International Journal of Science, Environment and Technology, Vol. 5, No 1, 2016, 111 – 118

ISSN 2278-3687 (O)
2277-663X (P)

EFFETIVE STAKEHOLDERS COLLABORATION FOR SUSTAINABLE ENGINEERING EDUCATION IN NIGERIA

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Abstract: The high rate of technology advancement globally, its economic and social impact with the associated environmental sustainability challenges is motivating each country in the world to invest more in educational research and development. The technology manpower development being one of the major factors to sustainable technology growth and healthy environment, the stakeholders (Government, Industries and academic institution) in this area must collaborate to formulate policy, strategies and training approach to achieve sustainability. This paper review the involvement of each stakeholders in technology education, highlight the level of collaboration and current problem facing technological education in Nigeria. The likely ways forward are also suggested.

Keywords: Technology advancement, Technology manpower, Technology education stakeholders, Educational research and development, problem facing technological education.

1.0 INTRODUCTION

Technology manpower development has been the current challenges facing the educational sector of most countries based on the current trend of technological innovations and advancement which is alarming. Virtually, all sectors of the economy are now technology driven to achieve timely and efficient performance in best economical way. The yearning for a technology driven society, if not looked into by the key players (stakeholders) and plan ahead to satisfy this yarning, will lead to global technology crisis.

As sophistication is invading the global technology and steady increases in knowledge have spawned new subspecialties within engineering (e.g micro-electronics, photonics, biomechanics, mechatronics etc), the engineers of future will need to learn much new technical information and techniques and be conversant and embrace a whole realm of new technologies [1].

The big question is - What is Nigeria doing to confront this technological challenge?

*Received Jan 2, 2016 * Published Feb 2, 2016 * www.ijset.net*

1.1 THE PACE OF CHANGE IN TECHNOLOGY

A parameter that remains constant is change itself; the world has witnessed accelerated change more in the past 100 years than in all those preceding it. The twentieth (20^{th}) Century has witnessed a healthier, safer and more productive world, a world where engineering had forged an irreversible imprint on our lives and our identities through technology. According to recent analysis, scientific and engineering knowledge presently doubles every 10 years [3]. The geometric rate of growth in technology is reflected in rate of technology introduction and adoption acceleration. The product cycle times continue to experience reduction and each cycle offers more functional and often less expensive versions of the existing products.

The older technologies are becoming obsolete fast at an alarming rate and emergence advances in material science, engineering and other totally unanticipated technologies will include the changes with which engineering and engineering education will need to contend.

1.2 THE GLOBAL TREND

Where have all our engineers and technicians gone? [2]. In 2001, the British Government commissioned an important study into the supply of people with science, technology, engineering and mathematical skills. The findings discover a significant drop in number of students taking science and engineering degrees in Britain.

The recent study on the percentage ratio of the science, mathematics, engineering and technology graduate recorded 7.9% in Australia, 27% in Korea, 19% in Germany, 10% in UK, 17% in USA and 68% in Singapore.

2.0 ENGINEERING EDUCATION

Engineering history can be grouped into the following four (4) overlapping phases, each orchestrated by a revolution.

(i) Pre-scientific revolutions: involve act of engineering scientific revolution (skillful invention era).

(ii) Industrial revolutions: remarkable industrial advancement of 18^{th} and 19^{th} centuries which translates the art of practical artists to scientific professionals.

(iii) Second Industrial revolution: characterized by world war which revolutionized the technological advancement and science-based engineering development of electricity, telecommunications, cars, airplanes, mass production based manufacturing sector.

(iv) Information revolution: After war era, engineering sciences that metamorphose new trends of technologies which include micro-electronics, computers and telecommunications integrated into what is called information technology.

The era of information revolution takes technology to a realm where new technology replace the existing ones so fast that it become necessary to;

1. Introduce continuing education and training to update the professional engineers/technologists/technicians in industries.
2. Update engineering education curricular to meet the current trend of technology innovation and advancement.
3. Continual knowledge update of the Engineering educators.

The global average years of the training trend in engineering education over the years compared with the other profession is shown in the table below;

	1900	1920	1950	1980	2000	2010
Engineering	4	4	4	4	4	4
Medicine	3	6	8	8	8	8
Pharmacy	3	4	5	5	5	5
Architecture	4	4	4	5	5	5
Accounting	4	4	4	5	5	5

Table 1: Years of post secondary education required to begin practicing in different fields
Source: Russell et al (2010). [5]

This result in table 1 does not reflect any change in trend of time in engineering education as technology become sophisticated and experience rapid knowledge transformation.

2.1 ENGINEERING EDUCATION CHALLENGES

The global focus on engineering education is developing engineering curricula that will cater for industrial research and development needs in the current and future technology driven world.

The workshop tagged Engineering Curricula organized by the National Academy of Engineering identified the following key points:

∗ What engineering education research trends are emerging and what are their implications for emerging curricula?

∗ What gaps exist between current engineering educational research and ideal research, what changes should be made?

∗ How can research findings become a part of sustainable innovation and change within engineering curricula?

With the variety of curricular issues highlighted at the workshop, three (3) overlapping global themes that emerge as follows;

∗ Need to restructure engineering curricula to focus on inductive teaching and learning (i.e. moving from the traditional deductive method).

∗ importance of applying integrated, just-in-time learning of relevant topics across the STEM fields (i.e learning opportunities that can be structured and delivered exactly when needed by individual allows for skills and knowledge acquisition at the instant the student is receptive.

∗ Need to increase significantly the use and implementation of learning technologies (i.e. there should be a paradigm shift from the existing classroom method of passing information from textbooks to virtual communities where collaborative links are established among and between education researchers, classroom innovators and traditional engineering faculty).

