replacement at the farm level (varietal replacement represents the pace at which farmers switch over to newer varieties to capitalize on the successive incremental gain in yield potential) all of these changes would take place due to enrichment of education (Roy, 1996). However the overall conclusion made by Asadullah & Rahman (2009) is that the education first ensures the efficiency of the farm operation and then impact on income, output and productivity. And the impact of neighbor's education is found to be insignificant to farmer's productivity and income.

Concluding, Kiresuri et al (2010) indicates that 10% increase of education could increase the productivity by 3.27%. On the other hand Januja et al (2011) recognized enrolment ratio to secondary education as an indicator of education showing 2.3682% or decrease of poverty due to 10% increase of such enrolment. Pudasaini (1983) recognize the importance of formal education and non-formal education separately in effect to rural and urban separately. The study indicated that due to 10% increase of education and extension services can effect on productivity by 0.22% and 2.12% respectively to rural sector while it is for the urban sector by 0.11% and 0.04% respectively. Edrisinghe et al (2008) refers that education, herd planning and veterinary attendance were recognized as formal and informal education aspects and indicates that 10% increase of education, herd planning and veterinary attendance decreases the inefficiency of production by 49.7%, 63.61% and 2.51% respectively. However the finding made by Lin et al (2001) is controversial as the study says that increase of education could results in increasing the poverty too.

Next Djomo (2012) recognize education and training separately and infer that 10% increase of such can increase productivity by 0.2% and 1.11% respectively. Umesh and Asogwa (2011) recognize education and extension programme separately to poverty with 0.013% and 0.015% of poverty reduction due to 10% increase of such education. Further Onphanhdala (2009) recognized that 0.716%, 1.9% and 2.5% increase of productivity occurs due 10% increase of primary, Lower secondary and higher secondary respectively.

Concluding the literature review, it appears that there is no considerable studies have been done regarding the impact of education agricultural productivity in Sri Lanka. And further, even in the education also most of the studies used only the formal education, not informal or non-formal education aspects. However the current study aims to use all threefold of education to see their impact upon Total Factor Productivity (TFP) to measure the pricing, scale and allocative efficiency of rural farmers in Sri Lanka.

III METHODOLOGY

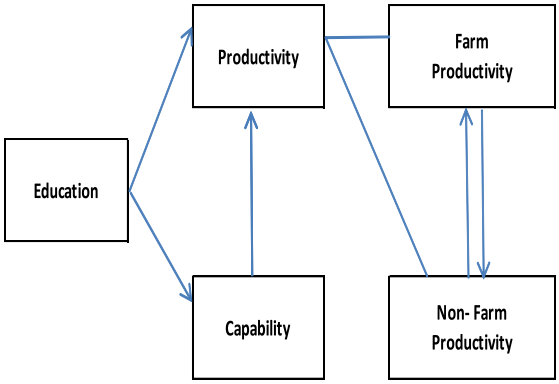
A Introduction to methodology

The methodology consist of formulation of conceptual framework based on the research objectives and empirical reviews; formulation of empirical model based on conceptual framework and research objectives; justification of the sampling area, data and variables; data collection tools and data analysis.

B Development of Conceptual framework

However, as most of the studies concern that the productivity and capability are influenced by education or human capital; the impact of education on poverty through productivity and capability can be conceptually drawn as below in the Figure 1.1.

Figure 1.1: Conceptual Framework-Impact of Education on Poverty through Productivity



The above framework, Figure 1.1 shows that the Education (Formal, In-Formal and Non-Formal Education) would impact on one's Productivity and Capability. However Non-Farm Productivity and Farm Productivity are influenced by each other reciprocally. Capability may make up the possibility of enhancing people's employment opportunities of which at the end influence on agricultural productivity (Farm and Non-farm). Therefore it can be deducted that impact of education on their development comes through capability and productivity via Farm Productivity, Non-Farm Productivity. Farm activities are influenced by Non-Farm activities and even the Non-Farm activities also NOS (influenced by Farm Activities to effect on both reciprocally. Due to this reciprocal interrelation, it requires to apply structural equation model system to evaluate the relationship between poverty and related variables.

