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Research Paper

A Structural Analysis of Capital Determinants of growth in LivestockproductionOutput in Nigeria.

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ABSTRACT: -The study examined the structural analysis of capital determinants of growth in Livestock production output in Nigeria. The objectives of the study were to examine savings, human capital formation and gross capital formation as a major capital determinants of livestock production output in Nigeria. Data for the study were sourced from CBN statistical bulletin and National bureau of statistics statistical bulletin. The econometric method of OLS, Co-integration and error correction methods and Granger causality tests were used as the analytical tools for the study. The study employed the E-view 7.1 econometric software in its analysis. The long run results depicted by the parsimonious error correction mechanism revealedthat the explanatory variables are rightly signed. Also, the coefficient of the parsimonious ECM has the appropriate sign, which is negative and statistically significant. Meaning that the short run dynamics adjust to long run equilibrium relationship. Evidence was drawn from the parsimonious ECM result. Therefore, the study recommends for strong policy reforms to boost livestock production output in Nigeria.

KEY WORDS:-Determinants, Production, Capital, Human development,

I. INTRODUCTION

1.1 Statement of Problem

The agricultural sector has been the mainstay of the economy since independence and despite several bottlenecks; it remains a resilient sustainer of the populace.The sector has several untapped potential for growth and development in the availability of land, water, labour and its large internal markets. It is estimated that about 84 million hectares of Nigeria's total land area has potential for agriculture; however, only about 40% of this is under cultivation (FMARD, 2012).In spite of these opportunities, the state of agriculture in Nigeria remains poor and largely underdeveloped. The sector continues to rely on primitive methods to sustain a growing population without efforts to add value. This has reflected negatively on the productivity of the sector, its contributions to economic growth as well as its ability to perform its traditional role of food production among others. From the perspective of sustainable agricultural growth and development in Nigeria, one of the fundamentalconstraints remains the peasant nature of the production system, with its low productivity, poor response to technologyadoption strategies and poor returns on investment. It is recognized that agricultural commercialization andinvestment may be the key strategies for promoting accelerated modernization, sustainable growth and developmentand by extension poverty reduction in the sector. However, to attract investment into agriculture, it is imperative thatthose constraints inhibiting the performance of the sector are first identified with a view to unlocking them andcreating a conducive investment climate in the sector. The development challenges of Nigeria's agriculture are, therefore, those of properly identifying and classifying the growth and development constraints of the sector,unlocking them and then evolving appropriate strategies for promoting accelerated commercialization andinvestment in the sector. Agriculture comprises the main fields of human activity concerning the primary production of food and cash crops, livestock, fishing, forestry and marketing of the products.Livestock subsector is one of the fastest growing agricultural subsectors indeveloping countries and the growth is driven by the rapidly increasing demand forlivestock products. This demand is being stimulated by population growth,urbanization and increasing incomes in developing countries (Delgado, 2005).

Livestock production being a major component of agricultural economy of Nigeriaaccounted for five to six percent of the total Gross Domestic Products (GDP) andbetween 15% and 20% of the GDP of agriculture in 2004 (Agunbiade, 2009).Domestic animals like cattle, sheep, goats, pigs, poultry, and other livestock areintegral to rural livelihoods and culture in Nigeria; providing food (meat, blood,eggs and dairy products), materials

