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### INNOVATION MAGNITUDE OF MANUFACTURING INDUSTRY IN EGYPT WITH PARTICULAR FOCUS ON SMEs<sup>1</sup>

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**Abstract.** This paper is based on the main findings of the 2015 Egyptian National Innovation Survey, which covered 2700 SMEs firms with different manufacturing activities. The main objective of paper is to try to evaluate the situation in the private SMEs, regarding to the innovation. Also highlights on the roles of cooperation in innovation on performance of SMEs. Our findings show that 35.5% of Egyptian SMEs have at least one type of innovation (product or process). The innovation activities increase with increasing the size of companies in term of number of employees. The majority of SMEs are in the manufacturing sectors, whereas 2.1 % of innovative SMEs firms depend on universities, government, and public research institutions as main sources of information to developing their product or process innovation.

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**Keywords:** Innovation; Innovation Survey; SME; Manufacturing; Measurement of Innovation

## 1. Introduction

Economic studies during the past several decades have concluded that innovation (and related capital and human investment) contributes nearly half of the nation's productivity, economic growth and standard of living.

It is thus imperative that government and business leadership pay the utmost attention to the role of innovation in developed countries growth, competitiveness and quality of life (Egils, 2015).

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 (Rezk, 2015).

Small and medium enterprises (SMEs) have been considered one of the 'driving forces' of modern economies due to their multifaceted contributions in terms of technological innovations, employment generation, export promotion, etc. Of these, the ability of SMEs to innovate assumes significance because innovation lends competitive edge to firms, industries and ultimately, economies. Therefore, innovation has the potential to spur growth of individual enterprises at the micro level and aggregate industries and economies at the macro level (Subrahmanya, 2010). There is extensive signal to show that a number of SMEs in a wide diversity of sectors do engage in innovations, and that these innovations are likely to be an important determinant of their success (Hoffman et al. 1998). However, the ability and innovative capacity of SMEs varies significantly, depending on their sector, size, focus, resources, and the business environment in which they operate (Burrone and Jaiya 2005).

The majority of structure of industry in Egypt depend on micro and SMEs Firms, the last Egyptian National Economic Census (ENEC) 2013, issued by Central Agency for Public Mobilization and Statistics (CAPMS) showed the number of firms in Egypt are 2.41 million firms. Only 824 enterprises are public sector representing 0.03 % of all firms while the majority of firms 2409541 are private sectors representing 99.97% of all firms. About 56.9% from all Egyptian firms work in wholesale and retail trade then 16% of all firms work in Manufacturing sector and the rest 9.2% of all firms work in other services as transportation, education, health, etc. (CAPMS, 2015). The Total output of goods and services for all Egyptian firms during 2012/2013 was 1688.4 billion L.E. classified into 257.3 billion L.E. from public sector and 1431.1 Billion L.E. from private sectors. By analysis of the contribution of enterprises according to types of economic activities, the highest contribution of sector was manufacturing (Industry) sector recording 39% of all total output, then mining activities 14.9% then wholesale and retail trade 14.8%. (CAPMS, 2015).

Private sector has the majority of employees have 8.3 million employees from total employees 9.3 million and one million employees works in public sector. Egyptian firms have Variety in size of enterprise based on number of employees from micro firms (less 10 employees), small (10-49 employees), medium (50-250 employees) to large (large than 250 employees). The Egyptian economy largely dependence on micro firms where 96.9 % of all Egyptian firms (2336239) are micro size firms, 2.7 % are small size firms (64399) and only 0.4% of all firms are medium and large firms (9727). (CAPMS, 2015)

The main player of industry in Egypt is Micro and SMEs, therefore the innovation policy should be aims to promote the commercial exploitation of new ideas as products, processes, and organizational techniques. 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 company. Measure of innovation for organizations conducted by surveys, workshops, consultants, or internal benchmarking (Davila, Tony, 2006). While the measurements of innovation at the political level are more focused on a country or region competitive advantage through innovation.

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)."