C Formulation of the Model

As per the objective of the study to see how education impact agricultural productivity in Sri Lanka; the following equations are drawn. Hence as education goes to farm productivity and non-farm productivity as supported by the literature, the productivity is influenced by the variables such as education, credit availability, irrigation availability, size of the household, distance to market are commonly influencing on both farm productivity and non-farm productivity. However when it comes to farm productivity; even non-farm affairs and employment benefits/experiences also influential. Again when it comes to non-farm productivity, both farm affairs and employment benefits/experience makes matters. Based on these the following equation (1) and (2) are shown

$TFP^{FM} = f$(NOS, PRM, SEC, EXT, RADIO, GOV, EXP, SOCAP, DISTMKT, CRAVA, IRRAV, AGE, HHSIZE, FULEMP, LABOURING, TFP^{NFM}, ERR1)

$TFP^{NFM} = f$(NOS, PRM, SEC, EXT, RADIO, SOCAP, EXP, LAND, TFP^{FM}, FULEMP, LABOURING, AGE, ERR2)

Both of the above equations try to see how far the three folds of education as Formal, Informal and Non-Formal, influence on farm and non-farm productivity. Formal Education comprise of No Schooling), PRM (Education up to Primary Education), SEC (Education up to Secondary and higher education). Non-Formal Education Indicates only EXT (Extensions Agricultural Services). However Informal education consists of RADIO (Having Radio), SOCAP (Impact of Social capital), EXP (Impact of Experience) and AGE (Age of the head of household).

Accordingly Equation (1) it explains that TFP^{FM} (Farm Productivity) is influenced by NOS (No Schooling), PRM (Primary Education), SEC (Secondary Education), EXT (Extension Contacts), RADIO (Availability of Radio), GOV (Membership of Govi[1] Associations), EXP (Professional Experience), SOCAP (Level of Social capital), DISTMKT (Distance to Market), CRAVA (Credit Availability), IRRAV (Availability of Irrigation), AGE (Age of the head of the Household), HHSIZE (family Size), FULEMP (Full Employment), LABOURING (Laboring Jobs) and TFP^{NFM} (Non-Farm Productivity).

Again followed by the Equation (1), Equation (2) indicates that TFP^{NFM} (Non-Farm Productivity) is

affected by NOS (No Schooling), PRM (Primary Education), SEC (Secondary Education), EXT (Extension Contacts), RADIO (Availability of Radios), SOCAP (Level of Social Capital), EXP (Level of professional Experience), LAND (Land Size), TFP^{FM} (Farm Productivity), FULEMP (Level of Full Employment), LABOURING (Level of Laboring Jobs) and AGE (Age of the head of the household). Here as most importantly, both TFP^{FM} as an indicator of Farm income and TFP^{NFM} as the income of Non-farm Opportunities are influencing for each other reciprocally as an recursive way.

D Data and Variables

However, the following observed variables exogenous variables are also used for the analysis

NOS	Head of Households with no schoolings
PRM	Head of Households with primary education
SEC	Head of Households with secondary education
EXT	Extension contacts
EXP	Experience
GOV	Member in 'Govi' Organizations
RADIO	Availability of Radio services
SOCAP	Membership of the other Societies
SAMURDHI	Availability of safety net like 'Samurdhi' relief offered by the government
DEPRATIO	Number of dependent those who are over 60 years of age and those who are lower 14 years of age
IRRAV	Availability of Irrigation facilities
CRAV	Credit Availability

Further the following observed endogenous variables are used in the model.

In addition to that even unobserved but exogenous variables are also there in the empirical model as error terms

ERR1	Error term for Total Factor Productivity
ERR2	Error term for Non-Farm Income

TFP^{FM}: Farm Productivity

Productivity measures the effectiveness and efficiency of using input resources to optimize output resources. Here current study plans to use both full productivity measures and partial productivity measures. Farm Total Factor Productivity (TFP^{FM}) becomes the full productivity measures while Seed Productivity and Land Productivity as productivity measures becomes the partial productivity measures.

However Total Factor Productivity is used for the estimation of empirical model. Total Factor Productivity is a measure of how efficiently all cost of inputs such as Capital, Fertilizer, Seeds, Labour, Land Rent, Hired Labour and etc. are used to generate better level of output of a single crop or from multiple crops. There are number of number of reason why current study selects the total factor productivity instead of partial productivity measures. Reason number one is that the sample area consists of farmers with multiple crops rather than single crop. Second reason is that the education has an impact on several dimensions such as pricing efficiency, labour efficiency, cost controlling efficiency, seed and land optimizing efficiency, efficiency in optimizing the benefits by seasons and etc. In order to make people think more on these aspects, they need education. Further education foster farmers to be vigilant in all aspects of farming not on single aspects. Due to all these reasons, the current study measure the total factor productivity instead of partial productivity to estimate the model.

