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ANALYSIS OF LAND SYSTEM AND PRODUCTIVITY OF CASSAVA BASED CROP MIXTURE FARMS IN IMO STATE, NIGERIA

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ABSTRACT

This study, analyzed land value systems and productivity of cassava based crop mixture farms in Imo state, Nigeria. The factors affecting productivity of crops such as cassava in its mixture with other crops in the study had not received adequate research attention in the study area. The objective of this study specifically examined the socio-economic characteristics of cassava based crop mixture farmers, estimate the partial productivity as well as the total factor productivity of the different land value system. Selection of respondents was based on purposive and random sample techniques. One hundred and eighty cassava based crop mixture famers across the three zones of Imo state were selected. A set of structured questionnaire was used to collect information from the farmers. Data collected were analyzed using inferential and descriptive statistics. Result of this findings shows that cassava based crop mixture farmers in Imo state were mainly married female with a maximum of secondary school education. Result also revealed that 86.1% farmers practiced mixed cropping because of diverse crop output. Most farmers in the study area cultivated cassava on suitable land, followed by marginal suitable and non-suitable farmland at 51.7%, 28.9% and 19.4% in that order. Total productivity of suitable, marginal and non-suitable had coefficient determinants of 0.682, 0.559, 0.582 and their F-ratios were significant at 1% level respectively. It is recommended that for optimal high productivity of cassava based crop mixtures, farmers should cultivate on suitable and marginal regardless of the rent paid.

Key words: Land Value System, Productivity, Cassava, Farms

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INTRODUCTION

Land is a natural resource and a factor of production. It is a free gift of nature, which houses the biosphere, the soil and geological properties underlying the soil, which include the hydrological portion and the atmosphere. It is mostly influenced by some natural and human factors that have advertently accounted for its developmental framework and value (Food and Agriculture Organization, 2010; Onyeagocha *et al., 2013*). The framework of land comprises of economic and social attributes that enhances its value (Onyeagocha *et al.,* 2013).

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All human life ultimately depends on land including the soil and water found there. From land food is grown, on it protective shelters are raised, and through and across it the fresh water we drink is purified and delivered (Food and Agriculture Organization, 2007). Land provides humans with the means of live, and from the first steps tread upon it, has been a patient provider of vital resources (F.A.O, 2013). But at the start of the 21st century, our lands are no longer able to keep up with the pressures placed on its limited resources. Increasing misuse and demands for its goods are resulting in rapidly intensify desertification and land degradation globally Ehirim*et al*., 2013). With the above view, improvement and value of land is very essential. The land value system includes all its improvement and upgrade (Alyson *et al.,* 2014). It is estimated in accordance to location, socioeconomics, government regulation, desirability, vicinity to school, park and recreational facility, road way accessibility and distance to retail establishment (Alyson *et al.,* 2014). Land value measures how much a plot of land is worth. It includes improvement such as better construction of irrigation and drainage system, leveling of land, construction of pathways, adding manure and land productivity. This can help to upgrade the value of that particular land. Some lands are more fertile than the other, and that influences its value. Land value may also be influence by the effect of other socio economical factors. The vagaries of nature such as bad weather condition, pest and diseases, flood, thunder storm, erosion and fire outbreak and human activities which include bush burning, continuous cropping and deforestation have continued to put much environment pressure on farm land resulting in loss of nutrient, late planting, marginal farmland value and decline in farm output (Eswaran, 2001; Bassey, 2008).

The various land value systems emerged from the land suitability classification. They are suitable land, marginal suitable land and non-suitable land Olayede and Heady, 1982). Food and Agricultural Organization (2012) observed that land which is said to be suitable has no significant limitation to sustained application of a given use or level of limitation will not significantly reduce productivity nor increase the cost of improvement. Ehirim *et al*.,(2007) observed marginal suitable land for arable crop production as land which its natural constituent has been tempered by continuous cropping without replenishment. He also observed that marginal suitable land has limitations which when aggregated are severe of given use and will reduce productivity. Oyakale (2008) further observed that marginal lands to be suitable for crops like cassava require an increasing average cost to give out its full potential value. Ehirim*et.al* (2007) observed non-suitable lands as lands that do not have full capacity to achieve its full potential due to massive degradation by human and natural factors. F. A.O (2013) observed that non-suitable lands may be useful for other uses but it is not useful to agricultural production except if it is approached with land improvement practices. Ehirim (2007) concluded that such land are usually not allocatively efficient and can attract very high opportunity cost as the cost of land improvement may be higher even in the long run.