Based on to Oslo Manual 2005, an innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations. The minimum requirement for an innovation is that the product, process, marketing method or organizational method must be new (or significantly improved) to the firm. (OECD,2005) Other international organizations such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the World Intellectual Property Organization (WIPO) have favored this definition (UNESCO,2013).

The requirement of "commercialization" is embedded in the definition. The Oslo Manual uses the word "implementation," but the meaning is clearly stated, "A new or improved product is implemented when it is introduced on the market. New processes, marketing methods or organizational methods are implemented when they are brought into actual use in the firm's operations" (OECD and Eurostat 2005). Therefore, the interconnection between trade and innovation works both ways. Trade rules, regimes, and flows provide some of the necessary inputs to innovative activities. On the other hand, inventions, new processes, goods, services, and intangibles benefit from global markets to increase sales, scalability, efficiency, profitability, productivity, and skills. Innovation activities are all scientific, technological, organizational, financial and commercial steps which actually, or are intended to, lead to the implementation of innovations. Innovation activities also include R&D that is not directly related to the development of a specific innovation. An innovative firm is one that has implemented an innovation during the period under review(OECD,2005).

Egypt from the first Arab and African countries conducted of innovation surveys. The first National Innovation Survey (NIS) was conducted in 2008 following Community Innovation Survey, then the second NIS survey in 2012 and the third one in 2015 covering the period from 2012 to 2014. Egypt design the survey according to international standards agreed upon in the Oslo Guide 2005 issued by the Organization for Economic Co-operation and Development (OECD). The following paragraphs will show the main results of NIS 2015 conducted by Egyptian science, technology and innovation observatory in Academy of scientific research and technology.

Given the above, this paper attempts to understand issues such as what types of innovation in SMEs, what is the nature of SME innovations, what are the cooperation network of SME innovations?

## **2. Research methodology**

### **2.1. Definition of SMEs**

It is difficult to define SMEs, not only with the fact that the definition changes with time but also the definition varies from countries to countries and in different size ranges (Peres and Stumpo, 2000). SMEs are generally considered to be non-subsidiary, independent firms, which employ fewer than a given number of employees where this number varies across countries (OECD, 2005). The most frequent upper limit designating an SME is 250 employees, as in the European Union. However, some countries set the limit at 200, while the United States considers SMEs of fewer than 500 employees (OECD,

2005). Small firms are mostly considered to be firms with fewer than 50 employees while micro-enterprises have at most ten, or in some cases, five employees (OECD, 2005). The definition of Egyptian SMEs is markedly different from other countries that may make it difficult to compare. Therefore, in our studies, we follow the OECD definition of SME, small firms from 10 to 49 employees; medium-sized firms between 50 and 249 employees.

