ICT and the Entrepreneurship: Escape Routes for Graduate Engineers in Nigeria

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Abstract— **Information and communication technology (ICT) is advancing rapidly and the world community has undergone a fundamental changes. Activities, jobs, skills, cultures, needs and have changed and been affected by this technology. Entrepreneurship is undoubtedly a major contribution and has had a special role in the development of these technologies; however, these technologies also have an impact on entrepreneurship and have created a sense of modern entrepreneurship. Nigeria has had quite a lot of challenge in the areas of graduate unemployment; millions of graduates are roaming the streets in search of non-existing white collar jobs. The graduates lack the necessary skill needed to prop up their know-how in the area of business entrepreneurship using ICT. This paper delves into the causes of graduate unemployment, the components of entrepreneurship, and the effects of ICT on business entrepreneurship, the success stories in Nigeria and abroad where ICT and entrepreneurship have helped create jobs and made big impacts on young people and the economy. The paper also explored the business areas in ICT field where Nigerian graduate engineers can benefit and start new businesses quickly and with little skills and capital, the factors that affect youth or graduate entrepreneurship negatively in Nigeria and what can be done to tackle these problems and encourage Nigeria graduates, especially engineers, to start up new businesses after graduation or completion of NYSC programme.**

I. INTRODUCTION

The educational sector in Nigeria has witnessed rapid growth both in size and output. From less than 3,000 at independence in 1960 with a total enrolment of 1.3 million pupils, there are now 44,000 primary schools nationwide with an enrolment of more than 20 million. At the secondary schools level, the Federal Ministry of Education (1994) statistics show that the number of schools rose from 883 in 1960 to 5,868 in 1994 while enrolment went up from 170,000 to 4.5 million during the same period.

At the tertiary level, there are now more than 148 institutions made up of universities, polytechnics and colleges of education with a total population in excess of 800,000 [1]. It is estimated that about 3 million people enter the labour market in Nigeria every year, most of these graduates or dropouts from the various levels of the educational sector, it is widely accepted that about 10% of these graduates find jobs in the formal sector. The vast majority of the remaining 90% are usually unemployed or underemployed for many years, with many drifting into the informal sector.

As a result of the above, there have been calls for clear policy and action on introducing entrepreneurial education into the national educational system, particularly at Technical and Vocational Education (TVE) level-Technical Colleges and Polytechnics and also into University curricula. This is to enable trainees be prepared to go into self employment and to start their own businesses as well as to work productively in small and medium sized businesses [1].

Information and Communication Technology (ICT) has had very much positive impact on the entrepreneurship advancement of Nigerian graduate engineers in the last one decade. ICT has what it takes to change the narratives in graduate unemployment in Nigeria if properly harnessed. Information entrepreneurship at different levels of hardware, software, information and communication is possible. In each of these levels, there are many opportunities for entrepreneurship that needs support of venture capital and entrepreneurial effort and it's interesting to entrepreneurs in the areas of information, much easier and more practical than entrepreneurs in other areas.

A. Problem statement and the importance of this research

The level of graduate unemployment in Nigeria has been on the rise since the last decade because higher institutions of learning shun out graduates who do not possess the requisite skills on ICT and business entrepreneurship. Government alone, in the formal sector, cannot provide jobs or employments to this teeming population. ICT has what it takes to contribute in reversing the narratives of graduate unemployment

in Nigeria. This is because ICT and business entrepreneurship have been proved to have a direct relationship to each other.

II. COMPONENTS OF ENTREPRENEURSHIP

In a study conducted by Ayubi in 2006 [2] titled "Teaching Entrepreneurship second grade school work and knowledge based on components for entrepreneurship and Information Technology" reached the following conclusions:

1. Entrepreneurship has 10 components that with order of priority are:

- Having an active mind and a sense of participation
- Creativity and success-seeking
- Decision-making authority and responsibility
- Accept change and independence
- Save opportunity and seeking success
- Modernization and new ideas
- Innovation and benefit from imagination
- Motivation to create interest to obtain information
- Create for mental deconstruction
- Commitment to accountability and ability to negotiate

