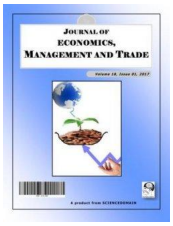

Journal of Economics, Management and Trade

21(3): 1-16, 2018; Article no.JEMT.25512
ISSN: 2456-9216
(Past name: British Journal of Economics, Management & Trade, Past ISSN: 2278-098X)

Technology Innovation and Sustainable Entrepreneurship Development in Nigeria: Stakeholders' Impact Assessment in Central Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author EMA designed the study, wrote the protocol and wrote the first draft of the manuscript. Author GOB managed the literature searches, analyses of the study, performed the spectroscopy analysis and author NDK managed the experimental survey of enterprises in Jos Metropolis and evaluation of data. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JEMT/2018/25512
Editor(s):
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Complete Peer review History: http://www.sciencedomain.org/review-history/23926

Original Research Article

Received 18th February 2016
Accepted 26th April 2016
Published 31st March 2018

ABSTRACT

This study seeks to find out the impact of technology innovation on sustainable entrepreneurship development in Nigeria. Technology innovation seems to impact on entrepreneurship, and one cannot deny the fact that entrepreneurship development can also impact on technology innovation. Nigeria's indigenous technology seems to have disappeared. The country has imported foreign technology worth billions of dollars, most of which have become obsolete in all sectors of the

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economy. It shows that technology absorption and mastery in Nigeria require more than importation. There has been the absence of remarkable indigenous efforts to evolve an indigenous technology. This study uses survey method and interview with sampled stakeholders in Central Nigeria. Evaluation of findings was done using simple percentages statistical technique. The level of technology innovation in Nigeria is low, as such, entrepreneurship is weak. This is caused by economic, political, socio-cultural and environmental factors. This study focuses on economic factors though with interlink with other factors. Supplementary multiple regression analysis is carried out using secondary data. The diffusion of indigenous technology will have widespread, albeit differentiated impact on Nigeria's entrepreneurship through the agricultural, industrial, service sectors, including telecommunications. The educational and private sectors in Nigeria should play a leading role in indigenous technology incubation, innovation, adoption and transfer. Innovation and entrepreneurship will increase employment for Nigeria. However, the institutional environment and capacities to encourage innovation are weak. Nigeria needs to evolve a comprehensive public policy for science, technology and innovation through technical education and training.

Keywords: Technology innovation; sustainable entrepreneurship; unemployment; influencing factors; small-scale enterprises; import-dependent.

1. INTRODUCTION

In pre-colonial times, Nigeria had numerous small-scale industries and handicraft enterprises based on the available raw materials and on local and regional demand. The earliest culture in Nigeria is identifiable by the art of Ife, the distinctive artifacts of the Nok people, and the terracotta sculptures in Northern Nigeria. These skilled artisans and ironworkers flourished between the fourth century B.C. and the second century A.D. in a large area above the confluence of the Niger and Benue rivers, boasted with a prosperous agriculture. Each main urbanized societies of the Hausa, Yoruba and Bini peoples –as well as other village-based societies- developed significant small-scale manufacture of goods for a variety of trade, social and religious purposes. Kano produced textiles and leather goods that were sold throughout the West and North Africa. Arriving in Kano in 1851, the German explorer Heinrich Barth wrote in his diary "*The great advantage of Kano is that commerce and manufacturing go hand in hand, that almost every family has its share in them"* [1].

As in per-industrial, industrial Europe, the West African manufacturing sector was based on clothing, metal working, ceramics, construction and food processing. The clothing industry in Nigeria consisted of cotton cloth spinning, weaving, dyeing and sewing, as well as manufacture of leather goods [2]. With tin, copper, iron, silver, gold and other metals generally available, blacksmiths made weapons, hand tools and agricultural equipment. Pottery was practiced everywhere, very famous in Ogoja. Wood was carved for buildings, furniture and ornaments in Oyo, and along the Ikom-Cameroun. Iron was being smelted at Nok, in the Benue Plateau region, and Bekwarra in the South-East, from at least 500 BC and iron working became generalized throughout the region. The trade was dependent on good supply of wood for making charcoal. A complex of iron ore mining villages, with specialized kilns for iron-making existed around Oyo, supplying a widespread regional market. In the Igbo region, smiths from the Awka and Ikwerri regions travelled from town to town to fulfill their customers' requirements on the spot. There was self-reliance industry with little or no dependence on imports.

Traditional manufacture in Nigeria survived well into the colonial period. It was the colonial period that failed to provide a sound basis for industrial change. Investment in modem manufacturing was only introduced slowly, dominated by foreign industrialist of British, Dutch and Lebanese, and focused on a combination of export processing mills for groundnut and palm oil-and import substitution. By the 1905, Lagos, Kaduna and Kano were the only significant centres of Nigeria's embryonic industrial sector. Factories were built for the production of cigarettes, beer, cement, footwear, textiles, furniture, and utensils. Kano was producing little more than textiles, footwear, confectionery and some wood and metal products. It was not until the 1960s that Kano's industrial base began to expand to include cement, paints, chemicals and printing industries. Lagos was always the dominant industrial centre and when growth in industrial investment took off in the 1970s, Lagos

accounted for 71 percent of Nigeria's industrial production in 1976. The present day industrial potential of Nigeria can be likened to the New York or London of Africa. But this potential is yet to be tapped through entrepreneurship development.

Sokoto caliphate begot some economic expansion built on a fairly crude, agrarian economy. Besides cereals, groundnut was an important food crop; cotton and indigo were important non-food crops. The establishment of some large plantations run by enslaved labour promoted both food and non-food crops production. Especially, cotton and indigo fed into a vibrant textile industry around Kano that produced luxury clothes for export across the Sahara, mainly on donkeys to North Africa. Leather goods too were produced for export. Overall however, contacts with European economies were minimal- evidenced by the survival of Kano textiles-but there were hardly any technological changes or innovations throughout the century. Economic growth was mainly a result of growth in exports of palm oil, groundnut, cotton and cocoa [3]. There was no technological learning or spillover from one sector to another. This makes Nigeria import-dependent and extremely vulnerable to external shocks.