Christensen and Jorgenson (1985), has introduced the basic formula to calculate the Total Factor Productivity formula as shown below to assess it.

$$\ln(TFP_t/TFP_{t-1})=1/2\sum(R_{it}+R_{i,t-1})\ln(Y_{it}/Y_{i,t-1})-1/2\sum(S_{jt}+S_{j,t-1})\ln(X_{jt}/X_{j,t-1})$$

Where;

Y_i are output indexes, X_j are input indexes, R_i are output revenue shares and S_j are input cost shares.

But as Fuglie (2009) has rearranged this formula by incorporating both overall input cost and overall output income. Hence as per him, the total factor productivity is a ratio between output income in terms of input cost. Based on that he has developed his formula as follows;

TFP	Total Factor Productivity
NFM	Non-Farm income
LABOURING	Earning from laboring jobs
FULEMP	Earning from full employments
POVERTY	Whether a household is poor or not

$$\frac{\text{Y (Total output income)}}{\text{X (Total input cost)}}$$

Where; Y indicates the total output income and X indicates the overall input cost

However the formula introduced by Christensen and Jorgenson (1985) has periodic comparison. Hence the current study remove the periodic comparison as the previous year's figures are not available and as such the figures for the period of (t-1) is removed and exclude even the log function also and develop the formula again as below;

$$TFP_{it}=\sum(R_{it})(Y_{it})/\sum(S_{jt})\ (X_{jt})$$

Y_i indicates the output indexes; X_j indicates the input indexes; and R_i shows the output revenue shares and S_j points out the input cost shares. However, the formula introduced by Christensen and Jorgenson (1985) to Total Factor Productivity is amended as below for the current study.

$$TFP=\sum(RM+RP+RV)/\sum(SM+SP+SV)$$

Where;

RM	Revenue share of Maize
RP	Revenue share of Paddy
RV	Revenue share of Vegetable
SM	Cost share of Maize
SP	Cost share of Paddy
SV	Cost share of Vegetable

Even Fuglie (2009) also has measured the productivity in a similar base by dividing the total income by the total cost spent (Y/X; where Y indicates the Total Revenue and X indicates the Total Cost; P.226).

Total income is by multiplying the total quantity of output harvested (sold, consumed and stock in hand) by the average market price. Total cost is taken by summing the cost of; labour, fertilizer, land rent, chemicals, seeds, harvesting expenses and etc. this is in consistent with Fuglie (2009) and Djomo et al (2012).

Data and indicators:

Total Factor Productivity :$\sum(RM+RP+RV)/\sum(MC+PC+VC)$

Seed Productivity : Total Household Output/Total Quantity of Seeds

Land Productivity : Total Household Output/Total Land area Used

TFP^{NFM}: Non-Farm Productivity

Non-farm Productivity measures how efficiently input varieties of non-farm options are used to generate maximum output. Here also like the farm Productivity, TFP is calculated using the modified equation as shown below

$$TFP^{NFM=}\sum(Y_{ij})/\sum(X_{ij})$$

Where; Y = Income from multiple sources of Non-Farm Options

X = Cost for multiple sources Non-Farm operations

This formula is moreover same as formula developed by Fuglie (2009) and Djomo et al (2012). However the monthly non-farm income and its cost are directly taken on the survey and it is verified using indirect questions.

Data nd variables with Indicators

Table 1.0 Data and variables with Indicators

Variable	Measurement Criteria
AGE	Age of head of Household
NOS	Education of Head of HH: No schooling- School Attended =0
PRM	Education of Head of HH: Education up to Grade 5
SEC	Education of Head of HH: Education up to Graduate level from Grade 6
EXT	Agricultural Extension Services: Number of times agricultural officers are visited
EXP	Experience of the Head of HH: Years in service
SOCAP	Social capital: Number of Years in Societies and etc
IRRAV	Irrigation Availability; Yes=1, No=0
CRAV	Credit Availability; Yes=1, No=0
GOV	Membership of Farmer Association; Yes=1, No=0
RADIO	Radio Availability; Yes=1, No=0
DISTMKT	Distance to market by kilometers (approximated to 0.5km
LABOURING	Monthly wages of Head of HH
FULLEMP	Monthly salaries of Head of HH

E Sampling

However the sampling method is planned to arranged in multi stage methods. The first stage is to identify the province where the appropriate sampling area is located. Then to decide which districts are suitable for the study, after that, it need to identify the DS divisions and to select GN \divisions , then to select the households and finally to select sample unit; whether head of household or household.

