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MEASURING OF INNOVATION ACTIVITIES IN EGYPT: THE CASE OF INDUSTRY[1]

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Abstract. This paper is based on the main findings of the 2012 Egyptian National Innovation Survey, which covered 2022 firms with different manufacturing activities. The main objective of this survey is to try to evaluate the situation in the private firms, with regards innovation. Our findings show that 11.3% of Egyptian firms have at least one type of innovation (product – process – organizational – marketing).
The innovation activities in firms increase with increasing size of companies in term of persons employed. In the majority of the manufacturing sectors, 1.5 % of innovative firms depend on universities, government, and public research institutions as main sources of information assisting innovation activities.

Keywords: Innovation Survey; indicators; innovation activity; statistics; measurement of innovation

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1. Introduction

Innovation is important to Egypt; it serves as one of the most important drivers of economic growth. The Asian miracles, countries like Japan, China, India, South Korea, Malaysia, as well as a number of other countries like Brazil, Argentina, Peru, etc. are examples of success stories that directed their efforts to invest in R&D and innovation, therefore resulting in the success of those economies as innovators of new products and services worldwide.

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Innovation system is composed of individuals and organizations that directly and indirectly invest time and energy in the production of scientific and technical knowledge. This knowledge flows and recombines in complex ways (Kline and Rosenberg 1986). The term *National Innovation System* (NIS) was first originated by Christopher Freeman and Bengt-Ake Lundvall in the late 1980s (Freeman 1987 and Lundvall 1985). The national innovation systems approach stresses that the flows of technology and information among people, firms and institutions are key to the innovative process (Lundvall 1985). There is no standard definition of national innovation systems. NSI has been defined in literatures as the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies (Freeman 1995). The national institutions, their incentive structures and their competencies, that determine the rate and direction of technological learning (or the volume and composition of change generating activities) in a country.

According scientists (Patel and Pavitt 1994) set of distinct institutions which jointly and individually contributes to the development and diffusion of new technologies and provides the framework within which governments form and implement policies to influence the innovation process. As such, it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artifacts, which define new technologies (Metcalfe 1995).

Here it is reasonable to make an excursion into contemporary literature if not directly tackling measurement of innovation but, anyway, facilitating revelation of new facets and forms of innovative activity. In changing contexts close observation of innovation processes enables introduction of additional metrics into innovation measurement systems. Such additional facets, could be, e.g. sustainability of innovativeness (Balkienė 2013; Tvaronavičienė 2014); capacity to create and innovate (Figurska 2014; Ignatavičius et al. 2015; Laužikas, Mokšeckienė 2013; Grubicka, Matuska 2015) innovativeness oriented to energy stewardship (Barberis et al. 2014; Cuneo et al. 2014), propensity to cluster (Bonetto et al. 2014), emerge of open-source innovations (Hoffmann, Prause 2015). Contemporary processes have to be taken into account and respective approaches towards sustainable development (Vasiliūnaitė 2014) and innovation measurement (Dudzevičiūtė, Tvaronavičienė 2011) discussed and evaluated. On-going scientific discussion is crucial for identifying facets of contemporary innovative processes, which with some time lag might, if relevant, addressed in national systems of innovation measurement.

For policy-makers, an understanding of the national innovation system can help identify advantage points for enhancing innovative performance and overall competitiveness. It can assist in pinpointing mismatches within the system, both among institutions and in relation to government policies, which can thwart the technology development and innovation. They are the "Policies which seek to improve networking among the actors and institutions in the system and which aim at enhancing the innovative capacity of firms, particularly their ability to identify and absorb technologies (OECD, 1997)."

The measurement and assessment of national innovation systems has centered on four types of knowledge or information flows: 1) interactions among firms, primarily joint research activities and other technical collaborations; 2) interactions among firms, universities and public research institutes, including joint research, co-patenting, co-publications and more informal linkages; 3) diffusion of knowledge and technology to firms, including industry adoption rates for new technologies and diffusion through machinery and equipment; and 4) personnel mobility, focusing on the movement of technical personnel within and between the public and private sectors. Attempts to link these flows to firm performance show that high levels of technical collaboration, technology diffusion and personnel mobility contribute to the improved innovative (OECD, 1997).

There are many different approaches to Measuring innovation at the organizational level and at the political level. Organizational level relates to individuals, team-level assessments, and private companies from the smallest to the largest. The measurement of organizations conducted by surveys, workshops, consultants, or internal benchmarking (Davila et al., 2006). Measurements at the political level are more focused on a country or region competitive advantage through innovation. The OECD Oslo Manual (1995) suggests standard guidelines on measuring types of innovation (OECD, 1995). These methods are used for example in the European community innovation surveys (OECD, 1995).

