
**EXPLORING THE POTENCY OF HIGHER EDUCATION IN
ENGINEERING RESEARCH AND INNOVATION TOWARDS
ACHIEVING SUSTAINABLE DEVELOPMENT IN NIGERIA**

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Abstract

Education plays a strategic role in all facets of nation's development. Knowledge resources have become the driver of modern economy. For any nation to achieve sustainable development therefore, education in such country should be proactively planned and implemented. More importantly, the pressure of globalization, the technology revolution and new kind of competition have mandated higher education to reposition, restructure or revalue the existing knowledge distribution practice through research and innovation. This paper examines the rationale for engineering research and innovation in higher education in Nigeria, it highlights some focus areas for research and innovation in education. The paper recommends among others that government should encourage and fund research in higher institutions, implement research and workshop outcoms and review of students assessment and evaluation process. Conclusion was drawn that higher education is the key actor in the education industry and will always remain the bedrock of all human development and progress.

Over the last decades or so, many governments of African countries have been faced with addressing citizen's concerns about the low level of developmental progress made in their various countries. Larsen (2004) observed that one thing common among underdeveloped African Countries is the poor quality and unresponsive education offered in those countries. He suggested that the countries should focus their education on national needs so as to enable them develop. Education plays a strategic role in all facets of a nation's development. Knowledge resources have become the drivers of modern economy. It has been amply demonstrated that economies that lag behind are characterized by relatively low capacity for the generation and use of economically relevant knowledge. For a nation to achieve sustainable development therefore, education of such country should be proactively planned in terms of educational philosophy and objective being realistic Vis-a-vis the content and methods of implementing the school curriculum. Education especially qualitative or relevant one is the key to effective sustainable development and an instrument for change in society. Any education that is not tied to development is never education.

Since the world education forum in Dakar in the 2000 (UNESCO 2001) there has been a worldwide awareness on the potency of education in the general development of a country, nation and states. African continent is no exception to this global guest. Many techniques and researches have been at work to checkmate the quality of education and to enhance sustainable development. All these efforts seem not to yield much positive results. Nigeria cannot benefit from the emerging global economy in the present state of the educational sector hence the need to engineer research and innovation in higher education. Higher education is seen as the basis on which the needed high level manpower for country is measured. Higher education is fundamental to the development and construction of knowledge economy and society. A more efficient and effective educational enterprise could only be achieved through engineering research and innovation by higher institutions.

High level of performance in any field is achieved by continual innovation that is motivated by desire to solve important problems and that is addressed systematically in a tight interplay of research proven practice. Higher education in Nigeria should be the key driver in this direction. The official federal Ministry of education (FME) website states that its vision for education is "to establish an enabling and sustainable environment for education to achieve the desired national reforms and human development objectives". The mission states that to aim is "to reform and restructure the education sector to empower and develop the citizenry to acquire skills and knowledge that would prepare them for the world of work" (FME 2010). Today Nigeria is characterized by numerous reports of economic problems, political crises, humanitarian disasters and climate change. There is also a growing awareness of the gap between those who have and those who have difficulties to meet social demand of society. These are contrary to sustainable development indices. The world is also changing, and more economic and Political voices point toward the flaws in our

economic, political and societal system, and their inability to tackle complex and uncertain issues. These issues go far beyond the system structure and capacities of today's society. Other ways to organize, produce, consume lead and live in society are needed to address these problems and to foster a sustainable development. Higher education is reasonably positioned for this task.

The thrust of this paper is to examine the role higher education could play in engineering research and innovation in the education sector in the quest for sustainable development in Nigeria.

Conceptual Clarifications

Sustainable Development

The simple dictionary meaning of the word sustain is to keep from falling or sinking; to keep up or maintain (the Lexicon Webster dictionary 1971). Able to be sustained for an indefinite period without damaging the environment or without depleting renewable resources, it is something that can be continued at the same level of activity or pace without harming its efficiency and the people affected by it. Development on the other hand has to do with improving people's life. Development is the accomplishment of the individual and groups that make up the society. It cannot be divorced from the peculiarities of culture of the people. Man from the beginning creates societies and originates development Oseigie (1985) in Edimeh (2007 P.27) defines development as an inclusive concept with its social political, and economic facets. He sees it as the qualitative and quantitative transformation of the lives of a people. This enhances both the material well being as well as the social well being of the people. Development is simply a process which helps people by providing them with skills and knowledge so as to improve their lives and enable them raise themselves out of poverty and foster self-pride and self confidence.

