

The Use of Key Activities of National Innovation Systems (NIS) in Promoting Innovation Capability in Ghana: A Conceptual Framework

Faisal Iddris

School of Business and Engineering, Halmstad University, Halmstad, Sweden

Abstract

The purpose of this paper is to examine the use of key activities of National Innovation System (NIS) in promoting innovation capability of firms. It addresses what institutional actors: Government, Private sector and Research institutions can do to generate NIS key activities that support Innovation capability. Compared to NIS literature, the use of key activities in innovation capability is unexplored. The use of key activities is assessed with special emphasis on innovation capability of firms. Exploratory research is used with the objective of examining insights from extant literature on innovation management, NIS and innovation capability of firms in LDCs. Key activities of NIS are identified and the positive impact of key activities on innovation capability disclosed. This study depicts that innovation capabilities may be influenced by key activities within NIS, supported by institutional actors such as Government, Universities/Research Institutions and the Private sector. It also shows that innovation capabilities may lead to firm competitiveness. Innovation capability can be source of competitive advantage. Furthermore, as firms exist in ever changing market environment, the best performing firms are classified as innovative and continually develop capabilities to innovate.

Keywords: Innovation capabilities, NIS, firm, LDCs, Ghana

1. Introduction

Innovation is widely recognised as a major determinant of economic growth and employment (Edquist, 2014). The role of capability building as a precondition for a successful catch-up for countries in Latin American and Asia has been shown in a number of empirical studies (Fransman & King, 1984; Kim, 1980; Lall, 1992). Kim for instance suggests that Less Developing Countries (LDCs) need to pay much attention to issues regarding innovation capability. The concept of National Innovation System (NIS) emerged as analytical framework to help develop and diffuse innovation since 1980s. Edquist (2005), defines NIS as “all important economic, social, political, organisational, institutional and other factors that influence the development, diffusion and use of innovations” (p.183). Hence, this paper argue that National NIS in LDCs should focus on developing firms’ capabilities to innovate, considering the mismatch between the natural and human resources in the Sub-Sahara Africa, and number of patents and breakthrough innovations that have been recorded so far. For example, by the end of 2013, Africa as whole registered 552 Patent, 7,743 trademark and 899 industrial designs whilst Sweden a small country registered 2,495 Patent, 21,336 trademark and 724 design designs (WIPO, 2014). The success of Sweden’s general innovation output is mainly due to implementation of strong National Innovation System. The lower growth rate of registered industrial designs, patents, trademarks and innovations in Africa require firms to develop their innovation capability. However, there is limited study on innovation capability (Bjorkdahl, 2012; Börjesson & Elmquist, 2011; Haynes & Stewart, 1992; Schreyögg & Kliesch - Eberl, 2007). Furthermore, most of the literature on NIS missed the study of key activities within NIS and its effects on firms’ innovation capability. In the light of the above, the purpose of this present study is to deepen our understanding of the extent to which the firm’s innovation capability building is affected by key activities in National Innovation Systems (NIS).

The structure of the paper is organised as follows: first it provides an overview of literature on National Innovation Systems, general management and innovation capability. Then the author outlines the influence of key activities within NIS on firm’s innovation capability. The paper concludes with implications and suggestions for future research.

2.1 LITERATURE REVIEW

National Systems of Innovation in Less Developing Countries (LDCs)

The growth and popularity of Traditional System of innovation as an analytical framework can be traced to (Edquist, 2011; C. Freeman, 1987; Chris Freeman, 1995; Christopher Freeman & Soete, 1997; B.-A. Lundvall, 2009; B.-Å. Lundvall, 1992.).

C. Freeman’s (1987), framework has been very influential and inspired the development of national systems of innovation. Several scholars including (Edquist, 1997, 2005, 2011; B.-Å. Lundvall, 1992.; Bengt-Åke Lundvall, Johnson, Andersen, & Dalum, 2002; B. Å. Lundvall, 2007), further developed the concept of NIS. Their studies focused on general innovation development and diffusion without specifically looking at how the key activities within NIS can influence firm’s innovation capabilities building.