Researcher intends to select 409 families in the sample area as per the calculation mad in the above Table 4.02. The numbers of households to be taken to sample is decided based on the population (Sri Lanka Census 2011) of each DS divisions. It is as per the following Table 1.1.

Table 1.1 DS divisions and Districts to be taken as Sample

SN	Poverty Rank (*)	Divisional Secretariat Division (*)	D (*)	Population (**)	Sample size (HH)	No of GND	Names of GND (Grama Niladari Divisions)
1	1	Siyambalanduwa	M	53059	230	4	Kotiyagala, Athimole, Kadurugoda, Wattegama
2	2	Rideemaliyadda	B	51435	36	2	Kirimatiya, Pahalayayagama
3	3	Meegahakivula	B	19540	48	2	Karamatiya, Galahitiyawa
9	23	Haliela	B	90179	60	7	Weragama, Gawala, Hinnaramgolla, Jayasinghagama, Watabadda, Weragamakanda, Dehiwinna
17	65	Welimada	B	100434	35	6	Ella, Nugathalawa, Idemegama, Dimuthugama, Amunearawa, Kohilagolla
				314647	**409**	21	
		No of Families		78661			

Source : * Sri Lanka National Report on Disaster Risk, Poverty and Human
** Sri Lanka Census of Population and Housing 2011 (DCS)
Development Relationship; UNDP (2009:377)
M; Monaragala, B; Badulla

However the principle base of the selection of number of households in each GN division is depend on the guidance taken from the Grama Niladari[i] and Samurdhi Officer[ii]

F. Data Collection Tool

Semi-structured questionnaire method was widely used.

G. Data Analysis

Meanwhile as the way farm activities affect to non-farm activities, non-farm activities too effects on farm activities as recursive relationships. In parallel, employment remuneration too influence on both farm activities and non-farm activities. Therefore as the variables are interchangeably influence on the other variables as a recursive relationship, structural equation method is selected as the evaluating model. Even Demi, Coleman-Jensen and Snyder (2010), Pedro Flores-Jiménez, Oswaldo Morales-Matamoros, Ricardo Tejeida-Padilla (2011) and Robert Walker, Mark Tomlinson and Glenn William also have used the structural equation method on their studies to evaluate their recursive relationships. However the current study also uses the structural equation model to analyze the empirical data collected followed by the conceptual framework and empirical model. The method of estimate is the Maximum Likelihood (ML) Estimates because SPSS Amos doesn't provide most accurate information form the alternative methods such as Generalized least squares method, Unweighted least squares method, Sale-free least squares method and Asymptotically distribution-free method. However ML gives consistent parameter estimates and as the calculation even for the bigger sample size is not difficult, ML is used here as the method of estimation.

H Model Fit

This study used the value of Chi-square ($\chi 2$), RMSEA, GFI and CFI value as criterion to examine the fit of the model.

However in order to find out the indirect relationships, indirect effects and the their significance and probability levels, the Bootrap Techniques which is a inbuilt technique with SPSS AMOS version 21 is used. Percentile Confidence Level of 95% and 90% Confidence Level in the Bootrap Technique is used instead Bias-Corrected Confidence Level. Most of the studies on poverty studies used the structural equation method to analyses the research data.

IV DATA ANALYSIS

The following section covers the results of data analysis from 409 households.

A Model Fit Summary

In order to see the fitness of the model, the indexes such as Root Mean Square Residual (CMIN/DF), Goodness of Fit Index (GFI), Adjusted Goodness of fit Index (AGFI), Parsimony Goodness of Fit Index (PGFI), Normed Fit Index (NFI), Relative Fit Index (RFI), Tucker-Lewis Coefficient Index (TLI), Comparative Fit Index (CFI), Parsimony Ratio (PRATIO), Parsimony adjustment to the NFI (PNFI), Parsimony adjustment to the CFI (PCFI), Incremental Fit Index (IFI) are used as follows in the Table 1.3