(wool, hide, horns, etc.), income, andmechanical power for pulling carts or for ploughing fields. Clearly, the relatively poor rates at which domestic savings in Nigeria is growing is a source of worry to agricultural growth and livestock production in Nigeria. Investment is also of a special interest as a limiting factor to and private investment in agriculture has been declining (World Food Summit (WFS), 1996).All across the world, livestock play vital role for lot of poor households because livestock is not only used as a source of income but also utilized as source of nutrition, draft power, fuel and store of wealth. In general, livestock is owned by rural households. Livestock is important for increased agricultural production in Nigeria. Among livestock based vocations, goat, pig and poultry occupy a pivotal position because of their enormous potential to bring about rapid economic growth. Livestock production systems can be defined based on feed source, as grassland - based, mixed, and landless. Grassland based livestock production relies upon plant material such as shrub land, rangeland, and pastures for feeding ruminant animals. Livestock production account for one third of Nigeria's agricultural GDP, providing income, employment, food, farm energy, manure, fuel and transport. They are also a major source of government revenue. According to a survey, the rapid growth in the livestock production is highest as compared with any other agricultural sub-sector and it is predicted that by 2020, this sector will produce more than half of the agricultural output (Ahuja & Redmond, 2001). The demand for livestock is predicted to arise in Nigeria due to high population growth; people are moving towards cities (higher standard of living) and increasing household incomes. The options for sustainable livestock in Nigeria will provide growth in rural income and accelerate the pace of production but opportunities require economic policies that will ease the production at farm and processing level. To unfold opportunities for sustainable growth in livestock sector, economic policies and institutions are not geared up to fulfill the demand for livestock. The subsector is characterized by low savings, lack of human capital formation as well as inadequate capital formation. Livestock production is carried out in many forms, usually referred to as production systems or agro-ecosystems. Production systems evolve as a result of agro-ecological potential, the relative availability of land, labour and capital and the demand for livestock products are major issues. Many production systems were before now at a sustainable equilibrium, with livestock being produced in harmony with nature and in environmentally sound systems. However, over the last decades, several production systems have lost this equilibrium because of the pressure caused by growing human populations and increased demand for animal products.

1.2 Objectives of the Study

The objectives of this study is to examine the capital determinants of growth in Livestock productionoutput inNigeria.

II. Literature Review

2.1.1 Theoretical Underpinnings

The growth of output in neoclassical growth model is achieved at least in the short run through higher rate of saving and therefore higher rate of capital formation. However, diminishing returns to capital limit economic growth in this model. Though the neoclassical growth model assumes constant returns to scale which exhibits diminishing returns to capital and labour separately. The neoclassical growth model was developed by Solow (1956) and Swan (1956).It is built upon an aggregate, constant- returns- to- scale production function that combines labour and capital (with diminishing marginal returns) in the production of a composite good. Savings are assumed to be a fixed fraction of output, and technology improves at an exogenous rate.
Suppose the production function is Cobb- Douglas, so that

$$\mathbf{Y = AK^{\alpha}L^{1-\alpha}}, \quad \mathbf{0} < \alpha < 1, \qquad 2.1$$

Where = Y denotes total production output,
L= the number of workers employed in the production process,
K= the capital stock

Where, A measures the level of technology. Output per worker, **y=Y/L,** is thus given by

$$\mathbf{y = AK^{\alpha}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots . (\mathbf{2.2})$$

Where, k denotes the capital- labour ratio.
Capital accumulation is given by

$$k = sy - (\eta - \delta)k, \qquad 0 < s\delta < 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.3)$$

Where, s denotes the propensity to save, n> 0 the exogenous rate of population growth, and δ the rate of depreciation of physical capital.

Endogenous growth theories believe that improvements in productivity is linked directly to a faster pace of innovation plus investment in human capital. The theory discussed on the need for strong government and private sector institutions to nurture innovation, and provide incentives for individuals and businesses to be

inventive. There are increasing returns to scale from capital investment especially in infrastructure and investment in education and health. That private sector investment in research and development is a key source of technical progress

Lucas (1988), Human Capital Model is one of the best- known attempts to incorporate spillover effects of human capital accumulation to explain growth processes. The model is built upon the idea that individual workers are more productive, regardless of their skill level, if other workers have more human capital. A simplified presentation of the model is as follows. Human capital is accumulated through explicit "production": a part of individuals' working time is devoted to accumulation of skills.Formally, let k denote physical capital per worker and h human capital per worker or generally, "knowledge" capital. The production process is specified as follows

$$\mathbf{y = Ak^{\sigma}[\mu(h)]^{1-\sigma}}, \qquad \mathbf{0} < \mu < 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(\mathbf{2.4})$$

Where, u denotes the fraction of time that individuals devote to producing goods.

