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Modeling Entrepreneurial Education within the Framework of Production Theory: a Way Out of Economic Doldrums in Sub-Saharan Africa

[1]Siyanbola, Trimisiu Tunji, [2]Adegbie, Folajimi Festus &
[3]Adesola, Munir Adekunle
[1&2]Department of Accounting, Babcock University, Ilishan Remo, Ogun State. Nigeria
[3]Department of Accountancy, Moshood Abiola Polytechnic, Abeokuta, Ogun State. Nigeria

Abstract

It was observed that no government of a nation can provide full employment to its citizens, which has brought the challenges of underemployment and productivity in the economy. This study was conducted to model entrepreneurial education within the framework of production theory by investigating the relationship between entrepreneurship and innovation and gross domestic products of 16 selected Sub-Sahara African states between 2010 and 2014 using endogenous growth model. In the model, we set the gross domestic product as a function of labour, physical capital and entrepreneurship and innovation on modified Cobb-Douglas production function using 'Stata version 11' software. The estimated elasticity of productivity include 0.9147434, 0.2588915and 0.7980022 as compared to entrepreneurship and innovation; labour and physical capital respectively. They all have high statistical significances. The result, amongst others, indicate positive effect of entrepreneurship and innovation on productivity, which means that increase in entrepreneurship and innovation coefficient will increase gross domestic products. It was therefore recommended that other Sub-Sahara African countries should borrow a leaf from South Africa and impart entrepreneurial education on all pupils of school age from primary to tertiary institutions not only the tertiary institutions so as grow productivity in geometrical proportion, as a way out of economic doldrums.

Keywords: *Entrepreneurship, Entrepreneurial education, Employment, Productivity.*

Corresponding Author: Siyanbola, Trimisiu Tunji

Background to the Study

Every successive government of the world, democratic or military, uses provision of full employment as their target. This has always become the focal points of every political party as campaign gimmick on which they want to effect a change on the existing system in the country. They often capitalise on the fact that the ruling party finds it difficult to provide full employment to the citizens. However, no government of a nation can single handily provide full employment to its teaming population, not even the developed countries, hence every government devices ways by which near full employment could be provided to employable adults. One of these devices is the introduction of Entrepreneurial education in tertiary institutions. This device is to provide the requisite education needed by undergraduates to be self-employed after graduation rather than looking for white collar jobs that are not always available after the compulsory youth service programme.

Before considering what entrepreneurial education entails, it is pertinent to explain the word entrepreneurship. This concept started in England during the industrial revolution in the eighteenth century. Oluwasanya (2011) stated that early English entrepreneurs demonstrated a creative and innovative personality by constantly inventing for commercial use through the application of new scientific discoveries for productive processes. Innovation is found to be the key word as every entrepreneur tries as much as possible to introduce new things that had never being in vogue in the society. Innovation is more pronounced in manufacturing processes as emphasised by Marshall (1890) when he asserts that four factors are necessary in production: land, labour, capital and organiser. This last factor is what is known as entrepreneurship. He believed that this factor is the coordinating factor that brings the other factors together, therefore it is the driving force behind the success of every concern.

The economies of countries of the world are based on entrepreneurship premised on small and medium scale enterprises, thus explaining why these businesses constitute the bedrock of the national economy of any nation, Chukwumezie and Osapka (2015). It is a known fact that not everybody that now finds himself/herself in small and medium scales activities does so willingly, some are forced into the activities as the last resort as captured by Shapero and Sokol (1982) where they explained the processes, stages and activities that led to launching of a business enterprise. According to them, motives for business formations are three i.e. negative displacements; between things and positive pull: (i) inertia guides human behaviour, until some events displace that inertia and unlock previously undesired behaviour, individual may not want to start up business enterprise. According to Ediagbonya (2013) death of spouse, who was the bread winner of the family, might alter the perception of the desirability of his widow to become self-employed. The other situations of negative displacement can be found in divorce, loss of job and insult. (ii) between-things category such as graduating from high school, tertiary institutions, military or being released from jail. (iii) positive-pulls refer to positive supports and encouragement from partners, mentors, inventors and customers that propel the individual to start up a business. From the classifications, it could be deduced that people are forced into self- employment, as captured by Kareem (2015), for survival

purposes following the economic downtown experienced by the country. Even the positive pulls cannot be said to be a willing affair, as temporary displacement could force ones family members to encourage someone with seed capital, at least, not to continue to become dependent on them.

The second category, between-things, compelled the Nigerian government in 2006 to introduce entrepreneurship education to be taught in tertiary institutions in the country, as a way of reducing unemployment challenges facing the government, as the rate of graduate unemployment was becoming unbearable for the government to control.