Sustainable Development is the kind of development that is based on enduring structure in the society. Without such supportive social structure, sustainable development is unlikely (Barrow 2001) Sustainable development means meeting the needs of the present, without compromising the ability of the future generation to meet their own needs. This is development without undoing future development.

Speneer and Amos (1971) in Edimeh (2007) urged that it is one thing for a society to experience increase in real per-capita income over a period of a few years; it is another thing for that society to sustain increase. Without sustained and continuous economic progress at individual as well as the societal level, the realization of human potential would be impossible. On the political plane, stable political conditions are necessary for sustainable all-round development. This is why Onuchego (2005) asserts that when development is achieved without jeopardizing or compromising the next generation, it is only then that one can talk of sustainable development. The following are some of the indices of sustainable development identified by Mezieobi (2007).

- Steady and progressive functional education

- Improved living standards of a nation's population now and in future.
- Absence of inequality and poverty.
- Reliable integrative nationalism with its co operative and cohesive connotation.
- Congenial and stable economy providing for uncertainty.
- A considerable measure of national, socio-political, economic independence or self-reliance
- Responsible political leadership, stability and fellowship.
- Commitment to national development plan and implementation and the display of national development attitudes.

The foregoing problem indicators of Nigeria's sustainable development raise the question: who, what and how can education provide for the above indicators? This is why engineering research and innovation in higher education becomes imperative.

Engineering Research

Research is a scientific investigation undertaken in order to provide solution to a problem. It tackles problems by inquiring into the unknown, raising questions not previously asked with the intention to discover and apply new facts or increase the possibility of acquiring more knowledge about a phenomenon that is already known. Engineering research means strengthening or repositioning new and comprehensive investigation into the problem in the education sector with the view to providing fruitful and novel answers to education issues. A result of research will lead to innovation or modification of existing practices (Akpereka & Uchegama 2016).

Engineering research and innovations as applied in Education refers to strengthening new and comprehensive scientific investigation to poor quality and unresponsive education offered in Nigeria. Denga (2016) looks on Engineering to "revamp" or "massage" the current system in such a way that it may address development needs of Nigeria more poignantly.

Innovation

Innovation on the other hand is a directed change that brings a fruitful result in the system. It should be seen as the modification of existing practices with the hope of providing a better result. Fabgbyly (1974) in Ijiga (2016) sees innovation as the introduction of novelties, the alteration of what is established, a moral practice or method etc. In essence, innovation is simply the change process in a progressive and dynamic sense. Change is inevitable in our higher education because of Knowledge explosion and shifting values.

Higher Education

Higher Education is the education given after secondary education in universities, colleges of education, polytechnics monotchnics including those institutions offering correspondence courses. This means that it is education given at

the apex level of our educational pyramid. Higher education refers to level of education that is provided by universities, vocational universities, community colleges, liberal arts colleges, institutes of technology, and other collegiate level institutions such as vocational schools and careers colleges that award academic degrees or professional certification (Wikipedia 2009)

Objectives and Goals of Higher Education

The objectives of Higher Education according to the National policy on Education (2004) includes,

- i. The acquisition, development and inculcation of the proper value orientation for the survival of the individual and society.
- ii. The development of the intellectual capacities of individuals to understand and appreciate their environment and intellectual skills.
- iii. The acquisition of both physical and intellectual skills which will enable individuals to develop into useful members of community.
- iv. The acquisition of an objective view of the local and external environment.

The goals of higher education as outlined by National policy on Education FRN (2004) are:

- i. Contribute to national development through high level relevant manpower training;
- ii. Develop and inculcate proper values for the survival of the Individual and society.
- iii. Develop the intellectual capacity to understand and appreciate their local and external environment;
- iv. Acquire both physical and intellectual skills which will enable an individual to be self reliant and useful member of the society.
- v. Promote and encourage scholarship and community services;
- vi. Forge and cement unity and;
- vii. Promote national and international understanding and interaction.

The national policy (2004) further stated that tertiary educational institutions shall pursue these goals through:-

- i. Teaching
- ii. Research and development
- iii. Virile staff development.
- iv. Generation and dissemination of knowledge
- v. A variety of modes of programmes including full-time, part-time sandwich etc.
- vi. Access to training fund (ITF)
- Students Industrial Work Experience Schemes (SIWESS)
- Maintenance of minimum education standards through appropriate agencies.
- Inter-institutional co-operation

➤ Dedicated services to the community through extra-mural service to the community and to be a store house of knowledge.

A close examination of the objectives/goals of higher education as listed above has revealed that higher education by its mandate and pursuit is strategically positioned to generate knowledge and skills for sustainable development.