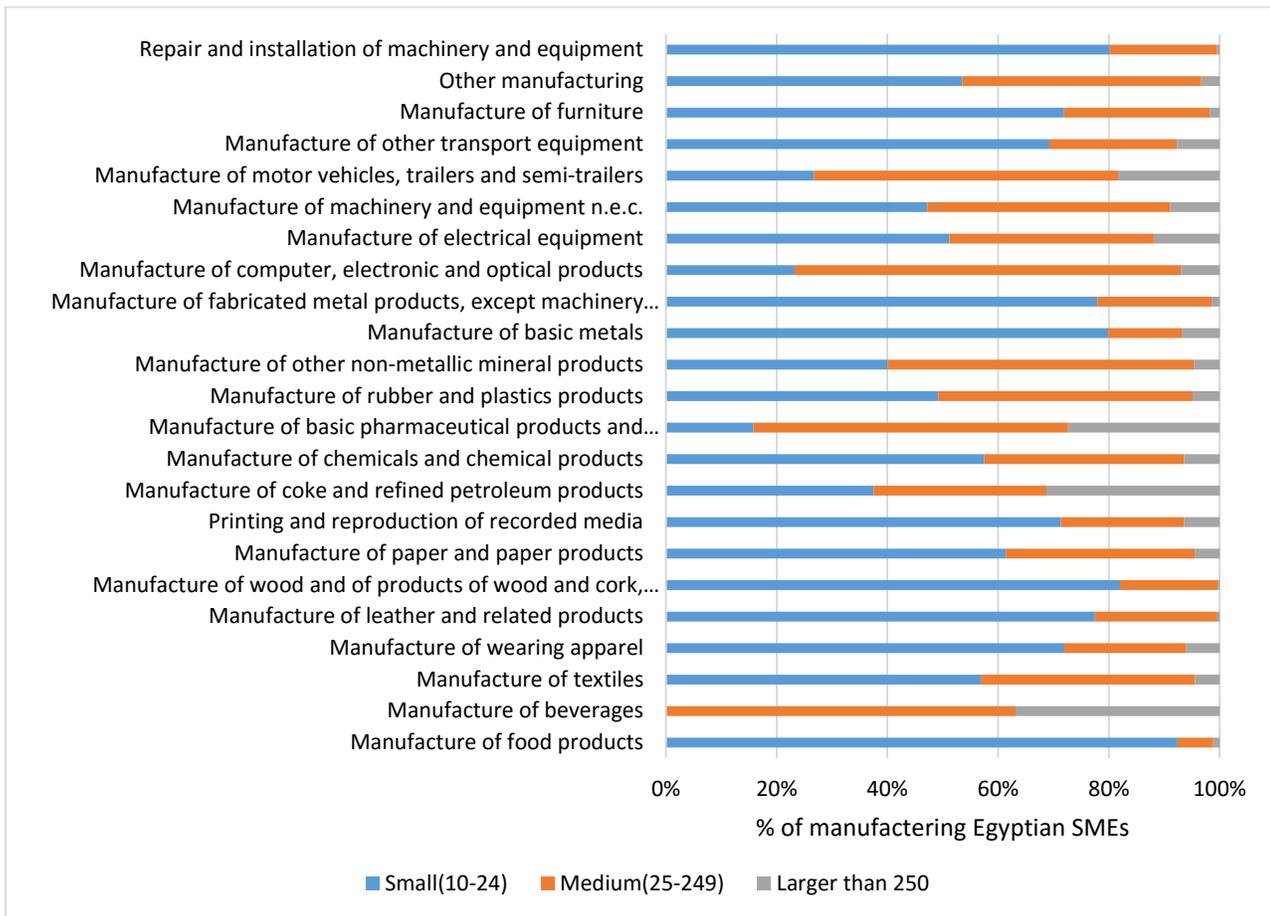
## **2.2. Survey design and data**

The data were collected via "Egyptian National Innovation Survey (ENIS), 2015" with a coverage of innovation activities of the period 2012 - 2014. Sampling frames were obtained from economic census 2013 that has been made by Central Agency for Public Mobilization and Statistics (CAPMAS), show that the overall enterprise in Egypt totaled of 2.4 million covered 80 different economical activities (Table 1). A stratified random survey sample of 3000 firms are chosen to reflect the area's industry and size mix, it allows circulates it to the level of this category with confidence level 95% and by a margin of error does not exceed 2%. A well-structured questionnaire following OSLO manual (OECD 2005) has been developed with the aim of collecting specific innovation insights in business. Certain minor adjustments were made to the questionnaire after conducting a pilot survey, followed by personal interviews conducted by trained personnel.

The total number of Egyptian manufacturing firms is 385582 distributions according to International Standard Industrial Classification of All Economic Activities (ISIC), revision 4 into 24 sectors (10-33) (United Nation statistics division, 2016). The majority of firm concentrated in furniture 27% of all firm, the second position is manufacture of food product firms 20% of all firms then manufacture of fabricated metal products, except machinery and equipment recorded 13.8% of all firms then manufacture of wearing apparel and manufacture of wood and of products of wood and cork recorded 12.6 % and 10.1 consequentially.

