HOW DO EGYPTIAN SERVICE SMEs INNOVATE

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This study aims to contribute to advance knowledge on service innovation in developing countries, by exploring the determinants of technological innovations developed by Egyptian SMEs in the financial and hotel services sectors. More specifically, three categories of determinants are examined: 1) firm's openness and receptiveness to the global technological sphere, 2) absorptive capacity of firms, and 3) financial and market barriers to innovation. Using data from the 2009 Egyptian National Innovation Survey, we estimated a binary Logit Regression model to identify the factors explaining the firm's propensity to innovate. Results show that the adoption of advanced knowledge management systems (a variable used to measure absorptive capacity), exporting (a variable used in measuring the knowledge acquisition determinant), firm size, the firm's sector of activity, as well as market barriers have all positive significant impact on the firm's propensity to innovate. Nevertheless, the impact of financial barriers and percentage of employees holding a university degree (another proxy to absorptive capacity), and being part of a larger group (also another proxy to knowledge acquisition) proved to be non significant to firm's innovation potential. This paper concludes with recommendations to researchers, managers and policy makers concerned with promoting and boosting service innovations in developing countries.

Keywords: Technological Innovations, Service SMEs, Absorptive Capacity, Egypt, Developing Countries, Logit Regression.

No economy nowadays can prosper without innovation. In a borderless world, competition is now on a global scale. Competition is fierce, so for companies to sustain their competitive advantage they have no other option than to innovate (Hsueh et al., 2010; Wolff and Pett, 2006; Cooper and Kleinschmidt, 1987). Despite of being a risky, costly and uncertain process, technological innovations are increasingly being recognized as a corner stone in raising levels of competitiveness and increasing a
country’s chances of reaching a sustainable level of development (Bogota Manual, 2001).

Early innovation research focused on innovation in manufacturing sectors, mainly the introduction of new or significantly improved technological products or processes (Brown and Eisenhardt, 1995). Service innovation has come in a secondary place compared to manufacturing sectors (Toivonen, 2004). In addition, it has been proven that, on one hand, many significant service sectors are highly innovative (Howells, 2000; Metcalfe and Miles, 2000), and on the other hand, service firms’ outputs are substantially different from manufactured artifacts. Actually, services are differentiated according to different basic unique characteristics that are described in the literature: intangibility, co-production/interactivity, production and consumption simultaneity, heterogeneity and information-intensity (Miles, 2004; Gallouj, 2002; de Jong et al, 2003).

Moreover, when analyzing growth in the developed world, the literature generally considers innovation as the advancement of the global technological frontier (Aghion and Howitt, 1998). In such context, the knowledge necessary for innovation is usually created through firm's intramural and collaborative R&D activities (Becheikh et al, 2006). When it comes to developing countries, the context is fundamentally different. Innovation is often about introducing technologies, products and services that do not advance the global technology frontier, but that are nevertheless, new to the adopting firms in these countries. In this context, innovations developed and/or adopted by firms contribute to foster their growth, help them close the gap with the global technological frontier, and increase their competitiveness in domestic, as well as foreign markets (Rahmounia et al., 2010).

This research aims to contribute to advance knowledge on service innovation in developing countries. More specifically, we examine the determinants of technological innovations developed by Egyptian SMEs in the financial and hotel services sectors. Three categories of determinants are considered: 1) firms' openness and receptiveness to the global technological sphere, 2) absorptive capacity of the firms, and 3) financial and market barriers to innovation. Following Becheikh (2011), we consider that innovation in less developed countries (LDCs) will depend heavily on the ability of firms to acquire and absorb technologies and knowledge from external sources, especially from countries in the global technological frontier, as well as harnessing and enhancing its internal knowledge sources. This is because most of firms from LDCs possess very limited pool of innovation capabilities and cannot rely on R&D to innovate as is the case in the developed world.

The remainder of the paper will be arranged as follows. In the next section we will layout the conceptual framework used in this research in the light of the literature on innovation in the service sector in developing countries. The research hypotheses will thereby be introduced and specified. We will then describe our research methodology and provide summary statistics. The results of the study will be presented in a third section. We will finally conclude with discussing the research findings and proposing some evidence-based recommendations for researchers, managers, and policy-makers concerned with fostering service innovation in developing countries.
Conceptual Framework and Hypotheses

The literature on innovation and technology transfer suggests that the main sources of technological progress in LDCs originate in the external domain (Almeida & Fernandes, 2008; Kesidou & Szirmai, 2008). However, it’s also argued that acquiring advanced knowledge and technologies has no value if the acquiring firm doesn’t possess the necessary technological capabilities allowing it to seize new technological opportunities and promote innovation (Hong, 2009; Morrison et al., 2008). The following sections provide more theoretical insights on these two major determinants of innovation in LDCs with a focus on service sectors.