Egypt is working to update on the national innovation strategy, once governments develop an innovation strategy, statistical measures are required to monitor the progress of specific interventions and to support evaluation. It is principally through evaluation that policy learning occurs, leading to the improvement of the intervention, or its abandonment if it is shown not to be working. The mix of interventions and measures can also support policy experiments (Lundvall et al., 2009), in February 2014 the Egyptian Science, Technology and Innovation Observatory (ESTIO) has been established in the Academy of Scientific Research and Technology as a policy tool to understand the current situation of science, technology and innovation system.

Egypt has started, since 2008, conducting a survey that covered 3000 firms. In 2012, the second innovation survey that covered 2022 firms was designed to give information on the innovativeness of different sectors and regions and to understand the degree of interest of the private firms in innovation. The study in cooperation between ministry of scientific research, Academy of Scientific Research and Technology (ASRT) and The New Partnership for Africa's Development (NEPAD).

2. Methodology

The measuring of innovation is based on Oslo manual (1995) and European community innovation surveys which has been adopted by the Human Sciences Research Council in South Africa (Blankley et al., 2009). The Egyptian Innovation Survey 2012 carried out on definitions of the Oslo Manual, implies a random sample of around 2022 firms using face-to-face interviews. The frame of the sample selection was drawn according to a pre-implemented list. The chosen firms are located in 10 different governorates that represent geographic distribution and basic activities in Egypt.
The chosen firms include three different main activities; manufacturing, services, and trade. The questionnaire is designed to match the Egyptian environment and cover four types of innovation (product, process, organizational, and marketing) (see Appendix A for definitions).

3. Main findings

3.1. Effect of size of firms on innovation rate

Innovative activities take place in small and medium-sized firms as well as in large firms. According their size, firms are classified in a survey into micro companies with up to 10 employees; small companies employ up to 50 employees, whilst medium-sized firms contain up to 250 employees and large firms more than 250 employees. The current situation of the Egyptian economy is mainly based on the performance of the few big internationally acting companies and depending highly on the economic performance of a high number of small and medium Firms.

Figure (1) shows that large firms have the highest innovation in both manufacturing and services sectors 29.8% & 17.6 % respectively. The innovative rate in medium firms is 17.3%, in small firms is (12.5%) and in micro firms is 5.3%. The result shows a strong relationship between the size of firms and the rate of innovation, where innovation activity increases with the increasing number of employees in firms.

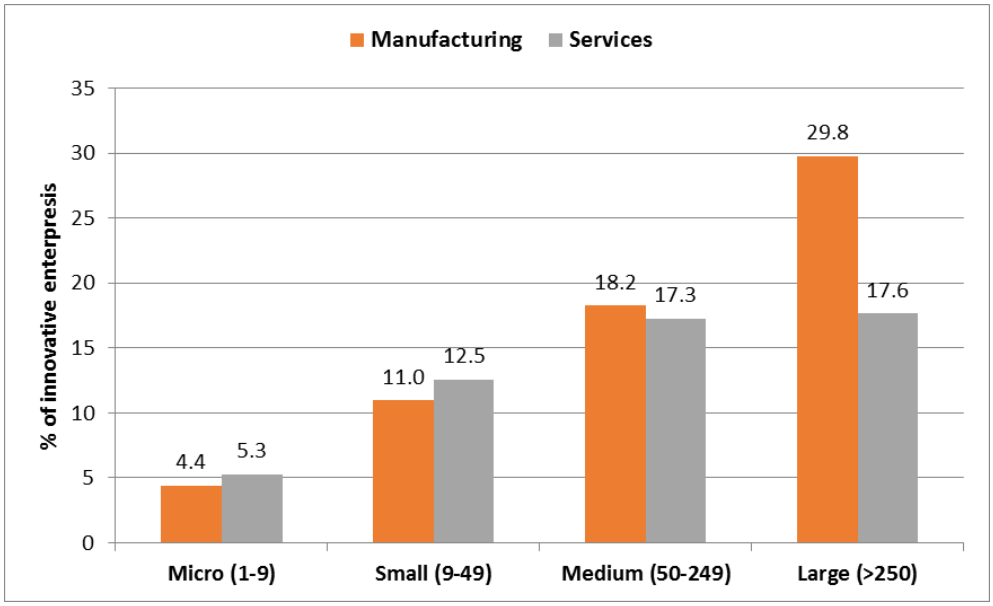

Fig.1 Innovation Activity of firms according to size of firms

3.2. Sources of information for innovation activities

The source of information for innovative activity is the sources that provided information for innovation projects or contributed to the completion of existing innovation projects. The Oslo Manual OECD points out the essence of information sources of innovation activity (OECD and Eurostat, 2005). Table 2 focuses on the sources of information regarded by Egyptian innovative-active firms as "high".