However, if going to distribution according to size of firm for Micro firm (less than 10 employees) the main dominate manufacturing is manufacture of furniture 28.6% then manufacture of food products 18.4% then manufacture of fabricated metal products, except machinery and equipment 14.3% of all micro manufacturing. For Small firms (10- 250 employees) the majority of firms concentrated in manufacture of food products then 46.6% then manufacture of wearing apparel and Manufacture of other non-metallic mineral products 9.6% & 6.5% of all small firms. For large size firms (+250 employees) the majority of firm is manufacture of food products as small size firms representing 17.4% manufacture of wearing apparel and Manufacture of textiles 16 %and 9.5 % of all large size firms.

The survey design includes firms with at least 10 workers following Oslo Manuel and a sample that is representative of Egyptian manufacturing firms that employ between 10 to >250 workers and that is stratified by firm size, sector and geographical area. In this paper, we selected the small- medium enterprises frame to study the innovation performance of SME. The firms were assessed in respect of the process; product and/or other innovations during the previous three years. Size classes have been defined following Oslo Manual (OECD 2005) classification: small firms 10-49 employees; medium-sized firms between 50 and 249 employees; large firm's  $\geq 250$  employee. A stratified random sample was selected according to International Standard Industrial Classification (ISIC), Revision 4 (reference). The target sample was 3000 firms representing 35 economic activities and distributed on 20 governorates. In addition, 1000 alternative firms selected for any reason are met, to be a replacement of the same classification of property category including number of employees and economic activity. (see Appendix A for definitions).



**Figure 1.** Population of Egyptian SMEs firms classified by International Standard Industrial Classification of All Economic Activities, Rev.4

### 3. Result and analysis

#### 3.1. Innovative performance of SMEs: introducing technological and non- technological innovation

Technological and non-technological innovative capacity of the SMEs has significant increased in recent years as indicated in table (1). Technology innovation activities include the innovation in the product and the process while non- technological innovation activities include the innovation in the organizational and marketing. The innovation rate of SMEs calculation is based on the firm has product or process innovation activities.

**Table 1,** Types on innovation activities in SMEs

Firm Size	Technological Innovation	Non-Technological Innovation
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		Product Innovation	Process Innovation	Organizational Innovation	Marketing Innovation	Rate of Innovation in SMEs
Small	10-49	22.70%	29.20%	16.8%	22.6%	32.60%
Medium	50-99	44.70%	61.20%	43.3%	41.9%	65.10%
	100-250	52.30%	64.00%	49.1%	48.2%	66.30%
SMEs		24.80%	32.10%	19.3%	24.4%	35.50%

During the past three years (2012-2014), (35 %) of the total Egyptian SMEs have at least one type of innovation product or process innovation (Technological). Table (1) Shows that the different types of innovation in SMEs, 24.8 % of SMEs have product innovation by introducing improved or new product to the market; 32.1% have process innovation include significant changes in techniques, equipment and/or software, 31.2% have at least one type of organizational or marketing innovation.

By examine the effect of firm size on the rate of innovation, taking into account that firm size to examine the effect of size (small firms (10-49 employees), medium firms 50-99 employees and 100 to 250 employees). The results show that increasing the rate of innovation with increasing the size of firms (Table1). Firms with employee size 10-49, have rate of innovation (32.6 %). This ratio increases to (65.1 %) in firm with 50-99 employees reach to (66.3 %) at 100-250 employees' Firm.

Egyptian SMEs engaged in many economic activities, they distribute on services, manufacturing, and construction sectors, many firm concentrate in specific activities as manufacturing of food, wearing apparel and Textile. The classified economic activities in our study is based on International Standard Industrial Classification (ISIC), Revision 4 (United Nations Statistics Programmes, 2008).