An example of the vulnerability of Nigeria to external shocks, which must be avoided, can be traced to the great depression in 1929, where British demand for Nigerian primary products collapsed with the onset of the great depression, and foreign trade suffered from 1930 until about the end of the second World War, with the result that production stagnated and incomes declined following the decline in foreign trade [4]. Government revenues, which had been dependent on taxing this trade declined as well, as it is today with petroleum. With the resource base so diminished, colonial Nigeria was in no position to provide a Keynesian response of demand management. Nigeria of the 1930s was not marked by the beginning of governmental intervention to stimulate the economy; it was run by purely entrepreneurship.

Entrepreneurship helped in the transformation of the economy from a low income, traditional economy to a modern economy, through the significant innovation in production methods. A process of change, in which entrepreneurs played essential roles; first in fabrication of tools, then creating new industries and employment for households [5]. Many Nigerian youths and some politicians today think that the only reason to start a business is to make plenty of money, in which the government of the people is also a business. However, the primary reason that people turn to entrepreneurship is for the sense of personal freedom and economic self-reliance. This was confirmed by some staff of Elim bottle water, Jos and some private educational institutions as well as other SMEs. They identify a window of opportunity to offer services, or produce goods to meet society's needs. A business idea could arise from an unfulfilled need, a fascination from a given technology in an existing product or service, or as an outgrowth of a hobby. The extent of quality with which the entrepreneur modifies the good or service to add value to society determines the plenty of money that will eventually become his or her reward in the process. The entrepreneurs may work as a team to achieve a common goal, as in the old community development of the Tiv Theatre and agriculture. Entrepreneurship therefore is the art and science of finding profitable solutions to societal problems.

2. STATEMENT OF PROBLEM

In the past, one cannot explain why Ife bronze works, which was even copied by Greek, reached such a peak of perfection in the 12th and 13th centuries, and then disappeared completely. Nigeria has imported foreign technology worth billions of dollars; most have become obsolete in communication, industrial, health and educational sectors. There has been the absence of remarkable indigenous efforts to evolve an indigenous technology. However, recently the public is hearing about innovation in the Nigerian military, and the invention of clone etc. This has been traceable to failure in the assimilation process and lack of supporting policies for entrepreneurship and innovation. There are several associated factors that work against technology innovation for sustainable entrepreneurship in Nigeria, which need to be studied, which is the concern of this study. The cost of new technology, example, and agricultural technology is beyond the reach of peasant farmers. Star-up entrepreneurs/farmers do not have access to credits. Others have difficulties in using new technologies for lack of extension services, while some have uncertainty about the profitability of innovations. Inadequate technology innovation impacts negatively on quantities of resources (inputs), process and the quality of output. Nigeria's low absorptive

capacity and underutilization of existing capacity seem to be caused by lack of technology innovation in entrepreneurship. Nigeria's economic circumstances require bold entrepreneurship. However, institutions and policies are yet to adequately support and motivate inventors, creators, investors and researchers in mechanized equipments, improved irrigation, environmental conservation, manufacturing, renewable energy sources, communication technology and other services. There is a wide gap between indigenous technology and imported technology which is slowing down development with associated factors in Nigeria. This study evaluates the gap with emphasis on local technology content for sustainable entrepreneurship development.

3. OBJECTIVE OF STUDY

The socio-economic and ecological conditions of Nigeria require technology innovation for entrepreneurship and sustainable development. The objective of this study is to stress the relevance of innovation activities and technological solutions to Nigeria's sustainable development. This study aims to analyze selected factors limiting entrepreneurship in Nigeria. There may be other factors limiting the performance of entrepreneurship in Nigeria, however, the choice of the selected factors is for a focused and objective analysis. We looked at the stakeholders and framework of factors influencing technology innovation in start-ups, small and medium scale enterprises and farmers innovation adoption. Innovative capability starts with a build-up of institutional capacity to support entrepreneurship.

4. REVIEW OF INNOVATIVE CAPAILITY AND SUSTAINABLE ENTREPRENEUR-SHIP

Entrepreneurship is one of the four mainstream factors of production; land, labor, capital and entrepreneurship. [6] described entrepreneur-ship as a process, and the entrepreneur as an innovator who uses the process to shatter the statuesque through new methods of production. [7] describes entrepreneurship as the result of any human action undertaken in order to generate value through the creation or expansion of economic activity. Entrepreneurship is a force of creative destruction whereby established ways of doing things are destroyed by the creation of new and better ways of getting things done [8].

With the role of skills acquisition and technological innovation in entrepreneurship, the origin is the classical production functin [9,10,11]. Thus, one can demonstrate by using the Cobb-Douglas (C – D) production function and introducing modifications to accommodate technological changes accounting for increasing returns to production [12].

$$Y = AK^b L^c \quad (1)$$

Where Y = Output (it could be GDP or index of industrial or manufacturing output).

A = State of technology or efficiency parameter, (in a broad term).
K = Capital employed
L = Labour employed
b + c = 1 (displaying constant returns to scale – CRTS).

However, this traditional C- D production function, has not displayed real life situation of the expectations of increasing returns to scale.

Technology changing entrepreneurial and skills capabilities are characterized by increasing returns to scale (IRS). That being the case, the function in equation1 can be modified. This is basically done to ensure that:

(a) Factors and policies which stimulate accumulation of technology – changing skills are accounted for.
(b) The efficiency in the use of factors of production (capital, and labor) associated with technology – using skills is taken in to account.