Other streams of NIS literature focusing on developing economies concentrate on examining the linkages among the institutional actors within NIS (Feinson, 2003; Intarakummerd, Chairatana, & Tangchitpiboon, 2002; Lee & Park, 2006), without paying attention to firms' capabilities to innovate. For example, a recent study by (Koria, Bartels, Koeszegi, & Carneiro, 2012), examined the role of computational ICT in promoting science, innovation and technology in Ghana. By this, their study missed the critical role of innovation capabilities in stimulating socio-economic development.

Kim (1997) and Adeoti (2002), propose the use of NIS in developing technological capabilities in LDCs, Kim describes technological capability as the ability to utilise technological knowledge in order to assimilate, use, adapt and change existing technologies. Technological capability has limitations due to the neglect of social dimensions of innovation. Innovation capabilities thus, extend beyond technological capability by including socio-economic dimensions in innovation capability building.

Fagerberg and Srholec (2008), empirically found a positive relationship between NIS and catch-up process through innovation capabilities. They examined governance, openness and political systems as the main innovation capability measures. Castellacci and Natera (2013), examined the relationship between NIS and co-evolution of two dimensions: absorptive capacity and innovation capability. They found a positive relationship between NIS and three innovative capability outputs (scientific output, innovative output and technological output). However, their studies rather focused on innovation performance measures instead of examining the role of key activities within NIS in stimulating a firm's capabilities to innovate.

2.1.1 Key Activities within National Innovation Systems (NIS)

Feinson (2003), highlights the importance of focusing on specific activities within NIS. Some of the most important key activities within NIS involved in the development and diffusion of innovation in a national economy has been identified by (Edquist, 1997, 2005, 2011) as follows:

1. Provision of R&D results
2. Competence building
3. Formation of new product markets
4. Articulation of new product quality requirements emanating from the demand side
5. Creating and changing organizations needed for developing new fields of innovation
6. Networking, interactive learning and knowledge integration
7. Creating and changing institutions—for example, patent laws, tax laws, environment and safety regulations, R&D investment routines, cultural norms, etc.
8. Incubation activities such as providing access to facilities and administrative support for innovating efforts
9. Financing of innovation processes
10. Provision of consultancy services relevant for innovation processes.

Edquist, further suggest that the key activities identified within NIS have broader application in overall innovation diffusion process. What is missing in the literature is examination of how these key activities can stimulate a firm's innovation capabilities. This study therefore contributes to existing literature by highlighting the extent to which key activities within NIS, with the support of institutional actors influence innovation capabilities which may in turn lead to firm competitiveness.

Characteristics of Ghana's National Innovation Systems (NIS)

Ghana's NIS is relatively small and underdeveloped. The National Science and Technology Policy document was revised and launched in 2010 as The National Science, Technology and Innovation (STI Policy). The main institutional actors responsible for shaping Ghana's NIS are the Universities/Research institutions, Government and the Private sector. I shall describe how the NIS may contribute to innovation capabilities by examining the institutional actors and linkages in Ghana's NIS. This description is based on Ghana's, Science, Technology and Innovation Policy Review presented to United Nations Conference on Trade and Development (UNCTAD, 2011).

2.1.2 Institutional Actors in Ghana's National Innovation Systems

Universities: Currently, there are seven (9) public universities and twenty two (24) private universities and Colleges. Statistics from (Legon), Ghana's first and largest University indicates that from 1999 to 2006, eighty two (82) percent of the student population concentrated in humanities whilst eighteen (18) percent concentrated in Sciences (UNCTAD, 2011). This trend is similar to other Public and Private Universities in the country.

