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University – Industry Collaboration and Innovativeness of Firms: Evidence from Kenya Innovation Survey

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Abstract

Knowledge driven economies have been recognized as the next frontier in developing and developed world. Universities are important institutions in the creation, dissemination, growth and preservation of knowledge from all sectors. This paper aims to provide an analysis and contribute to the discourse on the effect of University – Industry interaction on firms' innovative performance. Firm innovativeness is hereby measured as the degree of use or implementation of new or significantly improved method of production (Process Innovation); novelty of product (Product Innovation); and implementation of new organizational methods in the firms' business practices (Organizational Innovation). This study draws from data obtained from the Kenya Innovation Survey (2012) based on the Oslo Manual (which provides the guidelines on the methods and questions to be included in innovation surveys) and it was designed to measure the innovation activity based on a set of core indicators to inform policies that will help the country configure the national system of innovation in order to respond to socio-economic challenges. The analysis of the results is based on a sample of 296 enterprises located in Kenya which were randomly selected by ISIC sector from an entire sampling frame. A total of 194 firms were selected in Nairobi and its environs while 102 firms were selected upcountry as follows: Mombasa (25 firms), Kisumu (25 firms), Eldoret (24 firms) and Nakuru (25 firms). The results of this study indicate that universities are an important knowledge partner for firms to develop innovations. Most of the sectors indicate that the interaction between them and the universities has significant effect on product as well as process innovations.

Key words: Innovation, product innovation, process innovation, University-Industry Collaboration,

ACRONYMS

ISIC - International Standard of Industrial Classification
OECD - Organization for Economic Co-operation and Development
NSI - National System of Innovation
STI – Science, Technology & Innovation
EAC – East African Community

1.0 Introduction

In the present age, knowledge is argued as the new raw material that drives innovation, competitiveness, and economic development. In a similar vein universities are viewed as the economic engines that can positively contribute to a country's growth in addition to its primary role as a centre for knowledge (Tumuti et al., 2013). University-industry collaborations have attracted considerable attention in the last few decades. Several papers have pointed out the importance of scientific research for technological change, innovation and economic performance (Aissaoui, 2010; Vega-Jurado *et al*., 2010; Mowery & Sampat, 2005). Universities are therefore no longer simply considered as "ivory towers" that perform research for their own sake of knowledge but as real actors in the knowledge-based economy (Mowery and Sampat, 2005). With the hyper competitiveness and the changing landscape of the universities and industries as well, Scholars have underscored the role of University - Industry collaboration in response to global competition and change (Harley, 2003; Gumport & Snydman, 2002).

Vast literature on approaches to innovation indicates that individual firms are seldom capable of innovating independently and that a firm's internal technical capabilities are insufficient to cope with the challenges of the global market. These approaches emphasize relations with external agents as an important strategy, which allows the firm to learn from other organisations, thereby increasing its innovative capabilities (Vega-Jurado *et al*., 2010). Likewise, studies in the field of business management indicate that the search for new product ideas, new forms of organization and/or solutions to existing problems goes beyond the firm's boundaries to explore the capacities in other firms or institutions (Tumuti et al., 2013; Halilem, 2010; Mowery & Sampat, 2005). In theory, a wider and more diverse search strategy will provide access to new opportunities and enable the firm to build new organizational competences based on the integration of complementary knowledge sets from external agents (Teece, 1986; March, 1991).

This paper analyses and contributes to the discussion on the contribution of University – Industry collaboration using a large-scale cross-industry sample of manufacturing firms located in Kenya. Kenya has witnessed steady growth in the development and application of Science, Technology and Innovation (ST&I) in social economic development since the pre-colonial era. The Science and Technology Act (1977) Cap. 250 of the Laws of Kenya, was enacted after the breakup of the original East African Community (EAC). The Act and its subsequent revisions has been guiding the country in the integration of ST&I into national socio-economic endeavors, including both production and service sectors. Recently, in the pursuit of improved national socio-economic growth and global competitiveness, the Ministry of Higher Education, Science and Technology (MOHEST) in consultation with stakeholders came up with a national policy framework aimed at guiding the mainstreaming of the application of ST&I in all sectors and processes of the economy in order to ensure that Kenyan citizens benefit from acquisition and utilization of available ST&I capacities and capabilities and thus achieve the objective of Vision 2030, which is to have national transformation into a newly industrialized knowledge-based economy.