Knowledge Acquisition

Of all possible resources firms can possess, their knowledge base is one of the most strategic for obtaining a competitive advantage (Grant, 1996; Gupta and Govindarajan, 2000). Knowledge is a decisive input and the ultimate central factor to innovation and technological progress (Nelson and Winter 1982; Kogut and Zander 1992; Malerba and Orsenigo 2000). For instance, evolutionary theorists have long argued that innovation is a cumulative process built on past technological knowledge (Nelson and Winter 1982; Pavitt 1984), and the adherents to the knowledge-based view of the firm maintain that the most important role of firms is to transform existing knowledge into new products and services (Grant 1996), namely, into new innovations.

Notably, knowledge needed to innovation is widely disbursed across the knowledge space. It has become vital to grasp how this knowledge can be brought together in innovative activities. In fact, it's crucial nowadays that firms benefit extensively from using knowledge that lies outside their organizational boundaries for innovation purposes (von Hippel, 1988; Chesbrough, 2003). It's a given fact that firms often do not possess all the intelligence required to innovate in-house and therefore find it necessary to search for knowledge from various different external sources as well (Pavitt, 1984; von Hippel, 1988; Cohen and Levinthal, 1990; Chesbrough, 2003; Klevorick et al., 1995). There are a myriad of different external sources such as suppliers, manufacturers, customers, universities and competitors (Pavitt 1984; von Hippel 1988; Tether 2002).

A firm's external channels may be an important asset of knowledge acquisition. Access to external sources of codified and non-codified knowledge often provides valuable information and facilitates knowledge innovation (Assimakopoulos and Yan, 2006). Also, forming learning alliances which can enable firms to develop capacities quickly and minimize their exposure to technological uncertainties by acquiring and exploiting the knowledge developed by others (Grant and Baden-Fuller, 1995). Some valuable information or know-how, which usually is tacit, is still conveyed through intensive interactions among people from different organizations (Bontis, Crossan, and Hulland, 2002).

In developing countries, knowledge and technologies necessary for innovation are rarely developed by the firm itself and are often expected to be acquired from external, often international sources (Kesidou and Szirmai, 2008). This may occur through several channels including FDI, international joint-ventures, foreign suppliers
and/or clients, licensing, imported equipment, and the mobility of individuals across countries (Almeida and Fernandes, 2008, Morrison et al., 2008).

Based on the above literature, we hypothesize that:

H.1: The ability of a firm to acquire knowledge and interact with external entities increases its potential to innovate.

Absorptive Capacity

Absorptive capacity is crucial for firm innovation. It enables the firm to acquire knowledge and use it effectively, strongly affecting the firm’s ability to innovate, adapt to changes in its environment and be competitive (Daghfous, 2004; Escribano et al., 2009). Several scholars examined the relationship between absorptive capacity and innovation performance of firms, concluding a positive correlation between the two constructs (Cohen and Levinthal, 1990; Nieto and Quevedo, 2005; Tsai, 2001; Veugelers, 1997; Lim, 2004). The capability of an organization to exploit external information (i.e. absorptive capacity) is supposed to increase the speed, frequency and magnitude of innovation while, at the same time, innovation produces knowledge, which becomes a part of the organizational absorptive capacity (Lane et al., 2002).

Gray (2006) indicates small firms have the capacity to absorb and use new knowledge; especially those with employees that have higher educational levels and clear growth objectives. A key component of human capital is the possession of specific knowledge, which yields competitive advantage and therefore, the types of education, and experiences of employees are important in assessing high performing companies (Dimov and Shepherd, 2005). Nevertheless, the employment of graduates would raise competency levels, introducing new skills (especially in the area of information technology) and be indicative of an attitude, or willingness, conducive to growth and information (Westhead, 1990). In developing countries, absorptive capacity is among the major factors allowing firms to move from the simple acquisition of foreign knowledge and technologies, to assimilation, and eventually to improvement (Hobday, 2005; Hong, 2009). With a well developed capacity to absorb external knowledge and technologies, firms are able to apply the knowledge acquired or accumulated through engineering, and marketing, to produce new products and processes. Amongst the many factors that help firms developing and sustaining absorptive capacities are a qualified and experienced workforce (Traore and Rose, 2003), as well as sophisticated and effective knowledge management systems (Matusik and Heeley, 2005). These variables proved to be critical to build a firm’s absorptive capacity, because they allow the accumulation of the knowledge-based assets necessary to assimilate and use external knowledge (Jantunen, 2005; Lim, 2004; Prajogo and Ahmed, 2006). This will in turn help firms be more successful and more innovative in increasing flexibility in production or service delivery (Murovec et al., 2008). Therefore, we hypothesize that:

H.2: The existence of absorptive capacity mechanism is positively associated with the firm's propensity to innovation.

