African Journal of Inter/Multidisciplinary Studies 2023 | *5(1): 1-9* | *DOI: https://doi.org/10.51415/ajims.v5i1.1063*

RESEARCH ARTICLE:

Building Thriving Innovative Entrepreneurial Ecosystems in Higher Education Institutions (HEIs)

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Received: 30 January 2023 | **Revised:** 02 October 2023 | **Published:** 13 October 2023

Reviewing Editor: Dr. Grace Temiloluwa Agbede, Durban University of Technology

Abstract

Higher education institutions (HEIs) must adapt to the demands of the digital revolution and play a bigger part in the ecosystems and economics of innovation. HEIs and policymakers now need to reconsider how they should be creating entrepreneurial innovation systems to support a robust global economy and a better world. The objective of this article is to describe the socio-institutional and techno-economic innovation components of innovation systems. The development of a theoretical framework for constructing a healthy innovation ecosystem at HEIs will be guided by an analysis of the already available literature and practical responses to the issues. The methodology followed a systematic review approach that considered articles found within the google scholar website. According to the research cited in this article, HEIs must comprehend how innovation systems affect their innovation to conduct research, innovate, and commercialise. The ramifications of this research emphasise how crucial it is to forge connections between academic universities and commercial enterprises as part of formulating a roadmap for developing robust support systems for research, innovation, and commercialization.

Keywords: *higher education institutions (HEIs); innovation; entrepreneurship; support systems; research commercialisation*

Introduction

Three areas may be used to categorise the literature on innovation studies that pertain to the growth of technical advancements. As a starting point, Freeman (1987) created the National Innovation System or National Innovation Systems (NIS) approach to categorise innovation activities via a network of public and private sector entities. The theoretical underpinnings of other influential researchers, like Lundvall (1992), Nelson (1993), and Edquist's work on innovation processes and ecosystems, were then provided by Freeman (1987). The third and final solution looks at growth and underdevelopment challenges to widen NIS viewpoints. This strategy aims to close the gap between the difficulties of the innovation environment and economic growth by concentrating on the factors that determine the development of creative, learning, and capacity-building processes in the production process (Lundvall *et al*., 2002). According to Godin (2009), the NIS approach's two drawbacks are that it lacks substance and has no functional value, and that the idea could not be evaluated using the current qualitative and quantitative metrics. Godin (2009) contends that the NIS model, in comparison, does not provide much insight into the distribution of knowledge and instead places a heavy emphasis on national institutions and economic growth. To get over these restrictions, Castellacci and Natera (2015) defined six NIS dimensions that span the socio-institutional and techno-economic spheres. According to a study by Leisyte (2011), route dependencies help the process of research commercialization in several ways, particularly in terms of time and the kinds of policy instruments that influence institutional system circumstances. Therefore, at HEIs, entrepreneurial ecosystems may be developed within these six dimensions and their respective regions (Maresova *et al*., 2020).

There are organisations and entities in every NIS. To understand their role in a SI, it is necessary to explain them accurately. This may be challenging at times since they are often used as synonyms in everyday language and

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the vocabularies of certain institutional theorists (Edquist and Johnson, 1997). The contributions of North (1990) are cited by Soete *et al.* (2010) as a good place to start when defining the role of institutions and creating a cogent description. They are distinguished as participants and institutions by the term "Northian" (organizations). In his illustration, institutions provide the rules for the game that organisations play, and both have an equal and varying degree of influence on one another (North, 1990). North's suggestion to develop a taxonomy for classifying institutions and organisations in direct and suitable links to innovation systems based on their numerous characteristics is expanded upon by Edquist and Johnson (1997). Edquist and Johnson (1997) defined groups as formal entities with specific goals, such as enterprises, venture capital firms, universities, governmental agencies, and research and development facilities. These authors emphasise the existence of enterprises as a deviation from North's (1990) definition and argue that they are viewed as organisations similar to universities because of their significant contributions to the advancement of technology. Private and public organisations are distinguished by Edquist and Johnson (1997). Examples of private organisations include professional and scientific societies, business associations, and trade associations. "Those that design and implement technology policy; regulatory agencies; higher education and research; technology support institutions; standard-setting organisations; and patent offices" make up the bulk of public entities (Edquist and Johnson, 1997: 59). The authors further categorise organisations into three groups: knowledge distributors, knowledge regulators, and knowledge creators, such as universities and patent offices (for example, science parks). Institutions are a "collection of shared habits, routines, established processes, conventions, or laws that control the connections and interactions between persons and groups," according to Edquist and Johnson (1997: 46). Edquist and Johnson (1997) identify institutions as crucial elements in such interaction, something neither institutional theory nor innovation theory had done previously, continuing Lundvall's (1992) view of innovation as the result of interacting processes.