This study builds on previous studies that explore the effects of research co-operation on firm's innovative performance using data from national innovation surveys **(**Vega-Jurado *et al*., 2010; Aschoff and Schmidt

2008; Amara and Landry, 2005; Belderbos et al., 2004b). Similar to a study done on Spanish Manufacturing firms (Vega-Jurado *et al*., 2010) this work considers two types of strategies thorough which firms draw on knowledge generated by universities: a) cooperation in innovation activities, and b) contracting out R&D to universities. In so doing, the study attempts to integrate this investigation of the effectiveness of university–industry links into an analytical framework that considers two types of strategies for acquiring external knowledge: cooperation and outsourcing of R&D to universities. This represents an important contribution since there are several studies on the effect of industry cooperation with universities, but few investigations of the relation between outsourced research and innovation output. A major limitation of this study, however, is lack of historical data since this is a maiden Innovation survey in Kenya. While this may raise questions about causality relations, the study forms a good starting point to inform common national stakeholder debate on issues affecting innovation, and help guide better understanding of the dynamics and processes of the national innovation ecosystem. The study will immensely contribute to the current discussion on University - Industry collaboration, while providing critical insights into the national system of innovation by measuring innovation activities at firm level. The outcome is expected to result in policies that will assist the country configure the national system of innovation and create an environment that will boost innovation in the manufacturing sector, as envisaged in the Kenya Vision 2030 development blueprint.

The rest of the paper is organized as follows: Section 2 provides a brief review of the literature; Section 3 describes the methodological aspects of the study; Section 4 presents findings & discussions; and Section 5 offers some conclusions & recommendations from the study.

2.0 Literature Review

Innovation refers to the process of converting knowledge into value through the implementation of new or improved products, processes and systems; It refers to the creation of new value to a company, its stakeholders and customers. However, scholars argue that definition of the term 'Innovation' varies with the field of study and social theories (Goldsmith and Foxall, 2003). According to most definitions, innovation refers to the creation of new, better or more effective products, processes, technologies, or ideas that are accepted by markets, governments and society (OECD, 1981; KNIS, 2012). Innovation encompasses two basic ideas: novelty and commercialization or diffusion to varying degrees depending on who is defining it. The aspect of novelty or improvement is crucial to the concept, as well as acceptance by the affected subsystems of society for example consumers, users and government among others. In the present highly turbulent environment, Innovation is considered as key to competitive advantage and a major driving force for economic growth. Effective leveraging of innovation is essential for wealth creation in all nations (Neely & Hii, 1998). It is apparent from the definition that innovation can be classified into product innovation and process innovation as well as Organisational innovation. Whereas Product innovation refers to the new or improved product, equipment or service that is successful on the market; Process innovation involves the adoption of a new or improved manufacturing or distribution process, or a new method of social service and Organizational innovativeness encompasses the capacity and ability to innovate, whereby the necessary skills, knowledge, and capabilities are readily available to take advantage

of market opportunities ahead of the competition The three are however not mutually exclusive; Process innovation for instance may lead to product innovation, whereas, organization innovation may induce product innovation as well as innovation in processes.

Literature is vast with theoretical and empirical literature on the determinants of university - industry collaboration, especially on the critical role of universities in knowledge production and dissemination of knowledge necessary in development of new and improved products, processes and organizational systems. Noteworthy though, the main change, as far as universities are concerned, is that knowledge production and dissemination (research and teaching) are no longer self-contained, quasi monopolistic activities, carried out in relative institutional isolation. Today universities are only one amongst many actors involved in the production of knowledge (Gibbons, 1998). An effective innovation ecosystem is therefore important for a country to harness the potential offered by the expansive research, modern science and technology to its social and economic advantage. An innovation system essentially refers to the interactions among diverse group of actors involved in the production, diffusion and use of new, and economically useful knowledge. According the KNIS Report of 2012, most innovation systems; "*lack coordination among actors; is linear and fragmented; has limited linkages between academia, industry and the government; and has inadequate funding and support for innovations*".

Vega-Jurado et al., (2010) notes that work within the frame of industrial organization literature focuses mostly on the relationships between different types of spillovers and R&D cooperation; while the management literature mainly examines the impact of different firm level characteristics (size, age, R&D intensity) as factors determining the propensity of firms to collaborate with universities. According to Hagedoorn et al., (2000), the main motivation to collaborate with universities is the possibility to access new knowledge and to increase the internal capacity of the firm. In the same vein, Klevorick et al., (1995) notes that the use of the universities as knowledge sources is more widespread in science based technology fields.

Several studies have suggested that the technological capability of the firm (measured as investment in internal R&D) is directly related to the use of universities as a source of knowledge for innovation (Laursen & Salter, 2004; Mohnen & Hoareau, 2003) and that improving a university's research system increases local innovation (Jaffe, 1989). The foregoing proponents of University – Industry collaborations agree that interactions with universities can increase the firm's ability to recognize, absorb and apply externally received knowledge which is critical to their innovative capabilities. These findings augur well with Cohen and Levinthal's proposition that prior related knowledge enables firms to increase their absorptive capacity. On the other hand, the evidence related to firm size is more contradictory, with some studies reporting a positive relationship (Miotti and Sachwald, 2003; Bayona et al., 2002) and some a non-significant one (Vega-Jurado, 2010; Abramovsky et al., 2009). The influence of spillovers – especially those derived from scientific agents - is usually found to be positive (Belderbos et al., 2004a). Though a considerable amount of research has been devoted to analysing the determinants of university-industry collaboration, there is clear dearth of literature discourse on the effects of these interactions on innovation performance. In an econometric analysis of data taken from the fifth French Community Innovation Survey (CIS) of 2007, Aissaoui (2012) found out that cooperation with universities and other establishments of