Figure (2) show that the top ten innovative economic activities SMEs, the results indicate that 13.4 % of firms work in manufacture of food products are innovative; 3.8 % of firm in manufacture of wearing apparel have at least one type of innovation in product or process; 2 % of firm have innovation in manufacturing of textiles and manufacture of leather and related products sectors. While the innovation rate in other economic activities are less than 2 %,

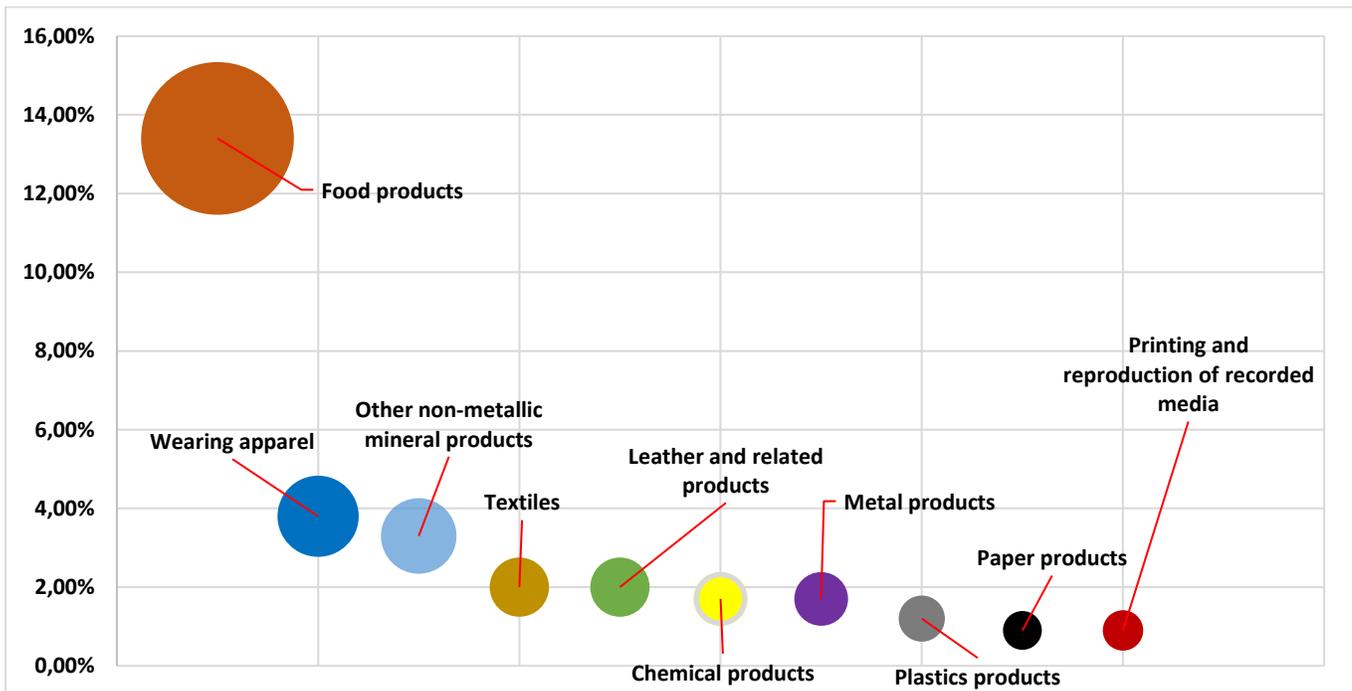


Figure 2. Top 10 Innovative SMEs sectors

The Y-axis refers to innovation rate in SMEs and size of circle refers to number of innovative firms in each sector.

### 3.2 Relationships between innovation and Sources of information

Innovation activities in SMEs are complex, requiring the co-ordination of multiple inputs. Firms can gain guidance, Ideas or advice, for their future innovation product from a broad range of sources (OECD, 2005). Accordingly, the firms were asked about 10 sources, which are split into four groups: (1) internal sources: within enterprise or enterprise group, (2) market sources: customers, Suppliers of equipment, Competitors, (3) institutional sources: Universities, Research institutes, and (4) other sources: conferences, scientific journals, associations. The firms should indicate for each source whether it had a low, middle or high importance for their innovation activities.

Table 2 presents the results for the entire range of sources of information for manufacturing SMEs. Overall, the results indicate that sources within the enterprise or enterprise group are the most important for innovation (63.1%). The second most important source is suppliers of equipment, materials, components or software (37.8 per cent), followed by clients and customers (29.2 %). Only slightly fewer firms retrieve information from competitors or other enterprises (18.4 %) and on conferences, trade fairs and exhibitions (11.5 %). By focusing on institutional sources, only (2.3 and 2 %) of the firms consider universities and research institutions respectively as main sources of information. It seems that the industry-university/research institutions relations are very weak and knowledge of the science sector is usually rather far from actual application and not ready to use in firms' innovation activities.