Agricultural lands are valued based on their suitability for crop production and its productivity (Al-Kaisi, 2012). Agricultural land value is the amount (of money, goods or services) that is considered to be a fair equivalent for its use and or what the land can produce. This means that land must be suitable having possessed a high potential for maximum output (Ehirim *et al*., 2013). Hence suitable land produces a relatively increased quantity of crop per unit area than other parcels of land within the same area (Ehirim *et al*., 2013).

Cassava (*Manihot esculenta)* has become one of the popular crops gaining ground increasingly in South-east Nigeria (Nwosu and Arene, 2013). Despite the fact that cassava grows in marginal

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suitable and non-suitable fertility condition, its productivity differs with the quality of land (Korie et.al, 2006: Okere, 2012). Cassava productivity as observed by Oyakale (2008) is the ratio of cassava output per unit of input used in the production process. In many crop farming systems in southeast of Nigeria, cassava usually the base crop is intercropped with other arable crops like maize, yam, melon, okro and vegetable. Cassava- based crop system (CBCM) is one of the two-common crop mixture system practised in Imo State, Nigeria (Nwosu and Arene, 2013).

Total factor productivity is the ratio of total output (crop production) to total inputs (labour, capital, land and material). An increase in TFP implies that more output is being produced from a constant amount of resources used in the production process. Partial factor productivities measure relates output to a simple input while total factor productivity relates an index of output to a composite index of all input. It is based on this background that, this study analyzed farmland values, determine net productivities of cassava based mixed crops, determined socio-economic factors influencing cassava based mixed crop productivity in different land values.

Some attempts have been made to study land value systems in sub-Saharan Africa (Alyson *et al*., 2014; Olayiwola *et al.*, 2006; Fidelis *et al*., 2013). There studies focus on determining the various land value systems operated in Africa and the quality or stability of various land value determinant in Nigeria. Other similar studies looked at land improvements and upgrades in Canada, analysis of various determinants of residential land values and the strength of the different factors contributing to land value variation in Onitsha, Nigeria. Some researchers looked at land resource utilization and productivity (Moses and Adebayo, 2006; Oluwatosin, 2006; Iheanacho *et al.*, 2000; Ike and Ogba, 2004; Onyenweaku *et al.,* 1996). None of these studies paid attention to land value and land value system and their relationship with productivity of cassava based crop mixture operated in Imo state, Nigeria, where the bulk of smallholder farmers are into cassava-based crop production systems. It is on this reason that this study is considered important to provide information in this direction.

The broad objective of this study is to analyze the productivity of arable crop land under different value systems with cassava based crop mixture in Imo state Nigeria. Specifically the study examines the socio-economic characteristics of cassava based crop mixture farmers in the study area; identifies the various land value systems in the study area and estimates the total factor productivity of different land valued systems in the study area. In order to achieve these, a hypothesis of no significant influence of the socio-economic characteristics of the farmers on the productivity of different land value systems was formulated and tested.

MATERIALS AND METHODS

The study was conducted in Imo State, of the south-east of Nigeria. It lies within latitudes of $5^{0}40^{1}$ and $7^{0}5^{1}$ North and Longitudes $6^{0}35^{1}$ and $8^{0}30^{1}$east (Ministry of Lands and Survey, 2007). Imo State is bounded by Anambra State to the North West, Abia State to the East, Enugu to the North East and Rivers State to the South. Administratively the state is divided into 27 local government areas (Asiabaka*et.al,* 2007). It is also divided into three agricultural zones namely, Owerri, Okigwe and Orlu. The state has a population of 3.93 million with a growth rate of 3.2% (National Population Commission, 2006).