Barriers to Innovation

Common barriers to innovation in developing economies are high costs associated with innovation, unavailability of working capital, high rates of income tax and social insurance, predilection for jobs security in larger firms’, and low return on investment
Such barriers to SME innovation are suggestive of a lack of overall government strategy and support to overcome hurdles that are specific to smaller firms (Teece, 1996).

Small firms often have more difficulty to face constraints hindering them from innovation than the larger counterparts (Griffith et al., 2009; Nieto and Santamaria, 2009). SMEs firms operating in developing countries often face additional barriers to innovation, including a lack of technological and policy infrastructure, low levels of innovativeness, unfavorable location and inappropriate firm size for the chosen "niche" market (Levy, 1993; Lall, 1983). These constraints may include lack of technically qualified labor; poor use of external information and expertise; difficulty in attracting/Securing finance and relating inability to spread risk.

The existence of financial institutions and venture capital networks as well as public and private funds is a major asset to firms in developed countries. The situation in developing countries is on the contrary; capital markets are underdeveloped to a great extent, supply of capital for private sector and SMEs is constrained especially for risky long-term projects (Stevenson, 2010). It’s argued that economic cost and the lack of finance are among the most serious obstacles to innovation in developing countries (Benavente et al., 2005; Prochnik and Dias, 2005; Bogliacino et al., 2009). This forms a paramount defect to innovation ecosystems in developing countries and cripple firms’ innovation efforts, and prevents them from investing in innovation related activities. Hence, we hypothesize that:

**H.3:** The existence of financial barriers to innovation is negatively associated with firms’ ability to innovate.

Because developing countries have different market characteristics when compared to developed economies, we'll include market barriers as specific determinant of innovation performance of firms. Market barriers pertain to that factors that make a market an “innovation-friendly” one or, on the opposite, a “graveyard” to technological innovations commercialized by firms. These factors include the market size, the demand for new products (goods or services), the level of competitive rivalry among firms, etc (Becheikh, 2011). With a population of approximately 84 million citizens in 2011 (WEF, 2011), the Egyptian market is considered among the largest in countries in transition from the factor-driven stage to the efficiency-driven stage of economic development. Such a large market is very important to allow firms exploit economies of scales and capture the value of their technological innovations. However, according to the same source, the GDP per capita equaled 5,451 USD in 2011, which remains low and below the average of the Middle East and North Africa (MENA) countries. This raises questions about the purchasing power of Egyptians and the ability of the Egyptian market to absorb the new products and services commercialized by firms. Therefore, a careful attention has to be paid to the impact market barriers may have on firms’ innovation performance. This leads us to hypothesize that:

**H.4** The existence of market barriers to innovation is negatively associated with firms’ ability to innovate.

**Firm Size and Innovation**

The role of the firm size in the innovative capacity of firms is an old debate that continues to be inspired by the contrast that exists between the analyses of Schumpeter (1934) (where small entrepreneurial firms are the main source of
innovations) and Schumpeter (1942) (that underlines the necessity of being large for developing R&D activities and innovation). A very extensive literature exists on the connection, between firm size and propensity to innovate (Becheikh et al., 2006; Cohen and Levin, 1989; Cohen and Klepper, 1996).

Two types of argument have been advanced to explain the relationship between organizational size and innovation. On one hand, small organizations are more likely to be innovative because they have an advanced responsive climate for making quicker decisions to go ahead with new and ambitious projects, less bureaucratic inertia and more flexible structure, higher ability to adapt and improve, and less difficulty in accepting and implementing change (Chandy and Tellis, 2000; Dean, Brown and Bamford, 1998; Nord and Tucker, 1987; Acs and Audretsch, 1990). On the other hand, large organizations are more likely to be innovative because they have more financial and technical capabilities, the economies of scope to spread the risk of failure and absorb the costs of innovation, ability to establish and maintain scientific facilities, resources to hire professional and skilled workers in diverse disciplines, and ability to raise capital and market the innovation (Chandy and Tellis, 2000; Hitt, Hoskisson and Ireland, 1990; Nord and Tucker, 1987). Even if the debate is not settled with one global agreeable conclusion, firm size especially in developing countries seems to be important for the firm capacity to innovation, especially through the role it plays in financing innovation activities. Therefore, we hypothesize that:

H.5: Firm size is positively associated with the firm's ability to innovate.

**Sector's Impact on Innovation**

Due to the growing importance of services at the firm and societal levels, service innovation has increasingly become a topic of interest to researchers, policy makers and managers (Miles, 2005). Menor et al. (2002: p.138) describes service innovation as "an offering not previously available to a firm's customers resulting from the addition of a service offering or changes in the service concept that allow for the service offering to be made available". Moreover, Van der Aa and Elfring (2002: p.157) stated that service innovation "is encompassing ideas, practices or objects which are new to the organization and to the relevant environment, that is to say to the reference groups of that innovator". Service innovation may encompass both product and process innovations, or as elucidated by de Jong et al. (2003: p. 17); "because of the simultaneity of services, product- and process innovations usually coincide. New services often go together with new patterns of distribution, client interaction, quality control and assurance, etc."