The growth of physical capital depends on the savings rate (I=sy), while the growth rate of human capital is determined by the amount of time devoted to its production:

$$\frac{h'}{h} = \alpha(1-\mu), \qquad \alpha > 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(2.6)$$

This means that the long- run growth rate of both capital and output per worker is $\propto (1-\mu)$.The rate of human capital growth and the ratio of physical capital to human capital converge to a constant. In the long-run, the level of income is proportional to the economy's initial stock of human capital. The savings rate has no effect on the growth rate.The important implication of Lucas (1988) model is that under a purely competitive equilibrium its presence leads to an underinvestment in human capital accumulation because private agents do not take into account the benefits of human capital accumulation. The equilibrium growth rate is smaller than the optimal growth rate, due to the existence of externalities. Because the equilibrium growth rate depends on the rate of investment in human capital, the externality implies that growth would be higher with more investment in human capital. In conclusion, government policies are necessary to increase the equilibrium growth rate up to the level of optimal growth rate. This implies that a government subsidy to human capital formation or schooling could potentially result in a substantial increase in the rate of economic growth.

Human capital directly influences agricultural productivity by affecting the way in which inputs are used and combined by farmers. Improvements in human capital affect acquisition, assimilation and implementation of information and technology. Human capital also affects one's ability to adapt technology to a particular situation or to changing needs. Public policy and budgetary decisions regarding infrastructure also have a profound effect on agricultural production.

2.1.2 Empirical Literature

Dauda, 2010 examined the link between human capital and economic development in Nigeria using the Error Correction Mechanism (ECM). Sectoral growth (Agriculture) was used as a proxy for economic development, the independent variables identified were gross capital formation (GCF), labour force, primary, secondary and tertiary school enrolment rates. The study showed that a one per cent increase in the labour force, tertiary and secondary school enrolment, and GCF would increase real agricultural growth by 13, 48, 104, and 76 per cent respectively. Amassoma and Nwosa (2011) studies the causal nexus between human capital Investment and increased production in Nigeria for sustainable development in Africa at large between 1970 and 2009 using a Vector Error Correction (VEC) and Pairwise granger causality test. The findings of the VAR model and pairwise estimate revealed no causality between human capital developments and increased in production.

Udoh, (2012) employed bounds test and Autoregressive distributed lag (ARDL) modeling approach to analyze both short- and long-run impacts of public expenditure and foreign direct investment on agricultural output growth in Nigeria. Their results indicate that an increase in public expenditure has a positive influence on the growth of the agricultural output and that government spending has a relatively higher elasticity than foreign direct investment.Using Vector Auto Regressive (VAR) and Vector Error Correction (VEC) model, Adelakun (2011); and Zaren and Akbas (2013) empirically investigated the relationship between savings and growth. Their findings rejected the Solow's hypothesis that saving precedes economic growth, and accept the Keynesian theory that postulated that it is economic growth that leads to higher savings. Bakare (2006) investigated the growth implications of human capital investment in Nigeria using the vector autoregressive error corrections mechanism. The study revealed that there is a significant functional and institutional relationship between the investments in human capital and economic growth in Nigeria. It was revealed that 1% fall in human capital investment led to a 48.1% fall in the rate of growth in gross domestic output between 1970 and 2000.Garba(2002) showed that there are positive correlation between educationalattainment and economic

growth and development carrying out a cross-country analysis using regressions. Lawanson(2009) in his work used an ordinary least square model to estimate the role ofeducation and health in human capital investment and economic growth in Nigeria. He found that on the average,human capital actually enhances economic growth in Nigeria although, the government expenditure on healthand primary education enrollment have negative coefficient which are inconsistent with a prior expectation.

Arora (2001) in his study revealed that there is a cointegrated relationship between health and income;innovations in health according to him lead to economic growth and not vice versa.Khan and Rehman (2012) used analytical techniques, which are OLS and Johansen cointegration to investigate the impact of human capital in economic growth of Pakistan. The result support significant positive association between secondary education and economic growth.Wilson and Briscoe (2003) in their study on impact of education and training found out that increased investment in education is shown to lead to higher productivity and earnings for the individual and similarly, such investment results in significant social rates of return. They also discovered that there is a spill over gain of investing in education to other sectors of the economy.