2. Traditional teaching style has no significant influence on student learning but the use of ICT for teaching caused a significant difference between pre-test and post-test [3]. If you consider this issue, think more pronounced the effect of technology entrepreneurs; we can see that the future of business is directly related to the advancement of technology. It is depicted in Fig. 1.
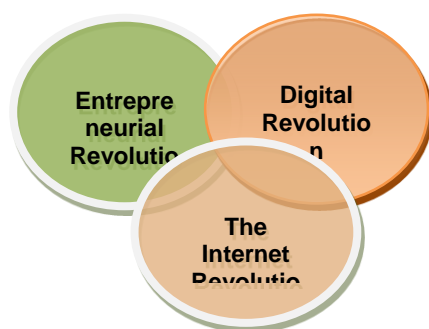

Fig.1. Value of business in the future [2]

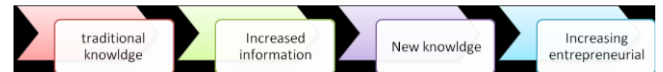Fig.2 shows the relationship between increased knowledge on ICT and entrepreneurship.

Fig. 2.The relationship between increased knowledge and increased entrepreneurship [2]

III. IMPACTS OF ICT ON BUSINESSES AND ENTREPRENEURSHIP

ICT can touch several sectors of any national economy. ICT has both direct and indirect effects on the growth of health sector, manufacturing, construction, education, governance, advertising, transportation, telecommunication, oil and gas, rural development and other key sectors of the economy as depicted in Fig.3.
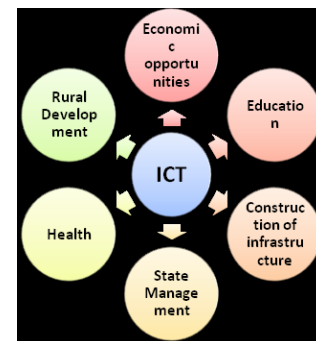

Fig. 3. ICT and its interaction with other key sectors of the economy [2]

Some of the direct impacts of ICT on entrepreneurship developments are enumerated below:-

1. *It allows remote collaboration.* With telecommunications, telephone, teleconferencing, video conferencing and collaboration systems, social media platforms, blogs, internet chat forums, interactive websites, remote collaboration can be possible. These can touch business entrepreneurship positively.

2. *It enhances increase in data processing and transfer speed.* ICT allows faster calculation and processing of data and data transfer, thereby reducing labor time and therefore increase productivity.

3. *It increased accuracy.* ICT ensures accuracy of work. In human-based businesses the accuracy of the work is varied, while this technology provides high and constant accuracy.

4. *It reduces the physical size of data repositories.* With the development of this technology and applying it there is no longer necessary to carry and store large volumes of specialized reference books. Information that were hitherto compiled in voluminous text books are now stored digitally online and in storage discs like hard disk and optical storage or can be accessed through computer networks such as Local Area Network or Intranets.

5. *It facilitates business transactions and easy payment across borders.* Nowadays, entrepreneurs need not to travel to China or Dubai physically to place orders or make payments. One can place order using

his laptop or tablet, make payment via e-payment platforms such as PayPal, MasterCard, VisaCard and get his/her goods delivered to him/her within few days here in Nigeria using courier services such as DHL, UPS etc.

6. *It helps in eliminating administrative corruption.* Using this technology increases the transparency and eliminates many intermediaries. This two key advantages lead to the elimination of some administrative corruption especially at low levels.

A. *What is engineering or technological entrepreneurship?*

The age of enterprise has arrived. Strategic use of technology, such as ICT, in all sorts of businesses makes the difference between success and failure. The global, and even, local competition in manufacturing, product distribution and multinational enterprises will continue to translate to a demand for engineers and technologists with 'entrepreneurial' spirit, the drive and the persistence to make a difference to their companies. Large and medium sized corporations will seek the entrepreneur (an entrepreneurial individual who prefers to work inside a larger firm rather than to start or run their own) to be the leaders. However, there is an increasing demand for people seeing the advantages of doing their own thing, in their own way, in their own time i.e. entrepreneurs. While self-employment generates jobs, many people wanting to establish their own enterprise experience difficulties in converting their ideas into reality. Education and training in scientific and technical subjects is vital to well-being as it helps in creating qualified man-power for the industrial and service sectors. However, the scientific and technological knowledge itself may not be sufficient for those considering self-employment by establishing their own small private enterprise. Experiences from other developing and developed economies have shown that there is a need for a more focused and deeper exposure of such people to technology and business so as to impact a set of skills oriented towards setting up of new business ventures based on exploiting technologic-driven market opportunities.