However, not all service sectors are equally innovative. In manufacturing, the characteristics of the sector in which a firm operates (e.g. technological dynamism, demand growth, industry structure, etc.) have a significant impact on its innovation performance (Becheikh et al., 2006; Evangelista et al., 1997; Kalantaridis & Pheby, 1999; Kam et al., 2003; Nielsen, 2001; Quadros et al., 2001; Smolny, 2003; Uzun, 2001), and this seems to remain valid in service sectors. Therefore, we hypothesize that:

H.6: The service sector in which a firm operates has a significant impact on its propensity to innovate.
The following figure shows the conceptual framework of this research. It summarizes our hypotheses and portrays the dynamic between innovation and the determinants investigated in this study.

![Conceptual Framework](image_url)

**Figure 1: Conceptual Framework**

**Methodology and Summary Statistics**

**Data and descriptive Statistics**

This paper is using data from the survey conducted by the Egyptian ministry of scientific research (MOSR) as a component of the National Statistics System. The survey collects information about product and process innovation as well as organizational and marketing innovation during the three-year period 2005 to 2007 inclusive. It was released in 2009. The survey sample included 3000 enterprises, randomly selected from different Egyptian governorates and cities. The sample was stratified to represent the different sectors of activity as per the Federation of Egyptian Industries classification. The questionnaire used for the enterprise innovation survey was designed on the bases of the Oslo Manual's second edition, which contains guidelines for collecting and interpreting innovation data. Based on a questionnaire adapted from South Africa, the Egyptian questionnaire was translated while maintaining the same codes. The adjustments were done by the team prior to the starting of field work. Prior to launching the survey, a pretest of the survey questionnaire was conducted with 150 firms, and the questionnaire has been reviewed accordingly.

Data were collected by university graduates with a prior experience in data collection. The data collection personnel received a specific training on the way to collect data on
innovation and the specific use of the survey questionnaire. All data were collected via personal interviews with the representatives of responding firms. In the end, 2943 firms answered the survey for an exceptional response rate of 98%.

The scope of this study is small and medium-size enterprises (SMEs), working in the financial and hotel services sector. A subset of 376 firms of the database is used in this study.

The following table lists the descriptive statistics of the measurement variables used in the data model.

### Table 1: Descriptive Statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Type</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>S.D.</th>
<th>Cronbach's α</th>
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<tbody>
<tr>
<td><strong>Continuous variables</strong></td>
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<tr>
<td>• Number of employees</td>
<td>Continuous: number</td>
<td>1</td>
<td>250</td>
<td>32.4</td>
<td>45.9</td>
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<td>(SIZE)</td>
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<td>• Percentage of employees</td>
<td>Continuous: %</td>
<td>0</td>
<td>100</td>
<td>75.0</td>
<td>30.6</td>
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<td>with a university or</td>
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<td>technical degree/ diploma</td>
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<td>(SQRPERCUTEC)</td>
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<tr>
<td>• Financial barriers</td>
<td>Index: 3 items</td>
<td>0</td>
<td>9</td>
<td>3.00</td>
<td>2.71</td>
<td>0.72</td>
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<td>(FINBAR)</td>
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<tr>
<td>• Market barriers</td>
<td>Index: 3 items</td>
<td>0</td>
<td>9</td>
<td>2.58</td>
<td>2.44</td>
<td>0.75</td>
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<td>(MKTBAR)</td>
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<td><strong>Dichotomous variables</strong></td>
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<td>• Percentage of innovative</td>
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<tr>
<td>firms (TPPINNOV)</td>
<td>21.6 %</td>
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<tr>
<td>• Firm is part of a larger</td>
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<td>group (PARTGROUP)</td>
<td>47.9%</td>
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<td>• Export (EXPORT)</td>
<td>23.8%</td>
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<tr>
<td>• Improved knowledge</td>
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<td>management systems</td>
<td>32.8%</td>
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<td>(KMGTSYS)</td>
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<tr>
<td><strong>Sector</strong></td>
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<tr>
<td>• Financial Services</td>
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<tr>
<td>(Banks and Insurance)</td>
<td>39.1%</td>
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<td></td>
<td>26.6%</td>
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<td></td>
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<tr>
<td>• Hotels, Restaurants,</td>
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<tr>
<td>Tourism Offices and Booking</td>
<td>60.9%</td>
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<td></td>
<td>18.5%</td>
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</table>

The above table exhibits the descriptive statistics of the data sample. The overall innovative firms account for 21.6% of the whole sample. Financial services firms represent 39.1% of the data sample, with 26.6% innovative firms. Moreover, hotels and tourism offices firms represent 60.9% of the total firms in the sample, with only 18.5% of these firms are considered innovative.