Having explained entrepreneurship and the motivating reasons for going into entrepreneurship activities, it is pertinent to discuss what entrepreneurship education entails. In the word of Nabi, Holden and Walmsley (2010), enterpreneurship can be described as the process of bringing together creative and innovative ideas and coupling these ideas with management and organisational skills in order to combine people, money and resources to meet an identified need and create wealth. The coordinating efforts involved in coupling the creative and innovative ideas with management and organisational skills is all that entrepreneurship education entails. Even though, it may be concluded that people do not need to go to tertiary institutions to acquire such education, this study will throw light on the impact of self employment among graduates of tertiary institutions on the entire productivity of the nations, proxied by Gross Domestic Products.

Production theory is the study of production, in other words, it is the economic process of converting inputs into outputs. In economics, production theory explains the principle by which a business firm decides how much of each commodity that it sells, it will produce and how much of each kind of labour, raw materials, fixed capital goods, that it employs. This is microeconomic perspective of production theory, but in relation to macroeconomics this is aggregated to be the Gross Domestic Product of a nation, as the total production of a country is the aggregate of all business firms' productions in a given period.

African continent is made up of 5 regions: west, east, central, north and south; with 54 countries spread across all the regions: west (18); east (16); central (8); north (7) and south (5). The Sub-Saharan Africa is geographically, the area of the continent that lies south of the Sahara desert. It consists of 49 of the 54 African countries fully or partially located south of the Sahara excluding Sudan, even though Sudan sits in the Eastern portion of the desert, and 4 other Arab states (Somalia, Djibouti, Comoros and Mauritania).

Economic models, according to Wooldridge (2006), consists of mathematical equations that describe various relationships. Those models are not econometric models until an error term is introduced to them to test for the relationship between the dependent and the independent variables. In this study various models developed on production theory, specifically the endogenous growth theory anchored on Cobb Douglas production function, would be considered to ascertain the effect of entrepreneurship education on productivity of selected sub-saharan african countries.

This study has been organized into six main sections: Section 1 is the introductory section of the study; section 2 reviewed various literatures on the subject and the section is made up of conceptual framework, theoretical framework and empirical review of previous studies. Section 3 states the hypothesis while section 4 is the hearth of study that deals with the methods adopted in this research. Section 5 is on data presentation and analysis while Section 6 is the concluding section of the study.

Objective of the Study

The objective of this paper was to investigate the effect of entrepreneurship education and innovation on productivity or what is regarded as economic growth, as the level of productivity determines the rate of the growth of every nation. This was done through modelling using data obtained from World Bank and other relevant data. This study was confined to some sub-Sahara African states.

Hypothesis

Ho Level of entrepreneurship education and other production factors have no significant relationship with the productivity of Sub-Sahara African states

H1 Level of entrepreneurship education and other production factors have significant relationship with the productivity of Sub-Sahara African states.

Literature Review

Conceptual Framework

Entrepreneurship: In simple economic theory, economic resources are regarded as factors of production, which Marshall (1890) classified into four as land, labour, capital and organisers. This latter word is what was later introduced as "entrepreneur" by early 18th century French economist Richard Cantillon (Hisrich,2002). Many authors have come up with different definitions of entrepreneurship; all of them boil down to the original description of Marshall, who regards it as the organiser of all other resources. Hisrich (2002) regard entrepreneurship as the process of creating something new with value by devoting the necessary time and efforts, assuming the accompanying financial psychic and social risks and receiving the resulting rewards of monetary and personal satisfaction and independence. Hisrich was of the view that for somebody to be regarded as an entrepreneur he must bring in capital and enjoy both the reward and risk involved in his investment. This assertion was well captured by Obasan (2005) when he asserts that entrepreneurship is the process of creating something new and assuming the risks and rewards thereof. The key word here is invention that is, creating something new and be able to assume the risks and rewards resulting from that decision.

Entrepreneurship Education: the English Oxford dictionary describes education as the process of facilitating learning or the acquisition of knowledge, skills, values, beliefs and habits. This assertion was supported by a former administrator of defunct East Central State in Nigeria, Dr Ukpabi Asika as cited by Ekankumo and Kemebaradikumo (2011) , described education as a process of confusion, whereby one brain rearranges the other, the more you know, the more you realise that you don't know anything. The general belief is that entrepreneurial education aims at acquisition of knowledge from a master,

which could be formal or informal. It is regarded as formal, when it is acquired in an institution of learning and informal when one is an apprentice, learning from a master. The entrepreneurial education here connotes formal training during the course of study in a tertiary institution. According to Ekankumo & Kemebaradikumo (2011) entrepreneurship education seeks to provide students (especially in tertiary institutions) with the knowledge, skills and motivation to encourage entrepreneurial studies in a variety of settings. Entrepreneurship education is a form of empowering the youth to be creative so as to be less dependent on government in searching for employment that is very scarce to come by. This education is necessary to bridge the gap created by demand and supply for employment in Africa as government of Nigeria, as an example, keeps on churning out graduates that are hardly self-reliant but solely depend on white collar jobs (Ediagbonya, 2013). This has also been found to be the general problem in all the 54 countries of the continent.