Barro (2001) also examined a panel data of around 100 countries. It was observed from the study that expenditures are found to constitute a form of investment. It increases the individual's chances of employment in the labour market, and allows him to get returns and gives him opportunities for job mobility. It is well known and widely accepted that education plays a great and significant role in the economy of a nation, investment in education is critical for economic growth and social cohesiveness of any society.

Rutherford (2002) defined saving as the residue of income of a government, a firm or a household after all their expenditures have been incurred. In national accounts terminology, saving is the net surplus of income over consumption or, stated differently, the amount of resources or income produced in the economy in a given period that is not consumed immediately but put to use in a way that will provide returns to the economy in future (Menander, 2010). Saving, therefore, means forgoing consumption today so as to enjoy a better standard of living in the future while national saving, on the other hand, is the sum of saving by households, businesses, and all levels of government.

Enoma, (2010) Study applied the Cobb-Douglas production function to establish the relationship between credit and agricultural output. In general, there is consensus that credit influences agricultural output and its coefficient is positive. The other variables included in the agricultural production function are land, rainfall and capital. Sial (2011) have argued that improved seeds and other inputs like tractors, fertilizer and biocides that may be purchased using credit money play an important role in agricultural production and these can be directly influenced by the availability of credit.

Bankole and Fatai (2013), focusing on the cause and effect relationship between domestic savings and growth in Nigeria for the period of 1980-2010. While employing Granger-Causality and Engle-Granger co-integration, he found that causality runs from savings to growth by accepting the Solow's hypothesis.Nwachukwu and Egwaikhide (2007) studied the determinants of private saving in Nigeria bycomparing the estimation results of the ECM model with those of partial-adjustment, growth rateand static models. They found that real interest rate on bank deposits has a significant negativeimpact while external terms of trade, inflation rate and external debt service ratio have positiveimpact on private saving. They also found that savings rate rises with the level of disposableincome; and that the ECM performed better than the other models and that agro production can only increase through increased private and public savings.

Mohan (2006) studied the relationship between domestic savings and agricultural growth for various economies with different income levels using the Granger causality test. He adopted the time series annual data from 1960 to 2001. His empirical results indicated unidirectional and bi-directional Granger causality from economic growth rate to growth rate of savings in 13 countries and five countries respectively.

(Dauda, 2010) further examined the link between human capital and economic development in Nigeria using the Error Correction Mechanism (ECM). Sectoral growth (Agriculture) was used as a proxy for economic development, the independent variables identified were gross capital formation (GCF), labour force, and primary, secondary and tertiary school enrolment rates. The study showed that a one per cent increase in the labour force, tertiary and secondary school enrolment, and GCF would increase real agricultural growth by 13, 48, 104, and 76 per cent correspondingly.

III. Estimation Techniques

The methods of study applied in this study following the literature is based on time series data sets. Data for the study were generated from the central bank of Nigeria statistical bulletin and the National bureau of statistics statistical bulletin. The study adopted the ordinary least squares (OLS) techniques of multiple regression and co integration test. The choice of co-integration test for our analysis was informed by the shortcomings that often characterize time series data. Hence the use of co-integration tests to help correct these inadequacies. The E-view 7.1 econometric software was applied to run the model.The unit root test via the ADF test precedes the cointegration and ECM test in order to test for stationarity of the variables.

i. Unit-Root Test:

There often exists the problem of non-stationarity in empirical research involving time series data and this renders the traditional tools of econometrics (like OLS) inappropriate. To overcome this unit-root problem, we test for stationarity of the series in use. The Augmented Dickey-Fuller test (ADF) is of choice in this study because of its efficiency in detecting unit root. It is specified as follows:

$$\Delta Y_t = \theta_o + \theta_1 Y_{t-1} + \sum_{i=1}^{k} b_i \Delta Y_{t-i} + \mu_t \quad \text{..... (3.1)}$$