Organizations are simpler in their taxonomy than institutions, which need a thorough explanation. Both formal and informal institutions exist. Formal institutions include things like "laws, patent laws, government regulations of bank conduct, formal instructions for officials of a technological service system, regulations and instructions for electrical equipment installation," while informal institutions include things like "common law, customs, traditions, work norms, cooperation norms, conventions, practises" (Edquist; Johnson, 1997: 50). These authors think that this distinction is crucial since institutions differ substantially across countries. While codes and conventions make it easier to identify formal institutions, the behaviour of organisations and the people who work there sometimes need a closer look into informal institutions. The distinction between fundamental institutions, such as the constitution or ground rules, which "define basic rules in economic processes" like "property rights and rules for cooperation and conflict resolution in the labour market and in firms," and support institutions, which "define and specify certain aspects of the fundamental rules" like "restrictions on the use of private property in particular situations," is another significant one (Edquist and Johnson, 1997: 50). Finally, they distinguish between mandatory and/or policed institutions and more suggestive institutions, referring to the former as "hard institutions" (Edquist and Johnson, 1997). The fact that the authors do not focus as much on them as they do on the others suggests that the best way to identify them is via the cultural context at hand. They are comparable to the formal/informal distinction. According to Edquist and Johnson (1997), these institutional variations are a useful place to start to identify and define prospective institutional variants since they often overlap more accurately. Because they perform three crucial tasks—reducing uncertainty, settling conflicts, and generating incentives—institutions are crucial to innovation (Edquist and Johnson, 1997). Institutions play a crucial role in addressing uncertainty by providing the necessary information since uncertainty is an "unavoidable component" of every innovation process (Edquist and Johnson, 1997: 52). These authors, for instance, demonstrate how property rights and patent rules may serve to reduce uncertainty and provide some stability for individuals or organisations concerned about potential appropriation. Without institutional support, they believe it would be difficult to allocate resources, which would make innovation initiatives unusual due to their high-risk, no-warranty character.

The methodology employed in this article involved an extensive review and analysis of relevant literature to derive its findings. To ensure comprehensive coverage, a systematic approach was adopted to search and select appropriate scholarly sources from reputable databases, academic journals, books, and other credible publications and this focused majorly on google scholar. The inclusion criteria were carefully defined to focus on works that directly addressed the research question and provided empirical evidence or theoretical insights. The gathered literature was then critically examined and synthesized to identify patterns, trends, and gaps in the existing knowledge. The integration of diverse perspectives and methodologies from various studies enabled the article to present a robust and evidence-based account of the subject matter.

The Role of Higher Education Institutions in Innovation Ecosystems

The strength of public research and higher education institutions (Mazzoleni and Nelson, 2007), industrial clusters (Furman *et al*., 2002; Sun *et al*., 2020), and RandD expenditures and human capital in RandD are among the factors that research on innovative technology development at the national level has identified as explaining the level of innovative output produced by various countries. When Uppsala University, like many other Swedish HEIs, was only beginning to build its innovation infrastructure, the PET Centre was being marketed. The Uppsala University-connected innovation support infrastructure now comprises of an innovation office providing patent counselling, a holding company for pre-seed and seed investments, and a standalone business incubator. In response to a Swedish government initiative, this design was created in part. In Sweden, a number of legislations passed by the government starting in the 1990s indicate the desire to deepen ties between academia and society. HEIs must pursue a "Third Mission" in addition to doing research and teaching classes. Because of this, it is their responsibility to interact with the general public, educate them about their activities, and work to create strategies that will guarantee that the results of academic research are beneficial to society (Swedish Government, 2014). In other words, academic science must be beneficial. Although the idea of making science useful is complicated, one thing is certain: HEIs should not limit their economic and social contributions to the work done by faculty members and the knowledge shared by university graduates who enter the workforce. Therefore, it is expected that the utility of academic research will be shown in the research topics selected, not least by its company to directly contribute to the creation of economic value through activities like contract research, academic-industry collaborations, patenting, licencing, and the creation of spinoff companies.