Government: In Government's desire to promote technological development in the country, Science and Technology policy document was adopted by cabinet 2000. In the year 2010, the policy document was refashioned into Science, Technology and Innovation policy (STI). The innovation policy has not received needed support from the policy makers. The STI policy is being implemented under Ministry of Environment, Science and Technology, instead of being implemented under separate Ministry.

Research Institutions: The Centre for Scientific and Industrial Research (CSIR) is the largest and oldest public research institution established in 1968, CSIR has 13 research institutes. Funding for research is very low, for example in the year 2004, eighty one (81) percent of budgetary allocation to CSIR went into payment of emolument and only nine percent (9) for research funding. These developments render the research institutions incapable of

supporting innovation activities in the country. A study by Lall and Pietrobelli (2005), examining NIS in sub-Saharan Africa including Tanzania, Kenya, Uganda, Zimbabwe and Ghana, concluded that most of the Public R&D institutions “generally lack the facilities (physical and human) to provide meaningful support to industrial enterprise. The public research institutions and universities are currently not in a better position to make a significant impact on technological and innovation capability that may lead to technology assimilation and adaptation, design engineering and innovation diffusion.

Private sector: The private sector in Ghana comprises of SMEs, Multi-National Companies (MNCs) and financial institutions. Most of the private firms do not invest in innovations or undertake R&D activities in Ghana, but rather invest in R&D activities in their home country (UNCTAD, 2011).

1.1.1 Linkages among Institutional Actors in National Innovation Systems

Intersectoral knowledge Flow in an Input-output Perspective

The report indicates that output from public universities/research institutions are not being turned into product and services. Linkages between universities and SMEs are very weak, since most of the SMEs seem not to value any partnership with universities. The MNCs are reported to undertake innovation related activities in their home countries (UNCTAD, 2003a). The Universities are confronted with poor academic infrastructure and comparably low research output. These developments further weaken the relationship between universities and industry. However, the Universities and other tertiary institutions are making significant contribution to the economy by educating critical and skilled knowledge workers.

Weak Links between Public Research Institutions and Private Sector

The poor linkages between research institutions and private sector have contributed to the poor innovation capacity in Ghana (UNCTAD, 2003a; UNESCO, 2007). The report further indicates that the public research institutions lack appropriate marketing strategy in commercialising research output to businesses and industrial sector. The following section present innovation capabilities

2.1.3 Innovation Capability

Innovation is often described in relation to the degree of novelty of an idea, Garcia and Calantone (2002), described innovation as incremental (new), really new or radical or as a continuum ranging from incremental change to radical change. In LDCs the focus on innovation can be directed toward incremental innovation, which requires modification to existing product or services to suit local context. In that perspective, innovation capability is considered as mandatory for firm growth and survival in less developing countries (Bell & Figueiredo, 2012). The growing interest in innovation capability and its relationship to socio-economic development has led to the increase in body of literature on various aspect of innovation capability. In the literature there are numerous definitions of innovation capability. Lawson and Samson (2001), define innovation capability as a firm’s ability to “continuously modify knowledge and ideas into new systems, processes and products for the benefits of firms and its stakeholders (p.384).

Ngo and O’Cass (2009), defined innovation-based capability as “the integrative process of applying the collective knowledge, skills, and resources of the firm to perform innovation activities pertaining to technical innovations (products and or services, and production process technology), and non-technical innovations (managerial, market, and marketing)” (p.84). The above definitions suggest that innovation capability mainly focus on how a firm continuously utilise available resources both internally and externally to create and capture value. Bell and Figueiredo (2012), point out, innovation capability correspond to degrees of novelty in innovation, processes, products, services and organisation, but not the traditional measure of patent citations or R&D expenditure.