Table 1. Sources of information for innovation rated as highly important by innovative firms

Source of information		Economic activity		
		All activities	Manufacturing	Services
Internal Sources	Sources within your enterprise or enterprise group	81.40%	84.40%	66.70%
Market Sources	Suppliers of equipment, materials, components or software	32.56%	32.50%	20.80%
	Clients or customers	22.48%	20%	33.30%
	Competitors or other enterprises in your sector	22.48%	20%	33.30%
Institutional Sources	Consultants, commercial labs or private R&D institutes	3.10%	2.90%	4.20%
	Universities	1.55%	1.90%	0.00%
	Research institutes	0.78%	1%	0.00%
Other Sources	Conferences, trade fairs, exhibitions	22.48%	24.80%	12.50%
	Scientific journals and trade/technical publications	13.18%	16.20%	0.00%
	Professional and industry associations	5.43%	6.70%	0.00%

The Egyptian innovation-active enterprises found the ideas of their employees as the most important source of information for starting up Innovative activity, The significance of this internal source was confirmed by 84.4% of manufacturing and 66.7% of the service sectors, making it the most important source. The most of innovative firms in developed countries (Finland, France, and Norway) during the period of 2008 -2010 mainly depend on their own information for creation of innovation that means they are well knowledge employees (see http://data.uis.unesco.org/OECDstat_metadata[1]).

One of the more robust observations, the institutional sources were recognized by the Egyptian innovation-active firms as the least important, only 1.55% of innovative firms highly depend on universities for creating or

developing innovation. This result is quite alarming, because it shows a large gap of cooperation between industry and the scientific organizations in Egypt (universities and research centers).

3.3. Factors, which are hampering innovation activities

It is important for Egypt to be able to measure the factors that hamper innovation activities; analyze and solve it to increase innovation performance. A large percent of Egyptian firms did not perform any type of innovation activities. Firms were asked to rate the degree to which a number of specific factors hampered their innovation activities during the period 2008 – 2010.

Reasons for not starting innovation activities at all, or factors that slow innovation activity or have a negative effect on expected results include market, knowledge and cost factors, such as high costs or lack of demand, lack of skilled personnel or knowledge. Figure (2) shows the factors hampering innovation activities in non-innovative firms, 33.1% of non-innovative firms indicated that developing innovative activities within their firms were hampered or restrained because of a lack of information on markets.

The second most cited factor was a lack of information on technology (25.4%), although non-innovative firms have lack of information on technology to create or develop innovation, they did not cooperate with universities or research institutions to acquire the deficiency of information. The third was that uncertain demand for innovative goods and services (21.2%).

