CHEMISTRY ENTREPRENEURSHIP: A PANACEA FOR ECONOMIC RECESSION IN NIGERIA

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Abstract

Chemistry is a science discipline that offers wide varieties of business opportunities. Professional chemists with training in entrepreneurship skills can begin to commercialize their innovations in chemistry to reap great financial benefits, become job creators and contribute positively to the national economy especially in global economic recession period. For nations to achieve economic development, its citizens must acquire entrepreneurship skills to contribute meaningfully to the national economy. The need to become an entrepreneur in Nigeria is becoming more glaring in the face of increasing unemployment and over saturated labour market. In view of this, there is the need to entrench entrepreneurship into chemistry curriculum most especially in higher institutions. This paper discussed what chemistry entrepreneurship is, and its benefits in terms of commercialization of chemistry projects and innovations thereby reducing unemployment and the turning around of sour ailing and weak economy in Nigeria. Teaching and learning of chemistry entrepreneurship should be implemented as discussed in this paper in all tertiary institutions and adequate funding of chemistry research and innovation by government and private sectors were recommended.

Keywords: chemistry, entrepreneurship, chemistry entrepreneurship, innovations and unemployment.

Chemistry is the study of matter and energy and the interactions between them (Helmenstine, 2010). Bagley (2014) defined chemistry as the study of matter, its properties, how and why substances combine or separate to form other substances, and how substances interact with energy. Chemistry is used in most fields of human endeavours such as engineering, pharmacy, agriculture and medicine. Qualitative functioning chemical knowledge is practical and useful that is, chemistry-taught in such a way that it reflects on their immediate environment and developmental need (Suleiman, 2010).

It is interesting to note that chemistry can be found in the kitchen, restaurant/fast food, laundry, beauty salon (costimetics), swimming pool, hospital, hotel and beer parlour, toilet and bathroom, air, bakery, water corporation, military formation/barrack, photo laboratory, paint and textile stores, business centre, house roof, cars, trains and air craft, waste dump among others in all human endeavours. Today, advances in chemistry in the areas of biochemistry, electrochemistry, computational chemistry, synthesis and analytical sciences, bio and solar fuels, surpramolecular chemistry and nanoscience, and prosthetics sciences among others, have made human life more comfortable.

Formal education in Nigeria particularly chemistry education has not provided learners with functional education but has continued to turn out half baked graduates with mere certificates that are almost useless in most labour markets and industries (Jatto, 2004). There is much discrepancy between formal curriculum and the present day market and industrial demands. The missing gap in the chemistry education curriculum is entrepreneurship.

Entrepreneurship is the process of creating something different with value by devoting the necessary time and assuming the accompanying financial psychic and social risks and receiving the resulting rewards of most personal satisfaction (Abdu, 2010). It is about self-reliance which involves identification of a market and mobilizing necessary resources to serve that market through a business outfit. It is essentially about someone creating a market from his own resources.

Entrepreneurship education helps to redirect the mind of youths towards the world of business and independence, increase innovation and creative spirit thereby increasing the number of employers rather than employees as well as stable national economic growth and sustainability. Uduma (2009) described education as an intellectual yeast that ferments all spheres of national development. Skills development is synonymous with the best mode of learning science that is learning by doing, for it is only by practice that skills in doing things develop in individuals. It is however sad to note that in the early period of their education youths find themselves in an environment not fully prepared for teaching and learning practical skills due to lack of adequate teaching and learning materials.

Chemistry Education and the Need for Entrepreneurship Education

Although Nigeria is rich in human and natural resources, it is still one of the poorest and under developed countries of the world. The climax is that there are so many graduates from the nation's educational system who are roaming about the streets as unemployed or job seekers (Matazu, 2010). This clearly shows that the policies and practices in the schools have some gaps otherwise, graduates of chemistry ought to have acquired sufficient skills that would make them self-reliant or able to be self-employed in various enterprises.

Entrepreneurship Education

Entrepreneurship education is a form of education which makes human to be responsive to their personal, families and national needs and aspirations. Entrepreneurship education is about developing attitudes, behaviours and capacities at individual level. It is also about the application of those skills and attitudes that can take many forms during an individual's career, creating a range of long-term benefits to society and the national economy.

The concept of entrepreneurship education according to Anho (2011) is associated with various activities such as innovation, creativity, risk taking, initiative, visionary, focus, determination, team spirit, resourcefulness, financial control, self confidence, versatility, knowledgeable, dynamic thinking, optimum disposition, originality, people oriented, flexible in decision, responses to suggestions and criticism need, achievement driven, profit oriented, persistent and persevering, energy for hard work, adjustment to challenges and future expectation.

