

**Conceptualising the Roles of University-Industry-Government Interactions for
Knowledge-Based Economy in Nigeria**

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Abstract

This paper problematises the over dependency on the oil sector in Nigeria by pointing to the need to consider the alternative perspective of building the economy of the country. For the past two decades, the country has been operating a mono commodity-based economy with about 90% of revenues from the oil sector. To counter this over-dependence, Nigeria launched Vision 20:20 which is a long-term intent to launch Nigeria onto a path of social and economic progress and fast-track the development of an economically prosperous Nigeria. This study seeks to advocate for a paradigm shift from a mono-sectoral dependence to a knowledge-based economy, exploring the roles of Universities-Industries in Nigeria. The study aims to investigate the factors that influence the interaction, the motivations for and the factors that impede the interaction. To study this University-Industry interaction, the conventional National Innovation System Model was adopted to develop a conceptual framework through which the dynamics of the interaction will be examined, and the impediments to the interaction will be identified. The conceptual model was piloted through semi-structured interviews with participants drawn from the academia and the industry that engage in technological development in Nigeria. Initial findings from the pilot study give a clear indication of the weak University-Industry interaction in Nigeria.

***Keyword---** Industry, Innovation, Knowledge economy, University*

Introduction

Nigeria is the most populous African Nation with an estimated population of 186 million. Before the discovery of oil in 1956, Agriculture was the mainstay of the economy, however, after the oil discovery; there was a neglect of agriculture and other sectors which hitherto made tremendous contributions to the economy. The past two decades have witnessed Nigeria operating a mono commodity-based economy with about 90% of revenues coming from the oil sector. To counter this over-dependence, Nigeria launched Vision 20:20 which is an articulation of a long-term intent to launch Nigeria onto a path of social and economic progress and fast-track the development of an economically prosperous Nigeria

This study seeks to advocate for a paradigm shift from a mono-sectoral dependence to a knowledge-based economy, exploring the roles of the interaction between Universities–Industries-Government in Nigeria. A knowledge-based economy is now considered important because wealth creation through the application of human creativity is increasingly outpacing natural resource extraction (Powell and Snellman, 2004). Information and knowledge are now seen as the primary and the most productive source of wealth creation and employment generation (Veselá and Klimová, 2014). Therefore, for Nigeria to realise its dream of joining the league of the top 20 economies by the year 20:20 and beyond, it needs to urgently leapfrog into the global trend and make a transition to a knowledge-based economy.

The roles of the trilateral interaction of University-Industry and Government, therefore, is to commercialise the scientific breakthroughs, innovation and technological achievement into commercial success (Bercovitz and Feldman, 2006; Filippetti and Savona, 2017; Archibugi and Filippetti, 2017). Examining the trilateral interactions is significant in the context of Nigeria to investigate the factors that influence the trilateral relations, the motivations for and the factors that impede the interaction. To study the trilateral relations of the University-Industry-Government interaction, the conventional National Innovation System Framework was adopted to develop the conceptual framework through which a transition for Triple Helix will be identified. The conceptual model was piloted through semi-structured interviews with participants drawn from the academia and industry that engage in technological development in Nigeria.

The paper is structured as follows. First, a literature review of theoretical perspective is conducted to understand the theory of natural resource curse, followed by the knowledge-based economy and innovation systems. A conceptual framework is then proposed in this section which illustrates the University-Industry linkages to foster knowledge-based economy. In the third section, initial findings from the pilot study are presented based on the field trip to Nigeria in 2016. The purpose of the pilot study is to illustrate the recognition, identification, and limitation of the conceptual model while mapping out limitations and refinements arising out of the process for the second fieldwork.