Employment: in economics full employment is attained when all eligible people who want to work can find employment at prevailing wage rates. This does not, however, imply 100% employment because allowances are normally given for frictional unemployment and seasonal factors in economic senses. According to Adesola (2015) frictional unemployment is caused by industrial friction, such as immobility of labour, ignorance of job opportunities, shortage of raw materials, breakdown of machinery and others. He also state that sessional unemployment is due to seasonal variations in the activities of particular industries caused by climatic changes, changes in fashion or by inherent nature of such industry. Like we stated in the introductory part, every reasonable government aims at providing full employment and entrepreneurial education is provided as succour for bridging the gap between employment and unemployment.

Productivity: productivity, which accounts for the economic growth of a nation, is measured by the size of the gross domestic products (GDP) of that nation and according to Iyoha, (1978) employment generation is a significant drive of growth rate of GDP. It is noticeable in Africa that majority of those who drive this growth are in the informal sector of the economy, self employed people with low income, mostly found in small and medium scale enterprises (SMEs). This accounts for the poverty level of most african states as productivity is low due to low income and inability to bring out the best out of the employees due to low remunerations and poor motivations, which make the latter to engage in ratchet processes most of the time. Many studies have found direct relationship between full employment and productivity. This study aims at confirming these assertions by studying the data of 16 Sub-Sahara African states.

Theoretical Framework

Studies on productivity theory are anchored on economic growth theory and in this paper we reviewed the three main schools of thought on economic growth, namely: classical, no-classical and endogenous theories.

Classical Theory: One of the originators of classical economics is Adam Smith (1776) and the focus of this school was economic freedom where laissez-faire and free competition rules the nation. According to Onakoya (2015) the entire community benefit most when

each member follows his/her self interest in such a system. A better alternative theory was developed by Ricardo (1772-1823). This theory called, theory of comparative advantage, was premised on the fact that the value of goods produced and sold under competitive condition tends to be proportionate to the labour input engaged in producing them. Harrod-Domar (H-D) Model provides a more linear form of growth of saving and capital formation. Harrod (1936) and Domar (1946) approached economic growth from different perspectives but came to the same conclusion that investment is critical to economic growth, distinguishing between the demand pull and supply pull of investment. According to them, demand effect creates income while supply effect is the productive capacity of the economy. This theory had been criticised because of its assumption of the equal use of labour and capital in production. This led to the neo-classical movement of the 1950s.

Neo-classical Theory: Solow (1956) and Swan (1956) recommended a growth model where capital output ratio, v, was the adjusting variable which will lead the system back to steady growth path, in place of Harrod Domar model. Their model displays a sort of autarky (closed economy) with competitive markets. This model regards Harrod Domar model as a short term model and built in a long run growth variable into the H-D model by including labour as a factor of production, relaxed the fixed proportions in production as well as the substitutability between capital and labour. The relationship is given in form of production function: $Y = f(K, L)$ where Y is the output; K is the capital and L is the labour input.

New Growth (Endogenous) Theories

These new theories believe that investment in human capital, innovation and knowledge contribute positively to economic growth of a nation, Romer (1986). This movement focus on externalities as well as the spill over effects of a knowledge based economy as a lubricant for economic developments. The leader of this endogenous growth movement, Arrow (1962) anchored his study on the economic implications of learning by doing, an extention of this study was done by Levhari & Sheshinski (1969). Different variants of this model, learning by investment, were given by Romer (1986) and Lucas (1988).

Romer's model of technical change invokes human capital along with the available stock of knowledge to produce new knowledge. To him, growth is driven by technological change as well as capital accumulation that arises from intentional investment decisions made by profit-maximising agents. Onakoya's view on this assertion is that the stock of human capital determines the rate of growth but a large population is not sufficient to generate growth. This is the current problem facing most states in Africa, most especially Nigeria, where we have 177.5m population and classified as low middle income country, compared to Seychelles with just 91,400 people classified as high income or even Botswana with 2.22m population classified as upper middle income country according to Legatum Prospect Index (2014). The model believes that both technological change and investments are both needed to generate growth in a nation, as absence of investment hinders technological advancement. The conclusion is that newly introduced investment would definitely run into diminishing returns that would bring growth to a halt without

technological change. Nevertheless, the production of new technology can be enhanced through the use of physical capital, human capital and existing technology.

