

Roles of Higher Education in Building Endogenous Technological Capabilities in Nigeria

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ABSTRACT

Higher education is a knowledge production field. There are technology transfer and innovation from higher education to local firms, which makes it possible to emphasize higher education to build endogenous technology. This paper examines the roles of higher education in building endogenous technological capabilities. The outcomes indicate that higher education plays a role in technological capabilities in agriculture, technological knowledge creation for industrial innovation, and economic purpose amongst others in building a strong nation. However, some challenges are hindering higher institutions from having the capacity to play their roles fully. Considering the lack of adequate research funding, insufficient staff development, and lack of proper planning which draw higher institutions backwards in building endogenous technological capabilities, the authors conclude that, the quality of higher education can be maintained when the sciences and researches can be advanced. Also, if Nigeria higher institutions should import critical technologies to develop giant industries, there will be a balance in the educational system. It is recommended that Universities need to train a new generation of technical and technological experts and build strong links to enhance innovation for competitiveness. The institutions also need to reinvent their curricula to reflect problems in the economy. Furthermore, the universities need to upgrade the capacity of their researchers to give them a competitive edge over researchers in other sectors. This will help get managers for Centers of technology and innovation.

Keywords: Higher Education, Knowledge production, technology transfer, nation-building.

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I. INTRODUCTION

All over the world, especially African countries seeking to enter the mainstream of contemporary technology and commerce must include scientific development as a critical part of nation-building. Countries such as Malaysia, Singapore, South Korea, and Taiwan were once regarded as Third World Countries, but today they all emphasize higher education, advanced technology, and scientific development.

In Nigeria, the role of higher education is in the process of scientific growth where much of the scientific infrastructure is in the universities. Universities provide training for scientists and stand at the Centre of research. Higher education is also regarded as knowledge production in the field of Information Communication Technology (ICT), agriculture, mining, commerce, to mention a few in building a nation. There are technology transfers and innovations from higher education to local firms. This is to say that technological capabilities are the result of these transfer processes. In this regard, special attention has been paid to the role of higher education to provide a crop of qualified human capital as well as research that is relevant to the local industries. This means that the knowledge produced at the higher educational institutions is highly advanced to be applicable in industrial innovations.

Etzkowitz and Leydesdorff (2000) and Jacob (2006) agreed that there are interactions between the university and industry. Mowery and Sampat (2005) also underline assumptions that there are linkages that need to be strengthened and supported if scientific knowledge is to be used for innovations. They again stated that universities could supply crucial expertise to the industry in the form of scientific and technological knowledge, human capital, specific skills, prototypes for new products and processes, as well as a network of scientific and technological capabilities.

Technology can be defined as technical information that is codified and accessible through a written report, for example, documents which are associated with hardware production. Stewart (1977) defined technology as all skills, knowledge, and producers required for making, using, and doing useful things.

Chen (1996) stated that technology transfer is not just acquiring knowledge in production, but also a building of the nation's technological capability. Similarly, Autio and Laamanen in Ankras (2007) stated that technology includes the ability to recognize technical problems, the ability to develop new concepts and tangible

solutions to technical difficulties, the ideas and tangibles designed to solve technical issues, and the ability to exploit the concepts and tangibles effectively.

Technological Capabilities in Agriculture

Higher Education in Nigeria is positioned to delve deeply into research and development to address food insecurity. For example, genetic modification, methods for improving soil fertility and irrigation technologies can increase food availability post-harvest, and agro-processing technologies can address food accessibility, bio-fortification can make food more nutritious. The goal 6 of Sustainable Development Goals (SDGs) in ensuring “Zero Hunger” by 2030 can be achieved if the research departments play their role diligently.

FAO (2016) indicated that food security exists when all people, all times, have physical, social, and economic access to sufficient, safe and nutritious food which meets their dietary and healthy life.

Technological Knowledge Creation for Industrial Innovation

Industrialization in Nigeria is an activity aimed at freeing the nation from underdevelopment and economic dependence. Higher education institutions in Nigeria stand a chance to be able to train, research and focus on the policy, which will intervene in science and technology to transform the nation’s economy since the nation has abundant resources. The application of scientific knowledge will bring about an exchange of knowledge among the nation’s scientists and technologists. Technology which is considered as ability and capability to create and use knowledge is given a pride of place in many advanced countries and such nations are technologically advanced.

Hughes (2007) had identified four modalities of university-industry links. They include training either through regular courses or through the specialized course which produce adequately qualified human capital for industry basic research which becomes accessible without a transaction to society; problem-solving which can be through technical assistance or advisory services aimed at addressing the specific needs of businesses and what he has termed the public space function of universities.

There is a rapid technological change and increase in competition in the production and sale of services and goods, which led the industries to have mechanisms of knowledge acquisition into outsourcing research and development activities in the nation’s higher institutions.

Economic Roles of Higher Education

The economic role of higher education provides skills and techniques which are required to improve competencies. Higher education provides the necessary human resources to meet the commercial needs of society. This contributes to social resource development. Investment in higher education is a crucial contributor to economic growth.