Basic functional entrepreneurship education has been used by many nations as a means of enhancing poverty eradication, self reliance, national development and security. Basic functional entrepreneurship education is capable of reducing the high rate of unemployment and poverty in both urban and rural areas by equipping the recipients with the knowledge and skills for setting up and running small scale businesses. The biggest employer is the private sector and basic functioning entrepreneurship education has the capacity of providing jobs for millions of people in factories, agricultural enterprises, other service industries and small scale businesses.

According to Anho (2013), basic functional entrepreneurship education is capable of building good human and personal relations thereby addressing personal and social challenges vital to the prosperity of any enterprise in an efficient, capable trust worthy and social cohesive and considerate personality which is the hall mark of an educated citizen. This idea of personal and social challenges can be addressed with basic functional entrepreneurship education. Managers and administrators with such education will allow their personality to radiate joy and goodness in their endeavours. Sarwoko & Hadiwidjojo (2013) also noted that the greatest success skill we ever develop in lives in the ability to build healthy relationship with others. Entrepreneurship according to Barika (2007) and Oyeku (2009) introduces new ideas, new goods, new methods and technology used in re organizing the enterprise in a country. This level of entrepreneurship is affecting a change commensurate with the economy found in a developing nation. Basic functional entrepreneurship education reduces rural-urban migration by engaging the rural population in gainful employment. This will check the overcrowding of the unemployed and under employed in the urban centres. Such overcrowding can be associated with agitations due to joblessness and thereby making the youth to indulge themselves in robbery, stealing and other vices which can breach a personal and societal peace thereby becoming a national security concern. Through entrepreneurship, goods and services are supplied to other enterprises and bigger

organization factories or industries. These may include farm produce such as cocoa for food and beverage manufacturing industries, rubbers for plastic and applied product industries, cassava and yam for chips, flour and other allied product industries. The supply of such products to bigger factories and organizations brings growth in the economy by increasing indigenous raw material resources utilization which leads to economic empowerment and job creation.

Chemistry Entrepreneurship

If chemistry plays a vital role in every human endeavour such as production of soap, paint and dye, then why are chemists becoming job seekers instead of job creators? The integration of entrepreneurship education into chemistry education termed chemistry entrepreneurship should produce chemists that can convert research project into commercial or marketable products with a view to converting projects into commercial or marketable products with a view to reaping individual financial benefits as well as providing opportunities for national economic development and a sure gate way from the present economic recession.

Chemistry entrepreneurship therefore involves the process of converting innovations in chemistry into marketable products for commercial gain. With increasing awareness, there is a paradigm shift from conducting basic research whose results end up only in academic journals. Today chemists and scientists in general are thinking of their work beyond academic journals publications by patenting and commercializing them for economic gains. Thus, achieving transformation of novel science into successful business ventures, is key to the long term profitability of the world's chemical and related industries but this goal requires scientists who possess a critical combination of both technical and entrepreneurial skills. This is because activities of commercialization need additional entrepreneurship skills different from technical skills acquired in the chemistry laboratories. Increasingly, such individuals are playing a pivotal role in today's knowledge driven economy by enhancing existing businesses and by setting up new ventures themselves.

Chemistry Entrepreneurship in Nigerian Schools

The Federal Government has been making efforts to enhance skill acquisition of youth, however, education for all (EFA) reported by Babalola (2011) showed that sufficient attention is not given to skill training for youths and adult. Babalola (2011) reported that efforts at integrating entrepreneurship into the curriculum of Nigeria Public Universities seem to be inadequate. As at 2010, the most coordinated entrepreneurship education in Nigeria Public Universities is reported to be at the University of Ibadan which commenced in the 2003/2004 Academic session. The programme was reported to be integrated into the curriculum and only concentrated on few students who were interested in developing their entrepreneurial skills.

At the University of Nigeria, Nsukka in 2010, the centre for entrepreneurship and development research was set up to promote entrepreneurial culture and mind-set skills acquisition, self employment, economic independence and self-actualization. The University of Ilorin was reported to have agreed since 2005 to create a directorate to handle entrepreneurship training, however, it was only in 2008/2009 that the university established the directorate of technical and entrepreneurship centre. University of Benin also established an entrepreneurship development centre to develop and offer courses, seminars, workshops, and conferences to advance and propagate entrepreneurship. In Delta State University, it is the policy of the university that those reading Business Management or Accounting courses must register, study and pass courses in entrepreneurship. In other state universities in Nigeria, it is only offered as general courses. However, in Covenant University, Sango Ota, serious efforts have been made to integrate entrepreneurship development study into the curriculum making all students from 100 to 400 levels to register for and pass entrepreneurship development study. It is therefore observed that there is no standard curriculum and courses outline/content to guide and develop entrepreneurship in the universities. Showing that entrepreneurship education in Nigeria schools, Colleges, Polytechnics and Universities is not given the serious attention it deserves.