Lucas' model emphasised the fact that investment in education leads to the production of human capital which is very germane to growth process of a nation. He considers both the micro economic and macro-economic effects of investment in human capital, the micro-economic effect was regarded as internal effects where individual worker in a firm is undergoing training and thereby becoming more productive, using the skill acquired from the training. The macroeconomic or the external effect is the spill over effect of that particular training through the increase in productivity of the economy, thus adding to the GDP of the nation. This can be attributed to the theory of Invisible Hand of Adam Smith (1776). This theory was anchored on the fact that human being is working to improve their personal welfare, but the additional input coming from his productivity has an effect on the entire economy of the nation. Externality was introduced into the model by contending that people are more productive when they are in the midst of clever people, hence investment in human capital, not capital in its physical term, that increases the level of technology through spill-over effects. His model defines the output of firm 'i' in an equation form as:

$$Y_i = A (K_i), (H_i), H^e$$

where Y_i = output of firm 'i'
A = the technical co-efficient
K_i = inputs of physical capital
H_i = inputs of human capital
H_e = economy's average level of human capital
$_e$ = the strength of the external effects from human capital in each firm's productivity.

To him technology is provided as a side effect of investment decisions by firms and as such could be treated as a public good, hence firms are only price takers under perfect market condition.

Even though all three listed theories are important to the study, human capital development, particularly in growth theories, had been the main focus of both neo-classical and endogenous growth models hence our study would focus these two theories. We would specifically make use of the endogenous theory of Lucas where training is considered as a process which change the production technology, facilitates conformity with externalities and makes the transfer of resources easy through the most dynamic and technologic sections. We would adopt Cobb Douglas production function, in which the real productivity level is a function of labour, inventory of the physical capital, entrepreneurship and innovation, for estimating the impact of entrepreneurial education on productivity of the selected Sub-Sahara African states.

Empirical Review

Many studies have been done on entrepreneurial education and economic growth, which represents productivity of a nation, but entrepreneurial education have been concentrating on self-reliant among the youth, hence Ojeifo (2012) argued that entrepreneural education will equip students with the skill needed to be self reliant and concluded that educational programmes at all levels should provide the youth the needed entreprenurial skills. But Legas (2015) was of the opinion that inadequacy of comprehensive entrepreneural training and the small market size is the most critical challenge entrepreneurs face in Sub-Saharan African states. It is apparent that growth in entrepreneurship improves productivity both at the firm and the national levels as revealed by studies carried out on sixteen developed countries by Zacharakis, Bygrave & Shepard (2000) which revealed that entreprenuerial actitivy explained about 50% of the differences in GDP growth among countries. Empirical studies in Africa also attest to this, Abor & Quartey (2010) confirmed that small and medium sized entreprises contributed to 52 – 57% of GDP of Ghana and around 61% of employment in South Africa. It is also on record that most of the graduates provided with entrepreneurial education while in school end creating job after graduation, as evidenced in the Global Entrepreneurship Monitor survey data on the job creation rate of Sub-Saharan African states. In that survey only 2% of the enterprises created 20 and more jobs; more than 83% created jobs only for 5 and less than 5 individuals. The report asserts that job creation rate is very low in Ghana, Uganda and Malawi as 82% of entrepreneur in Malawi and 59% in Ghana and Uganda run only one person business (GEM, 2012). The problem of low rate of job creations have been adduced to inadequate capital to run business, time consuming and expensive laws and regulation, and lack of adequate infrastructure which makes the cost of doing business to be very expensive in the sub-regions (World Bank, 2016).

It is noticeable that only few of African states attach importance to entrepreneurial education as reported by Efe (2014). Tanzania education has no entrepreneurship curriculum but its education objective supports self-reliance through the study of science, arts, technology and other vocational studies. Universities and polytechnics in Cameroon are just re-shaping the education to include technical, vocational and entrepreneural education. Both the old 7-4-2-3 system of education and the 8-4-4 system introduced by President Moi in 1985 failed to solve the entrepreneural aspiration in Kenya, however newly introduced 2-6-6-3 is expected to accommodate entrepreneurialship education in the nation's educational curriculum. Right from the regime of President Obasanjo, Nigeria has paid greater emphasis on entrepreneural education and the National Universities Commission has also designed an entrepreneurship course, Graduate Self Employment, with the theory and practice components, to be taught as a required course in Nigerian Universities, Efe (2014). Presently there is a call for entrepreneurship education in Gabonese schools and paucity of teachers to handle this aspect is also obvious (Enombo, Hassan & Iwu (2015). South Africa has made a success in entrepreneural education by introducing mechanism whereby children can actively become involved in entrepreneurial activities. The goal of the policy was to teach children to become creative and constructive members of the community by developing their entrepreneurial skills, by so doing becoming masters of their destinies.

Methodology

Research Design

This study adopted an ex-post facto, explanatory and non-experimental research design to investigate the relationship between production function variables and productivity, proxied by GDP, of selected Sub-Sahara African states. Secondary data were collected from World Bank Data Index (WDI), African Economic Outlook, Global Entrepreneurship Monitor (GEM) and Legatum Prosperity Index (LPI) amongst others. Most of the states have incomplete data especially in 2015, but we were able to accumulate complete data of 16 nations for 5 year period 2010-2014, which form the basis of our analysis. Hypothesis was formulated and regression analysis was done on data obtained using OLS. The paper is also a product of structured survey of articles and recently published texts. The emphasis of this paper was on equation models that allow the determination of the relationship between production factors variables and productivity (proxied by GDP) using the above mentioned secondary data for the period of the study.