Table – 1.3 Models Fit Summary

Short Name	Name of the Model Fit Index	Default model (Present Study)	Saturated model (Norm/ Standard)
DF	Degree of Freedom	135	0
P	Probability	0	0
CMIN/DF	Root Mean Square Residual	3.3554	5
GFI	Goodness of Fit Index	0.9082	1
AGFI	Adjusted Goodness of fit Index	0.843	1
PGFI	Parsimony Goodness of Fit Index	0.5308	1
NFI	Normed Fit Index	0.8405	1
RFI	Relative Fit Index	0.7519	1
IFI	Incremental Fit Index	0.8824	1
TLI	Tucker-Lewis Coefficient Index	0.8119	1
CFI	Comparative Fit Index	0.8791	1
PRATIO	Parsimony Ratio	0.6429	0
PNFI	Parsimony adjustment to the NFI	0.5403	0
PCFI	Parsimony adjustment to the CFI	0.5651	0
RMSEA	Root Mean Square Error of Approximation	0.076	
PCLOSE	P-Value	0.0000	0.0000

Source: Developed by the Researcher based on SPSS AMOS (21)

Demi, M., Coleman-Jensen, A., & Snyder, A. (2010) refer that their model is fitted due to the fact that the fitting data was healthy enough to indicate a good fitness of the model. Because (CMIN/DF=1.18; DF=132; p=0.07; CFI=0.99; RMSEA=0.02; Bollen-Stine bootstrap p=0.34), however they re-estimated the model to achieve a more parsimonious fit by adjustment with covariance. Then the final model is more parsimoniousand fitted the model by (CMIN/DF=1.15; DF=139; P=0.11; CFI=0.99; RMSEA=0.02; Bollen-Stine bootstrap P=0.40; PCFI=0.80). As the study indicates that AMOS provides fit indices for parsimony goodness of fit (PCFI) that takes into account the number of parameters in a model. A value above 0.50 along with other appropriate fit indices indicates a parsimonious fit.

Further as per the study done by Pethiyagoda (2011), in their study on '*Explaining fish consumption in Sri-Lanka The role of consideration set size, attitude, knowledge, convenience orientation, price consciousness, and variety seeking tendency*' indicates that their df = 144, p= .01); RMSEA = .038; GFI = .921; CFI = .960.

However, even the present study (after making adjustment for covariance) has fixed the model by 0.076 by RMSEA (which is better up to 0.08 as indicated by Browne and Cudeck (1993), and further they refer as a rule of thumb by indicating that *RMSEA* of about .05 or less would indicate a close fit of the model in relation to the degrees of freedom. This figure is based on subjective judgment. It cannot be regarded as infallible or correct, but it is more reasonable than the requirement of exact fit with the RMSEA = 0.0. Therefore it is the opinion that a value of about 0.08 or less for the RMSEA would indicate a reasonable error of approximation and would not want to employ a model with a RMSEA greater than 0.1 (SPSS AMOS Interpretation).

In case of GFI, it is 0.9082 (0.90 and above is considered as good fit). Further even CFI also has taken 0.8791 is a good indicators of fitness of the model. In addition to that even, CMIN/DF (Root Mean Square Residual) is 3.3554 which is less than 5, hence it consider as a indicators of fitness of the model. Further even, PCFI is also 0.5651 which is greater than 0.5 measures a fitness of the model. The other indexes also show very good healthy rates to shows that the model is extremely fit.

Further having 'P' 0 also indicates a good fitness to the model. Finally even Bollen-Stine bootstrap P=0.34, also shows a better indicators of fitness.

As most of the indexes shown in the above Table 6.36, used to evaluate the model's fitness is close to 0.9, and the SPSS AMOS indicates that the minimum was achieved, it can be concluded that the model is fit enough to continue for the estimation.

However, in order to see the real gravity of education on rural poverty, it needs to look into P-Values of which represents in the '*Sig*.' column in the Table 1.4. Column number four of the Table 1.4, indicates under the 95% confidence level interval, which variables are significant or not. If the significance value (Sig.) comes less than 5% or 0.05, it concludes that particular independent variable is more significant to change dependent variable.

Standardized Beta Coefficient as shown in the following data tables, column number two measures how far the changes in one unit of independent variable or mediating variable shown in the column number one in the table, would change the status of poverty (as an example) being the dependent variable. If the figure indicates a plus (+) mark, it points out there is a positive relationship with the dependent variable or if the figure indicates a minus (-) mark, it points out there is a negative/inverse relationship with the dependent variable.