Theoretical models of resource curse, knowledge-based economy, and innovation

A natural resource is linked to economic growth and development retardation that it is regarded as resource curse rather than a blessing (Mikesell, 1997). The theory was coined to explain the paradoxical situation where the possession of natural resources like oil, natural gas and

other mineral deposits does not lead to prosperity. Several African nations such as Angola, Nigeria, Sudan, and the Congo are rich in oil, diamonds, or other minerals, and yet the record of their economic growth has been abysmal. (Frankel, 2010). This theory recently attracted many scholarly debates and raised many important questions (Gelb, 1988; Auty, 1994; Sachs et al., 1995; Sachs and Warner, 1997; Mikesell, 1997). Sachs et al. (1995) described it as a ‘conceptual puzzle’ and ‘oddity’, which is the adverse relationship between natural resource abundance and economic growth. Consistent with the findings of Sachs and Warner, (2001) Leite and Weidman, (1999) also extended the discussion on the causes, effects, and solutions to the resource curse phenomenon. The approach was based on structural, economic, institutional, and political economy alternatives.

The literature on the knowledge-based economy appears to be vague, but various attempts have been made by scholars to provide a comprehensive definition. Mayer (1996) define knowledge-based economy as the economies which are directly based on the production, distribution, and use of knowledge and information. Another definition by joint publication between the World Bank and OECD defined knowledge-based economy like the one which encourages its organisations and people to acquire, create, disseminate and use knowledge more effectively for greater economic and social development (Radošević and Reid, 2006). The World Bank is one of the strongest drivers of knowledge economy initiatives through its many determinations in various sectors like education, and its online Knowledge Assessment Methodology which is a means through which nations gauge their strength and weaknesses in transiting to the knowledge-based economy via Knowledge Methodology Index. World Bank has provided the most comprehensive definition widely used and cited by scholars and commentators in various fields. The definitions encompass four pillars: Education and Skills; Economic and Institutional regime; Information and Communication Infrastructure; and National Innovation Systems.

The literature on National Innovation System is a diverse one (Peters, 2006). Hence, Lundvall (1992 p 2.) described the situation as an ‘anything that is not chaos’. Freeman (1987) defined National System of Innovation as the network of institutions in the public and private sectors, whose activities and interactions initiate, import, modify and diffuse new technologies. Nelson (1993) also defines it as a set of institutions whose interactions determine the innovative performance of national firms. Lundvall, (1992 p2), described it the ‘‘elements and relationships which interact in the production, diffusion, and use of new, and economically useful, knowledge and are either found within or rooted inside the borders of a nation-state’’.

According to Oslo Manual (2005 p.46), innovation is “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations” This definition has four elements. First, Product innovation: goods or services that are new or properly enhanced. This includes significant enhancement in the technical products, improvements in technical specifications, components and materials, incorporated software, user-friendliness or other functional characteristics. Second, Process innovation: new or meaningfully improved manufacture or distribution means. This includes significant changes in techniques, equipment and software. Third, Marketing innovation: new methods of marketing with improved changes in product design or packaging, product placement, product promotion or pricing. Fourth, Organisational innovation: this involves presenting fresh organisational methods in the business practices, workplace organisation or external relations (Smith, 2005).

Nigerian University system; a brief background

The Nigerian university system has gone through a historical evolution from independence in the 1960s till date. Initially, the Nigerian university system was administered based on the colonial influence (Nwagwu, 2008). During the 1970s and 1980s, the university system went through yet another intensive change in structures and the institutional setup. The first major change relates to the institutional and structural configurations of the universities which were inherited from the British colonial government. The process of nationalisation of the universities redefined the administrative structures and roles based on the indigenous realities in the country. However, the universities were mainly concerned with basic research like surveys, data collections and executing the script of the British colonial masters (Nwagwu, 2008).

According to Gaillard (1992), most African universities during the 1980s went through a radical transformation which led to the rise of student enrolment, creation of more departments and increased demand for access to higher education. Subsequently, the number of Nigerian universities grew rapidly from 45 in 2000 to 132 in 2004 and 155 in 2017 (Adetunji 2015). Universities are owned either by the federal government, state government or private individual/organisation. There are 40 federal universities, 46 state universities and 69 private universities in Nigeria (NUC 2017). This rapid growth of the Nigerian universities was realised through the Federal Government of Nigeria (FGN) privatisation policy of 1991, which was a policy approach to complement the federal universities with state and privately-owned universities. The

Nigerian universities are regulated and supervised by the Nigerian Universities Commission (Akinsanya, 2009).