Edquist points out that:

Scientific knowledge is not sufficient – it has to be transformed into innovations in order to create growth and employment. Some research results are never transformed into innovations and research is only one of the many determinants of the innovation process. It is not always necessary, and it is never sufficient to achieve innovation-based growth. (Edquist, 2014),

Edquist concluded by stating that innovation policy instruments cannot directly influence the ultimate objectives (e.g. growth, the environment or the health system) in an immediate sense, but the innovation policy instrument for NIS must be translated into concrete terms that is achievable. This means that giving the right NIS policy direction, firms in LDCs with lower scientific capacity compared with their counterparts elsewhere can still develop their capability to innovate, because e innovation have been found to emerge mostly through interactions among customers, suppliers, competitors and other relevant stakeholders. Other scholars have echoed the diminishing view on “linear model” of innovation (Cobbenhagen, 2000; Edquist, 2014). The “linear model” assumes that innovations resulting in products need to follow for example basic research, applied research, and development work. Innovations rather originate from the market (Cobbenhagen, 2000). Table 1. Show summary of innovation capability dimension derived from literature. The dimensions have empirically examined and have been found to positively influence firm’s capability to innovate. Thus, generating key activities of NIS by the institutional actors can stimulate firm capability to innovate.

Table 1 Dimensions of Innovation capability

Dimension	References
Strategy for innovation	(Bjorkdahl, 2012; Lawson & Samson, 2001)
Idea management and implementation	(Boeddrich, 2004; Lawson & Samson, 2001; Saunila & Ukko, 2013b)
Organisational culture	(Lawson & Samson, 2001; O'Connor, Paulson, & DeMartino, 2008)
Organisational learning	(Calantone, Cavusgil, & Zhao, 2002)
Leadership	(Kallio, Kujansivu, & Parjanen, 2012; Lawson & Samson, 2001; Saunila & Ukko, 2013a)
Creative self-efficacy	(Bandura, 2011; Kallio et al., 2012)
External linkages	(Albaladejo & Romijn, 2000; Bjorkdahl, 2012; Laforet, 2011)

2.1.4 Influence of Key Activities within NIS on Innovation Capability

An important issue is the degree by which the institutional actors within NIS: Government, private sector and universities/research institutions can facilitate the generation of key activities in NIS on regular basis to stimulate innovation capability. In this study we consider key activities of NIS to include constancy services, incubation activities, competence building and financing of innovation. For example Government and the private sector may provide the financing, incubation activities whilst the Universities/research institutions provide competence building and consultancy services to firms, since firms are at the center of diffusion and commercialisation of innovations (Edquist, 2011, Kim, 1997), and they are regarded as the key element in any innovation systems (Metcalf and Ramlogan, 2008, Lundvall, 2007).

Incubating Activities and Idea management and Implementation

Incubating activities may help firms to nurture a promising business idea from idea generation to delivery of the product or service to the market. Idea management can be described as systems, structures, and routines instituted by a firm to search and generate valuable ideas and to device mechanisms for its management (Bjorkdahl, 2012). The *incubator* "is an organisation – private or public – which provides resources that enhance the founding of new small business, and are assumed – directly or indirectly – to support corporate spin-offs, such as new technology-based firms" (Löfsten and Lindelöf, 2001). The idea of incubation and financing of innovative ideas have been shown to increase the level of SMEs capability to innovate. For example, Albaladejo and Romijn (2000), in their study on SMEs in UK found that roles played by the regional science base in nurturing high-tech spin-offs positively influence capabilities to innovate. In Ghana, NIS has been perceived from a linear perspective. The Universities/Research Institutions are seen as knowledge generation outfit, without proper linkages with industry. Thus through incubating activities firms may be better prepared to handle idea management and idea implementation which can ultimately lead to commercialisation of products or services.

Competence Building and Creative Self-efficacy

According to Lundvall et al. (2002), *competence building* refers to "...formal education and training, the labor market dynamics and the organization of knowledge creation and learning within firms and in networks."(p.224). Competence building include processes and activities related to the capacity to create, absorb, and exploit knowledge for individuals and organizations (Edquist, 2011).