Such opportunities includes: proprietary technological innovations based on scientific research and development. Unfortunately, the little tradition of cooperation between business and research communities has led to only a few cases of Research and Development (R & D) results lading to new enterprise formation in most developing economics. Addressing these issues come under the purview of what is now recognized as technical entrepreneurship or *technopreneurship* or *technological entrepreneurship* or *engineering entrepreneurship*.

In what follows, the word 'technopreneurship' as defined below:

"Technopreneurship is the innovative application of scientific and technical knowledge by one or several persons who start and operate a business and assume financial risks of achieve their vision and goals."

Technically, engineers are well qualified in many respects for this activity, but often lack the necessary business skills and entrepreneurial mentality. Through proper education and experience, engineers, scientists, and technologists provide an essential bridge between the continuous development of science and the practical needs of society. With increase access of today's computing resources; engineers can be equipped to translate scientific discoveries into useful products and services. Through the possession of such tools and know-how, they can improve substantially the quality of lives; ensure the attainment of macro-economic objectives (e.g. unemployment reduction, balance of payments surplus and by innovating in goods and services and generating durable, knowledge-based employment).

Implementation of technical entrepreneurship, as distinct from general business entrepreneurship, has started to gain momentum in many countries-developed and developing.

B. *Who Is An Entrepreneur?*

An entrepreneur is a person that has the following four basic characteristics:-

- He/she sees opportunity,
- Turns it into a business,
- Creates value,
- Mobilizes resources.

An entrepreneur sees opportunities in a situation while others do not.

IV. METHODOLOGY

This research is generally a qualitative study and the purpose is applied research. Indicators of research quality such as purposefully selected sample, the use of multiple methods such as interviews and research partnerships in the learning management system to collect information and use categories and simplification to analysis of data has been used.

The research questions for this paper are as follow:-

1. Can ICT and entrepreneurship change the narrative of graduate unemployment in Nigeria?

2. Have ICT and entrepreneurship added values in creating new jobs in Nigeria?

3. Are there success stories in Nigeria and the rest of world of how ICT and entrepreneurship have transformed the lives of young graduates and increased economic base and GDP of their countries?

4. What are required to be done in Nigeria for our young graduates to embrace and start entrepreneurship using ICT as vehicle immediately leaving school or completing the NYSC programme?

5. What should be the roles of government and private sector in this regard of boosting ICT and entrepreneurship for our young graduates in the country?

A. ICT Business entrepreneurship opportunities for graduate Engineers in Nigeria

The following areas or opportunities are suggested by the authors for Nigerian graduate engineers to move in immediately, with some little training and capital, start something good and create value.

1. Website design, Portal design and Hosting

2. Vehicle & Auto tracking business

3. Blogging and Affiliate Marketing business

4. Forex & Future Trading and Training (using the computer software to predict in order to buy and sell foreign currency pairs)

5. ICT Training and consultancy

6. ICT Security consulting for Banks and businesses

7. Telecommunication businesses- installations, maintenance, recharge card printing, etc.

8. Solar panel and inverter installation and maintenance

9. Laptop repairs and installation

10. Importation and sale of computer accessories and parts from China and Dubai

11. Software development and sales

12. Epayment solution provider (helping customers to pay for goods and services using both at home and abroad using digital platforms)

13. Computer Networking and Maintenance

14. Embedded systems' design and construction

Millions of Nigerians and businesses need services and solutions from these identified areas. These areas do not require much capital and learning curve. Most of these businesses can be started from home. In the USA, Jefferson Bezzos, the CEO of Amazon, the richest man in the world today, started www.amazon.com from his car garage. But today he is even richer than Microsoft Founder, Bill Gates and African richest man, Aliko Dangote, who built hundreds of cement and sugar refining factories all over Africa.

B. Typical Examples of success stories of Graduate ICT Entrepreneurs in the World and Nigeria

When we talk of graduate entrepreneurship success stories in the world, the stories of the founders of Facebook.com (Mark Zuckerberg), Microsoft (Bill Gates), Twitter.com (Jack Patrick Dorsey), Alibaba.com (Jack Ma), Yahoo.com (Jerry Yang and David Filo), Google.com (Larry Page and Sergey Brin), Oracle.com (Lawrence Joseph Ellison), Amazon (Jeff Bezos) and Paypal.com (Daniel H. Schulman and Elon Reeve Musk) easily come to mind. These founders are today multi-billionaires and are in the exclusive lists of the world's richest persons. They did it with ICT entrepreneurship, and they started small from home but today their companies are amongst the biggest in the world.