Nigerian Industrial sector, a brief background

At independence in 1960, agriculture was the backbone of the Nigerian economy providing employment opportunities and contributing to government's revenue and foreign exchange earnings. After the discovery of oil and beginning of exportation in commercial quantities, the prosperities of agriculture gradually reduced. Oil became the main source of income and export earnings. Despite the drive for industrial development in Nigeria dating back to the early 1960s with the first National Development Plan from 1962-68, the ambition was yet to materialise, with the country experiencing a plethora of economic challenges (Okejiri, 2000).

The second Development Plan 1970 to 1974 saw a policy change from private to public sector-led industrialisation. Industrial planning took place in the public-sector, the government was the major investor into the productive activities because of the paucity of funds and lack of technical knowledge in the industry to manage their enterprises successfully. In the third National Development Plan, (1975-80), the government continued to invest and lead the industries, industries mostly invested in the light, low technology sector which was heavily dependent on imported machinery and raw materials. According to Okejiri, (2000) the past National development Plans were based on post-civil war reconstruction and infrastructural development, but no emphasis on scientific and technological development was stressed.

The fourth National Development Plan (1981-85) concurred with the global economic meltdown which led to falling foreign revenue earnings. Consequently, this development affected the import-reliant manufacturing sector. After that, the government adopted Structural Adjustment Programme (SAP) in 1986, to substitute the failed development plans and address weaknesses of earlier development plans. The SAP policy emphasised and encouraged non-oil exports, private sector-led industrialisation, privatisation, and commercialisation of state-owned enterprises, encouraged the development of indigenous technology. Consequently, Nigerian government formulated National Science and Technology (S&T) policy and launched in 1986 to promote research and development to encourage innovation, translate research into products, attract market and promote competitiveness.

Since the transition to democracy in 1999, many other policy initiatives have also been introduced to promote industrialisation in Nigeria. Some of the strategies include National Economic

Empowerment and Development Strategy (NEEDS) 1999-2007, 7-Point Agenda, 2007-2011, Transformation Agenda 2011-2015. Etc.

The NEEDS framework considered Science Technology and Innovation (STI) as one of the drivers of economic development and diversification strategy. Similarly, Vision 20: 2020 ponders the essentials of STI in critical sectors of the economy. Those sectors include biotechnology, nanotechnology, renewable energy, ventures capital, space research, small- and medium-scale industry targeted research, knowledge-intensive new and advanced materials, STI information management, information and communication technology; intellectual property rights etc. (Chete et al., 2014). Currently, the Nigerian industry is made up of diverse activities as indicated in figure 1 below.

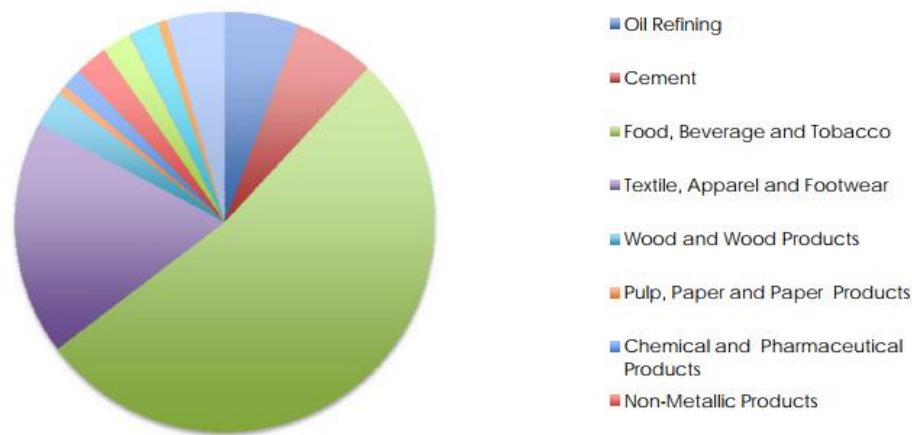


Figure 1 Nigerian Industries Source: NBC (2014)

Conceptualising the University-Industry-Government interaction

To understand how University-Industry interact with the country's economy, it important to think of the interaction from economic, social, and technical perspective. Since the 1990s, the interconnectedness and interdependence of actors building National Innovation System have become prominent (Arora and Gambardella, 1990; Lundvall, 1992; Nelson, 1993; Tether and Tajar, 2008). The relationship between firms, research organisations and universities stimulate the creation of innovative products and expose all organisations to noble sources of knowledge and technology (Arora and Gambardella, 1990; Ankrah et al., 2013). Santoro (2002) points out four inter-related channels of communication between the actors of this interaction: which are technology transfer, knowledge transfer, collaborative research and research support.