Uche (2013) observed that investing in education at any level in any country is cost-intensive especially in developing nations, investing in higher education is more demanding because it is seen as a base for knowledge production, high-level human capacity building for globally competitive research, innovation, development, and production of well-prepared personnel to fill the labour market. Nations have also realized that the economic success of the states is directly determined by the quality of their higher education system, and the most effective factor of production is human capital. Higher education is an essential contributor to technological capability to technical change in the industry.

Ajienka in Osaat and Uche (2018) stated that human capital is expressed in the knowledge, skills, creative abilities, and moral qualities of individuals in society. Higher education is always concerned with knowledge based economy, knowledge-driven society and information, and communication technologies.

Higher education also plays a vital role in the economic development of any nation and Nigeria cannot be left out as the nation needs professionals across all sectors; doctors, teachers, and engineers who are vital to the success of the nation’s future. Another role higher education plays is creating a quality workforce. This is to say that higher education allows a person to succeed in today’s global economy. Programmes in the higher education institutions help the students to stay and progress in the labour market for long. It will also help the students to keep pace with changes in the global economy and innovation process. Uche (2013) stated that there is widespread recognition that tertiary education is a major driver of economic competitiveness in a developing knowledge-driven global economy.

As economies move up the technology ladder and the gap between some of them and leading industrial economies narrow, their need for education and skill level grow, particularly at the higher education or tertiary level. This means that the tertiary institutions take on more extensive responsibilities and they can help accelerate industrial change. This is because they are the source of an increasing share of entrepreneurs, managers, and skilled workers.

Additionally, a few research universities contribute to innovation through basic and applied research that generates ideas and technology transfer. Higher education has much evidence of the economic benefits when individuals attain higher education, and there is a likelihood that the individual will be employed, and they are less likely to experience poverty than an individual without higher education.

Research and Development Roles of Higher Education

One of the most critical roles higher education plays in society is in the research the institutions carry out, apart from teaching to advance learning and disseminate new knowledge. The research is usually conducted within global priority areas which will contribute to social outcomes such as health and social engagement. It is also aimed at designing technologies that result in new products and the supply of advanced technology for use.

Countries such as Russia, China, Japan, and Sweden are putting knowledge at the services of their societies to create a better world. This can be achieved in Nigeria through the training of first-class minds, through significant advances in science and technology in the higher institutions. It is, therefore, for the institution to maintain a proactive stance, strengthen its position as a bedrock upon which the nation builds a new road to growth.

It is important to note that research in higher education expands the knowledge base in providing direct service to society, thus to government, industry, agriculture, and a variety of special interests.

Universities and other higher education institutions in Nigeria can solicit research contracts with government agencies and also the private sector for pure and applied research. It is also imperative for the academic institutions to have entered into long term agreements with industrial firms to provide funding for university-based research. Similarly, to deliver research that can enhance innovation and productivity, higher education has a role to play in research and has strong links with firms and other research providers. The international experience in developing high technology industry suggests that universities can play a diverse set of roles.

Providing generic science and engineering graduates. Thus, in some cases, the high tech industry evolved on the back of science and engineering graduates who were not necessarily trained in a specialization relevant to the industry. In Japan, where companies took a large number of graduates with the view of educating them on the job, universities were expected to provide generic science and engineering skills.

Another role that higher education plays in research and development is relevant education in emerging technical fields. In this case, the institutions and countries were quick to offer new areas or skills relevant to industrial needs than others.

Besides, higher education which is the centre of research, relevant advanced research training is given to master's and doctoral degree students which may provide knowledge-intensive and of the high-tech industry. Moore and Davis (2004) affirmed that some American universities were capable of producing relevant research training which was deemed critical for the evolution of Silicon Valley. Martin (2007) stated that Chinese universities appear to have developed the capacity for application-oriented research, which helps localization of technologies, with an increasing emphasis on fundamental research.

Universities are expected to play their roles when it comes to research to disseminate knowledge. In Korea and India, the presence of public research institutes may have inhibited universities from developing significant application-oriented research capacity.

Social Roles of Higher Education

Apart from economic, research, and development roles played by higher education institutions, they also play a social purpose. Hofstede in Osaat and Uche (2018) rightly pointed out some social roles higher education plays. They are as follows;

- The inculcation of the right type of values and ideologies for personal development
- Equip individuals with social skills needed to fit neatly into one's immediate society.
- Acculturation and continuous exposure to outside influence from which one can intelligently borrow to expand the horizon provided by one's immediate society.
- Development of productive traits and progressively improving on the capacity to imbibe attitudes, values, and other behavioural qualities that facilitate one's relationship with fellow human beings.
- An improvement in our social interaction process, thereby making the world a global village.

In modern society, science, economics, and politics go hand-in-hand. Any social change or development inevitably makes itself felt in all these three areas. Today a large proportion of the young generation is enrolled in higher education. Universities have become mass institutions in modern societies, and they have a social function in fostering the intellectual and social development of society. This social development has come because life in a contemporary society increasingly demands specialized knowledge to improve and maintain living conditions, improve the organization of modern societies, and cope with the

growing complexity of work processes. This means that the work processes have become dependent on scientific and technical developments. More academically qualified young people with specialized knowledge are therefore needed to cope with the work.