higher education has a positive influence on firms' intensity of innovation. These results agree with those in Loof and Brostrom (2008); and Aschoff and Schmidt (2008), based on the Swedish and German CIS which found out that cooperation with scientific agents (Universities or research institutions) has a positive effect on the share of sales of products new to the markets.

Despite the consensus among several researchers on the theme, other findings indicate some major points of dissent, for instance, in analyzing the effect of interaction with universities on firm's innovation output, Vega- Jurado et al., (2010), using two waves of the Spanish Innovation Survey (2004 and 2007) conclude that neither cooperation with universities nor outsourcing of Research & Development services has a significant effect on product innovation. Using the UK Innovation Survey, Laursen and Salter (2004) found out that only a limited number of firms draw directly on universities as their source of information or knowledge for innovative activities. These authors indicate that compared to customers or suppliers as sources of knowledge for innovation, universities are only moderately important and suggest that the recent literature perhaps tends to overestimate the role of universities. Evidently then, existing studies have produced contradictory results. In addition, none of the previous research has sufficiently explored the situation in Africa, and Kenya Specifically, hence this points out to the need for a comparative study on the effect of interaction with universities on firm innovation in the context of Kenyan manufacturing firms.
This study aims to address the following research questions:

1) Does the acquisition of knowledge from universities influence the level of innovativeness of the firm?
2) Does firm innovativeness emanate from the firm's own initiativeness or through collaboration with other agents?

3.0 Methodology

Data used for this study was adopted from the Kenya National Innovation Survey (KNIS) of 2012, which was based on the guidelines of the Organization for Economic Cooperation and Development Oslo Manual (OECD, 2005). National Innovation Surveys are designed to highlight, among other things, the driving forces behind innovation, the importance, not only of products and processes but also of marketing and organizational practices, the role of linkages and diffusion, and the view of innovation as a system. The KNIS was designed according to the methodological recommendations for Community Innovation Surveys (CIS) 2006 provided by Eurostat, the Statistical Office of the European Commission. The CIS 2006 is the standard adopted by ASTII for innovation surveys in all AU countries. Sampling frame consisted of all registered firms, public/private universities and public research institutions, national polytechnics and NGOs. The firms were randomly selected by ISIC sector from the frame. A total of 194 firms were selected in Nairobi, the capital city of Kenya and its environs while 99 firms were selected upcountry as follows: Mombasa (25 firms), Kisumu (25 firms), Eldoret (24 firms) and Nakuru (25 firms). The survey was done in two phases; phase one was done in Nairobi, and comprised of ten teams covering ten clusters around Nairobi and its environs. Phase two had four teams that visited Mombasa City, Nakuru Town, Eldoret Town and Kisumu City, upcountry. Out of the targeted 293 firms, 160 firms completed and

returned the questionnaires, thus representing a 54.6 percent overall response rate. A detailed representation of the response rate is shown in Table 2.1 below:

Figure 2.1 Response rates of firms from different regions of Innovation Survey

Region	Targeted Firms	Responded	NO Response	Response Rate
Nairobi	194	84	110	43.3
Mombasa	25	17	8	68
Kisumu	25	15	10	60
Nakuru	25	23	2	92
Eldoret	24	21	3	87.5
Total	**293**	**160**	**133**	**54.6**

The survey collected information about the innovative behavior of the enterprises as well the extent of cooperation with the external agents during the 2008/2009 to 2010/2011 financial years. The statistical unit for the survey was an 'enterprise' which refers to a business, company or firm and ranges from a very small concern with one or two employees to a much larger formal business or firm. The ministry of Higher Education Science and Technology (MOHEST) working in collaboration with the Kenya National Bureau of Statistics (KNBS) were responsible for conducting the survey. The survey asked firms whether they had introduced a new product or process, or whether they had ongoing or abandoned innovation activities during the period covered by the survey. A positive answer to one of these questions classifies them as 'innovators'. If classified as innovators, firms were asked to identify the key sources of information whereby Information sources were categorized as internal, market sources, Institutional sources (Universities or Government/Public research institutions) and other sources. Firms were also asked whether they have cooperated with partners for innovation. If yes, they had to specify with whom they have collaborated and the geographical location of the partners (Kenya, rest of Africa, Europe, United States, Asia and other parts of the world).