The conceptual framework in Figure 2 used for the pre-pilot study was initially developed based on the National Innovation System model to examine the types of interaction, channels of the interaction and the output of such interaction. Knowing the types of interaction and the channels of the communication will give an idea of the intensity of network and knowledge flows between university and industry. It will also help in identifying the success of knowledge transfer and industrial innovation and commercialisation process.

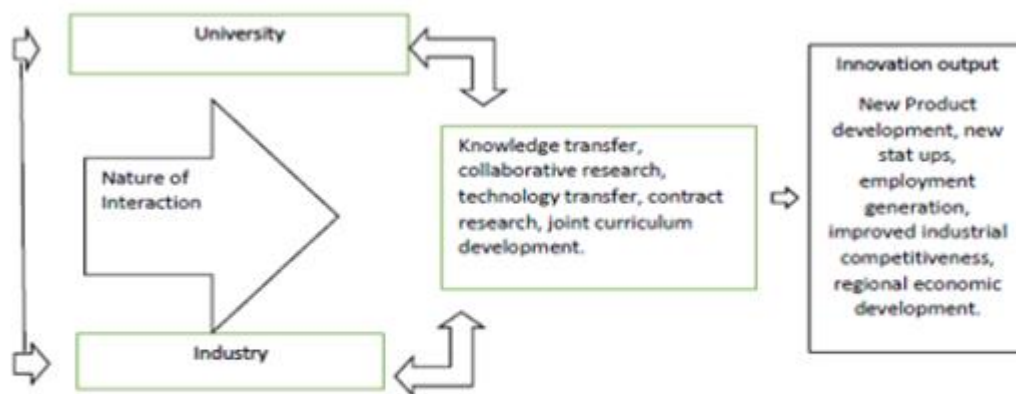


Figure 2 conceptual framework.
Source: Authors

After the pilot study, the pilot conceptual framework was refined to integrate the relevant government agencies into the study. To understand this relationship further, Triple Helix Model was developed by Etzkowitz and Leydesdorff (1995), as depicted in Figure 3 below. Ranga and Etzkowitz, (2013 p.6), describe the model, 'as the set of (a) components, (the institutional spheres of University, Industry and Government, with a wide array of actors; (b) relationships between components (collaboration and conflict moderation, collaborative leadership, substitution and networking); and (c) functions, described as processes taking place in what we label the 'Knowledge, Innovation, and Consensus Spaces'. The model presupposes that each institution takes the role of the other as a secondary duty while maintaining its core competence as a primary role (Etzkowitz, 2008; Etzkowitz, 2003). It helps in explaining the foundations of social, economic, and technological development in a nation. It can also develop approaches for the fluidity of knowledge flows – among enterprises, universities and research institutions (Mayer, 1996).

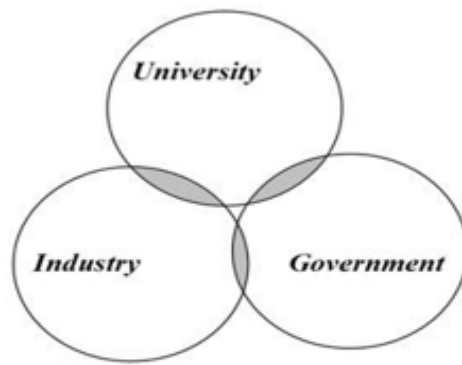


Figure 3 Triple Helix Model.
Source: Etzkowitz and Leidesdorff (2003)

The conceptual model also changed from National Innovation framework to Triple Helix Model. The Triple Helix framework is suitable because it integrates all the elements of the Innovation System Framework and assumes that university plays the leading role in knowledge creation (Etzkowitz, 2008). It is important to note, however, that Triple Helix Model underpins the study in the final data collection stage. Figure 4 depicts the amended framework.