The main food crop grown in the state are cassava, yam, maize, cocoyam and melon, while the major vegetables are okra, green, fluted pumpkin, bitter leaf and water leaf. On small holder plots,

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these crops are grown in mixtures through two main based crop mixture systems- cassava based crop mixture (CBCM) and yam based crop mixture (YBCM) systems (Nwosu and Arene, 2013). Cassava based crop mixture is composed of cassava, maize and melon with cassava as the lead crop (Nwosu and Arene, 2013). The livestock reared include; sheep, goats, fishes, pigs, and poultry.

A multi-stage sampling technique was used in the selection of respondents. The first stage was the selection of the three agricultural zones for proper representation of the state. The second stage was purposive selection of two Local Government Areas from each zone where cassava based mixed cropping practice was pronounced. The local government areas selected were Ngor Okpala and Mbaitoli from Owerri zone, Isu and Nwangele from Orlu zone and Isiala Mbano and Obowu from Okigwe Zone. A total of six (6) LGA's were used for this study. Next stage was random selection of two communities each from the selected local government areas making a total of twelve (12) communities. Lists of cassava based mixture farmers in selected communities were obtained from ADP and community leaders. Fifteen (15) cassava based mixture farmers were randomly selected from the lists, making a total of 180 cassava based crop mixture farmers.

The data for the study were collected mainly from primary source through the administration of structured questionnaire, oral interviews and personal observations by the researcher. Objectives were achieved with descriptive statistical tools and multiple regression model.The regression model was specified as follows;

$Y=f(X_1, X_2, X_3, X_4, X_5 \ldots\ldots, e)$

Where, Y= total productivity, X_1= labour input in man-days per farm, X_2 = land input per farmer (ha), X_3 = capital input (depreciation expenses) per farmer (₦), X_4 = age of the farmer (in years), X_5= educational attainment of the farmer (years), X_6= house hold size, X_7 = marital statues (Dummy variable; married=1, single=0) and e = random error.

RESULTS AND DISCUSSION

Socio-economic characteristics

Table 1 contains information about Socio-economic characteristics of the cassava farmers in the study area. It shows that majority of the farmers (43%) were within the age range of 50 – 59 years with mean age of 52.8 years. This is an ageing members of the society who may show declining productivity in cassava production. Analysis of marital status of the farmers shows that higher proportion of them (43%) were married. This may aid cassava production as married people assume more responsibilities in form of providing for more people than single persons and therefore may show more commitment in cassava production.

Examination of gender status shows that majority of the famers (56.7%) were females because cassava is regarded as female crop in some areas. A survey of education levels of the famers indicate that majority of them (55.6%) attained secondary education while only (8.3%) could attain tertiary education status this shows that they were educated and educated can encourage use of modern means of production which could enhance productivity. The mean years of experience of the farmers was 12.46 years indicating that they were experienced in cassava production which is capable of enhancing productivity? The farmers had large household because the mean household size was 7 persons. This is capable of enhancing production of cassava especially where it is made a family business.

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Various Land Value Systems

Table 2 shows various land value systems observed in the study area. The table revealed that 51.7 % lands are non- suitable for agricultural purposes, 28.9% are marginal suitable whereas 19.4% are suitable land for agricultural purposes. Relatively low percentage of suitable land in the area may lead to low out and low productivity of cassava. The findings is in line with Goh *et al.* (1998), Kee *et al* (1998) , who observed that large area of land in rural areas are unproductive and tenaciously held as property because of tradition, customary rules , prestige or other non economics reasons. According to Ezeogwu, 2006, non suitable agricultural lands may suddenly become expensive as a result of zone decision, urbanization or valued due to presence of natural resources. Food and Agricultural Organisation, (2012) noted that good crop protection and good fallow systems can make non suitable land suitable land in terms of productivity. Ehirim *et al.* (2007) suggested that marginal suitable lands required high inputs of soil improvement to give out its full potential value. He also observed that suitable and marginal suitable land may turn to non suitable due to degraded by erosion and flood or subjected to excessive grazing and unsuitable farming practices.