Model Specification

In econometrics a regression model is typically employed to investigate the effects of various independent variables on dependent variable. In this study, we make use of Cobb-Douglas production function with some modifications. Cobb & Douglas (1928) published their study modelling the growth of American economy between 1899 and 1922. It was a simple model in which production output is determined by only 2 factors, the amount of labour involved and amount of capital invested. This model is functionally related as follows:

$$P(L,K) = AK^{\alpha}L^{\beta}$$

where P = total production (total value of all goods produced in a year)
L = labour input (total number of person-hour worked in the year)
K = capital input (value of all machinery, equipment and building)
A = total factor productivity
α and β = output elasticity of capital and labour (technology parameters)

Simple explanation on the above function will throw light on the behaviour of the model:

The output elasticity is out to measure responsiveness of output to a change in level of either labour or capital used in production. This means that, if for example α is 25%, a 1% increase in labour would lead to approximately 25% increase in output. The model is premised on return to scale, which means that if $\alpha + \beta = 1$ we have constant return to scale, but if it is less than 1 there is decreasing return to scale. In a perfect market, return to scale is assumed to be constant which was the reason why the original model results in

$$Y = AK^{1/4}L^{3/4}$$

Cobb Douglas made use of partial derivative with respect to capital and labour in their model, ie. P/K or marginal productivity of capital (rate at which production changes with respect to amount of capital) and P/L or marginal productivity of labour (rate of production changes with respect to labour input).

In their model, they made the following assumptions:

i Vanishing of either labour or capital translates to no production;

ii Marginal productivity of labour is proportional to the amount of production per unit of labour;

iii marginal productivity of capital is proportional to the amount of production per unit of capital.

Production per unit of labour based on assumption 2:

$$\frac{P}{L} = \frac{\partial P}{\partial L} = \alpha \frac{P}{L}$$

This is holding K constant at 0. Making partial differential to become ordinary differential as

$$\frac{\partial P}{\partial L} = \alpha \frac{P}{L}$$

This can be solved by rearranging the terms and integrating both sides as follows:

$$\int_{P}^{\partial} \frac{P}{} = \alpha \int_{L}^{\partial} \frac{L}{}$$

In other words:

$\ln (P) = \alpha \ln (cL)$ or

$\ln (P) = \ln (cL)^{\alpha}$

This results in the first equation of the model as:

$$P(L, K_o) = C_1 (K_o)L^{\alpha} \quad (1)$$

Production per capital based on assumption 3 was also done based on the same process as under production per labour to derive the second equation as:

$$P(L_0, K) = C_2 (L_o)K^{\beta} \quad (2)$$

In conclusion, we combine the two equations to have the Cobb-Douglas function as:

$$P(L, K) = AL^{\alpha}K^{\beta} \quad (3)$$

Assumption 1 indicates that $\alpha>0$ and $\beta>0$ while A is constant and independent of both L and K.

Applying this model to our study and considering the importance the endogenous growth model attach to training which is a process which change the production technology and the bedrock on which entrepreneurial education is based, we tend to modify the Cobb-Douglas function to include the entrepreneurship coefficient. Therefore our study considers the modified Cobb-Douglas function as:

$$Y = AL^{\alpha}K^{\beta}E^{\lambda} \quad (4)$$

where Y = Gross Domestic Production of a nation or the value of final goods and products in each country

L = Labour – number of employed population of a country
K = Physical Capital- the value of factories, machinery, building, purchase and construction equipment and other infrastructure of a nation
E = Enterpreneurship and innovation, using the index of entrepreneurship and innovation of each nation
A = Technology parameter which reflects the production technology of a nation
α β and λ = productive elasticities of labour, physical capital and enterpreneurship and innovation respectively

Since production function is not linear, we have every need to convert to a linear function to estimate the coefficient of all the variables so as to derive the productive elasticity of all the inputs. Therefore our final model assume this position:

$$\text{Log}Y = \text{Log}A + \alpha \text{Log}\, L + \beta \,\text{Log}\, K + \lambda \,\text{Log}\, E + \varepsilon \qquad (5)$$

The a priori expectation is such that:

All estimated coefficient of input factors i.e. α, β and $\lambda > 0$ implying positive relationship between the explanatory variables (labour, physical capital and entrepreneurship and innovation) and the dependent variable, gross domestic product.