Where, Y_t is a vector of all variables in the model $\theta_i$and b_i are parameters of the model, μ_t is the white noise at time while k and Δ remain as defined. This we will achieve, conducting the test by first or second level difference if the series are integrated of order one or order two (i.e. I(1) or I(2)). The null hypothesis here is that Y_t has a unit root (that is, non-stationary) and the alternative is that there is no unit root (that is, stationary). If the variables turn out to contain unit roots, we will therefore, conclude that they are non-stationary.

ii. Johansen Co integration Test

Johansen co integration (Trace and Maximum Eigenvalue statistics) was used to ascertain the long run relationship between the regressand and regressors .The theory of cointegration according to Granger (1981) and Engle and Granger (1987), addressed the issue of integrating short-run dynamics with long-run equilibrium, Basically, the theory demonstrates that if two variables are cointegrated, it implies that there is a meaningful long-run relationship between them,, the short run dynamics can be described by the Error Correction Model (ECM).

The basic structure of an ECM is as follows:

ΔYt= a + ßΔXt-1- ßECt-1+ et ..... (3.2)

Where EC stands for the error correction component of the model and measures the speed at which prior deviations from equilibrium are corrected.

Model Specification

The model that analyzedthe relationship is stated as follows:

LVP = f (GCF, NNS, HCF)..... (3.3)

The equation (1) is transformed into a linear function thus:

$LVP = b_0 + b_{1t}GCF_t + b_2 NNS_t + b_3 HCF_t + U_t$ ..... (3.4)

LVP = Growth in Livestock Output

Capital determinants were disaggregated into the following:

GCF = Gross Capital Formation

HCF= Human Capital Formation

NNS = Net National Savings

IV. RESULTS

Table 4.1: Result of Unit Root (Stationarity) Test

Variables	ADF Test	Critical Value			Order of integration
		1% critical value	5% Critical value	10% critical value	
LVP	-5.357118	-3.653730	-2.957110	-2.617434	I(1)= 1st Diff.
NNS	4.790816	-3.711457	-2.981038	-2.629906	I(0) = At Level.
GCF	-4.068590	-3.661661	-2.960411	-2.619160	I(1) = 1st Diff.
HCF	-5.765974	-3.653730	-2.957110	-2.617434	I(1)= 1st Diff.

Source: Computed Result (E-view 7.1)

From table 4.1 above, the Unit Root Test results showed that at various levels of significance (1%, 5% and 10%), the variablesstudied were stationary. But also, all the time series were not stationary at their levels except NNS. But in any case, all the nonstationary variables become stationary at first difference. The results showed that LVP, GCF and HCF are integrated of order one 1(1). Therefore, having established stationarity of the variables, the long –run relationship among the variables was conducted using the Johansen (1988) method.

Table 4.2: Johansen Cointegration Test Result for Lives Stocks Production Model

Eigen value	**Max-Eigen Statistic**	**5% critical value**	**Prob. ****	**Hypothesized N0 of CE(s)**
0.809340	83.64246	47.85613	0.0000	None *
0.575123	32.26731	29.79707	0.0255	At most 1 *
0.143555	5.732716	15.49471	0.7268	At most 2
0.029517	0.928795	3.841466	0.3352	At most 3

Source: Computed Result (E-view 7.1) from Appendix IV
Note: * denote rejection of the hypothesis at the 0.05 level.
p-values. Max-eigenvalue test indicate 2 co-integrating equations at 0.05 level

The co integration results in table4.2 above showed that there are three co- integrating equations at 5% level of significance. This also revealed that three variables are co-integrated at 5% significance level. This is justified by strong evidence from the unit root test conducted, where the study observed that three variables are stationary at first difference while the other one was stationary at level. By implication, there exists a long-run relationship or equilibrium amongst the variables (the Max-Eigen Statistics are greater than the critical values). By this results and given that there are two co-integrating equations, the requirement for fitting in an error correction model is fulfilled.