Furthermore, higher education institutions are the right settings for individuals to socialize with peers. An individual with higher education tends to have a higher standard of living and better well-being. These individuals are less likely to indulge in criminal activities and other social vices. The children of parents who have obtained higher education with higher education themselves are more exposed to reading, have higher cognitive skills and better able to concentrate. Notwithstanding, higher education plays the intellectual capabilities role for the individuals to understand and appreciate their local and external environment.

Challenges Affecting the Role of Higher Education in Building Endogenous Technological Capabilities

From a global perspective, economic, research, social and intellectual development are increasingly driving the advancement and application of knowledge. Higher education is particularly fundamental to the construction of a knowledge economy, to develop human resources, teaching, research, community service, and disseminate necessary knowledge that is needed in industry and other sectors.

Also, individuals acquire the capacity to make decisions and act effectively. Higher education plays enormous roles in building technological capabilities but cannot be devoid of challenges. Considering the capabilities in higher education in Nigeria, there is very little investment in research, science, and technology development. This hinders the production of goods and services that can be realized through higher-education.

Coordination and implementation of changes in higher education is lacking at all levels of the institutions changes which should improve the management of resources to improve internal democracy.

There is a lack of adequate financing for higher education. The advancement of knowledge through research is an essential function of higher education in order to promote innovation and inter-disciplinarity, but then, financing research is far reaching in such a way that many types of research are left without reinforcing in the programs to support cultural and technological needs of the society.

Furthermore, staff development is insufficient. The activities which empower the staff to transform curricula and pedagogy toward the building of technological capabilities are minimal in Nigeria. Many Nigerians in the diaspora who are experts in research and other disciplines could not be encouraged to return home and be engaged in research. Salami (2012) showed that engaging those in the diaspora through the “brain circulation process” was practiced in South Korea, and it yielded an excellent result. In the same vein, Akaranta (2014) and Ohigbenga (2014) stated that engaging renowned Nigerians abroad in the brain circulation process had worked efficiently to improvement in delivery in both teaching and research at the University of Port Harcourt and University of Ilorin.

The development of human resources for the delivery of effective education is very critical. These are human resource needs for administration, management, research, and teaching as well as support for technical staff. In sufficient number of well-trained human resources is a problem in almost every area of higher education. There is an urgent need for capacity building in various commission charged with responsibility for governing and managing, planning, supervision, and monitoring mechanisms for the entire education system have been very weak. Management problems within the system have impacted negatively on the success of the system.

Data on higher education system have not been collected promptly or processed in a way that is adequate for planning. The system, however, suffered from insufficient preparation for the implementation of policies that are vital to improving quality and expansion.

State-of-Art of Roles of Higher Education in Building Endogenous Technological Capabilities in Nigeria

Today, there is a genuine threat that higher education can be dictated to by political decision making most especially those who control funding. It is, therefore, imperative that funds should be made available in higher educational institutions to enable a bright and healthy balance between the quality and social needs of these higher institutions to improve the society.

As academic institutions, knowledge is the real basis, its production via research; its transmission via teaching and its acquisition which is being used by students should remain the prime objectives of these institutions. The quality of the institution should be well maintained in such a way that the sciences and researches can be advanced, leading to the rapid growth of technological and economic society. As a new decade begins, Nigerian higher institutions need to import critical technologies and develop giant industries, notably in agriculture, mining, environment, electronics and other areas.

A well-balanced education system has played a critical role in this process, along with an early emphasis on engineering education; however, little reference is made to the part of higher education in the transition. Korean electronics companies made it during the 1980s to high technological fields such as computers and semiconductors (Kim, 1993).

When Korea has been observed strictly, the government invested in research, graduate education and university-industry relationships were also recognized. This boost the nation's capabilities to build their endogenous technology. It is therefore left to the governments in Africa especially Nigeria "the giant of Africa" to understand this university-industry relationship.

II. CONCLUSION

Universities play a crucial role in socio-economic transformation and development of the nation through; innovation of new technology, upgrading the existing low-level technology to medium or high technology, devising better or unique and effective management techniques and formulating and suggesting economic and other relevant policies.

III. RECOMMENDATION

1. Universities need to train a new generation of technical and technological experts and build strong links to enhance innovation for competitiveness.
2. The institutions also need to reinvent their curricula to reflect problems in the economy.
3. Furthermore, the universities need to upgrade the capacity of their researchers to give them a competitive edge over researchers in other sectors. This will help get managers for Centers of technology and innovation.
4. Again, the member of research and development scientists need their knowledge to be updated such that it can reflect in the midlevel of professional technical workers.
5. There is the need to which the academics undertake a joint research consultancy or contract work with industry to help address various technological problems. This interaction with industry allows academics to learn about industrial needs, but the relationships inform them equally about what is relevant.
6. Universities can play a less direct yet essential economic role by setting forth the social, cultural and intellectual tone of a local area.

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