

**THE USE OF INNOVATION CAPABILITY AND NATIONAL INNOVATION SYSTEMS IN PROMOTING
SUSTAINABLE DEVELOPMENT: A CONCEPTUAL ANALYSIS**

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ABSTRACT

The purpose of this paper was to examine the use of key activities of National Innovation System (NIS) and innovation capability of firms in promoting sustainable development. It addresses what institutional actors- government, universities/research institutions and private sector can do to generate key activities within NIS, which comprises of incubation activities, competence building, financing of innovation and consultancy services that may stimulates firm's innovation capability. Exploratory research was used with the objective of examining insights from extant literature on innovation management, NIS and innovation capability and sustainable development.

This study depicts that innovation capabilities may be influenced by key activities within NIS. It also shows that innovation capability dimensions such as strategy for innovation, idea management, idea implementation and creative self-efficacy may contribute to sustainable development. Furthermore, the best performing firms are classified as innovative and continually innovate in order to ensure sustainable development.

Keywords: Innovation capabilities, NIS, sustainable development, LDCs, Ghana

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. Capability to innovate largely depends on how different parts of National Innovation Systems (NIS) are adapted to each other and worked jointly (Lennart, 2014). NIS emerged in the 1980s as analytical framework to help develop and diffuse innovation. 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). A well-structured NIS may potentially support a firm’s innovation capability which may in turn create sustainable development. World Commission on Environment and Development (WCED, 1987) States that "... sustainable development is ... a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with the future as well as present needs". This suggests that sustainability development may lead to achieving economic and social development in a manner that does not exhaust a country’s natural resources, especially in developing countries where food, clothing, shelter, jobs are not met (UN Documents Gathering a body of global agreements). Since recent policies and development plans of many African countries centers’ around sustainable development (Bugaje, 2006), there is therefore the need to identify innovation capability mechanisms that can promote sustainable development in Africa.

Hence, this paper argues that NIS in LDCs should focus on developing firms’ capability to innovate, considering the mismatch between the natural and human resources in Sub-Sahara Africa, and the number of patents and breakthrough innovations that have been recorded so far. For example, by the end of 2013, Africa registered 552 Patents, 7,743 trademarks and 899 industrial designs whilst Sweden a small country registered 2,495 Patents, 21,336 trademarks and 724 industrial designs (WIPO, 2014), The success of Sweden’s general innovation output is mainly due to implementation of strong NIS, coupled with strong sustainable development policy. The low growth rate of registered industrial designs, patents, trademarks and innovations in Africa require firms to develop their innovation capability for socio-economic and sustainable development.

However, there is limited study on innovation capability (Bjorkdahl, 2012; Börjesson & Elmquist, 2011; Haynes & Stewart, 1992; Schreyögg & Kliesch-Eberl, 2007), and previous research failed to explain how innovation capability translates into sustainable development (Metz, Terziovski, & Samson, 2007). Furthermore, most of the literature on NIS missed the study of key activities within NIS and its effects on firms’ innovation capability and sustainability development. 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) and its effects on sustainable development.

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

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; Freeman, 1995; Freeman & Soete, 1997; Lundvall, 2009; Lundvall, 1992). Freeman's (1987) framework has been very influential and inspired the development of NIS. Some scholars (Edquist, 1997, 2005; Edquist, 2011; Lundvall, 1992.; Lundvall, Johnson, Andersen, & Dalum, 2002; Lundvall, 2007) have 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 capability.

Other streams of NIS literature focusing on developing economies concentrated on examining the linkages among the institutional actors within NIS (Feinson, 2003; Intarakumnerd, Chairatana, & Tangchitpi boon, 2002; Lee & Park, 2006), without paying attention to firms' capability to innovate. For example, a recent study (Koria, Bartels, Koeszegi, & Carneiro, 2012), examined the role of computational ICT in promoting science, innovation and technology in Ghana. The study however, missed the critical role of innovation capability in stimulating sustainable development.