Technology – changing skills expand the capability to produce the technological goods by broadening the frontiers of adaptation, adoption, invention and discovery, while technology – using skills enhance efficiency in the use of capital goods and other production inputs [13,4]. Both capabilities are necessary to build a strong, proudly Nigerian entrepreneurship. Technology – changing skills are in the form of skills and knowledge which promote total factor productivity. The state of technology is made to affect the key explanatory variables for self-reliance, industry and economic development. It is the key explanatory variable for rapidly developing economies like China, Brazil – India and South Africa. The success of China's poverty reduction policies, for instance, is connected to technology-changing in agriculture, manufacturing,

infrastructure, and rural development [14]. Technology-using skills and knowledge promote efficiency in the use of existing production inputs [15,16]. Nigeria has enormous potentials, but even in the oil and gas industry, there is a lot of wastage of human, material and natural resources. Nigeria has not achieved efficiency in the use of natural and human resources. Both technology- using and technology-changing capabilities complement each other and are needed to take Nigeria to the next level among nations. [17] reviewed the fundamentals of technology-changing (dynamic) capability, issues, relevance and established the link with technology management [18]. technology capability changes with environmental and market needs. Entrepreneurs build new competitive advantage that meets market needs in a timely manner. The change is created through R&D, integration, building, and reconfiguration of competences to match changing business environment [15].

The modified C – D function is given, thus:

$$Yt = AKt^{b} L^{c}t \quad (2)$$

Where b + c > 1 (indicating increasing returns to scale) IRTS

By introducing an exponential element (e) into the function, equation (2) can be modified into equation (3) to allow for other direct and indirect explanatory factors, thus:

$$Yt = AKt^{n} Lt^{1-n} et^{v+s} + Ut \quad (3)$$

In log – linear, form, equation (3) can be shown in equation (4).

$$\text{Log } Yt = \text{Log } A + n \text{ Log } Kt + (1-n) \text{ LogL } t + \text{Vloget} + \text{Sloget} \quad (4)$$

V = Rate of embodied technology in equations (3) and (4)
S = Growth rate of output due to influence-factors which promote technology – changing and technology – using. “s” is the output growth rate indicated only in the right hand sides of equation 3 and 4, not on both sides. It is endogenous and not simultaneous.
U = stochastic error term.

It should be noted that this model of the production function is an abstraction for the sake of emphasis. In real life situation, production can face IRTS, CRTS or DRTS. Other factors that affect output such as organization of production, entrepreneurship or management, government policy, competition etc could be introduced into the model to expand the analysis. Table 1 is a summary of enterprise stakeholders involved in technology-changing and technology-using capabilities.

Table 1. Analysis of enterprise’s stakeholders

Stakeholders	Interests
Equity Stockholders	Profits, wealth accumulation, returns on investments
Employees	Stable income, job security, pride of successful venture, business ethics
Consumers	Reliable source of products and services, value added enterprise, dignified treatment ,nationalism, improved standard of living, info to producers
Suppliers, retailers and Vendors	Exporters, importers, stable customer for products and services, competent distributors
Managers and Owners	Career positions, higher – valued enterprise, wealth accumulation, and psychological satisfaction.
Local Citizens	Social responsibility, contribution to community economy, job creation, tax source to community.
Producers, Society and Humankind	Value-added products and services, social improvement through the enterprise, and creativity, sustainable development.
Government	Tax payments, environmental protection, Quality control, exchange rate control, fair prices, infant industries protection, tax holiday, incentives.

As indicated in the Table 1, there are composite interests in the enterprise which include profitability, customer satisfaction, and long term continuity of the enterprise. The customers for instance are not only interested in the value-added to the goods and services offered by the enterprise. The continuity of the enterprise gives the customers a sense of security. This continuity is sustained through innovation. No customer would want to patronize an enterprise which they cannot be assured of quality, after sales service, warranties or predictable distributors. Also, community stakeholders in the business environment are interested in a profitable enterprise that can guarantee jobs and generate tax revenue for community development. They want the enterprise to be successful so as to assist in community services/projects such as electricity, pipe-borne water, access roads and community health and education infrastructures. Unemployment in Nigeria is structurally caused by inadequate innovation. Local entrepreneurs are stakeholders, expected to have skillful combination of factors of production through government-supported innovation policy. A well understood preposition is that entrepreneurial innovation will increase profits and employment [5,19]. It is innovation that creates technology-changing, initiated by producers, and technology-using by employees and other imitating producers. Consumers are also introduced into the innovation by technology-using skills. Innovation concept covers new product, new method, new market, new source of raw materials or manufactured goods and new industry.

Entrepreneurship requires skills in planning, managing, manufacturing and marketing. Scientific and technical knowledge is a fundamental requirement for sustainable entrepreneurship [19]. In the Schumpeterian view of entrepreneurship and technical progress (innovation), induced investment in technology can be targeted in competitive markets. As the market is promising, it attracts new entrants into the industry. This will increase output of goods and services, bringing prices down. As prices fall, profits fall also, and some entrepreneurs are pushed out, except for those with exclusive innovation in their products. This process by which output quality increases, costs reduce, as a result of induced investment in technology, prices and profits fall, and some entrepreneurs are ruined is called creative destruction. Creative destruction creates monopoly power for exclusive entrepreneurs [20,5]. The key variable for enterprise survival and exclusiveness is technology innovation. A good example is the ICT sector. In the electronics industry for instance, there is creative technological disruption in that market. Touch-screen digital television, camera and mobile phones have high performance demanded at the high end of the market as opposed to analog black and white television. The latter has performance demanded at the very low end of the market. In agricultural biotechnology, high yield, stress resistance varieties with value-added have performance demanded at the high end of the market, as compared to wild, stressed varieties used by majority of Nigerian farmers.