The survey results also show that 47.9% of the firms are part of a larger group, 23.8% of the firms are engaged in exporting activities to regional and international

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1Following the European Commission, we define SMEs as firms employing less than 250 employees.
destinations. Moreover, 32.8% of the firms adopted new or significantly improved knowledge management systems.

The average service sector firm employs 32 employees. At the same time, 47% of firms employ between 10 and 60 employees, and just 13.9% of firms employ more than 60 employees. Moreover, 75% of the employees in an average Egyptian service SME have a university or technical degree, which is somehow important in the context of service industry which is constantly changing and requires high caliber in order to respond and react to changes.

As for innovation barriers, on one hand, the financial barriers measurement is an index of values ranging from 0 to 9. The average value is 3, meaning that firms in the sample are not facing high level of financial barriers. On the other hand, the market barriers measurement variable is also an index of items ranging from 0 to 9. The average value is 2.58, which means that firms in the sample came across low level of market barriers to innovation.

**Econometric model and variable measurement**

The following binary Logit regression model was estimated to identify the factors that explain firms’ propensity to innovate:

\[
\log\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 \text{PARTGROUP} + \beta_2 \text{EXPORT} + \beta_3 \text{SQRPERCUTEC} + \beta_4 \text{KMGMTSYS} + \beta_5 \text{FINBAR} + \beta_6 \text{MKTBAR} + \beta_7 \text{LNSIZE} + \beta_8 \text{SECTOR} + \epsilon
\]

Where:

- $\beta_i$ ($i=0 \ldots 8$) are the regression parameters to be estimated.
- $\log\left(\frac{P_i}{1-P_i}\right)$ is the Logit of the dependent variable TPPINNOV (see Table 1). It corresponds to the logarithm of the ratio of the probability that a firm innovates relative to the probability that it does not innovate.
- PARTGROUP: a binary variable coded 1 if at the time the survey was conducted the enterprise was part of a larger group, and 0 otherwise.
- EXPORT: a binary variable coded 1 if during the three years 2005 to 2007 the enterprise sold products outside Egypt and 0 otherwise.
- SQRPERCUTEC: competence and qualification of employees measured by the square root transformation of the percentage of total employees that had a university or technician degree or diploma in 2007.
- KMGMTSYS: use of advanced management systems measured by a binary variable coded 1 if during the three years 2005 to 2007 the enterprise introduced new or significantly improved knowledge management systems to better use or exchange information, knowledge and skills within the company, and 0 otherwise.
- FINBAR: financial barriers to innovation measured by a three-item index (see Table 1).
- MKTBAR: market barriers to innovation measured by a three-item index (see Table 1).
- LNSIZE: size of the firm measured by the logarithm of the number of employees.
- SECTOR: the sector of activity measured by a categorical variable (see Table 1).
PARTGROUP and EXPORT are used as agents to firms’ knowledge acquisition measurement. PARTGROUP variable is a yes or no question of whether the firm is part of a larger group or not. Firms that are part of larger groups can rely on the parent technological and marketing resources and competencies to decrease the technological and commercial uncertainty of their technological innovations. EXPORT variable is a yes or no question of whether the firm is engaged in exporting activities in the period of (2005-2007). The interaction with external stakeholders brought by exporting to foreign markets exposes the firm to higher levels of innovative ideas, advanced knowledge, and sophisticated technologies.

Moreover, SQRPERCUTEC and KMNGTSYS are used as proxies to firms’ absorptive capacity measurement. SQRPERCUTEC is a variable used to measure employees’ qualifications. It's the percentage of employees having a university or technical degree or diploma. A square root transformation was conducted to the variable to normalize the dataset. KMNGTSYS variable is a yes or no question of whether the firm has installed or improved knowledge management system in the period of (2005-2007).

As for innovation barriers, we tested two types of barriers. The first one is the financial barrier FINBAR. In order to measure it, we used the multiple-item index of three questions related to the following: cost factors of innovation activities, lack of funds influencing decisions to innovate, and innovation is too costly to pursue. Afterwards, a factor analysis and reliability of the scale tests were made.

The second innovation barrier is the market barrier MKTBAR. We also used a multiple-item index of three questions revolving around market dominance by established firms, uncertain demand of innovative artifacts, and inexistence of market need due to no demand of innovative services or goods. To measure the unidimensionality of these two variables, we conducted a principal component factor analysis with VARIMAX rotation on the items included in the scales (Ahire and Devaray, 2001). The factor analyses results show that: 1) one factor explains 71.8% of the original variance of the phenomenon for the FINBAR index and 2) one factor explains 74.8% of the original variance of the phenomenon for the MKTBAR index. The results for the Kaiser-Meyer-Olkin (KMO) and Bartlett tests are all acceptable and significant showing a good adequacy of the factor solutions. In light of these results, we can consider that the observed items used to measure the financial and market barriers are, respectively, associated with each other and represent a single concept. In addition, Chronbach’s alphas were computed to assess the statistical reliability of these two scales. As shown in Table 1, the Chronbach’s alphas are .72 for FINBAR and .75 for MKTBAR. These levels are very acceptable considering that Ahire and Devaray (2001) and Nunally (1967, 1978) recommend the threshold of .50 for emerging construct scales and .70 for maturing constructs.