Fagerberg and Srholec (2008), empirically found a positive relationship between NIS and catch-up process through innovation capability. 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). Urgal, Quintás, and Arévalo-Tomé (2013) focused on innovative efforts on products, processes and sustainability, their study rather focused on innovation performance measures instead of examining the role of key activities within NIS in stimulating a firm's capability to innovate leading to sustainable development. Metz et al. (2007), integrated innovation capability model emphasised on the influence of sustainable development on innovation capability, in contrast the position of this paper is that innovation capability may rather influence sustainable development, due to innovative tendencies that may emerge out of a firm's interactions with customers, suppliers, government, universities, research institutions (Charles Edquist, 1997; Lennart, 2014). The next section presents key activities within NIS and characteristics of Ghana's NIS.

Key Activities within National Innovation Systems (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) , Edquist (2005b) and Edquist (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 (2014), further suggests 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 the key activities can stimulate a firm's innovation capability and sustainable development. 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 capability leading to sustainable development.

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. We shall describe how the NIS may contribute to innovation capability 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).

Institutional Actors in Ghana's National Innovation Systems

Universities: Currently, there are at least 16 research and development (R&D) institutes, 7 public universities, about 40 private universities, 10 public polytechnics, many technical institutes, several technology support and regulatory agencies. Statistics from (Legon), Ghana's first and largest University indicates that from 1999 to 2006, eighty two (82) percent of the student population concentrated on humanities whilst eighteen (18) percent concentrated on Sciences (UNCTAD, 2011). This trend is similar to other public and private universities in the country.

Government: As a result of Government's desire to promote technological development in the country, a Science and Technology policy document was adopted by cabinet in 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 the Ministry of Environment, Science, Technology and Innovation (MESTI), the aim of the ministry is to established scientific and technological base for sustainable development. Implementation of innovation policies under MESTI has not achieved the desired innovation output due to limited allocation of resources for various segment under MESTI.

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. 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 Small and Medium Size Enterprises (SMEs) Multi-National Companies (MNCs) and financial institutions. Most of the private firms do not invest in innovations or undertake Research and Development (R&D) activities in Ghana, but rather invest in R&D activities in their home country (UNCTAD, 2011).

Linkages among Institutional Actors in National Innovation Systems

Inter-Sectorial 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 the 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 capability.

INNOVATION CAPABILITY

Innovation is often described in relation to the degree of novelty of an idea. For example, Damanpour, (1991) defines innovation as the “adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to an organization” (p.556). 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 towards incremental innovation, which requires modification to existing product or services to suit local context. In that respect, innovation capability is considered crucial for a firm’s growth and survival in LDCs (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), define 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 explains how a firm continuously utilise available knowledge, resources, expertise and skills generated both internally and externally to create and capture value for the firm and its stakeholders. 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 (Bell & Figueiredo, 2012).

Edquist points 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.p.5).

Edquist concludes 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 are achievable. This means that giving the right NIS policy directions, firms in LDCs with lower scientific capacity compared with their counterparts elsewhere can still develop their capability to innovate, leading to sustainable development, because 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; Kline, 1985; Rothwell, 1992). The “linear model” assumes that innovation needs to follow for example, basic research, applied research, and development work. Innovations have been found to rather originate from the market (Cobbenhagen, 2000). Table 1. Show summary of innovation capability dimensions derived from literature. The dimensions have empirically examined and have been found to positively influence a firm’s capability to innovate. Thus, generating key activities of NIS by the institutional actors can stimulate a firm’s capability to innovate leading to sustainable development.

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)

Influence of Key Activities within National Innovation System 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 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 the firms, since firms are at the center of diffusion and commercialisation of innovations (Edquist, 2011; Kim, 1997), and they are regarded as the key elements in any innovation systems (Lundvall, 2007; Metcalfe & Ramlogan, 2008).

Incubating Activities, Idea management and Idea 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 devise 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 & Lindelöf, 2001. p.309). 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 role played by the regional science base in nurturing high-tech spin-offs positively influence capability 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, p.224), *competence building* refers to “...formal education and training, the labour market dynamics and the organization of knowledge creation and learning within firms and in networks.” 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 organisation (Bandura, 2011; Tierney & Farmer, 2002). Creative self-efficacy refers to one’s believe to produce creative outcomes (Tierney & 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 employee creative self-efficacy.