Total Factor Productivity on Different Land Value Systems

Total Factor Productivity on Suitable Land Value System

Table 3 shows total productivity on suitable land. The four functional forms of the model were tried and following the statistical and econometric reasons, the Double log form was chosen as the lead equation. It was chosen because it has the highest value of coefficient of determination (R^2) 0.682. It also has the highest value of F-ratio and also the highest number of significant variables. These mean that 68.2% of variations in the dependent variable were jointly explained by the independent variables. The F-ratio is significant at 1%, showing the overall significant of the model. The result also shows that Labour is negative and it is significant at 1% level which means that labour has a negative relationship with total productivity on suitable land. This implies that when the independent variable is increasing, the dependent variable is decreasing. Labour is negatively related to total productivity on suitable land. Also land had a negative effect on productivity. It implies that the rent paid on suitable lands significantly reduced productivity. As rent paid on suitable lands increases, total productivity decreases. This is significant at 1%. Capital is also negative and it had an inverse relationship with productivity. This implies that when the independent variables is increasing, the dependent variable decreasing. It is significant at 1%. Age had a negative effect on productivity and it is inversely related to productivity. Since younger people are productive than the older ones who are more in the field that is older work force are more in the field hence productivity is reduced and it is significant at 1%.

Education and experience had a positive sign. Both are positively related to total productivity. Education and experience are directly related to total productivity. The reasons may be that there were well educated cassava mixed crop farmers in the state, who used quality labour and good soil management practices hence increased total productivity on suitable land. It is highly significant at 1% level. This is supported by Jan (2010) who stated that Increase level of education of workforce improves the quality of labour inputs and thereby increased productivity. Another reason may be that well experience cassava farmers are more in the state who are aware of new technologies that

can improve cassava based crop mixture farms, hence increases productivity. This is significant at 1% level.

Total Factor Productivity for Non-Suitable Land Value

Table 4 shows the total productivity on non suitable land. The models were presented in four functional forms. The exponential form was chosen for analysis as the lead equation. This is because it has the highest value of coefficient of the multiple determinants (R^2) of 0.559, which provides the best fit of the model and shows that up to 56% of the variation of dependent variable were jointly explained by the independent variable. The F-ratio is significant at 1%, sowing the overall significant of the regression and satisfaction of the econometric assumption of error term.

Labour is negative and it is significant at 1%, which implies that it has a negative relationship with total productivity on non suitable land. This means that labour has an inverse relationship with land, it means that when the independent variables are increasing, the dependent variable is decreasing. Labour is negatively related to total productivity on non suitable land. Labour is increasing capital productivity is decreasing. Gender has a positive effect on total productivity and its relationship is significant at 5% level. It implies that, gender (dummy variable), female headed households recorded better total productivity than the male. The female households are more productive than the male. Capital has a positive effect on land productivity and it is significant at 5%. It implies that capital has a direct relationship with total productivity. As capital is increasing total productivity of Non suitable land increases.

Total Factor Productivity for Marginal Land.

Table 5 shows the total productivity on Marginal land. The four functional forms of the model were tried and following the statistical and econometric reasons, the semi log form was chosen for the analysis, because it has the highest value of coefficient determinations (R^2) of 0.582 of the productivity of marginal lands. This means that up to 58.2% of the variations in the dependent variable were jointly explained by the independent variable. The F-statistic is significant at 1% showing the overall significant of the model. The result also shows that Labour and experience are positively related to total productivity. Both are highly significant at 1% level respectively. This means that labour and experience significantly increases total productivity. It shows that as labour and experience level increases total productivity is increased on marginal land in the state.

Again, gender, land, capital and age had a negative effect on total productivity. Gender, Land, Capital and Age are significant at 1%, 1%, 1% and 1% level each. These means that increase in each of them reduced total productivity on marginal land. Gender (dummy variable) recorded that female headed household has better total productivity than the male. The female households are more productive than the males on marginal lands. Land has a negative effect on productivity. It implies that land is inversely related to productivity. As the rent paid on land increases, the productivity is reduced. Age also was negatively signed indicating that as one gets older, his total productivity declines.

CONCLUSION

High proportion of land in the study area were valued non suitable while a little proportion was value suitable. This implies that land productivity may be low since suitability and fertility are directly proportional. Therefore, Cassava productivity under the cassava based crop mixture for the

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land value systems would tend towards low productivity unless modern method of farming is incorporated. This is so because the study proved that under the three land values: labour, land, capital, and age were negatively related to TFP on suitable land. In other words increases in the use of the factors on suitable land did not improve productivity of the factors. On non-suitable land labour and gender, negatively related to TFP. Examination of marginal land, gender, land and age were not in support of productivity of marginal land. It follows therefore that there some socio economic factors and resource factors that do not enhance factor productivity when added in the cassava based crop mixture in any of the land suitability measures in the study area.