**Table 2.** Source of information in SMEs

Source of information		Small	Medium		SMEs
		10-49	50-99	100-250	
Internal Source	Sources within your enterprise or enterprise group	61.7%	66.8%	76.7%	63.10%
Market Sources	Suppliers of equipment, materials, components or software	36.6%	44.3%	44.3%	37.80%
	Clients or customers	28.9%	30.9%	31.1%	29.20%
	Competitors or other enterprises in your sector	17.8%	20.7%	23.2%	18.40%
	Consultants, commercial labs or private R&D institutes	3.6%	7.8%	7.8%	4.20%
Institutional sources	Universities	2.3%	1.9%	4.1%	2.30%
	Research institutes	1.7%	3.2%	1.9%	2%
Other sources	Conferences, trade fairs, exhibitions	9.4%	22.4%	22.3%	11.50%
	Scientific journals and trade/technical publications	7.7%	11.7%	15.2%	8.60%
	Professional and industry associations	2.8%	5.7%	5.4%	3.20%

### 3.3. Type of Innovation Activity in SMEs

Some of Innovation activities may be innovative in their own right, while others are not novel but are necessary to implementation (OECD, 2005). Innovation comprises a number of activities such as the acquisition of machinery, equipment and software, training, in-house and outsourced R&D expenditure, and the acquisition of other external knowledge. Some of activities that are not included in R&D, such as training and acquisition of other external knowledge.

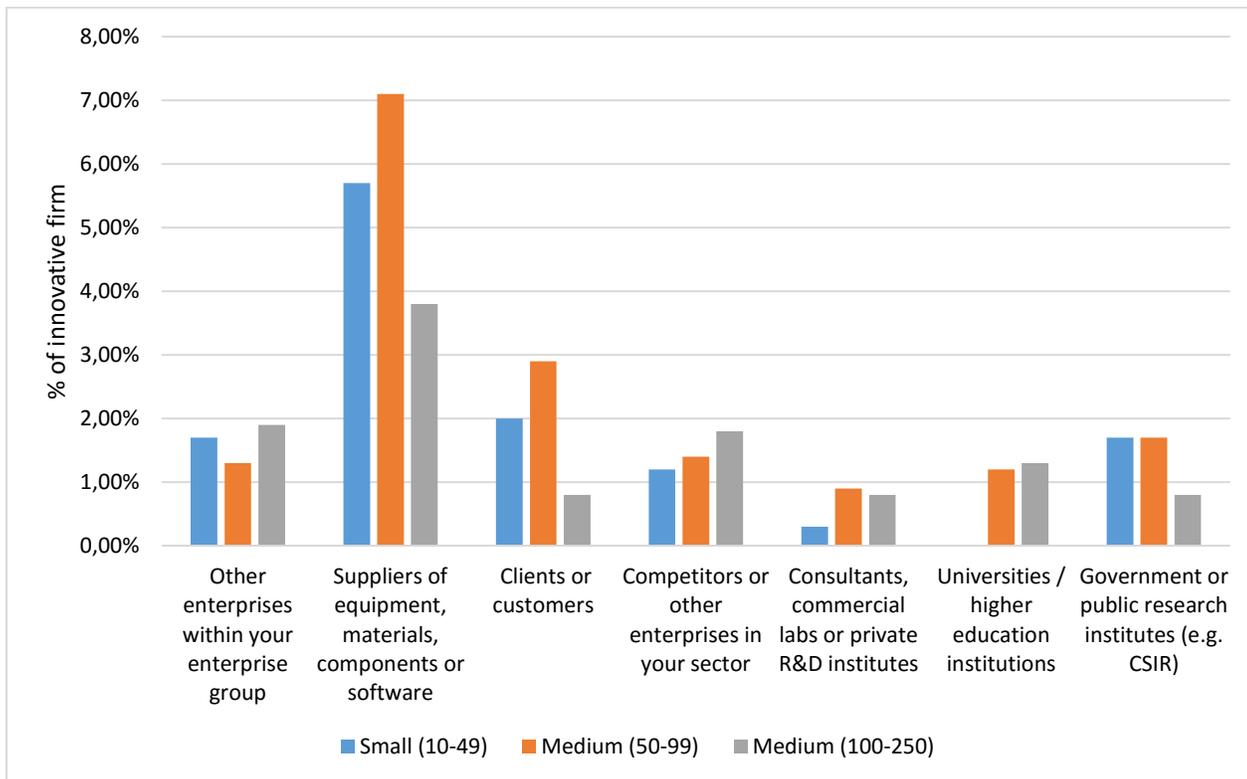
Table 3 shows that the most of small-medium innovative enterprises (80.2%) acquired new machinery, equipment or software as part of their innovation processes. Training was the second most important innovation activity (73.9%), followed by market introduction of innovations (48.7%). 27.7% of all innovative SMEs spent money on in-house R&D and 6.2% on extramural (outsourced) R&D. The percent of Intramural (in-house) R&D expenditure increased as size of firm increased due to increase ability of firm to spend on R&D. whilst the small firm spent more money on “market entry innovation” as innovation activities than other firms.