According to Familoni (2008), chemistry entrepreneurship as a course is currently offered in University of Lagos as part of General Studies courses where topics is been taught. In addition, chemistry entrepreneurship courses are currently being taught in Tansian University, Oba, Anambra State. In this University, the course called "Production Chemistry" is aimed at equipping students with the methodologies of chemistry (as it relates to production processes) necessary for technological progress in our modern world. Its objectives include:

(a) To enable students acquire the capability to conduct research in Chemistry related fields

(b) To engage the students effectively in analytical investigations required for quality control.

(c) To create room for broad awareness of the application of chemical principles and to equip the students to become useful hands in chemical and allied industries.

At Tansian, courses are taught in Cosmetics, soap, detergents, perfumes, paint, colour chemistry, wine and alcohol drinks, powder, bleach, flour and wheat chemistry (Akinriboya, 2009).

The Department of Chemistry in Adeniran Ogunsanya College of Education, Lagos an affiliate of Ekiti State University, Ado-Ekiti has introduced chemistry entrepreneurship as a course and is making money through the sales of products including soaps, hair cream, shoe polish, mosquito repellants, herbicides, gum, sanitizers, after shave lotion and many more. The graduates of this institution are most likely to be wealth creators rather than job seekers (Olatunbosun, 2017)

Ajagu (2005) argued that entrepreneurship is near absent in Nigeria and the dearth of information in this area has resulted in few venturing into it without the prerequisite information to succeed. Even though much awareness has been created for entrepreneurship development, most especially as a way out of the current high rate of unemployment and economic recession in Nigeria, Nigeria in 2014 was rated 74th in global entrepreneurship development index with countries like Malaysia (45th), Saudi Arabia (46th), South Africa (51st), Tunisia (61st), Cyprus (52nd), Lebanon (55th) and Namibia (55nd) coming ahead of Nigeria.

Chemistry Entrepreneurship in Developed Nations

It is generally believed that entrepreneurial behaviour remains a crucial engine of innovation and growth for the national economy and for individual companies. The increased focus of policy on entrepreneurship as a basis for new firm foundation particularly new technology-based firms (NTBFs) job creations and societal wealth in developed nations is a necessary tool for economic empowerment and self employment (Schmude 2007)

Since chemistry shows up as a scientific disciplines with many overlaps and interfaces to other fields and applications for a myriad of areas of day to day life, the chemical industry exhibits co-evolutions with many other industries such as textiles, paper, automotive, oil, food, electricity and electronics, water, energy (Ronge 2006). Consequently, chemistry entrepreneurship can be envisioned to be related essentially to chemistry and chemical engineering and a breadth of industry-relevant chemistry based or oriented areas such as instrumental analysis for example, chemical nanotechnology and material science.

Entrepreneurship in scientific and technical areas differs from non-technical areas. In scientific/technology entrepreneurship there are three initiating stages. “idea”, “change detection/discovery and serendipity” and opportunity which are treated as principally independent and have to be inter related and “channeled” into further entrepreneurial processes and actions. It is possible to generate ideas without identifying the business opportunity which is common to many research works endings up in journal publications and science libraries for instance, it was shown that in existing firms a very high proportion of individuals who generated the idea did not recognize the opportunities (Leifer, R, McDermott, Colarelli O’Conner, Peters, Rice and Veryzer 2000). It is also noted that when (inorganic) chemistry began in 1704 in Berlin (Germany), the chemist and “colour maker” H. Diesbach found “Berlin blue”, (Prussian blue) by serendipity, Dispatch told his “raw material supplier” C. Dippel about his observation and Dippel immediately recognized the commercial potential of the disruptive innovation. Even after 300+ years “Berlin blue” can still serve as a fundamental case for generic features and structures of innovation and entrepreneurship in chemistry (Ronge 2006). Moreover, it introduces the very important role of chance detection or discovery and serendipity in chemistry and other scientific and technical

disciplines for innovation, entrepreneurship and intrapreneurship (Ronge, 2006). Serendipity is finding something unexpected and useful while searching for something else entirely (Ronge, 2006).