In Nigeria, one cannot easily forget the stories of Akin Alabi (founder of www.nairabet.com), Seun Osewa (founder of www.nairaland.com), Linda Ikeji (www.lindaikejisblog.com), etc. These founders used ICT as leverage to start their businesses and today they are success stories. They are employers of labour and they pay themselves in 6-digit figures.

*C. **Factors that militate against graduate entrepreneurship in Nigeria***

The following factors militate against graduate entrepreneurship in Nigeria:

1) Lack of skills and entrepreneurship knowledge even after graduation

2) Poor curriculum in schools that reflect on ICT, entrepreneurship skills and business development

3) Lack of support from government, private sector and family.

4) Lack of capital to start up business after graduation or after NYSC programme.

5) Lack of self-belief and confidence on the part of young graduates

6) Inability to identify business opportunities by graduate engineers

7) Harsh economic climate that kills the business few years after start-up

V. CONCLUSIONS

Information and Communication technology (ICT) has created dramatic developments in all social activities including entrepreneurship and is regarded as the most important tool of modern entrepreneurship. Also entrepreneurship in ICT is diverse and has enough space to occupy and accommodate millions of graduate engineers and other graduates leaving schools every year in Nigeria. Entrepreneurship is the solution to graduate unemployment in the country. Entrepreneurship combined with ICT will develop the economic base of Nigeria just as it happened in USA, India and China (the GDP of these countries were raised considerably by ICT entrepreneurship). This will also reduce the high level of unemployment and crime rate in the country. The number of graduates looking for paid-employment will also reduce. Governments and private sector should, as a matter of urgency, do something tangible to encourage graduate entrepreneurship amongst our graduates so that the future of our country will be secured.

VI. RECOMMENDATIONS

The following recommendations are put forward by the authors to policy makers and governments to encourage graduate entrepreneurship:

1)   Federal government should provide universities, polytechnic and colleges of education in the country with research grants from TETFUND and ITF to fund trainings/workshops in the field of information and communication technology (ICT) and business entrepreneurship.

2)   All the necessary laboratory/workshops, tools and equipment should be provided in all tertiary institutions such as universities, monotechnics and polytechnics, colleges of education as well as technical colleges in Nigeria to facilitate and aid teaching of ICT and entrepreneurship studies.

3)   The teaching staff of Nigerian Polytechnics and Universities should be made to undergo compulsory training on Information and Communication (ICT) literacy and entrepreneurship to provide specialized workforce to train the teaming undergraduate or students who will soon graduate and add to the already saturated labor market.

4)   The NABTEB and NUC engineering curricula should be modified to make room for the introduction of compulsory ICT and entrepreneurship courses and training for all the engineering students in the polytechnics and universities from 100 Level or ND1 till final year or HND2 levels.

5)   There should be partnership between Nigerian institutions with private sector in establishing entrepreneurship centres in campuses so that students will be trained there before they graduate from school. Nnamdi Azikiwe University Awka is a classical example of institution-private sector partnership in the area of entrepreneurship; the founder of Emzor Pharmaceuticals, Dr. Stella Okoli, established an entrepreneurship centre known as "Chike Okoli Entrepreneurship Centre" inside the university campus since 2011 to cater for entrepreneurship trainings of the students. Thousands of students have been trained already in this centre since its inception.

6)   Business skills like branding, financing, advertising, marketing, accounting and management should equally be introduced in Nigerian universities, Polytechnics and Technical Colleges and made compulsory from the first to the final year. This will help the young engineers imbibe the needed skills of business management so that when they graduate they can add these to their skills.

7)   The National Youth Service Corps (NYSC) should be modified; government should use six months out of the one year to send the graduates to special ICT/entrepreneurship workshops/trainings in Nigeria and thereafter give them seed money or capital (at least one million naira (N1,000.000)) to start something in the areas of their training or acquisition. This seed capital may be repaid so that other graduates can benefit from the scheme in future.

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