B Impact of Education on Agricultural Productivity

However based on the coefficients of the independent variables as shown in the below Table 1.4, it can be seen that Professional Experience (EXP), extension contacts (EXT), Primary Education (PRM), Secondary Education (SEC), Availability of Land (LAND), Social Capital (SOCAP), Family Size (HHSIZE), Irrigation Availability (IRRAV), Availability of Radio (RADIO), Credit Availability (CRAV) and Membership of Govi Associations (GOV) positively correlates with the Total Factor (TFP) in order to stabilize farm income. However only the variable such as Professional Experience (EXP), Extension contacts (EXT), Primary Education (PRM), Secondary Education (SEC), Family Size (HHSIZE), Irrigation Availability (IRRAV) and Credit Availability (CRAV) are significantly and positively correlates with Farm Total Factor Productivity (TFP^{FM}).

Table – 1.4. Impact of Education on Farm Productivity.

Independent and Moderating variables	Standardized Coefficients		Sig.
	Beta	Std. err	
AGE	-0.0489	0.0428	0.2351
EXP	0.0877	0.0317	0.0048
PRM	0.33	0.0705	0.001
SEC	0.2772	0.0949	0.0051
NOS	-0.0273	0.0633	0.6514
LAND	0.0502	0.037	0.1826
SOCAP	0.045	0.0494	0.3433
DISTMKT	*-0.1038*	*0.0553*	0.0531
HHSIZE	0.0144	0.0317	0.6698
IRRAV	0.4485	0.0511	0.001
FULEMP	-0.1843	0.0626	0.0042
LABOURING	-0.0224	0.042	0.6184
RADIO	0.043	0.0381	0.2684
GOV	0.0456	0.0483	0.3391
EXT	0.2256	0.0391	0.001
CRAV	0.1054	0.0336	0.002
NFM^{TFP}	-0.3482	0.0594	0.001

Dependent Variables: Farm Total Factor Productivity (TFP^{FM})
Source: Developed by the Researcher based on SPSS AMOS (21)

As justification, the educational (formal or informal or non-formal) variables such as Professional Experience (EXP), Extension contacts (EXT), Primary Education (PRM), Secondary Education (SEC), Social Capital (SOCAP), Availability of Radio (RADIO) and Membership of Govi Associations (GOV) would enhance the rural public decision making ability on the sphere of better crop selection, better seasons selection, ability of using complimentary resources, ability of making decision on economy of scales, ability of preserving soil productivity and etc. would enhance their productivity concern so as to increase the rural farmers farm income. This further supported even by Janvry et al (2005) who indicates that education is impact on non-farm option positively. In addition to that even Kurosaki et al (2006) also hypothesize that non-farm sector and productivity are affected by the overall education not primary or secondary or likewise.

On the other hand the variables such as Age of the head of the household (AGE), No schooling (NOS), Distance to Market (DISTMKT), Full Employment (FULEMP), Employment in Laboring Jobs (LABOURING) and Non-Farm Productivity (TFP^{NFM}) show inverse relationships with the Total Factor Productivity (TFP) to reduce the importance of farm income as a source of poverty alleviation.

However not all variables are significant but Non-Farm Productivity (TFP^{NFM}) and Full Employment (FULEMP) are significant in reducing Total factor Productivity (TFP). As justifications, when head of housel hold is old, his active concern on decision making not be so active as he is young, therefore the age of the head of the household (AGE) is inversely relates with the Productivity. Further if a head of household is not going to school would limit his creative thinking, innovative ideas to make the things efficiency and effective, therefore 'No schooling (NOS)' variable has an inverse relationship with the productivity. Again when the distance to the market (DISTMKT) is higher mean, farmers loose the chances of having market information and as such selling their vegetable and other supplies at competitive prices would go down. Therefore

'Distance to Market (DISTMKT); indicates an inverse relationship with the productivity. Then when, farmers occupies in full employment, due to their time limitation, agricultural farming sector would not be as steady as full time farmers. Hence 'Full Employment (FULEMP)' shows an inverse relationship with the agricultural productivity. Usually the farmers with laboring capacity (LABOURING) don't have adequate education and thereby due to their poor decision making, it has an inverse relationship with the farm agricultural productivity (TFP^{FM}). Hence, 'Employment in Laboring Jobs (LABOURING)' has a negative relationship with productivity. As per the literature reveals and as per the sample observation, the farmers with Non-Farm Options enjoy a considerable high return than farmers. Therefore, the commitment done by the non-farm sector to agricultural productivity is low. Therefore, 'Non-Farm Agriculture (NFM)' shows inverse relationships with the Total Factor Productivity.