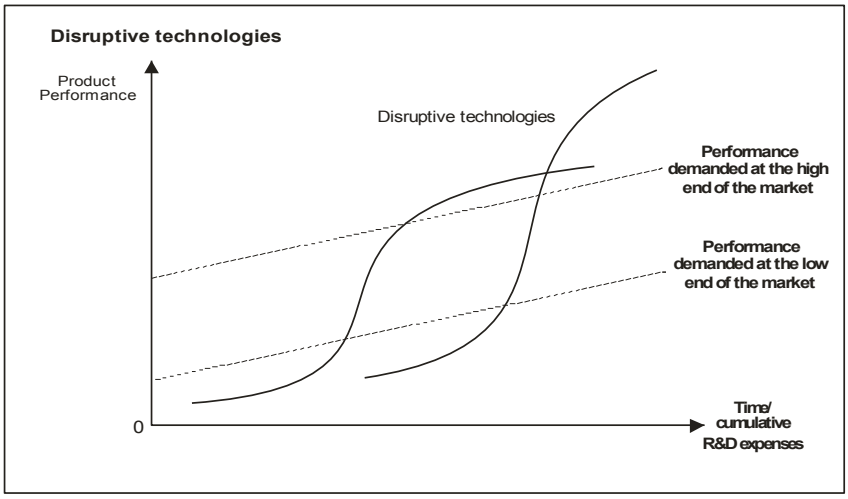

Fig. 1. Analysis of disruptive technologies caused by innovations
Sources: [21,8]

In Fig. 1 Nigeria needs disruptive technology in infrastructure, in oil refinery, manufacturing, agricultural biotechnology, waste management and environmental conservation, health and education. Entrepreneurs that key into these creative disruptive technologies will be handsomely successful. In education for instance, primitive white chalk boards as instructional materials have been displaced by computer programming, designs, coral draw, power point presentation; using projectors on white board as means of impacting knowledge and skills. Conventionally, there is inter-relationship between education, research and industrial development. University research has led to incubation centers, creating new industries, expanding small scale enterprises for larger economic benefits [22,23,24,25,26]. Attention should be paid to quality education, credits, subsidies and insurance schemes for start-up entrepreneurs and technology innovators. Nigerian universities and start-up companies should be empowered towards becoming major sources of innovations and entrepreneurship. Incentives for innovation include patents, copyright protection, trade secrets, and prizes being awarded to winners of entrepreneurship contests for finding technical solutions to Nigeria's economic problems. Health pilgrimage and tourism to India, America, Cuba, Britain etc, by Nigerians is another illustration of foreign disruptive technologies in the Nigeria's health sector. Presently, indigenous knowledge is poorly promoted in Nigeria, which is not to be. Investment in R&D, technology incubation centers etc are urgently crucial. Local industries should be encouraged through government fiscal and monetary policies; exchange rate control, import restriction, quotas, tariffs, incentives etc. Both public and private researches should be promoted. Public research for instance encourage sustainable development of costly innovations that may not be profitable to private investors but have very high social spillover effect on the society. Without research, Nigeria cannot develop or become self-reliant.

5. METHODOLOGY

We carried out a survey of 1000 stakeholders, using questionnaires and simple percentages statistical technique of evaluation [27] to investigate the factors influencing technology innovation and sustainable entrepreneurship in Nigeria. The sample design is a random survey or market research of small scale enterprises and stakeholders in Central Nigeria. The sample questions were designed to cover some selected factors influencing enterprise technology innovation.

5.1 Factors Influencing Technology Innovation for Sustainable Entrepreneurship

A framework of six key variables influencing technology innovation and sustainable entrepreneurship are; political factors, economic factors, legal factors, environmental factors, socio-cultural factors and technological factors. These are further presented in Fig. 2 and evaluated in Tables 2-7. We also surveyed the key industries trend, presented in Table 8.

Fig. 2. Framework of enterprise influencing factors

Environmental factors for instance consist in the business environment, a set of complex and dynamic variables with an abundance of potentially relevant elements. Put more clearly, the business environment consists of all the external forces that impinge on the industry, its markets and its firms [28]. The enterprise should anticipate innovations and plan accordingly. Rapid business environment changes are difficult to keep up with in acquiring and controlling needed resources. A constant process of scanning both quantitative and theoretical is required. However, forecasts and trend analysis are not actual facts [26].

In survey of 1000 stakeholders, using questionnaires and simple percentages statistical

technique of evaluation, we further breakdown the six factors captured in the disk (Fig. 2) as follows: Note that the valid questionnaires received were 856.

Table 2. Environmental factors

Environmental factors	Percentage scores	No of respondents
Environmental protection laws	21.5%	185
Water supply and Waste disposal	10.4%	88
Pressure of competition from foreign firms	26.6%	228
Energy supply and consumption	40.5%	347
Increasing environmental awareness	1%	8
Total	100%	856

Source: Authors' survey, 2016

Table 3. Political factors

Political factors	Percentage scores	No of respondents
Government stability	13.3%	114
Taxation policy	21.5%	184
Foreign trade regulations	10%	85
Social welfare policies	4.2%	35
R &D policy/capacity building	25.5%	218
Attitudes toward foreign companies	10.5%	90
Others	15%	128
Total	100%	856

Source: Authors' survey, 2016

Table 4. Economic factors

Economic factors	Percentage scores	No of respondents
Business cycles	10%	86
GNP trends	2.6%	22
Interest rates, imports/exports	13.7%	117
Money supply	4.6%	39
Inflation rates/interest rates/exchange rates policy	12.5%	108
Unemployment levels	15.5%	133
Disposable incomes	5.4%	46
Savings and investment	5%	43
Oil price	4.8%	41
Economies of scale and scope	3.5%	30
Capacity utilization/Absorptive capacity	12.2%	104
Access to inexpensive capital	8%	68
Labour productivity	2.2%	19
Total	100%	856

Source: Authors' survey, 2016

Table 5. Legal factors/business ethics

Legal factors/business ethics	Percentage scores	No of respondents
Monopolies legislation	25.7%	220
Employment laws	16.8%	144
Health and safety regulations	15.5%	133
Business registration	20.3%	174
Product safety	10.2%	87
Consumer protection	11.5%	98
Total	100%	856

Source: Authors' survey, 2016

Table 6. Framework of socio-cultural factors

Socio-cultural factors	Percentage scores	No of respondents
Population demographics, supply and demand for land	13.2%	110
Inequality/poverty/income distribution	25.4%	217
Social mobility	7.8%	67
Lifestyle changes	6.2%	53
Attitude to work and leisure	10.6%	91
Consumerism	8.2%	70
Level of education/human resource development	16.8%	15
Ethnic/Religious/tribal harmony	6.5%	56
Changing household structure	5.3%	45
Total	100%	856