The Universities in Brazil are currently going through a second revolution in which the socio-economic development is incorporated as part of their mission and scientific knowledge play a key role for the development of the society. In promoting chemistry entrepreneurship towards the attainment of this mission, the school of chemistry in conjunction with the Nottingham University Business School, U.S.A is running a programme on M.Sc Chemistry and entrepreneurship. The course aims to provide students an appreciation of inter relationships between fundamental research and its commercial exploitation. While the students will also be able to take advantage of the course's flexible structure to develop an understanding of specific areas of modern chemistry and to become knowledgeable in the financial, marketing and managerial aspects of modern business. Another objective of the course is to make students to acquire the technological and business background to enable them make a significant contribution to today's chemistry-based, technology-driven economy. The department of chemistry at Case Western Reserve University, Cleveland U.S.A started the chemistry entrepreneurship, a two-year professional M.Sc.

Entrepreneurship is where students study the state of the art of chemistry practical business and technology innovation while on a real-world entrepreneurial project with an existing company. The chemistry entrepreneurship programme also helps to connect students with mentors, advisors, partners, funding sources and job opportunities. The term chemical entrepreneurship which is a chemistry related discipline became significant since 1988 when the American Chemical Society held a conference on chemical entrepreneurship. The curriculum of chemical entrepreneurship provided at Karlsruke University through the institute of organic chemistry aims of preparing students, researchers and academic employers to increase their awareness about technology entrepreneurship and innovation and support mentality/motivation as well as readiness and behaviour for funding new technology based forms in the field of chemistry and related scientific and engineering disciplines through provision of education and skills using appropriate educational and training method, tools and materials following a "theory-to-practice" approach. To "experience" entrepreneurship, invited guest speakers from industry provide lectures on innovations, new business development and the intrapreneurship as part of the course.

Benefits of Chemistry Entrepreneurship

There are obvious benefits that can be derived from qualitative and functional chemistry entrepreneurship in Nigeria educational systems as discussed below.

- Reducing the unemployment rate: Enrolment in tertiary institutions in Nigeria is on the increase hence the Government and organized private sectors do not have the capacity to absorb all the graduates of these institutions. The national Bureau

of statistics put the unemployment rate in the first quarter of 2013 at 23.9% (Odia and Odia, 2013). The situation of unemployment in Nigeria is indeed alarming (Ogunsola 2009) and Aja-Okorie and Adali, 2013). The graduate unemployment problem has generated several other socio-economic problems in the country manifesting in the followings, militancy in the Niger Delta, Political thuggery among youths, increased rate of armed robbery and kidnappers and even the Boko Haram saga (Ibe, 2012). The most potent way out of this problem is to develop our chemistry entrepreneurship to enable chemistry graduate to acquire practical skills resulting to self employment or self-reliance.

- National economic growth:- Chemistry entrepreneurship will make a significant contribution to the national economy if laboratory research and innovation are converted into commercial gain of the individual and the society if the necessary funding is provided by Government and private sector partnership.
- Job and wealth creativity: Chemists well trained in chemistry entrepreneurship will definitely become employers thereby resulting to job and wealth creation.

Conclusion

The introduction of entrepreneurship education into chemistry education in all higher educational institutions in Nigeria has become very imperative. This curriculum restructuring in chemistry education will foster employment generation among the teaming youths, economic growth and wealth creation. Thus, entrepreneurship skills development according to Anho (2011) goes beyond training through education but also involves a process of human capacity building through formal and informal training inculcating in the entrepreneur basic skills such as financial skills, technical skills, creative skills, managerial skills, intellectual skills, marketing skills, communication skills and technological skills

Recommendations

Chemistry entrepreneurship is an indispensable tool in reviving the national economy especially in the present economic recession. The issue of graduate unemployment especially in science disciplines particularly chemistry discipline is so alarming that it needs restructuring of the present chemistry education curriculum by integration into it entrepreneurship education. The envisioned chemistry entrepreneurship in tertiary institutions would produce highly skilled professional chemists that will no longer be job seekers but job creators and are self-reliant.

Government at all levels should be involved in funding innovations from chemistry researches in order to assist the chemistry graduates in setting up their own businesses.

Locally produced products from chemistry innovations should be patronized by Nigerians to motivate chemistry research in Nigeria.

There should be adequate funding of research and development activities in chemistry related area by the Government and private sector. A strong linkage between the academic and industry should be encouraged.