Table – 1.5 Impact of Education on rural poverty in Sri Lanka through Non-Farm income with agricultural productivity

Independent and Moderating variables	Standardized Coefficients		Sig.
	Beta	Std. err	
AGE	-0.0158	0.0202	0.3786
EXP	-0.0223	0.0346	0.4911
PRM	0.1549	0.1015	0.1657
SEC	0.1538	0.1317	0.2896
NOS	0.0541	0.0903	0.5786
LAND	-0.1213	0.0295	0.001
SOCAP	0.1806	0.1012	0.0588
DISTMKT	-0.0423	0.0332	0.0560
HHSIZE	-0.0186	0.0285	0.5101
IRRAV	0.1826	0.0663	0.0056
FULEMP	-0.0924	0.0766	0.1955
LABOURING	-0.1212	0.0316	0.0015
RADIO	-0.1325	0.0309	0.001
GOV	0.0186	0.0212	0.3441
EXT	-0.0279	0.0437	0.5125
CRAV	0.0429	0.0184	0.0068
TFP^{FM}	0.3494	0.1042	0.0056

Dependent Variables : Non-Farm Total Factor Productivity (TFP^{NFM})
Source: Developed by the Researcher based on SPSS AMOS (21)

As in the previous Table 1.5, the variables such as Irrigation Availability (IRRAV), Membership of Govi Associations (GOV), Attainment of Primary Education (PRM), No schooling (NOS), Credit Availability (CRAV), Total Factor Productivity (TFP), Social Capital (SOCAP) and Attainment of Secondary Education (SEC) have positive impact upon Non-Farm Agriculture. However the variables such as Irrigation Availability (IRRAV) and Credit Availability (CRAV) have a significant positive relationship than other variables.

As justification when irrigation improves (IRRAV), in order to facilitate farm options (TFP), the need for non-farm options emerge as the facilitative requirement for the farm options, therefore 'Irrigation Availability (IRRAV)' has a positive relationship with Non-Farm options. When farmers join with the Govi Associations and all, they get

then necessary guidance and motivation to go for financially viable ventures such as dairy and mushroom and etc. As a result of that 'Membership of Govi Associations (GOV)' has a positive relationship with the Non-farm Options. However the impacts of formal education such as Attainment of Primary Education (PRM) and Attainment of Secondary Education (SEC) have a natural positive impact towards the non-farm Total Factor Productivity (TFP^{NFM}). Although it is up to questionable reason, having gained no education at all would find avenues to earn their livelihood from the sources such as fishing, hunting and etc. shows that 'No schooling (NOS)' and non-farm options are correlated. Credit Availability (CRAV) can be a good motivator to the rural sector to starts Non-farm options with the capital capacities gained from the credit facilities. Further the impacts of FarmTotal Factor Productivity (TFP^{FM}) to non-farm options are always positively correlates with non-farm options. As educational variables even the Social Capital (SOCAP) also have positive impact upon Non-Farm Options Productivity (TFP^{NFM}).

But when the family size increases, it limits resources availability and economic pressures would constraints the non-farm options negatively. Therefore Family Size (HHSIZE) has an inverse relationship with non-farm options. When the head of household is over, he does not see any interest of new things such as non-farm options, therefore 'Age of the head of the household (AGE)' has an inverse relationship with the non-farm options. The factors such as Availability of Radio (RADIO), Professional Experience (EXP), Extension Contacts (EXT), Full Employment (FULEMP), and Employment in Laboring Jobs (LABOURING), Availability of Land (LAND) and Distance to Market (DISTMKT) have an inverse relationship with the non-farm agricultural productivity as they are more focused to farm sector, employment and etc. not for non-farm sector.

V CONCLUSION AND FINDINGS

Education is the stock of knowledge or skill that a person hold within a period of time as per many studies. Productivity is the indicator which shows the output in terms of one unit of input. When something is 'Productive' mean 'output' generated from a one unit of 'input' is greater than one, if not it is called as 'un-productive'. Therefore in order to arrive at a maximum amount of output from a minimum level of input, education can be viewed as a crucial indicator. Further education has the possibility to develop people's capability as well in order to increase their economic strength

However, it is obvious that education makes the people a resource, hence this resourceful people can make the things productive. Then the productivity emerges with plenty of advantages to agricultural sector and then the rural sector. Primarily, it gives a clear pathway to enhance the rural capability by; cost advantages, higher income, higher wages, adequate volume of marketable surplus to higher income, enhancement of skills, ability meet the growing agricultural demand of people and so on.