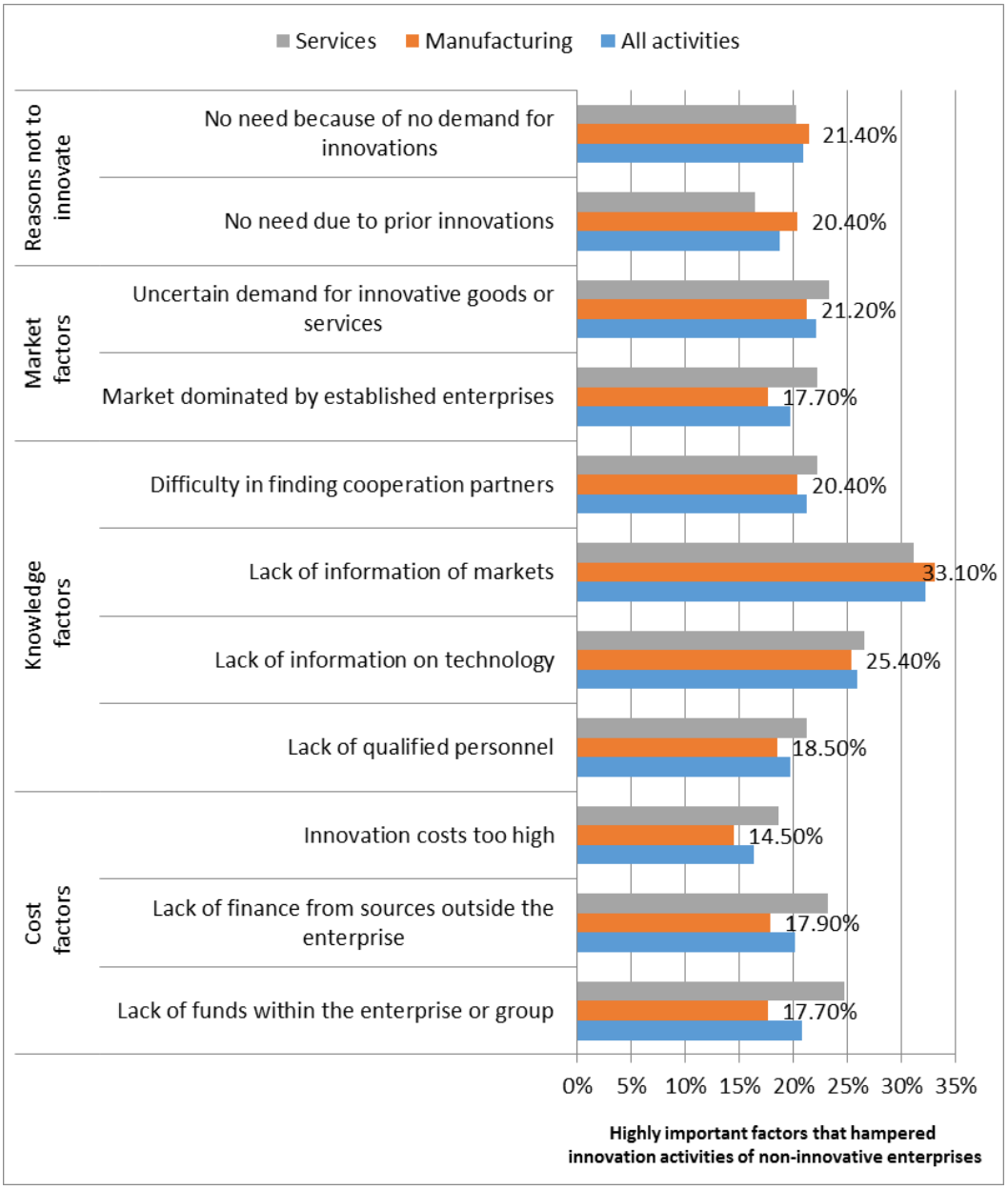

Fig.2 Highly important factors that hampered innovation activities of non-innovative firms (%), 2008–2010

3.4 Innovation Rate

Innovation activities include all scientific, technological, organizational, financial, and commercial steps that actually lead, or are intended to lead, to the implementation of innovations. Some of these activities may be innovative in their own right, while others are not novel, but are necessary for implementation (8). 2022 firms have been covered by the Egyptian National innovation survey, 11.3% of Egyptian Firms have at least one type of innovation (product – process – organizational –marketing) with different economic activities: manufacturing and services, while 88.7 % of Firms have not any type of innovation.

The innovation rate was defined as the proportion of firms that undertook any innovation activities during the last three financial years (2008-2010). Table (1) summarizes the result, 12.8% of manufacturing firms are innovative, compared with 9.4% of service firms. Almost 6.5% of all firms had both product and process innovations, while 4.2% had only product innovations.

Table 1. Percentages of innovative and non-innovative firms in Egypt, 2008–2010

	Total	Manufacturing	Services
Firms with innovation activity	11.3%	12.8%	9.4%
Product only innovators	4.2%	6.0%	1.8%
Process only innovators	5.8%	8.3%	2.5%
Product and process innovators	6.5%	9.3%	2.9%
Firms without innovation activity	88.7%	87.2%	90.6%

Conclusions

Such studies would also serve, for the users (planners, decision makers, managers,.. etc.) as tools for setting up S&T policies and information based decisions crucial in increasing competitive capacities of some strategic sectors in Egypt for global markets.

More surveys over longer periods are needed to gather data to try rebuild strong cooperation between business and science in Egypt and to measure the development of innovation. There was a strong relationship between the size of enterprises and the rate of innovation. Most of firms depend on their employment to create innovation and not going to university or research centers.

Appendix A. Basic definitions (OECD, 2005)

Innovation: Implementation of a new or significantly improved product, process, organizational method, or marketing method by an enterprise. An innovation must be new to the enterprise, although it could already have been implemented by other enterprises.

Marketing innovation: Implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.

Organizational innovation: Implementation of a new organizational method in the enterprise's business practices, workplace organization, or external relations.

Process innovation: Implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.

Product innovation: Implementation of a good or service that is new or significantly improved with respect to its characteristics or intended use. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness, or other functional characteristics.

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