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REFERENCES

Al-Kaisi, M. (2012).*Conservation Practices Saves Soil and Sustains Agricultural*. Integrated Crop Management News Department of Agronomy, Lowe State University, USA.

Asiabaka,C.C and Asoeqwu, S.N (2000). Fadama Infrastructural Study in Imo State.Www-wds.world bank.org.

Bassey, E.E (2008). *The Effect of Land tenure on Natural Resource conservation in Nigeria Rainforest Ecosystem.www.environsecurity.org/espa/PDF/ESA-DRC*

Ehirim, N.C, S.N.Odurukwe, J.Ajero, and C.A. Emenyonu (2006).Socio-Economic Analysis of Farming Risk in Cassava Production in Owerri,Nigeria. *International Journal* of Natural and Applied Science, 2 (2): 89-95.

Ehirim, N.C., R.U.Onyeneke, N.M. Chidiebere-Mark and V.C. Nnabuihe (2012).Effect and Prospect of Rural to Urban Migration on the poverty Status of Migrants in Abia State, Nigeria. *Agricultural Science Research Journal*, 2(4): 145-153.

Ezeogwu, N.C (2006). *Agricultural Science for School and Collages*, A.C Global Publishing Co.(Nig) Onitsha, Anambra State.

F.A.O. (2003).*Technology Assessment and Transfer for Sustainable Agriculture and Rural Development the Asia-pacific Region*, a research management prospective.FAP, Roma, Italy.

F.A.O, "*Agricultural Land Prices*".United Nations New York, June 1997.

http;//www.fao.org/sd/ltdrect/lTan0016.htm

F.A.O. (2010*) Nigeria Land Area*, F.A.O STAT.

F.A.O, Food and Agricultural Organization of United National Statistics, 2012 FAOSTAT database.*http://www.nass.usda.gov/publications/Ag_Statistics/2012/chapter03.pdf* (accessed 13 April 2013).

F.A.O, Food and Agricultural Organization of the United National Statistics. 2013.*Why cassava?* Available at *http://www.fao.orrg/ng/ag/agp.appc/gcds*.(Accessed 13 April, 2013).

F.A.O (2004). FAOSTAT Database FAO (2011). FAOSTAT Database.

F.G.N.(2006). Report of the final 2006 Census Results Published as Official Population figures of the Federal Republic of Nigeria. Official Gazzette.Vol.96, No.2.

Ibekwe,U.C, C.Chikezie, P.C.Obasi, C.C.Eze, and A.Henri-Ukoha (2012).*Profitability of Garri Processing in Owerri North Local Government Area of Imo State, ARPN J. Sci. Tech.* 2(4): 340-343.

IFAD/FAO (2004).*The Global Cassava Development Strategy*; A Cassava Industrial Revolution in Nigeria. Global Strategy for Cassava Development.www.fao.org/ docrep/007/y5548e/y5548e08.htm

Imo State Agricultural Development Programme (ADP, 2000). An Assessment Study of the Performance of the National Agricultural technical support project in Imo State with focus on Farmers Adaptation of Technologies and their Socioeconomic Improvements. Cochita Nigeria Ltd.

Jaiyeola, K.E (1979), *Land Use Classification in the Southern Nigeria*. www.elib.edu.et/bitstream 123456789/51598/2/25144.pdf

Kee.K.K, P.S.Chew, H.H.Gan and K.J.Goh (1998).Validation of site yield potential model for Oil Palms Malaysia.In proceedings of International oil palm conference, commodity of the past, today and future. Pp 150-163.

Korie, O.C, D.O, Ohajianyaand N.C. Ehirim (2006). Value Chain Analysis of Cassava and Cassava based products in Imo State, Nigeria. Federal University of Technology Owerri.*International Journal of Natural and Applied Sciences,* 2(4): 400-404.