3.0 ENGINEERING EDUCATION IN NIGERIA

It is a well-recognized truism that science, engineering and technology are critical to economic growth for a country. The state of engineering education in Nigeria reflects the level of technological development in Nigeria which categorizes Nigeria as a developing nation. Engineering education in Nigeria has suffered from;

(i) lack of adequate funding.

(ii) Unsatisfactory students –to-engineering educator ratio.

(iii) Poor student-to-facility ratio.

(iv) Non-regular curricula update to trail trend of technological advancement and industrial need.

(v) Poor student-to-industry ratio for student industrial work experience scheme (SIWES) leading to lack of industrial exposure of large ratio of the student.

(vi) Inadequate support of public organization to engineering education (visible in the way reality shows receive more patronage).

In addition to these problems, the poor primary-secondary school foundation and faulty admission policy has been identified as the factor affecting engineering education in Nigeria [4].

As against the 26% of total government expenditure UNESCO recommended for education allocation, only 6% of the Nigerian national budget is allocated to education and this was less in the past. Unlike Nigeria, South Africa allocated 18.5% while Malaysia allocation is 20.3% of their national budget to education.

4.0 ENGINEERING EDUCATION STAKEHOLDERS

The stakeholders in engineering education are;

* The Government that formulates policy and allocates funds.
* The Industries: the engineering graduates employers that are profit driven.
* The academic institution that produce the engineers, technologists and technicians that drive the industry technology.

4.1 THE GOVERNMENT

The Government in its role must formulate policy that will aid quality engineering education that will meet industrial need and as well fund it. The government must show interest in

* Funding.
* Engineering educator continual training.
* Effective engineering education policy.
* Workable curricula driven by current and future technology change.
* Result oriented monitoring.
* Collaboration with other stakeholders.
* Healthy compromising that yield positive result.
* Making policy that will attract industrial investors and support the growth of the existing ones.
* Performance evaluation through inputs from professional bodies.

4.2 THE INDUSTRY

The commitment of industries to reality shows in the recent time is outweighing that of education, and this is taking more attention of students as they see it as a quick way of making money. The industry as the user of the academic institutions product should show interest in

* Funding (especially in the area of research and skill development).
* Students' skill acquisition through SIWES program.
* Class-industry gap bridging through awareness seminars.
* Workable curricula through feedback of student performance and highlighting the needed technological skills.
* Government policy for technical skill development and quality engineering education.

4.3 THE ACADEMIC INSTITUTION

Being the producer of the engineering and technology graduates that support the technology driven industry which foster economic development of the country, we might need to ask;

* How many training/workshop/seminars/conferences (both local and international) attended in a year or a period of three years by engineering educators?

* What is the minimum number of such training/workshop/seminars/conferences mandatory for engineering educators?

* The ones attended, how relevant are they to the current and future technological challenges?

∗ What impact are academic institutions making on technological advancement trend and graduate scheme that suffices the need of the industry today?

∗ Performance evaluation through inputs from professional bodies.

If there are no satisfactory answers to these questions, then the Nigerian academic institutions should show interest in

(i) Developing training/workshop/seminars/conference curricular that address the current and future state of technology for the engineering educator, making such mandatory.

(ii) Explore aids means for supporting item (i).

(iii) Effective engineering education policy,

(iv) Conditional review of curricula to address the current and future challenges in technology.

(v) Feedback from the industry.

(vi) Collaboration with the government and the industry in achieving technology development goals.

5.0 IDENTIFYING CURRENT PROBLEMS

In one of the forum of tackling engineering challenges in United States of America (USA), Arden Bement (Head of the National Science Foundation) stated “If US industries can find engineering talents in the developing world for 20 cents on the dollar, they’re really going to do so, and probably should.” [2]

Also, John Marburger (Science Advisor to the US President) noted that the 98% of students who drop out of engineering cite bad teaching as the cause, and conclude by saying we need outstanding training and instructors.

The current problem in Nigeria is;

∗ The inadequate skill possession necessary for most cutting-edge technology spawned by the highlighted factors associated with the stakeholders. This will continue and worsen if not urgently addressed.

∗ Lack of collaborative forum where the challenges facing engineering education is collectively addressed by the stakeholders.

∗ Lack of strategic evaluation and continuous re-assessment of students and graduate performance in line with current technology and the foresee future trend.

6.0 SUGGESTED WAYS FORWARD

To have sustainable engineering education that will thrive in the face of current technology challenge and future technology driven economy, the following points should be given a critical look and implemented if possible;

∗ Government should make policy that will attract industrial investors and sustain the existing ones in the face of the current electric power problem.

∗ Commit result-oriented funds towards engineering education by monitoring every stage of expenditure process to avoid diversion and misappropriation of funds.

∗ Encourage research and development in the academic institution through adequate funding.

∗ Brainstorming forum at intervals between the stakeholders should be encouraged for continuous assessment, feedback and identifying areas of common interests towards technological growth.

∗ Attention should be given to the science education at the primary and post-primary level to ensure a solid foundation for student entering higher institution to study engineering.

∗ Introduce a graduate Internship Engineering Academy for a period of 12–24 months before graduates can practice, similar to the Law School for law graduates.

7.0 CONCLUSION

Reinventing engineering education that meets the current technology demand and master the future challenge, effective and cordial interaction between government, engineers in industry and academe are inevitable. I will conclude with a statement made in one of the National Academy of Engineering forum which states that “Ensuring the supply of highly skilled engineers and technicians in our country should be the highest priority if we want to continue to see a prosperous nation in the future”[2].

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