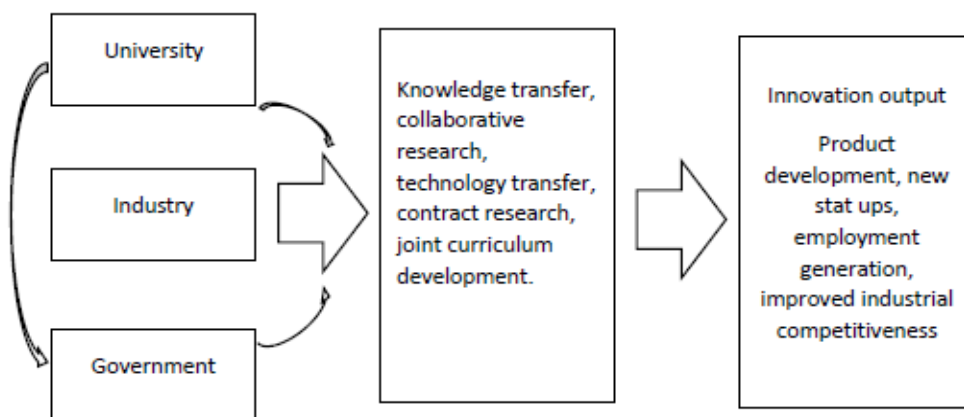


Figure 4: Amended Conceptual Framework
Source: Authors

Pilot Study Methodology

The main purpose of the pilot study was to test the feasibility and usefulness of the conceptual framework put forward in the earlier section. A set of 13 semi-structured questions were designed, based on the critical review of the literature, and focused on certain identifiable

variables based National Innovation System Framework. A separate set of questions was set for the university and industry participants. The pilot interviews were conducted with 5 participants, three from university, two from industry. The universities participants were selected based on the intensity of their university's research activities and the year of establishment. While the two participants from the industry were selected from the knowledge-intensive firms, precisely, entrepreneurs that are into software and hardware development. The pilot study was conducted from 9th to 25th September 2016. Each interview lasted between 45 minutes to 1 hour.

Preliminary analysis

The initial analysis of the pilot studies revealed that there is a low level of interaction between the university and industries. The evidence obtained from the university revealed that the cooperation between the universities and industries is very weak or does not exist at all in some cases. But there is an existing cordial relationship between universities and the government institutions. Based on this development that emerged, the researchers decided to broaden the focus of the research to include the relevant government institutions into the research for the final data collection. The pilot study also revealed that university has kept its traditional function of teaching and research, but remain weak to change its curriculums to become a more entrepreneurial university and make an economic impact on the development of the region and the country at large. On the other hand, evidence from the pilot analysis of the industry indicated that the industries have no confidence in the quality of research currently conducted in the Nigerian universities. This is not because of lack of competent faculty researchers that can execute research, but the universities lack cutting-edge technology and fully equipped laboratories to help the industries in their basic designs and manufacturing. The major inhibitors to the interaction also include;

Institutional differences: the results show that one of the major challenges which have created a wall between university-industry interactions is the institutional difference. The difference between the cultural orientation, mission, and aim between of the university and Industry is a major challenge. These fundamental differences have created an institutional conflict and tensions in relating to each other. These differences are deeply rooted in their institutional and functional variations; histories, believe and aims. (Bruneel, d'Este and Salter, 2010; Owen-Smith and Powell, 2001). The university creates knowledge through research and development to help the socio-economic well-being of the people and the immediate community. While in

the industry, profit maximisation drives the process of knowledge creation to enhance their competitiveness. Unlike the open science system in the university, knowledge and information's are restricted in the industry or disclosed in limited ways (Jain, George and Maltarich, 2009). Therefore, to achieve this shared aim might not be consistent with the core organisational mission Etkowitz (2008).