Kuo, S.H and B. Lin(2003). Estimation of Food Demand and Nutrient Elasticity from Different Survey.In Economic Research Service. USDA (2003).Pp1-8.

National Population Commission (2006).Census Ofice Owerri, Imo State. Federal Republic of Nigeria Official Gazette No.2 vol.96, Abuja 2nd February, 2009.

National Population Commission (2007). Nigeria's 2006 Census. Ngor-Okpala L.G.A, Statistical Data.

Nwosu, C.S. & C.J. Arene***(2013).****Effects of Agro climatic Change on Cassava Based Crop Mixture System in Crude Oil Producing Areas of Imo State, Nigeria*.G.J.B.A.H.S.,Vol.2(3):171-177.ISSN, Pp 2319-5584.

Ohajianya, D.O, V.A. Enwerem, J.A. Echetama and F.C. Anaeto (2007). *Comparative Analysis of Organic and Inorganic fertilizer use in cassava production in Imo State, Nigeria.* International Journal for Agriculture and Rural Development, 9(1):30-34. http://dx.doi.org/10.4314/ijard.v9i1.2660

Olayide, S.O. and Heady (1982).*Introduction to production Economics.* Ibadan University Press, Ibadan, Pp 42.

Oluwande, OA, C.C, Egolum, F.I. Emoh (2013). *Prioritizing Residential Land Value Determinant* in Onitsha, Nigeria.International Journal of Academic Research in Business and Social Sciences.

Oyekale, S.A. (2008): *Suitability of Land, Journal of Sustainable Development*. Department of Agricultural Economics, University of Ibadan.

Onyegocha, S.U.O, N.C. Ehirim, R.A Okere, M.A.Y. Rahji, T.T. Awoyemi, B.I. Oluwatayo and K.K. Salman (2013).*Econometric Analysis of Suitability and Marginal Value of Productivity of Farmlands for Cassava Production* in Imo State, Nigeria. November, 2013. Academic Journals, 5(11): 450-456.

Onyenweaku, C.E and B.C. Okoye, (2007). *Technical efficiency of Small-Holder Cocoyam Farmers In Anambara State, Nigeria*: A Translog Stochastic Frontier Production Function Approach, 9(1): 1-6.

Stobebe .E.T, J.E Alison, E.E. David, and G.V. Cornelis, (2014).*Farmland Protection and Agricultural land Value System at the Urban-Rural Fringe.* Agricultural Land Reserve, November, 2014.

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TABLE 1: Distribution of the cassava farmers based on their Socio-economic characteristics.

Variable	Frequency	Percentage	Mean
Age (Range)			
30-39	4	2	
40-49	40	22	
50-59	78	43	52.8 years
60-69	55	31	
70-79	3	2	
Total	180	100	
Marital Status			
Single	66	37.6	
Married	78	43.0	
Divorced	25	14.0	
Widowed	11	6	
Total	180	100	
Gender			
Female	102	56.7	
Male	78	43.3	
Total	180	100	
Education level			
No formal education	7	3.9	
Primary	58	32.2	
Secondary	100	55.6	
Tertiary	15	8.3	
Total	180	100	
Experience (range of years)			
0 – 9	9	5	
10 – 19	87	49.4	
20 – 29	28	15.6	12. 46 years
30 – 39	30	16.7	
40 – 49	19	10.6	
50 – 60	5	2.8	
Total	180	100	
Household size (range of person)			
1 – 4	30	16.7	
5 – 9	130	72.2	
10 – 14	15	8.3	7 persons
15 – 19	5	2.5	
Total	180	100	

Source: Field survey, 2017.

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Table 2: The Distributions of Various Land Value Systems for agricultural purposes

Variables	Frequency	Percentage (%)
Suitable	35	19.4
Marginal Suitable	52	28.9
Non suitable	93	51.7
Total	**180**	**100**

Source: Field Survey 2016

Table 3: Estimated Model of Total Productivity for Suitable Land.