Financing of Innovation, Idea Management and Idea 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 high cost of business operations in Ghana, any kind of financial aid has the tendency to stimulate firms’ capability to innovate. Another major source of finance involves 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 initiative 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 capability. Since most of the firms may lack capacity to determine in advance the emerging business opportunities requiring new set of skills and expertise. The next section presents innovation capability and sustainable development.

Innovation Capability and Sustainable Development

"Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations" (US Environmental Protection Agency, 2014). The importance of sustainability can be derived from our ability to continuously harness materials, resources and water to protect human and our environment. In the field of production, Hawken (1993) has this to say "sustainable production is the creation of goods and services using processes and systems that are: non-polluting; conserving of energy and natural resources; economically efficient; safe and healthful for workers, communities, and consumers; and, socially and creatively rewarding for all working people." (p.144). What it means is that sustainable development should be on the top agenda of all firms and nations: In the WECD's words: "... sustainable development is ... a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with the future as well as present needs. The exploitation of resources through a process of change requires firms to develop their innovation capability in converting the resources into goods and services. Through innovation capability firms can achieve some of the sustainable production principles as outlined in Hawken (1993), In sustainable production, processes are designed and operated such that:

- wastes and ecologically incompatible byproducts are reduced, eliminated or recycled on-site;
- chemical substances or physical agents and conditions that present hazards to human health or the environment are eliminated;
- energy and materials are conserved, and the forms of energy and materials used are most appropriate for the desired ends;
- work spaces are designed to minimize or eliminate chemical, ergonomic and physical hazard (Hawken, 1993) .

Hervani, Helms, and Sarkis (2005), note that a successful environmentally beneficial innovation demands that firms acquire new combinations of knowledge about product characteristics, process and material characteristics, and available technologies and markets. As building cultural transmission of local ecological knowledge demand various social mechanisms that create adaptive capacity (Folke et al., 2002), which emanate from capability to innovate. Hence we argue in this paper that a well-orchestrated NIS where the main institutional actors: the universities/research institutions, government and private sector collaboratively generate the key activities within NIS which, may stimulate innovation capability of firms which in turn will lead to sustainable development.

CONCLUSION

The purpose of this 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) and its influence on sustainable development. This study used exploratory research based on insights drawn from extant literature on innovation management, NIS, innovation capability and sustainable development. Exploratory research serve as a means to expand the understanding of a

phenomenon or knowledge of the subject under investigation (Cooper & Schinder, 2006). In this study we examined the contributions of (Castellacci & Natera, 2013; Edquist, 2011, 2014; Fagerberg & Srholec, 2008; Lundvall, 2009, 2002) in relation to the key role play by NIS in stimulating innovation in advanced countries. Particularly, In an empirically analysis of 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), empirically analysed 115 countries from 1992 to 2004, and their results show that NIS and governance promote innovation capability and economic development.

We began by examining NIS in Ghana and identified weak linkages between the main institutional actors in the system: universities/research institutions, government and the private sector. We also identified poor funding for R&D activities which adversely affects innovation capability building activities and there is no specific institution dedicated to the funding of R&D and innovation activities. For example, Ghana's expenditure on R&D is about 0.3 per cent of its gross domestic product (GDP), nearly all of which comes from government (UNCTAD, 2011), which is below 1% target for African Union member countries (NEPAD Planning and Coordinating Agency, 2014) and less than 0.97% of the GDP spent by Sweden in 2012 (WIPO, 2014).