Source: Authors' survey, 2016

Table 7. Framework of technological factors

Framework of technological factors	Percentage scores	No of respondents
Government spending on R&D and private sector investment in R&D	20%	171
Government and industry focus on technological effort.	15.6%	133
Inventions, innovations, new discoveries/development	25.3%	217
Speed of technology transfer/adoption	10.4%	89
Rates of obsolescence/fabrication	28.7%	246
Total	100%	856

Source: Authors' survey, 2016

Table 8. Trends in key industries

Trends in key industries	%Scores	No of respondents
Agriculture	43.5%	372
Telecommunication	15.3%	131
Transport	20.5%	175
Electricity	6.3%	54
Manufacturing	3.8%	32
Tourism	10.6%	92
Total	100%	856

Source: Authors' Survey, 2016

5.2 Supplementary Analysis Using Multiple Regression Results

We took some of the economic variables in a multiple regression analysis to supplement the primary data. Real Gross Domestic Product (RGDP) is used as a proxy for sustainable development and as the dependent variable. Two regressors or independent variables that are key factors influencing entrepreneurship in Nigeria, used in the secondary data analysis are unemployment (UNEMP) and Credits to the Private Sector (CRPS) or loan. Our econometric model is of the form:

$$RGDP = \beta_0 - \beta_1 UNEMP + \beta_2 CRPS + \mu \quad (5)$$

Where

RGDP= Real Gross Domestic Product
UNEMP= Unemployment Rate
CRPS= Credits to the Private Sector.
μ= The stochastic error term representing other influencing factors of entrepreneurship, not captured in the model.

The apriori expectations; β_0 and $\beta_2 > 0$, $\beta_1 < 0$

The full estimated regression results are in the appendices, while the summary of the supplementary multiple regression analysis is presented thus:

$$RGDP = \beta_0 - \beta_1 UNEMP + \beta_2 CRPS \quad (6)$$

RGDP= 4.222893 – 0.234248UNEMP + 0.000205CRPS

The t-statistics; 2.818571, 1.378334 and -0.769767 respectively,
Standard error of regression= (4.129437)
The coefficient of determination R^2= 0.391572
Adjusted R-squared =0.212579

From the results, the apriori expectations were met in terms of signs of parameter estimates. However, only a weak explanation of the dependent variable by the independent variables is given at 39% (i.e. R2 = 0.391572). Unemployment has serious negative consequences on RGDP or sustainable development in Nigeria. The credits to private sector as engine of growth and entrepreneurship are positively correlated with RGDP but its contribution as evaluated is very insignificant at 0.000205.

6. DISCUSSION OF FINDINGS

The framework of technological factors (Table 7) which determine resource employment in Nigeria is very weak, as presented in section 5, and hence, output efficiency and income is low, resulting to a cycle of underutilization of existing capacities in production. These factors are very important, while some are extremely problematic, and require urgent resolution. In Table 2, for instance, a score of 21.5% was recorded for environmental protection. This implies that out of 856 respondents surveyed, 185 small scale entrepreneurs confirmed that environmental protection laws seriously affect their business operation in terms of location and the National Agency for Foods, Drugs Administration and Control (NAFDAC). NAFDAC has strict regulations and standard control of business operations. For hygienic reasons, the business premises for making package water (pure water), fruit juice, Zobo, Restaurants etc must be well ventilated and quite spacious in a clean environment, and duly registered which most of these SMEs could not afford. Table 4 covers economic factors affecting entrepreneurship. Among these factors, unemployment takes the lead at 15.5%, followed by high interest rates and competition from imported goods which are problematic for domestic entrepreneurs. Table 8 is a summary of entrepreneurs' responses to key industries attracting entrepreneurship in the study area. Agriculture has comparative and absolute advantage with 43.5% responses. The inputs of land, labour, capital and entrepreneurship are underutilized and lowly absorbed, underfunded and undermanaged. Amongst the socio-cultural factors for instance, the demand and supply of land resources affects entrepreneurship in agriculture and all small and medium scale enterprises. The ownership of land, the growing urban-suburban sprawl affects fixed supply of arable land. Besides, the land tenure system negatively impacts on women entrepreneurship and large scale corporate agriculture. The body of rights and relationship between men that have been developed to govern their behavior in the use and control of land and its resources are gender sensitive. In the extended family system, ownership of land is by inheritance which perpetuates small and fragmented plots. Worse still, the tenancy leasing and ownership traditionally does not favor women or girl child, coupled with their denial of access to market and credits. Inheritance customs and traditions need some innovation for inclusive and sustainable entrepreneurship development. Women and the girl child should have a right to land ownership and inheritance. Road network (access and feeder roads) should be constructed to extend land resource use to interior virgin land beyond the fixed supply near settlements. Furthermore, settlement schemes that are backed by comprehensive socioeconomic feasibility study are necessary. Most entrepreneurs in agriculture are receptive to technology innovation because they cannot afford it. These entrepreneurs need incentives and innovation from the government, banks and the private sector. The lack of credit/capital supply work against the adoption of technology innovation. Agricultural entrepreneurs for instance, low prices and poor harvest can be enhanced through efficient processing and storage of produce. This will add value and increase peasant farmers' income, as well as government revenue. Credit to entrepreneurs is needed to introduce appropriate complementary enterprises, take advantage of economies of scale in the production chain. If entrepreneurs in agriculture can be empowered to add value to cassava, maize, rice, cocoa, cotton, yam, fruits and vegetables, it will drastically reduce unemployment by half in 2026. The success of agricultural enterprise in the United States, Japan, Israel, China and elsewhere is in no small measure attributed to the establishment of capital and credit facilities/institutions for the use of farmers. These facilities can be replicated in Nigeria for cotton, cocoa, rubber, maize, groundnut, cassava, rice, fruits and other crops. Presently, productive resources; land, labour, capital, entrepreneurship, credit management are not optimally utilized. There are a lot of wastages caused by obsolete technology, resulting to poverty and unemployment. This study identifies technical problems of marketing such as lack of value-added, poor pricing, storage, transportation and quality control as working against sustainable entrepreneurship in Nigeria. Others are poor finishing, high production cost, poor marketing, inadequate capital, lack of industrial

and marketing research, inconsistent trade policy, competition from outside, and lack of adequate education and training for start-up entrepreneurs. Nigeria and other African countries should opt for trade and not aid from developed countries. There should be enabling environment for accelerated flow of capital investment from developed countries with at least 70% of local raw materials sourcing and labour contents. Local entrepreneurs should undertake aggressive export market penetration and expansion. These involve the tapping of new markets for commodity exports through bilateral and multilateral trade agreements. The advantages are efficiency in entrepreneurship, industrial growth, foreign exchange, employment, capital formation, productivity increases and sustainable development.