As for the firm size and sector of activity, LNSIZE and SECTOR variables are introduced into the regression model.

Finally, the correlation matrix between the explanatory variables is shown in Appendix A. It shows that the highest correlation coefficient covariates is the one between FINBAR and MKTBAR and equals .51. This certifies that there is no serious multi-collinearity disturbance in the regression data model, which increases the reliability of the model results and justifies the inclusion of these variables in the model.
Results

In this model, the number of firms included is 376 firms, with 347 included in the analysis. The computed value of the likelihood ratio is 75.351, which is much higher than the critical value of the chi-square statistic with 8 degrees of freedom for 1% probability level. This suggests that the null hypothesis, that the parameter coefficients (except the intercept) are all equal to zero, is strongly rejected. The overall model is significant at the 1% level, where Nagelkerke R2 (Pseudo R2) value is 0.3 which is reasonable for qualitative dependent variable models. The model equation also is an indicator of having a good predictive power, with 82.7% of correct predictions for the firms' propensity to innovate. We are basing our analysis of innovation determinants on four pillars. In the following section we'll compare the results of the model with what have been hypothesized according to each pillar.

For the knowledge acquisition pillar, being part of a larger group PARTGROUP proved to be non significant for innovation. As for exporting to regional and international destinations, the model results show that EXPORT measurement variable has a significant impact on firm's probability to innovate. Moreover, its impact is positive, which means the increase in carrying out exporting activities will increase the probability of firm's innovation, conforming partially our hypothesis (H.1).

For the absorptive capacity pillar, installing a knowledge management system to help firms to assimilate, transform and exploit acquired knowledge has a positive significant impact on firm's innovation probability as shown by the results for the KMGTSYS measurement variable. On the other hand, surprisingly, having employees with university degrees or technician diplomas SQRPERCUTEC doesn’t seem to have a significant impact on the propensity of firms to innovate. The result of analysis of the absorptive capacity measurement variables partially conform our hypothesis (H.2). Moreover, it seems that both exporting activities and possessing knowledge management systems are important and crucial to firms' innovation in service sector's SMEs in the developing countries context.

For the innovation barriers, the impact of financial barriers (FINBAR) on firms’ propensity to innovate is not significant, disconfirming with the hypothesis (H.3). As for the market barrier MKTBAR, it's positive and significant. The probability of innovation in firms increases with the existence of market barriers. This result disconfirms with the hypothesis (H.4). One explanation of this result may be that when market barriers are present but not very high, they will create a challenge for the small and medium size firms to increase their innovation endeavors, regardless the uncertain or nonexistent demand for innovative products or services, or if the market is dominated by established enterprises.

For the firm size, SIZE is positive and significant with (.001) significant value, conforming the hypothesis (H.5) that states the relationship between firm size and capacity to innovation. As for the sector of operation, the model shows that the financial services firms are more innovative than the hotel & tourism services firms, conforming our hypothesis (H.6) which predicts an impact of the sector of operation on the firm's innovation propensity.
Table 2: Estimated Logistic Regression model of elements influencing firms' propensity to innovate.

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Coefficients $^a$ (S.E.)</th>
<th>Exp (치)</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERCEPT</td>
<td>-4.093 (0.89)***</td>
<td>.017</td>
<td>.000</td>
</tr>
</tbody>
</table>

Exposure to external knowledge & technologies

- Firm is part of a larger group [$PARTGROUP$] .319 (.33) 1.357 .339
- Export (YES = 1) [$EXPORT$] .992 (.34)*** 2.696 .003

Firm’s absorptive capacity

- Percentage of employees with a university or technical degree/ diploma [$SQRPERCUTEC$] .055 (.084) 1.056 .516
- Improved knowledge management systems (YES = 1) [$KMGTSYS$] 1.157 (.310)*** 3.180 .000

Barriers to innovation

- Financial barriers [$FINBAR$] -.083 (.068) .921 .224
- Market barriers [$MKTBAR$] .199 (.071)*** 1.220 .005

Control variables

- Number of employees [$LNSIZE$]$^b$ .461 (.144)*** 1.586 .001
- Sector $^c$: Hotels, restaurants, tourism offices and booking -.571 (.325)$^7$ .565 .079

Number of cases 376 (347 included in the analysis)
Chi-square (df) Calculated $\chi^2 = 75.351$; Theoretical $\chi^2 (8) = 20.090$ at 1%
Nagelkerke R2 (Pseudo R2) .301 Percentage of correct predictors 82.7%

$^a$, $^*$ and *** indicate that the coefficient is significant, at the 10%, 5% and 1% thresholds respectively.
$^b$ LN indicates the logarithmic transformation of the variable SIZE.
$^c$ Sector's reference category is Financial Services, Banks and Insurance

Discussion and Conclusion

Over the last decades, innovation has grasped the attention of researchers and practitioners alike. Not only innovation is of great importance for economies as a whole, but also a key success factor for the enterprises. Changes in the market and technology from one side and the fierce competition on the other are all part of the important aspects organizations have to monitor and try to keep pace through innovation. Innovative firms effectively use their capabilities to constantly align themselves with changing market needs in their efforts to capitalize on market opportunities more effectively than their competitors.