Hence, we identified four key activities within NIS- incubation activities, competence building, financing of innovation and consultancy services (Edquist, 2005b, 2011; Edquist & McKelvey, 2000), which policy makers and managers might use to stimulate innovation capability. We also identified innovation capability dimensions such as strategy for innovation, idea management, idea implementation (Björkdahl & Börjesson, 2011; Bjorkdahl, 2012; Lawson & Samson, 2001) and creative self-efficacy (Bandura, 2011; Kallio et al., 2012) of which the key activities within NIS can impact directly in stimulating a firm's innovation capability building leading to sustainable development. This approach of using NIS to stimulate innovation capability and sustainable development does not require substantial internationally acceptable funding of 1% in R&D which Ghana and most African countries are not able to meet.

Based on the insights drawn from the support of institutional actors and key activities within NIS, this study proposed that the key activities within NIS may influence innovation capability and that may lead to, sustainable development (Daly, 1990; Folke et al., 2002; Hopwood, Mellor, & O'Brien, 2005). An effort on the part of a firm to develop its innovation capability can lead to achievement of core objectives of sustainable development which invariably meets the essential needs of the world's poor of which Ghana is not an exception.

Implications

This study contributes to innovation capability literature by showing how NIS and innovation capability can contribute to a country's sustainable development agenda. This is because this study shows that activities of NIS should go beyond stimulating innovations alone but also contributes to the country's preparedness to achieve sustainable development through interplay of the key activities within each NIS. Thus, focusing on these four activities in NIS- incubation activities, competence building, financing of innovation and consultancy services, can help shape policy directions towards innovation activities and sustainable development. Finally the issue of sustainable development is still on top agenda of policy makers, scientist, corporate bodies, and non-governmental organisations in advance economies. Hence, drafting and implementing effective sustainable development policies in LDCs may largely depends on integration of NIS, innovation

capability and sustainable development. The four innovation capability dimensions identified in this study (1) strategy for innovation (2) idea management (3) idea implementation (4) creative-self efficacy may help managers and policy makers to actively deal with some of the core elements of sustainable development such as our ability to continuously harness materials, resources, and water to protect human and environment.

Suggestions for future research

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

REFERENCES

- Albaladejo, M., & Romijn, H. (2000). Determinants of innovation capability in small UK firms: an empirical analysis. *Eindhoven Centre for Innovation Studies, The Netherlands*.
- Bandura, A. (2011). On the Functional Properties of Perceived Self-Efficacy Revisited. *Journal of management*, 38(1), 9-44. doi: 10.1177/0149206311410606
- Bell, M., & Figueiredo, P. N. (2012). Innovation capability building and learning mechanisms in latecomer firms: recent empirical contributions and implications for research. *Canadian Journal of Development Studies/Revue canadienne d'études du développement*, 33(1), 14-40.
- Björkdahl, J., & Börjesson, S. (2011). Organizational climate and capabilities for innovation: a study of nine forest-based Nordic manufacturing firms. *Scandinavian Journal of Forest Research*, 26(5), 488-500.
- Bjorkdahl, S. B. J. (2012). Assessing firm capabilities for innovation. *International Journal of Knowledge Management Studies*, 5(1 2), 171.
- Boeddrich, H. J. (2004). Ideas in the workplace: a new approach towards organizing the fuzzy front end of the innovation process. *Creativity and Innovation Management*, 13(4), 274-285.
- Börjesson, S., & Elmquist, M. (2011). Developing innovation capabilities: a longitudinal study of a project at Volvo Cars. *Creativity and Innovation Management*, 20(3), 171-184.
- Bugaje, I. (2006). Renewable energy for sustainable development in Africa: a review. *Renewable and Sustainable Energy Reviews*, 10(6), 603-612.
- Calantone, R. J., Cavusgil, S. T., & Zhao, Y. (2002). Learning orientation, firm innovation capability, and firm performance. *Industrial Marketing Management*, 31(6), 515-524.
- Castellacci, F., & Natera, J. M. (2013). The dynamics of national innovation systems: a panel cointegration analysis of the coevolution between innovative capability and absorptive capacity. *Research Policy*, 42(3), 579-594.
- Cobbenhagen, J. (2000). *Successful innovation: towards a new theory for the management of small and medium sized enterprises*: Edward Elgar Publishing.
- Cooper, D., & Schinder, P. S. (2006). *Business Research Methods*. McGraw-Hill/Irwin NY.
- Daly, H. E. (1990). Toward some operational principles of sustainable development. *Ecological Economics*, 2(1), 1-6.
- Edquist, C. (1997). "Systems of Innovation Approaches – Their Emergence and Characteristics". in Charles Edquist (ed.).
- Edquist, C. (1997). *Systems of innovation: technologies, institutions and organizations*: Psychology Press.
- Edquist, C. (2005a). Systemes of Innovation. Perspectives and Challenges. . In Fagerberg, J, Mowery, D. Nelson R (2005) *Oxford Handbook of innovation*, Oxford: OUP, page 181-208
- Edquist, C. (2005b). Systemes of Innovation. Perspectives and Challenges. In Fagerberg, J, Mowery, D. Nelson