There is no time that Nigeria needs technology innovation for entrepreneurship development more than now. The economic circumstances in Nigeria have made it mandatory for young graduates and undergraduates to seek independent/self-reliance livelihoods [8]. Nigeria is faced with entrepreneurship challenges such as unemployment for educated and illiterates, lack of self-reliance, unstable income and poverty [27]. Issues of capacity building and human resource development have become topical in contemporary Nigeria, and other developing nations faced with poverty. Besides, with the changing economic situation and technology innovation all over the world, it is mandatory for a change in survival strategy. There is hope for the youth in entrepreneurship, especially now as Nigeria is on the global map of growing economies. It is no longer fashionable for young graduates to wait for white-collar jobs, while Nigeria spends billions of dollars annually importing most of the things she can produce. Opportunities exist for Nigerian entrepreneurs especially in the renewable energy, agriculture, manufacturing, and services industry to engage in entrepreneurship. Entrepreneurship entails acute observation, good memory for detail and transmission of knowledge and skills through teaching, apprenticeship, scrutiny and even story telling. These processes of transmitting skills represent much faster knowledge than stored in papers, or read from textbooks at the university library. They are a distinction between hearsay and direct observation, learning by doing. In order to achieve desirable innovation for sustainable entrepreneurship, Nigeria must pay attention to the framework of factors evaluated in Tables 2-8.

In our analysis of entrepreneurship in the Jos Metropolis, we found the following enterprises operating, though with very low technology innovation. The married women and men engage in these enterprises more than the young school leavers/graduates. The list in this table is not exhaustive anyway:

Entrepreneurship involves experiments, seeing, touching, crushing, smelling and testing technologies with the goal of finding opportunities to innovate, to create goods and services. In these testing processes, the products of other people can become an input for experimentation and creation of output. Questions are raised by curiosity on how? When? Who? What? and why of other people's innovation. The entrepreneur has an experimental mentality with a prudent curiosity. Innovation capabilities concern basic, applied research and development (R&D), prototype design, and manufacturing capabilities related to design hardware and software, Products manufacture and testing. Nigeria has been sentenced to uncontrolled importation of almost everything by weak entrepreneurial development. Weak entrepreneurship and industrialization, worsened by over-reliance on importation are the chief causes of unemployment and inflation in Nigeria.

Globally, new business or company ideas are given birth on daily basis. The inventors of the telephone, radio, airplane, computers, cars etc are long in history, but such innovations as Microsoft, Facebook, Apple, Blackberry, Samsung, Dell, IPod etc did not exist 30 years ago. Nigerians too can be in the list of global inventors. There are Nigerians that can take risks, think faster than computer, they are hardworking and super-intelligent. They need an enabling environment where innovation can flourish. There is a process of creative destruction in the global market place, where products from China, America, Germany, France, Japan, South Korea, Thailand, India, Brazil etc are displacing each other by creative competition. Nigerian entrepreneurs should be calculating how they could creatively displace some electronics, automobile products etc in the next 10-15 years. They should start by improving the quality of whatever they offer to the market place today. In effect, one must make a distinction between technological capabilities and production

Table 9. Key enterprises in Jos metropolis

Entrepreneurial opportunity	Capital requirements	Technology innovation level
Bar soap, toilet soap, liquid soap, powdered soap	Moderate, small scale	low
Hair relaxer, shampoo, hair cream, and styling gel	Moderate, small scale	high
Cake design and production	Moderate, small scale	high
Production of cake bread, chin-chin, bread	Moderate, small scale	high
Production of Biscuits and confectioneries	Moderate, small scale, large scale by NASCO	low
Production of egg roll, doughnut and fish roll	Moderate, small scale	high
Production of meat pie, hot dog and fish pie	Moderate, small scale	high
Preparation of coconut rice, fried rice	Moderate, small scale	high
Preparation of pounded yam, Amala, porridge, vegetable and draw soup	Moderate, small scale	high
Preparation of fruit juices: orange, water melon, pineapple, paw-paw, Zobo drink and soya bean drink	Moderate, small scale	low
Preparation of soya bean powdered milk, plantain chip	Moderate, small scale	low
Poultry farming, Fish Farming, Livestock farming	Moderate, small scale	low
Vegetable farming, fruits and grains farming	Moderate, small scale	low
Crops and grains storage business	Moderate, small scale	low
Vegetable and seeds oil and fruits processing	Moderate	Very low
Tin tomato and canned fish	Moderate and small scale	low
Textile and garments	Moderate and small scale	Very low
Hotel and tourism	High and large scale	low
Banking/financial services	High and large scale	high
Printing and telecommunications	High and large scale	Very low
Mining and quarrying	Large and large scale	low

capacities. The latter refers to the resources, mostly equipment and machinery, required to produce industrial goods at given levels of efficiency and input combinations. Technological capabilities on the other hand are the skills to initiate, manage and generate technical change, including human resources, capital and knowledge, experience and institutions. While industrial capabilities are a necessary condition for Nigeria, the technological capabilities are a sufficient condition. Both of them are means to an end which is entrepreneurial development. Nigeria at present lacks adequate innovation and design capabilities which are negatively impacting on entrepreneurship, employment and self-reliance of Nigerians. Though Nigeria has enormous natural, economic and social potentials, at the moment she is still a gross importer and consumer of other people's technology but not a producer and exporter of home-made technology. Nigeria is yet to utilize her abundant natural, human and material resources for sustainable development.