This research's econometric model showed that firms in service sector have a different reaction to innovation determinants other than the manufacturing sectors' firms of the
study conducted by Becheikh, 2011. Being part of a larger group determinant doesn't have any significant value on the firm's innovation probability. Implementing innovative activities that originated from the mother international companies may not be a best fit, considering the sophistication and characteristics of the Egyptian markets and consumers. As for the export determinant, it has a significant positive impact on the innovation probability. Dealing with foreign markets and different customer bases & characteristics indeed increases knowledge acquisition activities, as firms in order to sustain their market share in foreign markets have to enhance their offerings, by acquiring new knowledge—among many factors—to match the specifications of these foreign markets, and in return their innovation probability will increase.

Moreover, employing people with university degree or technical diploma determinant doesn't have any significant impact on firms’ innovation propensity. On the other hand, establishing and improving knowledge management systems has a significant positive impact on firms’ innovation probability. If anything these results tell us is that it may be important to employ knowledgeable trained caliber, but more importantly is having a system for storing knowledge and using it for the benefit of the firm’s innovation activities. This knowledge management system is available for employees in the firm to use in their specific area of work. In addition, it'll also encourage knowledge sharing and codifying tacit knowledge, all of which will increase the probability of pursuing innovative projects.

For the innovation barriers, the impact of financial barriers on firms’ propensity to innovate is—surprisingly—not significant. As for the market barrier it's positive and significant, which means that the probability of the firm to pursue innovative projects increases with the existence of market barriers. One explanation of this result may be that when market barriers are present but not very high, they will create a challenge for the small and medium size firms to increase their innovation endeavors. This explanation is reinforced by the low mean values of the descriptive statistics of the variables (see Table 1) which can justify that although there are barriers, their influence on the innovation performance is not high.

Moreover, increasing the firm's size by hiring new employees has a positive significant impact on firm's innovation probability. Indeed, hiring new employees whom have diverse capabilities can nurture innovative activities undertaken by the firm. Moreover, results show that financial firms are more innovative than their counterparts in hotels and tourism sector. One possible explanation for this result is that the financial sector is one of the most established sectors in Egypt (GAFI, 2010). With the large and growing consumer base, as the majority of the nation's 78 million people use consumer banking and insurance services (GAFI, 2010). This fast growing and edged competition environment is pressuring financial firms to provide innovative and new services to sustain their market share and stepping ahead their rivals. This result also suggests that hotels and tourism sector's firms have to enhance their activities for innovation.
Our recommendations for managers when it comes to firm size are that they should consider increasing their firm size by expanding their activities and therefore recruiting new employees, as this research proved that innovation probability is increased by this factor. Indeed, employing fresh minds, especially if they're trained and talented, can lead to pursuing unconventional activities and then it may lead to innovative outputs.

Moreover, engaging in exporting activities is associated with higher ranks of economic growth and it also proved to have a positive significant impact on firms' innovation propensity. Networking with outside markets and international firms increases knowledge acquisition potential. In addition, different markets and customers require that firms should be aware of the latest technological trends if they were to compete in these markets. Hence, managers are encouraged to engage in exporting activities to acquire knowledge and compete globally.

In addition, it's highly recommended that services firms' managers invest in establishing and improving knowledge management systems as it proved to have great impact on the firms' innovation propensity. Knowledge management systems are shared among the firm's employees available for everyone to use, which in turn encourages employees to codify and internalize knowledge. Knowledge management systems also help firms assimilate, transform and exploit knowledge acquired from various sources in their quest for innovation. Due to services nature: simultaneous and constantly changing, responding faster to market demands; the existence of knowledge management system is highly recommended.

It's also recommended that service firms' managers consider market barriers -such as market domination by established firms or no demand for innovative products or services- as a sort of a challenge for firms to find a niche market and better offer their products than their rivals. On the other hand, financial barriers have no significant impact on innovation propensity. This suggests that managers don't necessarily have to pause or delay innovative projects due to lack of funds.