The sample area and its 409 families have shown real characteristics of rural sector. However their dependency on agriculture, their sources of income from farm, non-farm and employments are closely linked with the education. As per the analysis, it was evident, that education has a close relationship with; consumption, agricultural productivity, non-farm income, full employment and laboring jobs. Education and consumption is positively correlated. Primary education and secondary education are positively correlated with the agricultural productivity while No Schooling has an inverse relationship with the farm productivity. Further primary and secondary education are positively related with non-farm productivity.

However the role of education is considerable in making sure the maximum output for minimum farm or non-farm inputs due to their better decision making abilities, abilities in spotting opportunities and abilities in taking making risk decisions through environmental threats and etc. of which are fostered by the education. Not only education makes a key role in establishing productivity, education level can make people to be more capable than that of no-educated people. Further, higher educated people are more capable than the people with secondary education. Besides the people with secondary education have more capabilities than those with primary education. Not only formal education can make the people to be more productive and capable like this, even the informal and non-formal education also help to achieve a higher level of capability and productivity.

REFERENCE

Asadullah, M. N., & Rahman, S. (2009). Farm productivity and efficiency in rural Bangladesh: the role of education revisited. *Applied economics*, *41*(1), 17-33.

Bhati, S.K. (1995). Basic aspects of rural development in India. in SG Hundekar (eds), *Management Of Rural Sector, KM Rai Mittal for Mittal publications*, New Delhi, pp.23-40

Djomo, J. M. N., & Sikod, F. (2012). The Effects of Human Capital on Agricultural Productivity and Farmer's Income in Cameroon. *International Business Research*, *5*(4), p149.

Edirisinghe, J. C., Edirisinghe, M. P., & Auwardt, D. M. (2008). Reasons for variations in the levels of efficiency in smallholder dairy milk production in Sri Lanka: A Cross Sectional Data Analysis. *Journal of Food and Agriculture*, *1*(2), 30-39.

Edirisinghe,N (1990). Poverty in Sri Lanka: its extent, distribution and characteristics of the poor. Paper submitted to the World bank Sri Lanka: Sri Lanka Poverty Alleviation and employment project

Hemachandra, D., Kodithuwakku, S. (2006). Business orientation among poor dry zone farmers in Sri Lanka. *Sri Lanka Journal Of Agricultural Economics*, 8, pp.31-49

Jimerson, Lorna (2005). Placism in NCLB—How rural children are left behind. Equity & excellence in education, 38(3), pp.211-219.

Kiresur, V. R., Melinamani, V. P., Kulkarni, V. S., Bharati, P., & Yadav, V. S. (2010). Agricultural Productivity, Rural Poverty and Nutritional Security: A Micro Evidence of Inter-Linkages from Karnataka State. *Agricultural Economics Research Review*, *23*, 29-40.

Onphanhdala, P. (2009). Farmer Education and Agricultural Efficiency: Evidence from Lao PDR. *GSICS Working Paper Series*, *20*.

Oxaal, Z. (1997). Education and poverty: a general analysis. *Bridge*, 53, pp.1-22

Pudasaini, S. P. (1983). The effects of education in agriculture: Evidence from Nepal. *American Journal of Agricultural Economics*, *65*(3), 509-515.

Roy, I. (1996). Stagnating productivity in crop agriculture: the quest for sources of growth. *Asia Pacific Journal Of Rural Development*, VI(2), pp.63-84

Tabari, N. A. Y., & Reza, M. (2012). Technology and education effects on labor productivity in the agricultural sector in Iran. *European Journal of Experimental Biology*, *2*(4), 1265-1272.

Umeh, J. C., & Asogwa, B. C. (2011). Econometric Model of Poverty for the Farming Households in Nigeria: A Simultaneous Equation Approach. In *2011 2nd International Conference on Agricultural and Animal Science (CAAS 2011), Maldives. International Proceedings of Chemical, Biological and Environmental Engineering, November* (pp. 25-26).

Wong, W. P. J. (2012). Effects of education on Sub Saharan Africa.

BIOGRAPHY OF AUTHORS

[1]UG Rajapaksha is a lecturer of Management and Finance of Sir John Kotelawela defence University of Sri Lanka. His research interests include studies on Poverty.

[2] Dr. WM Semasinghe is a senior lecturer of Department of Economics of University of Kelaniya, Sri Lanka. His research interests include Poverty Studies. He has produced more than 20 referred international and local Journal publications to his credit.

[3] Dr. DAC Silva is a senior lecturer of Department of Economics of University of Colombo, Sri Lanka. His research interests include studies on Tourism.