In order to encourage company level innovation in the Ghanaian environment, Amankwah-Amoah (2016) suggests an efficient design of governmental policy and resource allocation. What is also evident is the seeming lack of confidence and trust between the business and academic sectors (Adler and Kwon, 2000; Hitt *et al*., 2002). Of course, these challenges are lessened to a larger degree in developed nations, and as a result, the relationship between universities and industry is much improved and incredibly fruitful in many sectors (Mothe and Quelin, 2000; Etzkowitz, 2002). Considering these factors, the goal of this research is to make the case for an adequate framework for the use of developing nations, particularly those in the West African sub-region, in studies of the interactions between academia and industry. Furthermore, higher education must reform, modernise, and completely collaborate with business to successfully fulfil industry demands, boost its influence on the innovation process, and, ultimately, spur industrial growth. This is especially true for universities in developing nations (Fu *et al*., 2014, OECD, 2013). Unfortunately, this is not something that happens often in developing economies in general. Universities in poor nations are obsessed with their own internal, urgent challenges including teaching, peer-reviewed publications, staff, growth, student numbers, and funding (Cloete *et al*., 2011; IMF, 2006). For their part, industries are worried about their own issues, such a lack of enough markets and infrastructure. These crucial knowledge players in the developing world may not yet fully understand the complexity of innovation, and rigid institutional boundaries preclude an interdisciplinary approach to solving systemic issues (Mwamadzingo, 1996). Academics and businesspeople alike continue to undervalue how much they might learn from one another in a collaborative environment for knowledge necessary for everyone's welfare (Frazer, 2005; Fu *et al*., 2015).

Through their research and teaching, universities have long been a source of knowledge, but they have had minimal interaction with the general public. Today, it is evident that national development agendas in industrialised countries are closely related to the work that universities and other educational institutions do (Mowery and Sampat, 2005b). Knowledge creation has also evolved, moving from mode one (a Newtonian concept of knowledge production) to the mode two model of innovation (which is transdisciplinary). The creation of knowledge has advanced to the point where many people now contribute significantly to society as a whole. As a result, universities now must take the initiative, articulate how they directly benefit society, look for other sources of income, and effectively fulfil their new duties. Universities cannot continue to be "ivory towers," generating research discoveries with little direct benefit to the public that supports them. This convergence of variables offers a serious challenge to higher education and the research process at universities (Mowery and Sampat, 2005b). In fact, the challenges posed by globalisation have compelled institutions of higher learning to adapt to the growing needs of the information society, forcing a change in thinking from universities' original mission to include closer linkages to industry and governments (Subotzky, 1999; Cerver Romero *et al*., 2021). With this change, universities are forced to expand outside their conventional bounds to meet social needs and transform into entrepreneurial organisations with a duty to the general public.

The institutions and governments in underdeveloped countries are unable to grow in accordance with this new paradigm. Although they are unable to wait, developing nations have embraced this trend in science and technology and are asking universities and business to work together in a network of relevant players to play the new roles and take proactive steps to accomplish desired outcomes. Saad *et al*. (2011) assert that the 'new purpose' of higher education has altered the role of universities in the growth of the national economy and has given people a voice in how research outcomes should influence their lives or how innovation should be handled. This is also supported by Sorenson and Fleming (2004), who contend that companies that actively engage in science and innovation are better for society and the economy as a whole. They also draw the conclusion that people working for such networks of talented actors are free to conduct research, produce new ideas, and share knowledge with anyone, including competitors. A generic model for low-income countries will provide a platform for businesses in all sectors and the majority of small-scale enterprises to engage with universities for knowledge and innovation. Regrettably, the triple helix principle and other models, such as the open innovation framework, are viewed as borrowed concepts that do not yet fit well into the underdeveloped innovation systems of developing economies.

A lack of institutional flexibility within university research and knowledge transfer processes in less developed countries, according to Singer and Peterka (2010), significantly impedes university relationships with enterprises. In many nations, resistance to change and novel ideas has also been a formidable obstacle to innovation (Cloete *et al*., 2011, Mensah, 2011). Additionally, governments may develop public policy which integrates the "triple helix" notion and formalizes the relationship. It is within this context that the appropriate execution of the "triple helix" may overcome conventional hurdles to innovation, and it does not need a pre-existing cluster of entrepreneurial enterprises and academic knowledge to produce tangible advantages (Coussi *et al*., 2018). Furthermore, local governance players, including governments, universities, and businesses, have collaboratively reduced these obstacles. Specifically, they participated in a multifaceted approach consisting of: (1) establishing exchange relationships with Korean partners at the government, company, and university levels; (2) establishing multi-local firm–university links; and (3) aligning these links with career routes (Manning and Richter, 2023). By linking degree and exchange programmes to internships and entry-level positions, these alignments helped recruit and retain talent. The findings illustrate how peripheral areas might learn to minimise their disadvantages in upgrading by using transnational infrastructures that increase their potential to attract people and business investments (Manning and Richter, 2023).