Furthermore, our recommendations for policy makers are that more knowledge exchange networks amongst universities and firms should be established to help firm acquire knowledge. Moreover, providing the policies that govern and ease the exchange with foreign companies to acquire knowledge and expand their potential to new overseas markets. This will put a pressure for companies to innovate and compete outside the country's border. As the service sector accounts for 46% of the Egyptian GDP in 2010 (World Development Indicator –WDI) which is the biggest share of the Egyptian GDP -11% of GDP in agriculture and 43% in industry- draws the attention of its importance to the national innovation.

This research is limited to exploring only two service sectors, the financial services and hotel and tourism services sectors. Further research work is required to explore other services sector in order to build a complete picture on the service sector

innovation performance. Moreover, the sample size of the firms included in our analysis is relatively small. Hence, more research work has to be conducted with larger data samples to include more variations and to better map the sector's innovation performance. The inclusion of other innovation determinants to test their impact on Egyptian firms will provide a better understanding to the service sector characteristics as well as helping to further identify problems and obstacles in order to tackle them and map this sector's innovation performance.

Acknowledgements

The authors would like to thank the Egyptian Ministry of Science Research for accepting to make the raw data of the Egyptian Innovation Survey available for the purposes of this research.
# Appendix A: Definition of Dependent and Explanatory Variables

<table>
<thead>
<tr>
<th>Measure</th>
<th>Sub-items</th>
<th>Method (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variable</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propensity to innovate [TPPINNOV]</td>
<td>Binary variable, coded 1 if the enterprise had introduce new or significantly improved goods, services, or processes during the three years 2005 to 2007, and 0 otherwise</td>
<td></td>
</tr>
</tbody>
</table>

## Independent Variables

### Exposure to external knowledge and technologies

- **Firm is part of a larger group [PARTGROUP]**
  - Binary variable coded 1 if at the time the survey was conducted the enterprise was part of a larger group, and 0 otherwise.

- **Export [EXPORT]**
  - Binary variable coded 1 if during the years 2005 to 2007 the enterprise sold products (goods or services) outside Egypt, and 0 otherwise.

### Absorptive capacity

- **Percentage of educated employees [SQRPERCUTEC]**
  - Square root transformation to percentage of square root transformation of total employees that had a university or technician degree or diploma in 2007

- **Improved knowledge management systems [KMNGTSYS]**
  - Binary variable coded 1 if during the three years 2005 to 2007 the enterprise introduced new or significantly improved knowledge management systems to better use or exchange information, knowledge and skills within the company, and 0 otherwise.

### Innovation Barriers

- **Index of financial barriers to innovation [FINBAR]**
  - Significance of the following factors in restricting the firm’s innovation activities or projects or in influencing a decision not to innovate during the three years 2005 to 2007, measured with a Likert importance scale (0= Not relevant to 3= High).

- **Index of market barriers to innovation [MKTBAR]**
  - Significance of the following factors in restricting the firm’s innovation activities or projects or in influencing a decision not to innovate during the three years 2005 to 2007, measured with a Likert importance scale (0= Not relevant to 3= High)

  - Lack of funds within the enterprise or group
  - Lack of finance from sources outside the enterprise
  - Innovation costs too high
  - Market dominated by established enterprises
  - Uncertain demand for innovative goods or services
  - No need to innovate because of no demand for innovation

### Control Variables

- **Firm size [LNSIZE]**
  - The firm’s total number of employees in 2007
  - Binary variable coded: 0 if the firm operates in the financial services, banks and insurance. 1 if the firm operates in the hotels, restaurants, tourism offices and booking.

- **Sector of activity [SECTOR]**
  - Binary variable coded: 0 if the firm operates in the financial services, banks and insurance. 1 if the firm operates in the hotels, restaurants, tourism offices and booking.
Appendix B. Correlations between explanatory variables

<table>
<thead>
<tr>
<th>PARTGROUP</th>
<th>EXPORT</th>
<th>SQRPERCUTEC</th>
<th>KMGTYS</th>
<th>FINBAR</th>
<th>MKTBAR</th>
<th>LNSIZE</th>
<th>SECTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARTGROUP</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXPORT</td>
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<td>1</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SQRPERCUTEC</td>
<td>.271</td>
<td>.208</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KMGTYS</td>
<td>.219</td>
<td>.303</td>
<td>.136</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FINBAR</td>
<td>-.143</td>
<td>-.066</td>
<td>-.051</td>
<td>.021</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MKTBAR</td>
<td>-.046</td>
<td>.019</td>
<td>.110</td>
<td>.048</td>
<td>.506</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>LNSIZE</td>
<td>.211</td>
<td>.200</td>
<td>.274</td>
<td>.162</td>
<td>-.104</td>
<td>.020</td>
<td>1</td>
</tr>
<tr>
<td>SECTOR</td>
<td>-.301</td>
<td>.010</td>
<td>-.159</td>
<td>-.094</td>
<td>.201</td>
<td>.086</td>
<td>.022</td>
</tr>
</tbody>
</table>

References