Data Collection

The study utilized data collected on Sub-Sahara African states from World Bank Data Index (WDI), African Development Index (ADI) and other. Because of paucity of information about entrepreneurship education, using graduate self-employment indices, we made use of calculations of an authentic British research centre, Legatum Institute to obtain statistics on entrepreneurship and innovation. Legatum Institute calculates standards on prosperity every year for most nations in the world, the statistics covered 110 countries from 2009 to 2011, increased to 142 countries as at last year from 2012. The statistics is called The Legatum Prosperity. Eight variables are considered to make the entire prosperity of a nation, these are economy, entrepreneurship and opportunity, governance, education, health, safety and security, personal freedom and lastly social capital. According to Hansen (2015), the 2015 Prosperity Index highlights continued rise of many South Asian economies, with Singapore climbing to the first position in the Economy sub index; the UK is an increasing world leader in entrepreneurship; Canada is the most tolerant country towards immigration; Central African Republic is the lowest ranked country with 142nd position in almost all the indices. For most of the variables, a score ranging from zero to 100 is considered for each country based on the performance. For this, a country with a higher score will also have a higher entrepreneurship and innovation attributes. Ten variables were used for calculation of index for entrepreneurship and innovation. These are personal computers; secure internet; research and development; internet bandwidth; royalty receipt; value added in service industry; information and communication technology; high-tech exports; new businesses registered and business start-up cost. Each of the variables is assigned weight and the average weight gives the figure regarded as entrepreneurship and innovation index for the country concerned, Legatum (2015). A sample of 16 Sub-Sahara African

states were selected and their data for the year 2010-2014 were analysed using both descriptive and inferential statistics. This analysis was limited to 16 as these were the only countries with complete information about the variables considered. Africa is affected by paucity of information, hence we could not capture most of those countries in Central Africa, where we had complete information on only Central Africa Republic; 4 from the East (Kenya, Zimbabwe, Tanzania and Rwanda); 3 from the North (Algeria, Egypt and Tunisia); 3 from South (Botswana, South Africa and Namibia) and 5 from the West (Senegal, Nigeria, Cameroon, Mali and Ghana).

Data Presentation and Analysis

Our sole hypothesis using equation (5) of our model:

$$\text{Log}Y = \text{Log}A + \alpha \text{Log}\, L + \beta \,\text{Log}\, K + \lambda \,\text{Log}\, E + \varepsilon$$

Using regression and correlation analysis, since our objective is to test relationships.

Ordinary Least Square (OLS) technique of data analysis was employed to estimate the specified model equation. An econometric software: 'stata version 11', was used to regress the formulated model which incorporated data on relevant variables for 2010 - 2014. This study used descriptive statistics such as measure of central tendency (mean); measure of dispersion (standard deviation) to assess the spread of variables among the studied countries; minimum as well as the maximum values for the variables.

Data for the study as well as the choice of regression analysis were checked and ascertained through two robustness tests, hausman specification and heteroscedasticity tests to determine whether Random Effect Generalised Least Square (REGLS) Regression or Fixed Effect Generalised Least Square (FEGLS) Regression was suitable for the analysis.

The heteroscedasticity test was conducted to check whether there was unequal variability in the variables across the range of the predictor variables. Where the probability value of the Hausman test is less than 5%, then Fixed Effect GLS would be appropriate else we use Random Effect GLS. Further, where the probability value of the heteroscedasticity test is less than 5%, then there is presence of heteroscedasticity which should be corrected through the use of Ordinary Least Square (OLS) robust. The study after carrying out the pre-tests, conducted correlation analysis while the presence or otherwise of multi-collinearity was confirmed through Variable Inflation test (VIF). Finally, OLS robust regression analysis was used to analyse the data and the result of the regression analysis was also used to test the formulated hypothesis. The evaluations were based on the statistical significance of the estimated coefficients using 5% level of significance.

Data Summary
Table 1: Statistics Result

Variable	Obs	Mean	Std. Dev.	Min	Max
gdp	80	24.26114	1.51231	21.15358	27.06628
c	80	22.72961	1.551171	18.70832	25.17456
1	80	15.84614	1.106252	13.63045	17.837
e	80	.1890518	.1331332	1.00e-05	.49302

Source: Generated by the researcher from the data of the studied countries using 'stata' version 11

Table 1 shows the summary of the data collected on the sixteen countries for a period of 5 years. The mean physical capital is about N23b which suggests that countries in the Sub-Sahara Africa have relatively moderate physical capital as the mean value (N23b) is greater than the average of the minimum and maximum value of physical capital. The standard deviation of 1.5512 implies relatively similar physical capital as there is low level of dispersion in the physical capital of the studied countries in the region.

The mean description for labour is high compared to the maximum number of labour in the countries under review i.e. 15.84615 against 17.837. Generally the summary of the standard deviation reveals that factors that influence the number of labour employed in production are evenly distributed across all the countries in Sub-Sahara Africa.

Entrepreneurship and innovation index reveals very low mean and dispersion compared to the maximum level.

Test of Multicollinearity
The existence of multicollinearity is assessed using correlation and Variable Inflation Factors (VIF).

