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ACADEMIC INSTITUTIONS, INDUSTRIES AND THE GOVERNMENT – ROLES IN SUSTAINING THE DEVELOPMENT OF ENGINEERING ENTREPRENEURIAL SKILLS AND COMPETENCE

*F.O Adeyemi[1], I. K. Akpodonor[2], I. M. Oyerinde[3], M. J. Odedina[1], O. O Olomo[3], O.O. Obanisola[2], S.O. Ogunrinde[4], Y. O. Bodija[4]

[1] Department of Civil Engineering, Ajayi crowther University, Oyo. Oyo state.
[2] Department of Electrical Engineering, Ajayi crowther University, Oyo. Oyo state.
[3] Department of Computer Engineering, Ajayi crowther University, Oyo. Oyo state.
[4] Department of Mechanical Engineering, Ajayi crowther University, Oyo. Oyo state.
*Corresponding author's email**:** fo.adeyemi@acu.edu.ng, festusade4@yahoo.com

Abstract – There has been growing concern of high rate of unemployment among engineering graduates, roaming the nation's streets in search for white collar jobs, despite the fact that entrepreneurial courses have been introduced to the engineering curriculum, as a distinct set of commercial skills and techniques to improve the employability of these graduates. This paper, which draws strength from detailed review of literature, presents views on how the academic institutions, industries and the government can help to reinforce, sustain and consolidate the engineering entrepreneurship programme, with the hope to produce well rounded, morally and intellectually capable engineering graduates with entrepreneurial skills, who could create jobs rather than look for jobs. This will go a long way to reduce the unemployment rate and enhance positive impact on national economic development. Some suggested roles which the academic institutions, industries and government can play in building the skills and competences of the engineering students include: frequent organization of seminars and practical classes or hands-on business activities based on innovative engineering projects, new business development, preparation of business plan, formation of strategic alliances or strong ties outside the university setting to include alumni and local businesses communities that can interface with the entrepreneurial program, mixing students from several engineering departments, and ensuring entrepreneurial courses which relate market needs to the research activities offered by academic institution. Similarly, more funds should be provided by the government for entrepreneurship programs and creation of adequate well equipped entrepreneurship centers across the nation.

Keywords: Engineering, Entrepreneur, Institutions, Industries, Government, Skills, Competence.

1.0 Introduction

The tremendous recent changes in the world order present both challenges and opportunities to the engineering education. The environment we now face is very different from even a decade ago. The practice of engineering is changing with the globalization of manufacturing, research and development. New interdisciplinary fields have come to life and traditional engineering is increasingly influenced by the information technology and employment shifts to smaller entrepreneurial firms (Serge et al., 2007). The industry is also changing, following the evolution of big data systems, artificial intelligence and machine learning, and today's engineer therefore need to develop new skills to achieve success as a professional (Rafael et al., 2020). These skills can be transformed into creative and innovative ventures. Nigeria as a country is quest for accelerated economic growth, and it is important that active and virile youth population is assisted to develop and convert their innovative ideas into business ventures. This underscores the need to actively promote and train students to be entrepreneurial within our educational system (National Universities Commission, 2014). Besides, there has been a growing concern in Nigeria that engineering graduates do not have the necessary entrepreneurial skills to start their own business. Many of them prefer to become job seekers and to get employed rather than being job creators due to lack of entrepreneurial competence. Some engineering students often think that they only need these skills and competences if they intend to become an entrepreneur and set up their own business as a graduate, meanwhile, employers often seek an entrepreneurial mindset in their graduate recruits. The engineering skills–entrepreneurship gap appears most prominent in Nigeria than what higher institutions in Nigeria offer, and the demands of the labor market tend to be widening steadily as university and graduates seem more exposed to theory than the practical aspects of their training (Frederick (n.d.)**)**. This has prompted the National Universities Commission to incorporate entrepreneurship into academic programs, emerging as a distinct set of commercial skills and techniques. It involves introducing commercial and business skills in the training of engineers, exposing them to business skills and the market to make them better engineers and stronger business men.

This entrepreneurship is the foundation of successful economies and the beacon of hope for developing economies. Today, engineering entrepreneurs are changing the world at an unprecedented speed as technology and innovation have never been so important, if not a panacea, for industrial and economic development. Without entrepreneurs, the world would not have known such innovative breakthroughs as the wheel, electricity or the Internet, to

name just a few. The magnitude and reach of their contributions, however, extend much beyond the world of business and economy, and to them goes irrefutable credit for the growth and evolution of societies at large. Developed nations across the world owe their current prosperity to the collective effort of intrepid entrepreneurs, on whose innovation also rests the future prosperity of much of the developing world.