Variable	Double log	Exponential	Linear log	Semi log
Constant	13.950	3.036	10.644	52.347
	(1.214)	(2.499)**	(2.209)**	(1.153)
Labour	-0.935	-4.962E-005	0.000	-3.047
	(-9.704)x***	(-1.295)	(-1.103)	(-0.800)
Experience	0.107	0.007	0.16	0.224
	(6.235)***	(0.840)	(0.471)	(0.331)
Gender	-0.106	-0.086	-0.387	-0.464
	(-0.658)	(-0.590)	(-0.672)	(-0.732)
Land	-0.173	-4.595E-005	0.000	-1.305
	(-3.358)***	(-0.259)	(-0.569)	(-0.641)
Capital	-0.126	-4.415E-005	0.000	-0.564
	(-9.433)***	(-1.719)*	(-1.764)*	(-1.072)
Age	-0.210	-0.006	0.019	-0.643
	(-3.317)***	(-0.463)	(-0.409)	(-0.258)
Education	0.194	-0.022	-0.068	0.625
	(12.161)***	(-1.170)	(-0.898)	(-0.994)
Marital Status	0.184	-0.190	0.740	0.728
	(0.985)***	(1.061)	(1.041)	(0.985)
R^2	0.682	0.232	0.196	0.152
F-ratio	.659x***	0.981***	0.790***	0.561

Source: Field Survey, 2017

*** Significant at 1%, ** at 5%, * at 10%, Values in parenthesis are "t-values"

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Table 4. Estimated Model of Total Productivity for Non Suitable Land

Variable	Exponential log	Double log	Semi log	Linear log
Constant	1.019	9.606	15.026	2.271
	(1.40)	(1.863)*	(1.960)*	(2.283)**
Labour	-2.937E-005	-1.041	-1.516	-4.143E-005
	(-8.598)***	(-8.348)***	(-8.181)***	(-8.060)***
Experience	0.001	0.008	-0.007	0.000
	(0.408)	(0.167)	(-0.097)	(-0.112)
Gender	0.138	0.124	0.212	0.237
	(2.389)**	(2.177)**	(2.497)**	(2.729)***
Land	0.000	0.137	0.216	0.000
	(0.482)	(0.240)	(0.254)	(0.592)
Capital	3.804E-005	0.154	0.170	4.383E-05
	(3.313)***	(2.897)***	(2.152)**	(2.537)**
Age	-0.006	-0.279	-0.283	-0.006
	(-1.646)	(-1.456)	(-0.994)	(-0.950)
Education	0.009	0.092	0.086	0.011
	(1.149)	(1.640)	(1.030)	(0.950)
Marital Status	-0.021	-0.019	-0.022	-0.029
	(-0.023)	(-0.256)	(-0.200)	(-0.273)
R^2	0.559	0.552	0.524	0.519
F-ratio	13.289***	12.957***	11.553***	11.342***

Source: Field Survey, 2017

*** Significant at 1%, ** at 5%, * at 10%. Values in parenthesis are "t-values".

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Table 5: Estimated model of Total Factor Productivity on Marginal Land

Variable	Semi log	Double log	Linear	Exponential
Constant	-8.603	-0.933	1.599	0.907
		(-0.086)	(0.433)	(0.734)
Labour	3.584	1.174	0.000	4.947E-005
	(13.787)***	(1.351)	(1.473)	(1.446)
Experience	0.455	0.133	0.017	0.006
	(11.312)***	(0.990)	(0.757)	(0.742)
Gender	-0.0555	-0.051	-0.082	0.069
	(-13.495)***	(-0.370)	(-0.195)	(-0.492)
Land	2.428	-0.959	0.001	0.000
	(-11.497)***	(-1.359)	(-1.391)	(-1.265)
Capital	-0.549	-0.186	0.000	-3.630E-005
	(-14.252)***	(-1.444)	(-1.391)	(-1.325)
Age	-1.068	-0.449	-0.014	-0.007
	(-6.825)***	(-0.859)	(-0.441)	(-0.632)
Education	0.420	0.117	0.029	0.004
	(1.181)	(0.987)	(0.618)	(0.274)
Marital Status	0.857	0.229	0.819	0.205
	(0.988)	(0.789)	(0.956)	(0.716
R^2	0.582	0.164	0.145	0.136
F-ratio	7.484***	1.053	0.908	0.847

Source: Field Survey, 2017

*** Significant at 1%, ** at 5%, * at 10%,Values in parenthesis are t-values.