Table 2: Correlation Result

obs=80

	gdp	c	1	e
gdp	1.0000			
c	0.9799	1.0000		
1	0.7402	0.6792	1.0000	
e	0.4011	0.4065	-0.0638	1.0000

Source: Generated by the researcher from the data of the studied countries using 'stata' version 11

From table 2 there seems to be existence of high correlation between physical capital and GDP and also between labour and GDP. We also record the same high correlation position between labour and physical capital. But there seem to be low correlation

between entrepreneurship and innovation and other variables. All these point to the fact that predictive ability of each of the combined independent variables is different.

Test of multi-collinearity using Variable Inflation Factor (VIF)
Table 3: VIF Test Result

Varible	VIF	1/VIF
C	2.98	0.335510
1	2.50	0.400273
E	1.61	0.620295
Mean VIF	2.36	

Source: Generated by the researcher from the data of the studied countries using 'stata' version 11

Multi-collinearity exists when the predictor variables are themselves highly correlated. If the variables have VIF of above 10 and TV less than 0.10, then there is a strong indication of the existence of excess correlation, Gujarati (2004). With the above value of VIF, all of which are less than 10 and the value of TV (1/VIF) which are also more than 0.10, there is therefore absence of multi-collinearity.

Husman Specification Test Result
Table 4: Husman test

.hausman fixed random

	coefficients			
	(b) fixed	**(B) random**	**(b-B) difference**	**sqrt(diag(v_b-v_B)) S.E.**
c	.4019236	.6086429	-.2067193	.0326012
1	1.197445	.4592816	.7381635	.2281544
e	.5913382	.9356452	-.344307	.

b=consistent under Ho and Ha; obtained from xtreg
B=inconsistent under Ha, efficient under Ho; obtained from
Test: Ho: difference in coefficients not systematic
Chi2(3)= (b-B)′ [(v_b-v_B)^(-1)](b-B)
= 38.08
Prob>chi2 = 0.0000
(v_b-v_B is not positive definite)

Source: Generated by the researcher from the data of the countries using stata 11

We mentioned in section 5.0 that where the probability value of the Hausman test is less than 5%, then Fixed Effect GLS would be appropriate else we use Random Effect GLS. From the result on table 4, since the probability value of 0.000 is less than 5% the appropriate Hausman test to be carried out is Fixed Effect GLS as reflected in table 5 below.

Fixed Effect GLS result

Table 5: Fixed effect within Regression

Fixed-effects (within) regression			**Number of obs**	**=**	**80**
Group Variable: id			**Number of groups**	**=**	**16**
R-sq:	**within**	**= 0.7342**	**obs per group:**	**min =**	**5**
	between	**= 0.7993**		**avg =**	**5.0**
	overall	**= 0.7986**		**max =**	**5**
				F(3,61) =	**56.15**
Corr(u_i,xb)		**= 0.5664**		**Prob > F =**	**0.0000**

gdp	**Coef.**	**Std. Err.**	**T**	**p>|t|**	**[95% Conf.**	**Interval]**
c	.4019236	0.560191	7.17	0.000	.2899064	.5139408
1	1.197445	.2419304	4.95	0.000	.7136754	1.681215
e	.5913382	.1989135	2.97	0.004	.193586	.9890905
_cons	-3.961112	3.392254	-1.17	0.247	-10.774434	2.822118
sigma_u	.84186756					
sigma_e	0.06716197					
rho	.99367582	(fraction of variance due to u_i)				
F test that all u_i = 0:		**F(15,61) =**	**64.02**		**Prob > F = 0.0000**	

Source: Generated by the researcher from the data of the countries using stata 11

If the result of hausman test had shown a probability greater than 5%, we would have used random effect GLS, though subject to the outcome of the heteroscedasticity test, but now that we have a lower probability than 5%, we use the fixed effect GLS, the result as shown. With this lower than 5% probability, there appears to be presence of heteroscedasticity which should be corrected using OLS robust. Owing to the above pre-test results, OLS robust regression was used to analyse the data.

Regression Analysis

The result of the OLS robust regression is shown in Table 6:

Table 6: OLS Robust Regression Result

Source	SS	df	MS	Number of obs = 80
Model	176.072667	3	58.690889	F(3, 76) = 968.26
Residual	4.60671811	76	.060614712	Prob > F = 0.0000
				R-squared = 0.9745
				Adj R-squared = 0.9735
Total	180.679385	79	2.28708082	Root MSE = .2462

gdp	Coef.	Std. Err.	T	P>|t|	[95% Conf.	Interval]
c	.7980022	.0308292	25.88	0.000	.7366004	.859404
1	.2588915	.039577	6.54	0.000	.180067	.337716
e	.9147434	.264174	3.46	0.001	.3885952	1.440892
_cons	1.847497	.4434334	4.17	0.000	.9643225	2.730671

Breusch-Pagan / Cook-weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of gdp
Chiz(1) = 0.05
Prob > chiz = 0.8241

Source: Generated by the researcher from the data of the countries using stata 11

The regression result presented in Table 6 shows that all independent variables (physical capital, labour and entrepreneurship/innovation) are positively related to the dependent variable, GDP, and are all significant at 5% level of significance. Both the R^2 and adjusted R^2 (coefficient of determination) suggest that the independent variables used in this study account for about 97% of growth in GDP, while other factors and variables not included in this study, account for the remaining 3%.