The concept of self-efficacy contributes to creativity in an organisational (Tierney and Farmer, 2002, Bandura, 2011). Creative self-efficacy refers to one's believe to produce creative outcomes (Tierney and Farmer, 2002). Competence building has the potential to promote creative self-efficacy which will in turn lead to capabilities to innovate. Competence building focuses on learning-by-using, learning-by doing and learning-by-interacting (Edquist, 2011). Therefore, competence building may significantly influence innovation capability through creative self-efficacy of employees of a firm.

Financing of Innovation and Idea Management and Implementation

Innovation financing is critical for conversion of knowledge into economically viable innovations and to aid their diffusion (Edquist, 2011). In the study of SMEs in Ghana, Quartey (2003), found that access to finance significantly affects enterprise growth. Given the cost high cost of business operations in Ghana, any kind of financial aid have the tendency to stimulate firms' capability to innovate. Another major source of finance involve a situation whereby the state places an order for non-existing goods or provides required inputs or information needed to produce the goods (Edquist, 2011). This activity may help firms to prioritise in terms of what to produce and at what point in time. In this instance, firms are assured of ready market and enjoy pre-financing facility option from the state. This policy initiatives may accelerate the process of generating business idea to the final stage where the ideas can be turned into commercially viable products or services.

Consultancy Services and Strategy for Innovation

Government, private sector or research institutions can offer consultancy services, in the form of commercial information, market opportunities, transfer of technology and partnership opportunities (Edquist, 2011).The consultancy services can strengthen a firm's innovation capabilities. Since most of the firm may lack capacity to determine in advance the emerging business opportunities requiring new set of skills and expertise.

3.1 Conclusion

This study used exploratory research based mainly on insights drawn from extant literature on innovation management, NIS and innovation capability. Exploratory research serve as a means to expand the understanding of a phenomenon or knowledge of the subject under investigation (Cooper and Schinder, 2006). As argued elsewhere (Tuominen and Hyvönen, 2004, Börjesson and Löfsten, 2012), and in this study, firm competitiveness can be achieved through capabilities to innovate. Saunila and Ukko (2013b), conducted an empirical study and found that performance measurement positively influence innovation capability in SMEs. Börjesson and Löfsten (2012), survey high-tech SMEs to examine the effect of innovation capability on firm competitiveness, focusing on Sweden. A crucial drive towards firm competitiveness should be the ability to continually use existing internal and external knowledge to develop innovative products and services.

The main contribution of this study is to understand the effects of key activities within NIS, with the support of institutional actors: Government, universities/research institutions and the private sector on influencing innovation capability. In the literature several authors found the crucial role of NIS in stimulating innovation process (Lundvall, 2009, Lundvall et al., 2002, Edquist, 2011, Edquist, 2014). Edquist (2014), argued that a proper NIS policy can impact innovation activities. In an empirical analysis measuring national innovative capabilities and absorptive capacity for 87 countries from 1980–2007, Castellacci and Natera (2013), found that dynamics in NIS is mainly driven by innovation capability and absorptive capability. Fagerberg and Srholec (2008), empirical analysis of 115 countries from 1992 to 2004, shows that NIS and governance promote innovation capability and economic development.

The key activities with NIS including consultancy services, incubating activities, competence building and financing innovation may play a major role in all aspects of innovation capability building which may in turn lead to firm competitiveness. Based on the insights drawn from the support of institutional actors and key activities within NIS, the study proposed that the key activities within NIS will influence building of innovation capabilities and that may lead to achievement of firm competitiveness.

Some ideas reflected are somehow idealised, as key activities within NIS are difficult to operationalise in large scale. So far there has been little research on the question of the use of key activities in NIS in promoting innovation capability. Further empirical research is planned towards examining the key role that key activities with NIS in supporting innovation capability building in SMEs in LDCs, and to what extent key actors in NIS significantly contribute to the generation of these key activities within NIS.

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