Rationale for Engineering Research and Innovation by Higher Education towards Sustainable Development in Nigeria

There are two major areas in which higher education plays a direct role in development. The first is that higher education produces Graduates/Labour with skills needed to support the knowledge intensive economy. The second is that it produces knowledge through research and innovation. Higher education is the key actor in the narratives and the production of ‘evidence’ that contribute to societal perceptions and behaviours. Researchers and academic therefore have to assume some responsibility for how these behaviors influence transitions towards sustainable development or more specifically to the ability to navigate away from unsustainable future. It is therefore the duty of higher education to generate and disseminate knowledge.

Change in quality teaching and learning process is also domiciled in higher education. Change towards sustainable development requires more than just re-orienting curriculum. It applies deeper levels of commitment where schools are not only concerned about ‘what’ is taught, but ‘how’ students’ learning occurs. It is basically the re-orientation learning process of formal curriculum within existing education system. These involve rethinking what we learn and how we learn it. This requires refocusing of existing processes of teaching and learning thoroughly through engineering research and innovative in higher education.

Engineering research and innovation in higher education for sustainable development are aimed at improving research literacy in the educational and stake holders communities. Jucker (2014) argues that central to this endeavor is clarity of aims, what sustainable development; clarity about what is effective in collaborative structure and an appreciation of what is pedagogic in instructional and collaborative structure that needs to be in place to support this.

The increasing complexity of society and problems faced at different levels (Local and Global) together with uncertainty related to their solutions urgently call for new themes; spaces and approach to research and innovation in different fields in higher education.

In 2012, Unesco report on the global state of education for sustainable development emphasized that education for sustainable development has to build up competence for a more sustainable life and not teaching and learning about sustainable development only. From this perspective, learning to handle knowledge uncertainty and developing the necessary competences requires a learning environment tolerating and

even inviting uncertainty unto the learning process. This requires revigorating research and innovation in higher education for a sustainable development (Trautzitz 2012).

Today, the Nigeria educational system lies prostrate with instructional decay, doubtful quality and unacceptable basic values. There are some external forces which are influencing educational development in the 21st century. These external forces includes technological advancement inducing accelerated thrust and change; the growing symbiotic relationship between education and economy, the increasing urge for national development, especially in the developing nations, and the discovery of education as a catalyst for national development including political economic and socio-cultural development. The last led to the doctrine of integration of education and other aspects of national development in national development planning. The overall effect of all this was the ever increasing pressure on education for growth and expansion at all levels. Higher education has to take the bull by the horn on how best to handle these issues.

Critical Areas For Engineering Research And Innovation By Higher Education For Sustainable Development

Teacher Education

Education cannot neglect the significant and fast changes in culture, technology, economy and politics. Consequently there is a demand on existing classroom environment to develop a new vision and mission accordingly (Otoja 2015) In the past, traditional teachers had relied heavily on the “talk and chalk” method during teaching. The role of traditional teachers is fasting changing. The conventional instruction process of black board and teacher oriented approach should be replaced on the basis of technology and student – oriented approach. Presently, efforts are being made to bring computer into the classroom by government at all levels.

Higher education should strengthen research into teaching methodologies that will provide students with competences that will enable them cope with and formulate answers to the complex challenges of the future. What are needed are methods that will create and integrate knowledge that is solution oriented, socially robust and transferable to both scientific and social practice. If we agreed that the quality of education cannot be higher than the quality of teachers, then we must research to know how best to produce teachers who are knowledgeable towards achieving desired sustainable development.

Nation Building

Nation building is critical to sustainable development. Nations are built by exemplary men and women and sustained by institutions that promote good governance and thus socio-economic development (Gambari 2013). Nation building has many important aspects; firstly, it is about building a political entity which corresponds to a given territory, based on some generally accepted rules, norms, and principles, and

common citizenship. Secondly it is about building institutions which symbolize the political entity institution such as bureaucracy and economy, the judiciary universities, a civil service and civil society organization. A Nation building is about building tangible and intangible threads that hold a political entity and gives a sense of purpose (Gambari 2013).

Nigeria today is characterized by insecurity, religious intolerance, ethic crisis, terrorism, insurgency, absence of rule of law, social exclusion resulting from failure in leadership. How then can we build Sustainable development? Sustainable development cannot be realized without peace and security. Nigeria needs to build peaceful, just and inclusive societies that provide access to justice and that are based on respect for human rights (including right to development), an effective rule of law and good governance at all levels and a transparent, effective and accountable institution devoid of violence, corruption insecurity and injustices. (Gambari 2013)

If we accept the fact that education is an instrument for national development then, higher education in Nigeria should refocus and strengthen research into factors that can sustain nation building through comprehensive innovation in school curriculum that will give a direction for rebirth of the hearts of individuals. Nations are products of the human will and imagination and the institutions that sustain their collective efforts. Education must be relevant to those national issues and not separate from them.