The f-statistics and its probability show that the regression equation is well formulated explaining that the relationship between the combined independent variables and GDP are statistically significant (f-statistic = 968.26; f-pro. 0.0000).

Summarily, at 5% level of significance, the calculated value of f-statistics is greater than the corresponding value from f-table. The p-value of 0.0000 is lower than 0.05 level of significance adopted for this study. Thus the null hypothesis is rejected and the Alternate hypothesis validated, which implies that level of entrepreneurship education and other production factors have significant relationship with the productivity of Sub-Sahara African states.

Applying the Regression Result on the Model
Our modified Cobb-Douglas model is:
$\text{Log}Y = \text{Log}A + \alpha \text{Log}\, L + \beta \,\text{Log}\, K + \lambda \,\text{Log}\, E + \varepsilon$

The estimated coefficients are the production elasticity which show the percentage of changes that occur to GDP due to one percent change in each of the independent variables.The result of estimating the model, based on OLS have been shown in table 7:

Table 7: Estimated Coefficient

Dependent Variables	Estimated Coefficient	T calculation statistics
Constant (c)	1.8474970	4.17
Labour (L)	0.2588915	6.54
Physical Capital (K)	0.7980022	25.88
Entrepreneurial/innovation (E)	0.9147434	3.46
F-stat 968.26 (p = 0.000)	R^2 = 0.9745	Adjusted R^2 = 0.9735

Source: Generated by the researcher from the data of the countries using stata 11

Using the information from the table, we can rewrite our modified Cobb-Douglas production as:

$$Y = 1.8474970L^{0.2588915}K^{0.7980022}E^{0.9147434}$$

As specified, all productivity elasticity of the production inputs are positive. In other words, the productive elasticity of labour, which is 0.2588915, indicates that a 1% raise in employed population would translate to a 0.2588915 percent raise in gross domestic production. In the same vain, a 1% increase in physical capital leads to a 0.7980022 percent raise in gross domestic production. And finally, a 1% raise in entrepreneurship and innovation would lead to a 0.9147434 per cent raise in gross domestic production. To that extent, a raise in entrepreneurship and innovation positively impact the productivity of a nation, which proves the theoretical framework of this study.

F test shows the regression total meaningfulness test, the result above testify to this as it confirms the model total meaningfulness at 95% level of confidence. The coefficient of determination, R^2 and Adjusted R^2 show 0.9745 and 0.9735 respectively, both indicate that about 97% of changes in gross domestic production could be explained by all the variables introduced in the model, while the remaining 3% can be attributed to other variables outside the model or the error/disturbance variables.

Relevance to Accounting Profession

Even though the topic was based on economic theories coupled with the fact that Cobb Douglas production function is an economics concept, all attributes of the function, i.e. land, labour, capital and entrepreneurship also have bearing with accounting. In accounting, we employ the tool of cost accounting to estimate labour remuneration aside from accounting for wages and salaries in financial accounting. Accounting for capital is found in equity accounting in financial accounting. Rent paid on land is also part of financial accounting. Remuneration to entrepreneur is part of wages and salaries or the directors' remuneration, which is an aspect of financial accounting. Production theory is a cost accounting concept, which can be found in material, labour, direct and indirect expenses or overhead; all regarded as production cost in accounting. Entrepreneurial programme cuts across all professions in the wake of global campaign of creating entrepreneurial skills for self-employment by professionals for positive contribution to national development.

Conclusion and Recommendations

The study espoused the relationship between productivity and entrepreneurial education (proxied by entrepreneurial and innovation) in 16 of the Sub-Sahara African states, using the endogenous growth model. The result of the analysis revealed a meaningful relationship between entrepreneurship and innovation and the gross domestic production, which is in line with the findings of Musai & Mehrara (2014) and Moradi (2015). From the analysis, productivity increases through improvement in entrepreneurship and innovation, in such a way that a one per cent raise in entrepreneurship and innovation coefficient will results in 0.9147434 per cent raise in productivity. The result also revealed an enhancement in the productivity through a rise in both employed population and physical capital in a manner that a one percent raise in employed population would lead to 0.2588915 per cent rise in productivity and a one percent rise in physical capital would also increases productivity by 0.7980022 per cent.

Considering the positive and meaningful relationship between entrepreneurship education and productivity, we recommend that policy maker, particularly in Africa, should focus on entrepreneurship education. This should not be limited to the tertiary institution but should start from the primary school level, as is presently the case in South Africa; other countries should borrow a leaf from South Africa and start the training from the lowest level of education. With the implementation of this policy, productivity will continue to be on the rise in geometric proportion.

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