The entrepreneurship course aims at re-orientating students towards a job- creation mind-set rather than the fixed attitude of job seeking, equipping them with the skills required in establishing businesses or making them add value to existing systems, if employed in organizations. Economic trends and changes in the way employers organize and make decisions have led to an increased awareness of the potential value of entrepreneurship education to engineering students. Although, entrepreneurship education is believed to be complementary to an engineering education, little is known about the degree to which it plays in contemporary students' academic programs (Nathalie et al., 2012).

Entrepreneurship program to engineering students helps to empower them with skills that will enable them engage in income yielding ventures as well as increasing their entrepreneurial capacity. Item number (iv) of the Philosophy and Mission Statement underlying the programmes in Engineering and Technology aimed at achieving the goals and objectives of the National Policy on Industrialization and Self-Reliance, and this is to develop in the products, entrepreneurial knowledge, a sense of public responsibility and a spirit of self-reliance (National Universities Commission, 2014). Formal education and prior experience in entrepreneurship has been found to increase a student's self-confidence in entrepreneurship which correlates with the student having entrepreneurial intentions (Zhao et al., 2005). Kolvereid and Moen (1997) has also confirmed that students who have learned entrepreneurship have greater interest to become entrepreneurs and have acted more entrepreneurial than other students to start a new business. Possession of entrepreneurial skills results not only in improved learning but also in better preparation for the job market, participation in regional, national and international academic competitions, and the founding of new technology-based companies. Engineering Graduates with strong enterprise skills can spot an opportunity and use their initiative to make the most of it.

Engineers, in addition to their engineering, technology and innovative skills, acquire business, marketing and finance skills. There are many examples of great companies led by engineers, including Microsoft with Bill Gates, Oracle with Larry Ellison, and Google

with Larry Page, and there is strong evidence that it is possible to make the step from engineer to entrepreneur, or team with someone who can provide the complementary entrepreneurial skills and perspective.

In Nigeria today, apart from modeling, designing and construction, engineering students need to identify market opportunities and to take leadership roles in business. The engineer assumes that once he builds, the market will come, but in real life situations, building to solve problems of society cannot connect with customers, manage competition, or communicate and proselytize the offering in the industry. Businesses have a massive demand for engineers and technicians while engineering skills are particularly effective when combined with enterprise (Frederick (n.d.)).

Today, engineering students need an entrepreneurial mindset to be called entrepreneurial engineers (Mohd and Abdul, 2016), and they need to be innovative to become intrapreneurs and take leadership roles in companies or become entrepreneurs with thriving businesses (Kriewall and Mekemson, 2010). Entrepreneurs must be able to identify customer needs and market niches using lateral thinking skills, which should be taught to engineering students via collaborative roles of the academic institutions, industries and the government in other to sustain the entrepreneurial programme for engineering students. This will help to build their competence and improve Nigeria's economic development.

2.0 The roles of the academic institutions, industries and the government

2.1 The Institution

One of the compelling reasons for the curriculum review by the National Universities Commission included the need to update the standard and relevance of university education in the country as well as integrate entrepreneurial studies, and peace and conflict studies as essential new platforms that will guarantee all graduates from Nigerian universities the knowledge and appropriate skills, competencies and dispositions that will make them globally competitive and capable of contributing meaningfully to Nigeria's socio-economic development (National Universities Commission, 2014). Institutions can enhance and sustain entrepreneurship programs for engineering students by frequently organizing seminars and practical classes or hands-on business activities based on innovating engineering projects, new business development, preparation of business plan, demonstrating engineers' contributions to the society through business examples, launching, managing, and growing

technology based businesses etc., and making them obligatory for all engineering students to attend. These students need to be taught on how to look out for problems that have market potential and consider their product or design from the customer's point of view. Lumsdaine and Binks (2003a) proposed that students could be interviewed before registering for an entrepreneurship course like a job interview in order to increase the perceived "value" of the course.

Similarly, it would be necessary for universities to form strategic alliances or strong ties with outside of the university setting to include alumni and local businesses communities that can interface with the entrepreneurial program to serve as entrepreneurial promoters guest speakers, advisors, judges for competitions. Students can interact with entrepreneurial alumni and companies to see entrepreneurship in action. Generally, academic institutions should collaborate with one another to identify best practices in delivering entrepreneurship education in an engineering degree program (Kriewall and Mekemson, 2010).

Engineering entrepreneurship should also be based on multidisciplinary teamwork projects. Within the university, the heterogeneity can be achieved by mixing students from several engineering departments. All engineering students should participate in developing both engineering and entrepreneurial aspects of the project, this will add versatility and functionality to the teams and broaden their entrepreneurial experience.