7. RECOMMENDATIONS

Entrepreneurship in Nigeria thrives under extremely problematic factors, (as shown in sections 5 and 6), resulting in weak innovative capabilities. Innovative capabilities determine national economic performance, especially with interlink economies. Entrepreneurship can result in innovation in consumer goods and services with high local contents. Innovation and entrepreneurship will increase employment for Nigeria. However, the institutional environment and capacities to encourage innovation are weak. Nigeria needs to evolve a comprehensive public policy for science, technology and innovation through technical education and training. Technology absorption and mastery requires more than importation of technology; learning which demands explicit investment is a prerequisite for building the technical and managerial capabilities. The diffusion of technology will have widespread, albeit differentiated impact on Nigeria's entrepreneur-

ship through agricultural, Industrial and services sectors, including telecommunications. Technology innovation in agriculture will expand entrepreneurship. It is labour intensive with positive multiplier effects on employment, poverty reduction, food security, export earnings, industrial raw materials and generation of capital.

The educational sector plays a leading role in technology incubation, but the sector is historically underfunded in Nigeria. Nigeria has played down on research and development for too long, which does not support sustainable entrepreneurship.

Another important area which the government could encourage entrepreneurship is to guarantee intellectual property rights. A vibrant innovation-based economy requires a clear, and clearly enforced patenting and licensing system. With a patent protecting intellectual property, an invention can move to a company for market place development. The United States intellectual property law for instance, protects inventions and rewards risk. The Leahy-Smith America Invents Act, signed into law by president Barrack Obama in September, 2011 improves the United States patent law, providing incentives for inventors to disclose their inventions sooner. It also harmonizes United States patent process with other industrialized countries. Nigeria needs functional intellectual property laws to protect innovations and research results. Solid trade integration amongst African countries will stimulate and accelerate sustainable development. African countries need to improve and modernize the quality of their manufactures and agricultural products.

A successful program of sustainable development ought to aim at strengthening Nigeria's agriculture and manufacture, alleviating poverty, improving income distribution, enhancing political security and civil liberty, and building capabilities that enable individuals and groups to live meaningful lives. However, industrial societies are generally wealthier than agricultural societies. Nigeria is presently in the latter category. It is therefore not surprising that all leaders in developing countries seek as well, to build new industry fueled by indigenous entrepreneurship. The level of entrepreneurship in a country can be treated as a proxy for, or as an indicator of the level of industrial development, which is not possible without technology innovation. The capacities to absorb new technology and to innovate are the characteristics of entrepreneurship [28]. A good pack of industrial self-reliance policies and incentives provided for the sector's small and medium scale enterprises can before a decade make Nigeria a global economic miracle, the likes of China and South Korea. Entrepreneurship and value-addition will half poverty by helping to employ at least 40 percent of the unemployed work force by 2024. Nigerian enterprise policy should begin with local raw materials sourcing and widespread adoption of intermediate local technologies for production. There is urgent need to set conducive industrial environment in terms of providing the rural communities with basic infrastructure such as industrial zones, affordable, steady and reliable electricity, water supply, education and health services and security. These are preconditions for entrepreneurship and sustainable development.

8. CONCLUSION

Sustainable entrepreneurship is closely and positively linked with technology innovation, which the absence of the former is caused by the inadequacy of the latter. Selected amongst stakeholders, factors limiting sustainable entrepreneurship are critically evaluated. The factors or challenges influencing entrepreneurship are extremely problematic, and must be resolved for technology innovation to thrive in the country. This study shows that Nigeria has rich history in entrepreneurship, with presently weak innovative capabilities, enormous potentials, and sustainable entrepreneurship is yet to be attained.

COMPETING INTERESTS

Authors have declared that no competing interests exist. This work is the product of authors' original research.

REFERENCES

1. Richard S. Nigeria; The way Forward: Euromoney Publications, London; 1993. EC4V5EX:ISBN185564166.
2. Eneji MA, Nwanyanwu JO, Drenkat NK, Shi Li-Rong. Impact of foreign trade and investment on the Nigerian textile industry; The Case of China. Journal of African Studies and Development. 2012;3(2):48-62.
3. Tom-Forrest. The advance of African capital: The growth of Nigeria Private enterprise in Frances Stewart, Sajaya Lall