References

Abdu. B. (2010). Towards qualitative chemistry education for promoting entrepreneurship for sustainable development. *Journal of quality education. Isah Kaita College of Education, Dustin-ma 1 (1). 27-35*

Ajagu. A.N (2005). *The Entrepreneur,* Lagos Betcy Media

Aja-Okorie, U. and Adali, O. (2013). Achieving youth empowerment through repositioning entrepreneurial education in Nigerian universities: Problems and prospectors, *European Scientific Journal. 9 (28) 113-132*

Akinriboya. W (2009). Employment for Wealth Creation: A clarion call to Nigerian chemists. *A National magazine of the Chemical Society of Nigeria. 3 (3), 20-22*

Anho. J.E (2011). Impact of Entrepreneurship education and training on university graduates for sustainable development in E.A Arubayi, N.E Akpotu and E.P. Oghuvbu (Eds). *Education and training for Entrepreneurship*. Lagos, Thomas Nelson (Nig) Limited.

Anho. J. E (2013). Recreating the Management and Administration of Adult and Non-Formal Education Vis-avis Entrepreneurship Education. A paper delivered at the conference of Association of Nigeria Teachers (ASCONT) at National Open University, Enugu, 8th-11th July,

Babalola, J.B (2011). Eyeing sustainable Development. Entrepreneurship climate must change in Nigeria Universities in E.A Arubayi, E.Akptis and E.P Oghuvhu (Eds). *A book of Readings. Education and Training for Entrepreneurship* Asaba, NAEAP Publications

Bagley. M. (2014). Live Science Contribution, *Live science. Com/45986-what is chemistry*. *Html*

Barika. R.B (2007). Entrepreneurship in a Developing Economy (A case study of Nigeria). *African Journal of studies in Education* 9 (1). 38-43.

Elemo. O. (2014). Scientific Research and Technology Transfer: A catalyst for Industrial Development in Nigeria. A paper presented during the second Annual Conference of School of Sciences, Federal University of Technology, Akure, Ondo State, Nigeria. 17th-18th June.

Familoni, O.B (2008). "Chemist must stand out as professionals in Nigeria". *"ICCON News"*. 2 (3). 14-15

Helmenstine, A.M (2010). What is Chemistry Available from *http://www.chemistry.co.nz/what is chemistry*. Htm access on 27 sept. 2011

Ibe. E.O (2012). Re-engineering entrepreneurial education for employment and self productivity in Nigeria. *Knowledge Review.* 26 (1). 1-6.

Jatto. Y.A (2004). Challenges of Education in the twenty first century. *Lead paper presented at the 3rd National Conference organized by Federal College of Education, Katsina.* 3rd-7th May

Leifer, R, McDermott, C.M, Colarelli O'Conner, G, Peters L.S, Rice, M and Veryzer, R.W (2000). *Radical innovation. How mature companies can outsmart upstarts*, Boston, M.A.: Harvard Business School Press.

Matazu. S.S (2010). The Relevance of Science, Technology and Mathematics Education (STME) in developing skills for self-reliance; the Nigerian Experience. *African Journal of Teacher Education*. 1 (1). 223-225.

Odia. J.O and Odia A.A (2013). Developing Entrepreneurial Skills and Transforming Challenges into opportunities in Nigeria. *Journal of Educational and social Research.* 3 (3). 1-10

Ogunsola, T. (2009). Lessons from Boko Haram Sectarian crisis. *The Nigerian Education Times.* 26

Olatunbosun, S.M (2017). Chemistry Entrepreneurship: A panacea for chemistry Graduates unemployment- The Nigerian Experience. *International Journal of Education, Learning and Development.* 5(1). 32-36

Oyeku, O.M (2008). Starting your own business. A paper presented at a Seminar on "Be your own employer" organized by the Centre for Technical and Entrepreneurship development. University of Ilorin, Ilorin, Kwara State Nigeria.

Uduma. M.K, Ellah, B.E, Ebi. B.O and Ayeng. F.A (2009). Quality control in vocational and Technical Education for sustainable development in Nigeria: Vocational Technical Teacher Education programme in focus. *An unpublished paper presented at the educational conference. School of Education. Isah Kaita College of Education, Dusinna*. 11th-14th August

Ronge. W (2006). *Innovation, Research and Technology intelligence in the chemical industry: Integrated Business, Technical and System Approaches,* Stuttgert: Fraunhofer IRB Verlag.

Sarwoko, E.S & Hadividjojo (2013). Entrepreneurial characteristics and competency as determinants of business performance in SMEs. *Journal of Business and Management*, 7 (3), 31-38

Schmude. J. (2007). "VomstudentenzumUnternehmer: Welche Universities bietel die bestenchancep" (from student to Entrepreneur; citation:"StuddierendendasnotigeRustzeug for denschritt in die selbstandigkeitmitgeben"), exist (News from the ministry of Economics and Technology). Mannheim

Suleiman. F.B (2010). Functional Chemistry Teaching as bedrock for achieving qualitative science education. An unpublished paper presented at the 3rd National Conference Organized by school of Science, F.C.E Katsina.