Assessment and Evaluation

In the past, students and pupils are given what we call “test”. These were, score over hundred and that ended the matter. They never counted for students or pupils performance at the end of the term or the year. But the idea of continuous assessment has changed the whole process now because when students are given tests, the scores form part of their total score of the end of the term and even part of their final scores at the end of the year. Presently, the candidate’s school sends their cumulated continuous assessment scores to WAEC/NECO (real or fake) and these form part of senior secondary school certificate examination. All these were innovations against weakness of one-short examination of the early sixties. But then, the expected quality of education is still not attained.

Pirisig (2007) identified two types of quality that are needed in education. “Static quality” the one which pushes a system to enhance defined bench marks and standard, and “dynamic quality” the quality a system need when something new happens, when it is necessary to proceed in uncertainty where standards do not exist. Both are relevant and necessary. “without dynamic quality, an organic cannot develop, without static quality it cannot last”. (Pirisig 2001: 375). How can we close the gap between certificate’ and ‘performance? This is why engineering research and innovation in our Higher education to determine the better, rewarding and result

oriented methods of assessment and evaluation in our schools: In this way both the static and dynamic quality education will transcend to sustainable development.

Research and Innovation in School Curriculum

Scholars in Nigeria see our curriculum as inappropriate because of its functions. A functional curriculum is designed to equip individuals with appropriate vocational, communication and social skills to compete favourably in labour market nationally and internationally. Today there are millions of graduates in Nigeria who do not have adequate skill for self engagement in the absence of white scholar job and this suggests that our curriculum is ineffective, because the essence of 9-3-4 system is to ensure self reliance after completing school. (Umar 2016).

Higher education has to research and recommend innovation in our school curriculum to make it more relevant to the changing needs of the learner both in Nigeria and in international community.

Conclusion

Education remains the ideal vehicle to sustainable development in the universe. It equips individuals with the requisite skills and techniques to explore and develop the zeal to quest for knowledge. Preparing young people for complex and super complex decision making requires developing “uncertainty competence”. That includes specific sets of skills, knowledge attitudes and capacities needed to handle uncertainty, ambiguity and complexity in diverse contexts. (Tauritz 2012) Being able to handle complex and uncertain knowledge is often seen as a promise for sustainable development, higher education is the key actor in this regard. Higher education is the reservoir of information, and experts to help in harnessing procedures, contents and best practices that will continue to ensure that education is relevant, responsive and focused. This can be better carried out through strengthening research and innovation in higher education. Education is, and will always remain the bedrock of all human development and progress. In this way, sustainable development is assured.

Recommendations

Based on the fact that the whole world is targeting sustainable development, education industry needs to be refocused. It is on this basis that the following recommendations are made;

1. The federal government and its agencies should implement research findings by higher institutions. Government should encourage and fund the utilization of research findings by higher institutions. Government should provide the needed research infrastructure to all higher institutions.
2. Proper implementation of research and workshop outcome will greatly help to remedy the lapses in Nigeria education. Many researches have been carried out in education with reliable results. But unfortunately they are never implemented during

curriculum innovation. It is also expected that when workshops are conducted, school delegates should go back to their schools to train other staff; but in most cases training ends with participants.

3. They should increase research/ICT training and retraining through workshop, seminars and conferences to equip staff and students with skills for effective research. The different aspect of training should be monitored for quality assurance, and feedback used for improvement.

4. Teaching and learning should be learner-centred. This implies that classroom activities should be interactive through innovative techniques and instructional resources including information communication technology. Instructional emphasis is not on facts and memorization but on inquiry and discovery based techniques.

5. Students/pupils assessment should be redefined in favour of demonstration of success as against defined criteria, with each learner working at his/her own pace. Assessment is continuous using many devices, let the emphasis be on the quality of understanding and the performance rather than the use of paper.

6. Refocusing the teaching of Social Studies and Civic Education: The researchers have said earlier that nation building is critical to sustainable development. They also noted that what Nigeria needs is a rebirth of heart. Social Studies and Civic Education are concerned with value leader aspect of people, it teaches intrinsic values and high sense of awareness, upholds dignity and integrity at every level. Higher education should research how best to teach Social Studies and Civic Education to uphold the provisions in the Nigeria Coat of Arms “Unity, faith, peace and Progress”. Until these provisions are instilled in the heart of every Nigerian, the dream for true sustainable development will be an illusion.

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