The following section discusses the formal and informal modes of contact that are considered crucial in innovation performance as part of a better understanding of university-industry linkages.

Innovation Performance and the Nexus between University-Industry

In their book *Universities in the Global Knowledge Economy: A Triple Helix of University-Industry-Government Relations*, Etzkowitz and Leydesdorff (1997) proposed the triple helix concept, which sees interactions between universities, industry, and government as a breeding ground for future discoveries. New knowledge is generated by universities, while manufacturing and contractual relationship management are overseen by industry. Contrarily, the triple helix model postulates that both internal changes inside each of the helices and changes in the connections between them have occurred. In the knowledge-based society, universities have expanded and strengthened their responsibilities as entrepreneurs and proponents of innovation alongside industry and government. Both industry and government are undergoing a similar change. The helixes interact with one another, and in the next stage, new varieties of trilateral networks and organisations will form because of the interaction between the helixes (Etzkowitz, 2003; Etzkowitz, 2016).

The Community Innovation System (CIS) is another point of connection which is defined by Muchie and Baskaran (2009) as a system's capacity to mobilise and use resources, organise knowledge and human capital training, deploy institutions, deploy incentives and regulations, and conduct preferred experiments on activities and functions conducted by citizens at the grassroots and local communities. This CIS is intended to function as a director of attention to local innovation. Similar to this, the university-led CIS explains how the university participates in the CIS, how it directs the processes that result in a responsive CIS, and how it collaborates with local community activists. This has to do with how societies and their institutions respond to and adapt the novel issues they face. In order to address the local communities' needs for innovation and challenges, Doh (2012) claims that the CIS functions inside a NIS on a smaller geographic scale than the regional innovation system. This point of view contends that the CIS provides a strategy and framework for enhancing the effectiveness and adaptability of

national and regional innovation systems. Innovation may take many different forms, including altering a current product or developing something entirely new. A system for innovation is essentially a group of parts that work together to produce, share, and use fresh knowledge that is economically beneficial (Lundvall, 1992). Most literature on innovation systems has incorrectly labelled them as science-based technology systems. These presumptions cast doubt on a variety of innovation theories, especially those that relate to developing countries, where most innovation occurs in grassroots communities and whose economies are mostly informal. Innovation may also refer to the use of technology and expertise; it is not limited to innovation that is "new to the world."

In the larger framework of the innovation system, which is focused on company operations and people's abilities and skills rather than necessarily in terms of RandD, high tech, and science-based industries, it is crucial to emphasise the NIS Scholars Initiative as crucial for developing countries (Lundvall *et al*. 2002). However, it may be shown that this broad approach has no end to its constraints and that it is difficult to pinpoint the elements and forces behind innovation. The university has no place in the broad strategy. The triple helix is suggested by Doh (2012) as a starting point for creating a CIS since it is easier to understand and includes a leadership role for institutions. The personalities of the three characters in the triple helix vary. Doh (2012) argues that CIS led by universities are necessary to improve local innovation systems. Regional innovation systems are still under development, are poor, and seldom constitute a substantial role for the institution (Netshiluvhi and Galada, 2012), with South Africa seeming to be a pioneer in the innovation system approach to development in Africa. In much of Africa, the concept of the CIS is already taking shape, although it is still quite informal and lacks national importance (Netshiluvhi and Galada, 2012). The NIS's relationship to local communities is not specified in the emerging innovation systems. Finally, the sectoral innovation system technique by Breschi and Malerba (1997) is based on the formal, technologically focused approach of affluent industrial nations rather than on social innovation, which is typically found in most developing nations.

Doh (2012) suggests a quadruple helix, which adds a fourth angle for the community to the first three angles of the triple helix (university, industry, and government). The government's involvement includes establishing support programmes that connect local communities and universities to businesses, financing linkages, enabling market access, and organising and regulating relationships between industry, the community, and universities. It also involves connecting the university to local communities and fostering university community innovation. These intersections between CIS and the helixes are illustrated in the figure below.