4.0 Results

In each of the sectors that were considered for the study, the employees with at least a university degree provided the largest proportion of the likely human resource involved in innovations (either directly or indirectly) between 2008 and 2011.Higher presence of graduates were specifically found in Manufacturing, Finance and Insurance, Electrical and Agriculture sectors. It is noteworthy that, these sectors have great potential for leading the country to sustainability in terms of wealth and employment creation through increased innovation activities within the sectors

A comparison between turnover changes from firms with product and process innovations and those firms that did not innovate revealed that the former category reported higher turnover changes in absolute terms (Table 4.1 and Table 4.2). Other than the Wholesale and the Water supply sectors, the results of the rest of the sectors had a p-value much less than 0.05, indicating a significant relationship between firm

innovativeness and presence of high school graduates. The general conclusion is that university training positively influences innovation intensity of employees. The likelihood of innovation in firm grows with the number of graduate employees and so will be the resulting turnover. It was also observed that some non-innovative firms had higher proportions of graduate employees than those that were innovating. The high presence of graduates in non-innovating firms indicates that this human resource is either being under-utilized or is untapped. This result is consistent with the finding by Aissaoui (2012); Loof & Bostrom (2006) and Aschoff and Smith (2008) from their studies in France, Sweden and Germany respectively that cooperation with academia has a positive influence on a firms' intensity of innovation.

Table 4.1 : Turnover change and Distribution of Graduates in the Sectors by product innovative firms and product non-innovative firms between 2008-2011

	INNOVATIVE FIRMS		NON-INNOVATIVE FIRMS				
Sector	**Turnover change between 2008 and 2011**	**Proportion of graduate employees (%)**	**Turnover change between 2008 & 2011**	**Proportion of graduate employees (%)**	**Chi square value (Yates corrected)**	**P value**	**95% CI**
Manufacturing	30,151,081,576	6.9	7,081,320,271	5.1	19.468	0.0001	<0.05
Education	4242208631	45.3	180,000,000	64.1	170.518	0.0001	<0.05
Professional Services	194,742,127	21.7	-2,676,000	0.0	93.711	0.0001	<0.05
Financial	59,614,703,512	28.0	7,750,000,000	67	3016.925	0.0001	<0.05
Wholesale	1,076,626,000	4.2	0	5	0.017	0.8976	>0.05
ICT	31,442,385,216	10.3	23,700,000	35.3	8.757	0.0031	<0.05
Agriculture	2,625,164,160	5.5	53,500,000	3.5	1.981	0.1593	>0.05
Electrical	4,066,547,311	27.7	1,068,547,311	12.2	167.831	0.0001	<0.05
Water supply	123,842,242	7.7	183,503,211	8.9	0.057	0.8107	>0.05
Hospitality	1,799,321,612	6.4	842,610,406	3.7	6.344	0.0118	<0.05
Health	1,501,400,000	0.9	0	10.0	182.834	0.0001	<0.05
Others	26,054,052,000	1.8	89,409,358	0.7	10.254	0.0014	<0.05
Total	**162,892,074,387**		**17,269,914,557**				

Table 4.2: Turnover change and distribution of graduates in process innovative firms and process non-innovative firms by sector between 2008-2011

Sectors	**Turnover change 2008 & 2011**	**Proportion of graduate employees**	**Turnover change between 2008 & 2011**	**Proportion of graduate employees**	**Chi square value (Yates**	**P value**

		(&)		(%)	corrected)	
Manufacturing	25,130,271,374	6.7	10,089,809,939	4.2	47.849	0.0001
Education	3,713,020,631	48	100,000,000	87.8	24.108	0.0001
P r o f e s s i o n a l services	194,752,127	21.7	-2,676,000	12.0	21.16	0.0001
Financial	59,614,703,512	28	0	0.0		
Wholesale	902,626,000.00	2.9	275,000,000	10.2	37.022	0.0001
ICT	31,509,385,216	11	82,200,000	31.1	39.906	0.0001
Agriculture	2,625,164,160	5.5	53,500,000	3.5	1.981	0.1593
Electrical	4,066,547,311	28	0	0.0		
Water supply	125,342,242	7.7	309	9.0	0.105	0.7458
Hospitality	1,799,321,612	6	842,610,406	3.7	6.344	0.0118
Health	1,500,000,000	0.6	1,400,000	13.2	378.639	0.0001
Others	26,076,052,000	5	60,557,358	0.9	83.632	0.0001
	157,257,186,185	171	11,502,402,012	176		
Total	**157,257,186,185**	**18.1**	**11,812,147,156**	**4.8**		

5.0 Conclusions & Recommendations

The study focused on exploring the link between university-Industry interaction and firms' innovative performance. Using data obtained by the KNBS from the innovation survey of 2012, the study concludes that acquisition of knowledge from universities if properly harnessed, has a significant influence on the level of firms' innovativeness.

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