**Table 3.** Types of innovation activities among innovative SMEs

Innovation activities	Small	Medium		Total
	10-49	50-99	10-49	
Intramural (in-house) R&D expenditure	25.4%	37.5%	43.2%	27.7%
Extramural (outsourced) R&D	5.8%	8.0%	9.0%	6.2%
Acquisition of machinery, equipment and software	78.4%	88.8%	89.9%	80.2%
Acquisition of other external knowledge	34.7%	35.4%	39.5%	35.0%
Training	72.1%	83.2%	38.5%	73.9%
Market entry of innovations	77.8%	49.1%	61.8%	48.7%

### 3.4. Cooperation networks at the innovation of SMEs

For small and medium sized firms (SMEs), business networks are particularly important for enhancing innovative capability. This is because SMEs are typically not endowed with significant internal resources for innovation (or its market exploitation) and so, in such cases, external guidance and assistance is often crucial to aid their competitive edge (De Propris, 2002; Rogers, 2004). Networks are significant conduits for exposing SMEs to novel sources of ideas, improving their access to inputs and enhancing the transfer of knowledge and technological opportunity (Nieto and Santamaria, 2007; Zeng et al., 2010). It is usually held that co-operative enterprise activities can significantly contribute to firm innovation performance (OECD, 1997a,b). Firms co-operate to pool technical resources, achieve economies of scale and gain synergies from complementary human and technical assets. (Ali Uzun, 2000).



**Figure 3.** Collaborative partnerships for innovation activities by type of partner

Results of the present study indicate that the Egyptian SMEs have less significant partnerships in development or creation of innovation activities, (4.3 %; Table 3) of the firms engaged in innovation carry out joint Innovation with suppliers of equipment, raw materials and components; (1.7 %) with Competitors or other enterprises in your sector; only (1.2 %) of firms cooperate with universities and other higher education institutes and (1.0 %) with government or public research institutes. According to Hewitt- Dundas (2006), the external resources and capabilities that SMEs could access through external innovation partnerships might provide them with the stimulus and capacity to innovate, while the lack of innovative partnerships had a negative impact on innovation. Egyptian SMEs are required to seek more cooperation with other partners, such as research institutions, universities, and intermediary institutions by establishing cooperation networks.

## **Conclusions**

In spite of these positive outcomes, Egypt needs to make continuous efforts to maintain and strengthen its innovative power of SMEs. As innovation is needed in all manufacturing sectors and at all stages of production, extensive co-operation between universities and research centers and SMEs is required and policy should be working to improve the cooperation between them. Correspondingly, SMEs should be working on powering intramural and extramural R&D activities. There are about 35.5% of innovative SMEs in the industrial sectors,

## **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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