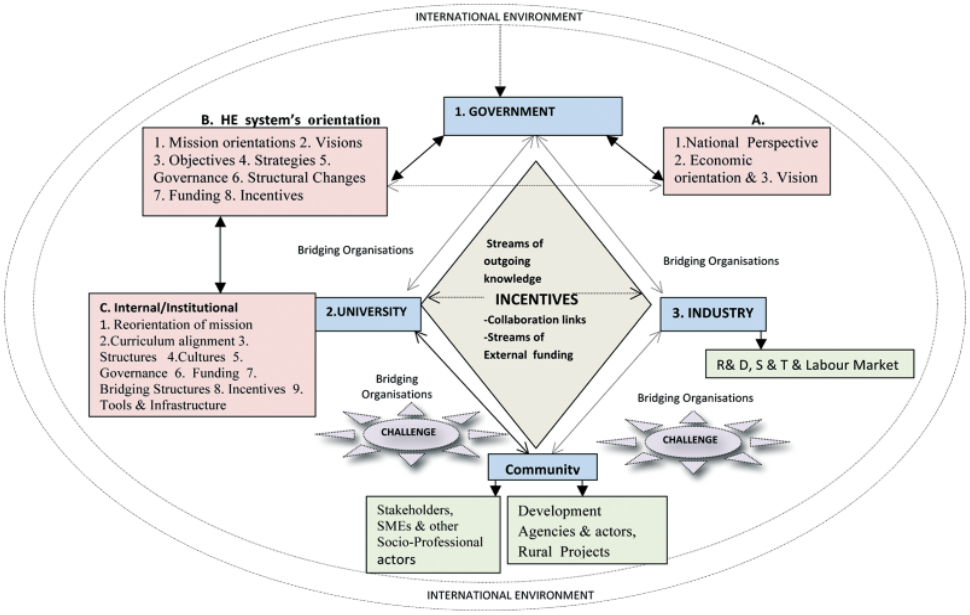

Figure 1: Framework for systemic adaptation of the Cameroonian higher education subsector (Doh 2012: 125)

The figure above highlights the proposition of this study, which is that university's responsibilities include producing and supplying knowledge and skills to businesses and society, providing a physical setting for research and instruction on regional innovations, transmitting and disseminating knowledge to businesses, incorporating local knowledge into RandD and science and technology, and encouraging academics to engage in community engagement (Nabaho *et al*., 2022). The responsibilities of local council officials include coordinating the structures

for community innovations, connecting the community to universities and industry, allowing the grassroots population to actively propose its knowledge and innovations to universities, giving councils the ability to connect innovations to the global market, and giving councils the ability to function as substitutes. The role of industry involves working with universities, providing resources to encourage innovation between universities and the public, giving universities feedback, and bridging interactions and locally developed innovations to the market, society, and the global knowledge economy (Nabaho *et al*., 2022).

Conclusion

This article explored the concepts of innovation ecosystems and the actors belonging to these innovation ecosystems. Further research may be conducted to investigate role of these innovation ecosystem actors to contribute to research and innovation in HEIs. The recommendations for the innovation ecosystem actors discussed in this article could also be researched further by engaging directly with stakeholders and policymakers in the quadruple helix to create a roadmap for framing resilient support systems for research, innovation and commercialization. The findings of previous studies indicated that components of innovation ecosystems, such as the system of financial support, the system of intellectual property rights, the system of innovation culture, and the system of education and skill development, have some bearing on the interaction between HEIs and industry. Additionally, in the development of healthy innovation ecosystems between HEIs and industry, RandD collaboration, financial support, dependable culture, contractual agreement, intellectual capital, knowledge exchange, and communication played key roles as reinforcing elements. It is advised that actors address concerns around poor investment on education and training, which results in less effort to maintain the present workforce, to overcome the lack of education and training between HEIs, low technical infrastructure, and low quality of research. As a result, there will be less creativity and innovation, which will eventually result in lower levels of education and a delayed conversion of knowledge into profitable endeavours. Actors are advised to address problems with subpar education and training, which results in a lack of practical skills, in order to solve the education and training gap between HEIs and human resources. This decreases worker education levels, which eventually results in slow economic growth. It is advised that actors provide chances for personal training to enhance individual education and promote possibilities to better nurture talent and skills in HEIs to combat the shortage of education and training between HEIs and the low number of patents and publications. This will eventually result in increased capacity and capability for the development of ideas and innovation, which will in turn stimulate RandD activities and create more patents and publications.

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