and Samuel Wangwe (Eds). Alternative Development strategies in sub-Saharan Africa. New York, St Martins press. 1992; 368-401.
4. Ndebbio JEU. Technological transfer and the growth process in less developed countries (LDCs): A myth or reality? Journal of International Foundation for Development Alternative (IFDA), Dossier 41, Switzerland; 1984.
5. Mouhammed A. Unemployment and the entrepreneur. International Journal of Economics and Research. 2010;1(1):1-14.
6. Schumpeter JA. The Theory of Economic Development; 1934.
7. OECD. Program and indicators of entrepreneurship. Communication, Prepositions and Definitions; 2007.
8. Eneji MA. Entrepreneurship and poverty reduction in Nigeria. Universal Academic Services, Lagos; 2014.
9. Bell M, Pavitt K. Technological accumulation and industrial growth: A contrast. Oxford University Press; 1993.
10. Adler JH. Absorptive capacity; the concepts and determinants. The Brookings Institute Publications. Washington DC. 1965;1-36.
11. Chenery HE. Interaction between Industrialization and Exports. American Economic Review. 1980;2(5):161-180.
12. Ndebbio JEU, Essia UE. Beyond Adjustment: Accumulation of technological capabilities as another development strategy in Nigeria. In Beyond Structural Adjustment in Nigeria, Ibadan. Nigerian Economic Society (NES); 1996.
13. John FEO, Poloamina ID. Building indigenous technological capacity in African industry: The Nigeria case in Stewart et al. (Eds). Alter nature development strategies; 1986:294-320.
14. Howard P, Larry EW. Industrial strategy and technological change: Theory versus reality. Journal of Development Economics. 1986;1(22):87-128.
15. Zhou KZ, Li CB. How strategic orientations influence the building of dynamic capability in emerging economies. Journal of Business Research. 2009;2:1-8.
16. Grobler A. A dynamic view on strategic resources and capabilities applied to an example from the manufacturing strategy literature. Journal of Technology Management. 2007:18(3);250-266.
17. Mohamad FAZ, Siti NO. The concept of dynamic capability for managing technology and change. Strategic Management Quarterly, American Research Institute for Policy Development. 2014:2(2);93-108.
18. Ekelund J, Hebert RF. A history of economics: Theory and methods. 5th Edition. Long Grove, Illinois: The Waveland Press; 2007.
19. Vecchi N. Entrepreneurs, institutions and economic change: The economic thoughts of Schumpeter JA. (1905-1925). London: Edward Elgar; 1995.
20. Werner S, Braun T. Management of technology for smaller and medium sized companies. International Summer Lecture on Sustainability and Eco-Management. UMC-POTSDAM University of Management and Communication; 2008.
21. Mortensen D, Pissarides C. Job creation and job destruction in the theory of unemployment. The Review of Economic Studies. 1998;63(3):397-415.
22. Manuell R. Technological change, the labour market and the stock market, NBER Working Paper 8022; 2000.
23. Gao Q, Zhuang H. Analysis of innovation capability of agricultural hi-technology industries in China. Journal of Innovation Management Policy and Practice. 2001: 13(3);278-290.
24. Kim H. Policy-making of Japanese Development Assistance to the Republic of Korea (1965-1983). PhD Dissertation, University of Michigan; 1987.
25. Mohammad FH, Asad A, Muhammad A, Naveed A, Rao MB. Impact of innovation, technology and economic growth on entrepreneurship. America International Journal of Contemporary Research. 2011;1(1):1-7.
26. Ndebbio JEU. Science and technology and development in ECOWAS: Issues and problems revisited. Science and Technology Policy for Development in Africa. New York: E.J. Brill; 1993.
27. Drenkat NK. Entrepreneurship education in universities of north-central states of Nigeria. Unpublished PhD Dissertation. Department of Economics Education, University of Jos; 2012.
28. Alice A. The rise of the rest: Challenge to the west from late industrialization Economies New York: Oxford University press; 2001.
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APPENDICES

1. **Estimated Multiple Regression Results**

Dependent Variable: _RGDP
Method: Least Squares
Date: 04/19/16 Time: 00:54
Sample: 1990 2015
Included observations: 26

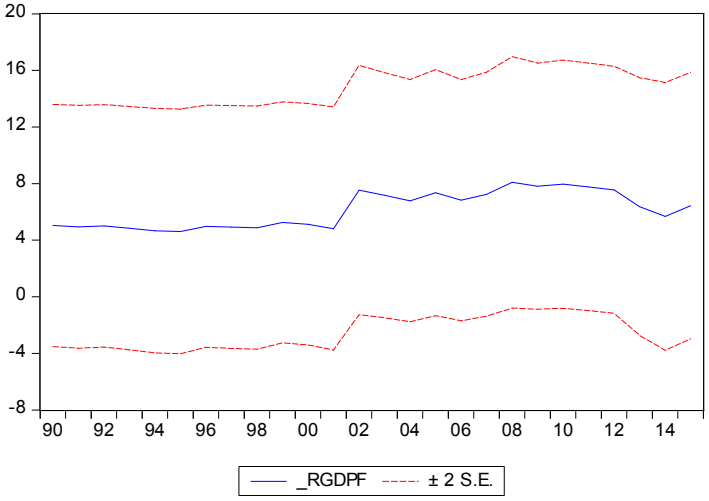
Variable	Coefficient	Std. error	t-Statistic	Prob.
C	4.222393	1.498062	2.818571	0.0097
UNEMP	-0.234248	0.169950	1.378334	0.1814
CRPS	0.000205	0.000266	-0.769767	0.4493
R-squared	0.391572	Mean dependent var		6.140385
Adjusted R-squared	0.212579	S.D. dependent var		4.155656
S.E. of regression	4.129437	Akaike info criterion		5.782326
Sum squared resid	392.2017	Schwarz criterion		5.927491
Log likelihood	-72.17024	Hannan-Quinn criter.		5.824128
F-statistic	1.159236	Durbin-Watson stat		1.312401
Prob(F-statistic)	0.331390			

2. Data for Regression

Year	UNEMP	%RGDP	CRPS
1990	3.5	2.6	30.4
1991	3.1	1.6	33.55
1992	3.4	0.78	41.35
1993	2.7	2.1	58.12
1994	2	4.1	127.13
1995	1.8	2.9	143.42
1996	3.4	2.8	180
1997	3.2	0.47	238.6
1998	3.1	5.3	316.21
1999	4.7	4.4	351.96
2000	4.2	21.3	431.17
2001	3	10.2	530.37
2002	14.8	10.5	764.96
2003	13.4	6.5	930.44
2004	11.9	6	1096.54
2005	14.6	6.4	1421.66
2006	12.7	6.8	1838.39
2007	14.9	10.5	2290.62
2008	19.7	6.3	3668.66
2009	21.4	6.9	6920.5
2010	23.9	7.8	9110.86
2011	24	7.4	10157.02
2012	23.5	6.4	10660.07
2013	22	6.8	14649.28
2014	20	7.2	15778.31
2015	24.3	5.6	16954.63

Sources: CBN Major Economic, Financial and Banking Indicators(2008); World Economic and Financial Surveys, (IMF,2015); Office of National Statistics(UK,2015); CBN Money and Credit Statistics(2015, 2013)

3. Forecast of Estimatimated Result for Sustainable Development



Forecast: _RGDPF	
Actual: _RGDP	
Forecast sample: 1990 2015	
Included observations: 26	
Root Mean Squared Error	3.883900
Mean Absolute Error	2.319547
Mean Abs. Percent Error	93.71185
Theil Inequality Coefficient	0.284900
Bias Proportion	0.000000
Variance Proportion	0.535380
Covariance Proportion	0.464620

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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history/23926