The universities can also offer wide range of entrepreneurial courses and intensify on courses that actually relate market needs to current university research activities such as courses in launching, managing, and growing technology based businesses available to engineering students and utilizing a variety of teaching methods: case studies, internships, guest lectures, external reviews of student assignments by venture capitalists, and student projects.

The universities can also encourage and advocate for some engineering students who might not be finding engineering interesting, peradventure, they were forced to study engineering, but can identify opportunities, understand market forces, commercialize new products, and have the leadership and communication skill. Finally, academic institutions should allocate more funds for entrepreneurship program. All these will enable the sustenance of the entrepreneurship program for engineering students.

2.2 The government

The Nigerian government can create adequate well equipped entrepreneurship centers, as part of the entrepreneurial education program to sustain entrepreneurial activities for engineering students, which provides educational programs, networking opportunities, technologies and

the necessary resources. These centers, as part of their programs can organize entrepreneurship annual competition for undergraduate engineering students, assess their entrepreneurial talent and ideas, and look for ways to improve their skills and talents. Mixing engineering students from different institutions will also broaden their entrepreneurial knowledge. The competition prizes could be money and business start-up services for the outstanding teams of engineering student entrepreneurs. The presentation can be broken into two parts: The first part could be technical industry-fair style presentation and the second part could be business plans which are to be presentation to the audience, with the teams having an opportunity to tell the panel of judges, who are experienced entrepreneurs, professional service providers and investors, the patent issues, potential customers, financial arrangements, etc. Assessment should base on the merit of their technical innovation, entrepreneurial, commercial potentials and social potentials: creativity, changed attitudes, behaviors and skills; organization and presentation that are evaluated individually and in groups. The panel will also judge the approved common formats of presentations (different media: videos, photos, viewgraphs, advertisements etc., different order and time allocation on technical and business presentations).

During the competition, the students may also be asked to present a one-page essay describing their future entrepreneurship plans. This approach was utilized at Stanford University by establishing the MIT Entrepreneurial center in 1996, called Stanford Technology Ventures Program (STVP) (Standish-Kuon and Rice, 2002). Government should also intensity their effort in ensuring that engineering graduate must be posted to companies/factories where they can acquire some entrepreneurial skills.

2.3 The Industry

In 1973, the Industrial Training Fund (I.T.F) initiated the Students Industrial Work Experience Scheme (SIWES), which was aimed at helping students undergoing courses in engineering and technology and other professional courses the opportunity to acquire the necessary industrial and practical knowledge to commensurate the theoretical knowledge gained in the classroom. This training would be the best way to get students involved directly in the entrepreneurial process through which they will be equipped with the essential skills apart from the technical skills such as business plan development. Industries can host conferences on teaching entrepreneurship educational program for engineering students founded on the premise that in addition to technical skills, they need to know how to

identify market opportunities and to take leadership roles in business. Large public lecture series by great entrepreneurs, organized by the Industrial Training Fund (I.T.F) can promote innovations by bringing together engineering students from colleges and universities, state and local government bodies, private sector firms, and nonprofit organizations with the aim to nurture entrepreneurial consciousness in the student body coming from very different backgrounds, and have a potential to improve their quality of life. General topics such as creativity, project management, opportunities, intellectual property, business oriented topics such as developing a business plan, how customers are identified and approached, financing and launching a venture, marketing strategies based on real technical constraints and how to translate customers' needs to engineering specifications, can be taught. This will actually help in sustaining the entrepreneurship program in our universities.

3.0 Conclusion

In Nigeria today, there is a need to reinforce the entrepreneurial programme of engineering students, by building in them some set of commercial skills and techniques in addition to their technical skills, so as to improve their employability. This calls for the collaborative efforts of the Academic institutions, industries and the government to help in sustaining the development of engineering entrepreneurial skills and competence. Some suggested roles which the academic institutions, industries and government can play in building the skills and competences of the engineering students include; frequent organization of seminars and practical classes or hands-on business activities based on innovating engineering projects, new business development, preparation of business plan; formation of strategic alliances or strong ties with outside of the university setting to include alumni and local businesses communities that can interface with the entrepreneurial program, mixing students from several engineering departments, and ensuring entrepreneurial courses which relate market needs to current academic institutions research activities are actually offered. More funds should be provided by the government for entrepreneurship programs and creation of more well equipped entrepreneurship centers across the nation. The results of these collective roles will not only bring about a change in the attitude of our academically oriented engineering students, in the realization that the entrepreneurial talent is also as important as scientific and engineering prowess, but also reduce unemployment rate, boost the economy and national development and reduce the reliance on white collar jobs which are not always available.

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