- R (2005) *Oxford Handbook of innovation*, Oxford: OUP, page 181-208.
- Edquist, C. (2011). Design of innovation policy through diagnostic analysis: identification of systemic problems (or failures). *Industrial and Corporate Change*, 20(6), 1725-1753.
- Edquist, C. (2014). Efficiency of Research and Innovation Systems for Economic Growth and Employment.
- Edquist, C., & McKelvey, M. (2000). The systems of innovation approach and its general policy implications. *Systems of Innovation: Growth, Competitiveness and Employment*, 2(21), 531-557.
- Fagerberg, J., & Srholec, M. (2008). National innovation systems, capabilities and economic development. *Research Policy*, 37(9), 1417-1435.
- Feinson, S. (2003). National innovation systems overview and country cases. *Rockefeller Foundation*, 13-38.
- Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, C. S., & Walker, B. (2002). Resilience and sustainable development: building adaptive capacity in a world of transformations. *AMBIO: A journal of the human environment*, 31(5), 437-440.
- Fransman, M., & King, K. (1984). *Technological capability in the third world*: Macmillan.
- Garcia, R., & Calantone, R. (2002). A critical look at technological innovation typology and innovativeness terminology: a literature review. *Journal of product innovation management*, 19(2), 110-132.
- Hawken, P. (1993). *The Ecology of Commerce*. (New York, New York: Harper Business, 1993).
<http://www.uml.edu/centers/LCSP/> Accessed 9 August, 2015.
- Haynes, M., & Stewart, N. (1992). Improving the capability of organizations. *Creativity and Innovation Management*, 1(4).
- Hervani, A. A., Helms, M. M., & Sarkis, J. (2005). Performance measurement for green supply chain management. *Benchmarking: An International Journal*, 12(4), 330-353.
- Hopwood, B., Mellor, M., & O'Brien, G. (2005). Sustainable development: mapping different approaches. *Sustainable development*, 13(1), 38-52.
- Intarakumnerd, P., Chairatana, P.-a., & Tangchitpiboon, T. (2002). National innovation system in less successful developing countries: the case of Thailand. *Research Policy*, 31(8), 1445-1457.
- Kallio, A., Kujansivu, P., & Parjanen, S. (2012). Locating the weak points of innovation capability before launching a development project. *Interdisciplinary Journal of Information, Knowledge, and Management*.
- Kim, L. (1980). Stages of development of industrial technology in a developing country: a model. *Research Policy*, 9(3), 254.
- Kline, S. J. (1985). Innovation is not a linear process. *Research management*, 28(4), 36-45.
- Koria, R., Bartels, F. L., Koeszegi, S., & Carneiro, S. (2012). *Free Open Source Software (FOSS) and Survey Methodologies: The case of the Ghana National System of Innovation Survey*.
- Laforet, S. (2011). A framework of organisational innovation and outcomes in SMEs. *International Journal of Entrepreneurial Behavior & Research*, 17(4), 380-408.
- Lall, S. (1992). Technological capabilities and industrialization. *World Development*, 20(2), 165-186.
- Lawson, B., & Samson, D. (2001). Developing innovation capability in organisations: a dynamic capabilities approach. *International Journal of Innovation Management*, 5(03), 377-400.
- Lee, J.-d., & Park, C. (2006). Research and development linkages in a national innovation system: Factors affecting success and failure in Korea. *Technovation*, 26(9), 1045-1054.
- Lennart, E. (2014). Innovations and new technology - what is the role of research? Implications for public policy. *VINNOVA Analysis VA 2014:05*, VINNOVA - Swedish Governmental Agency for Innovation Systems / Verket för Innovationssystem.
- Lundvall, B.-Å., Johnson, B., Andersen, E. S., & Dalum, B. (2002). National systems of production, innovation and competence building. *Research Policy*, 31(2), 213-231.
- Lundvall, B. Å. (2007). National innovation systems—analytical concept and development tool. *Industry and innovation*, 14(1), 95-119.
- Metcalf, S., & Ramlogan, R. (2008). Innovation systems and the competitive process in developing economies. *The Quarterly Review of Economics and Finance*, 48(2), 433-446.
- Metz, I., Terziovski, M., & Samson, D. (2007). Development of an integrated innovation capability model. *Building innovation capability in organizations: An international cross-case perspective*, Imperial