Other institutional differences identified by Nieminen and Kaukonen, (2001), is that universities ignore the market rules that guide the conduct of the industry and their commercialisation process. The university lacks market-oriented culture, and entrepreneurial intentions, which is a significant difference between the university and industry. Bruneel, d'Este and Salter (2010) suggest that the science systems operate outside the confines of the market transactions. In the university, faculty members compete on the bases of raising their status with their peers based on the number of publications record. The more they publish, the more they gain access to grants and it is on the bases of the winner takes it all. These internal university systems are not captured well by the market. These dynamics suggest that the science system operates outside the market transactions. Therefore, The industries find it difficult to relate, since their culture is market-oriented.

Trust: Trust is central to effective collaboration in inter-organisational relationships. Bstieler, Hemmert and Barczak, (2017 p.1) defined ‘‘Trust is a psychological state of willingness to be vulnerable based upon positive expectations of the intentions or behaviour of another party in uncertain situations’’. In today’s global knowledge-based economy; organisations create and share knowledge to derive competitive advantage. It has become necessary for organisations to ensure collaborative knowledge creation to compete and survive. However, knowledge sharing has proven to be difficult especially for firms because of the perceived knowledge protection in the firms. In knowledge management, electronic databases, networks and software are identified as a means of distribution of knowledge, but these mechanisms have been inefficient (Chow and Chan, 2008). More efforts have been developed to focus on social cognitive approaches to motivate behaviours that will help in promoting knowledge distribution including factors such as rewards, incentives and trust. Therefore, studies on the role of social relations of reciprocity and exchange of knowledge within institutions consider trust as a primary and fundamental mechanism in knowledge exchange and eliminating any associated risk (Bjerregaard, 2009). However, our analysis showed that inter-organisational collaboration faces a high level of uncertainty due to trust issues. Bstieler, Hemmert and

Barczak, (2017) notes that due to the cultural and institutional differences trust formation between university and industry is very difficult to develop. Scientific interest drives universities, incentivising academic performance without any regards to market strategies. Industries, on the other hand, delay publications of research output to scrutinise the potential for patents and create value. This development is a clash of interest that could lead to a breakdown of trust.

Lack of effective Communication: Communication is the transfer of meaning from one person to another. Communication is when information, ideas or concepts being communicated or conveyed between persons. Communication between individuals is not just face- to face contact or word contacts, but it also involves a variety of ways including emails, telephone conversation, voice mail, printed and written documents. It also includes non-verbal methods which may consist of symbols conveyed through body language and gestures. Effective communication between organisations or individuals whether representing the same organisation or different organisations is crucial in building a good rapport. Effective communication gap is one of the reasons why University-Industry interaction fails. (Santoro and Chakrabarti, 2002). The university community often develops their research activities and strategies without the involvement of the industry. University's disregard for the industrial input often results in teaching courses that have no relevance or value in the industry. That creates a gap regarding the industrial skills requirement and the university courses and the graduates. Without effective communication, and understanding, joint curriculum development, and collaborative research or commercialisation of research output cannot be executed.

Limitations of the study

The research had observed some limitations during the pilot study. The pilot study was conducted at a time when the university was conducting an election to fill in some vacant positions. The faculty members who were selected to participate in the pilot study were affected by the election activities. Some of them were preparing to hand over, while others were also preparing to take over. Gaining access to the participants after the elections and taking up positions within the university administrative hierarchy caused delays. The pilot was conducted on a smaller size of (5) participants. A larger sample would have generated richer results, and give an accurate description of the interactions between University-Industry interaction.

Conclusion and Further Work

This paper has presented the development process of the conceptual framework used for the pilot study and the preliminary results obtained to analyse the interaction between University-Industry. Changes from the initial study provide a useful guide for the refinement of the conceptual framework for the second phase of the research study. The study expects to give a policy recommendation for a stronger trilateral interaction of University-industry and Government which will pave the way for a smooth transition from a resource-based economy to knowledge-based economy. The research continues to complete the final refinement on the conceptual framework, findings from the second phase data collection, and analysis will inform policy recommendations.

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