Table 4.3: Parsimonious Error Correction Model for Lives Stock Production Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.225798	3.900603	1.083370	0.2958
D(LVP(-1))	-0.162419	0.276631	-0.587134	0.5658
D(LVP(-2))	0.212709	0.301279	0.706019	0.4910
D(LVP(-3))	-0.034878	0.290036	-0.120253	0.9059
D(NNS)	-1.19E-05	9.82E-06	-1.211148	0.2446
D(NNS(-1))	5.96E-06	7.98E-06	0.746532	0.4669
D(NNS(-2))	-2.36E-06	7.06E-06	-0.334407	0.7427
D(GCF)	-3.90E-05	0.000126	-0.308677	0.7618
D(GCF(-1))	0.000265	0.000133	1.994262	0.0646
D(GCF(-2))	0.000193	0.000167	-1.159586	0.2643
D(GCF(-3))	0.000112	0.000129	0.866909	0.3996
D(HCF)	0.000112	9.26E-05	1.206910	0.2462
D(HCF(-1))	1.16E-05	9.23E-05	-0.125863	0.9015
D(HCF(-2))	8.73E-05	0.000136	0.641686	0.5308
ECM(-1)	-9.543775	18.03494	0.529183	0.6044

R-squared	0.455339	Mean dependent var	6.770667
Adjusted R-squared	-0.053010	S.D. dependent var	10.16484
S.E. of regression	10.43078	Akaike info criterion	7.834252
Sum squared resid	1632.018	Schwarz criterion	8.534851
Log likelihood	-102.5138	Hannan-Quinn criter.	8.058380
F-statistic	2.895721	Durbin-Watson stat	2.017704
Prob(F-statistic)	0.009139		

Source: Computed Result (E-view 7.1)

Table 4.3 above showed that the coefficient of ECM is rightly signed but statistically not significant at the 5% level. This corrects any deviation from long-run equilibrium and the Durbin Watson value of 2.0 suggests no presence of autocorrelation. The overall fit is satisfactory with an R-squared of 0.45, thus 45 percent of the systematic variation in livestock production output is explained by the ECM. The F-statistic of 2.8 is very

significant at the 5% level. The results also showed that the current and lags forms (i.e lag one and two) of the independent variables (GCF and HCF) were positively signed while the current and lags forms of the independent variable (NNS) are negatively signed except lag one form that is positively signed. Also, for the one period, the independent variables were not statistically significant at 5 percent level.

V. CONCLUSION AND RECOMMENDATIONS

From the analysis and findings, the three ex

From the analysis and findings, the three explanatory variables showed a positive signs. Thereby meeting the appriori expectation. The variables were collectively significant but individually not significant in explaining variations in the dependent variable. From the results above one can conclude that savings, gross capital formation and human capital formation are not adequate enough to ensure major growth in livestock production in the country and also, the results can be said to have showed the ability of some variables other the ones studied playing major role in determining the growth of livestock production output in Nigeria. Therefore, the study recommends for stronger policy reforms to boost livestock production in Nigeria and the need to improve on majorly on funding allocation to the livestock sub sector.

REFERENCES

[1]. Agunbiade, J.A. (2009). *Meat from Wheat: animal feed resources in a flux.* 52nd Inagural Lecture, Olabisi Onabanjo University, Ago-Iwoye

[2]. Bakare, A.S. (2006). The Growth Implications of Human Capital Investment in Nigeria: An Empirical Study. *Journal of Economics and Social Studies.* Ado Ekiti, Pp110-125

[3]. Briscoe (2003). The Impact of Human Capital on Economic Growth: A Review. *Third report on vocational Training Research in Europe: Background report (cedefop Reference Series, 54)*

[4]. Delgado, C. (2005). Rising demand for meat and milk in developing countries: implications for grasslands-based livestock production. In McGilloway, D. A. (Ed.). *Grassland: A global resource*. The Netherlands:Wageningen Academic Publishers, pp. 29–39.

[5]. Dauda, O.R. (2010), Role of Human Capital in Economic Development: An Empirical Study of the Nigerian Case. Manuscript, Oxford Business and Economics Conference Program

[6]. Eke .I. C (2015) Capital Accumulation and Agricultural production output in Nigeria. A Ph.D. Thesis Rivers State University of Science and Technology Port Harcourt

[7]. Romer, D. (2012). *Advanced Macroeconomics* (4th ed.). Published by McGraw-Hill.

[8]. Solow, R. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, *70*, 65-94.