College Press, London.

- NEPAD Planning and Coordinating Agency. (2014). AFRICAN INNOVATION OUTLOOK II. *NEPAD Planning and Coordinating Agency (NPCA) (2014), African Innovation Outlook 2014, NPCA, Pretoria.*
- Ngo, L. V., & O'Cass, A. (2009). Creating value offerings via operant resource-based capabilities. *Industrial Marketing Management, 38*(1), 45-59.
- O'Connor, G. C., Paulson, A. S., & DeMartino, R. (2008). Organisational approaches to building a radical innovation dynamic capability. *International Journal of Technology Management, 44*(1), 179-204.
- Quartey, P. (2003). Financing small and medium enterprises (SMEs) in Ghana. *Journal of African Business, 4*(1), 37-55.
- Rothwell, R. (1992). Successful industrial innovation: critical factors for the 1990s. *R&d Management, 22*(3), 221-240.
- Saunila, M., & Ukko, J. (2013a). Facilitating innovation capability through performance measurement. *Management Research Review, 36*(10), 991-1010. doi: 10.1108/mrr-11-2011-0252
- Saunila, M., & Ukko, J. (2013b). Facilitating innovation capability through performance measurement: A study of Finnish SMEs. *Management Research Review, 36*(10), 991-1010. doi: 10.1108/mrr-11-2011-0252
- Schreyögg, G., & Kliesch - Eberl, M. (2007). How dynamic can organizational capabilities be? Towards a dual - process model of capability dynamization. *Strategic Management Journal, 28*(9), 913-933.
- Tierney, P., & Farmer, S. M. (2002). Creative self-efficacy: Its potential antecedents and relationship to creative performance. *Academy of Management Journal, 45*(6), 1137-1148.
- UN Documents Gathering a body of global agreements. Towards Sustainable Development. *A/42/427. Our Common Future: Report of the World Commission on Environment and Development:UN Documents: Gathering a Body of Global Agreements, www.un-documents.net/wced-ocf.htm Accessed 9 August, 2015.*
- UNCTAD. (2003a). World Investment Report. FDI policies for Development: Nationals and International Perspective. NY. .
- UNCTAD. (2011). Science, Technology & Innovation Policy Review-Ghana.
- UNESCO. (2007). A Human Rights-Based Approach to Education for All: A framework for the realization of children's right to education and rights within education:UNICEF
- Urgal, B., Quintás, M. A., & Arévalo-Tomé, R. (2013). Knowledge resources and innovation performance: the mediation of innovation capability moderated by management commitment. *Technology Analysis & Strategic Management, 25*(5), 543-565. doi: 10.1080/09537325.2013.785514
- USEPA. (2014). What is sustainability. <http://www.epa.gov/sustainability/basicinfo.htm> Accessed 9 August, 2015.
- WIPO. (2014). WIPO statistics database, . http://www.wipo.int/edocs/pubdocs/en/wipo_pub_943_2014.pdf Date Accessed April, 2015.

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