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How do Entrepreneurs Perceive Barriers to Innovation?

Empirical Evidence from Turkish SMEs

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Abstract

Purpose – SMEs play very important roles in national economies, because of their numbers and because of the large share of the workforce involved. However, despite the recognition of important roles of SMEs in the economy, some crucial barriers to innovation prevent SMEs from developing and contributing sufficiently. This paper identifies some important innovation barriers perceived and experienced by entrepreneurs in Turkish SMEs.

Design/Methodology/approach – A logit regression model was used to explain the innovation barriers of SME entrepreneurs based on a survey questionnaire of 224 respondents.

Findings – An analysis of 224 Turkish SME entrepreneurs reveals the fact that “lack of government’s R&D and technology policy” from formal barriers; “Informal economy’s negative impact on investment” from informal barriers; “high cost of innovation” and “lack of appropriate source of finance” from environmental barriers and “lack of qualified personnel” from skill barriers, are the most important variables, and they have a significant effect on the entrepreneurs’ innovation decisions in Turkey.

Research limitations and Implications – There are around two million SMEs in Turkey and it is not possible to survey all of them for this research. Because of the constraints on resources only a small sample of randomly selected SMEs from a large population was analysed. Therefore our findings represent this small sample only rather than all manufacturing SMEs in Turkey.

Practical Implications – We believe that our results may be considered by policy makers in their decision making process to overcome some innovation barriers for entrepreneurs and to improve their economic performance in Turkey.

Originality/Value – Understanding basic innovation barriers for entrepreneurs in SMEs will be a critical condition for Turkey’s future growth and prosperity. This study provides an important theoretical insight into the innovation barriers encountered by SME entrepreneurs, and presents empirical evidence to the entrepreneurship and innovation literature with a case study from Turkish SMEs. As the findings of this research highlight some obstacles for Turkish SME entrepreneurs, it also contributes to the developing country literature.

Key words – SMEs, Barriers to Innovation, Entrepreneur, Logit Model, Turkey

Paper type – Research paper

1. Introduction

The conceptual relationship between innovation¹ and entrepreneurs² has attracted considerable attention in the literature for many years. The earlier theoretical attempt to establish a link between entrepreneur and innovation came from economics. One of the well known economists and the writer of *Principals of Political Economy*, J. S. Mill (1848: 1909), stressed the significance of entrepreneurship for economic growth and claimed that entrepreneurship requires "no ordinary skill". In economic terms, nevertheless, the necessity of entrepreneurship for production was first formally recognized by Alfred Marshall in 1890. In his famous book, *Principles of Economics*, Marshall (1890: 1920) emphasised that there are four factors of production: land, labor, capital, and organisation. Among them organisation is the coordinating factor, which brings the other three factors together and the driving engine behind organisation is entrepreneurship. Accordingly, Marshall says, by being innovative, entrepreneurs generate new commodities or improve "the plan of producing an old commodity" (Marshall, 1890: 1920). As entrepreneurs have a thorough understanding about their industries as natural leaders, they have the ability to foresee changes in supply and demand; and act on such risky forecasts in the absence of complete information (Marshall, 1890: 1920).

In 1951, Schumpeter first used his famous phrase 'entrepreneur as innovator', in his book, *The Theory of Economic Development*, and referred to the entrepreneur as the key engine for economic development. In his later work, *Capitalism, Socialism and Democracy*, Schumpeter (1942) extended his previous view of 'entrepreneur as innovator' by further declaring that an increase in the number of innovative activities by entrepreneurs leads to an increase in economic growth, and a dynamic economy is rooted in innovation and entrepreneurship throughout the process of creative destruction. After Schumpeter, the modern school of thought also agreed about the role of entrepreneur as an innovator; however, they debated about the definition of innovation. Kirzner suggests that 'the process of innovation is actually that of spontaneous

¹ *The term 'innovation'* originates from the Latin 'innovate', meaning to take something new. Until recently, innovation has been perceived as the application of new technologies or application of formal research and development to produce new products or processes to acquire competitive advantage. In that context, Tidd et al. (2001) viewed innovation as 'a challenge to organisations in essence unless organisations are prepared to renew their products and processes on a continuing basis their survival chances are seriously threatened' (p.12). Moreover, Hattori and Wycoff (2002) stated that 'the challenge now is to live and thrive in the new world, where the call is for more innovation' (p.25). Porter (1990) also assessed innovation in regard to "newness", and adds that companies achieve competitive advantage through acts of innovation by including both new technologies and new ways of doing things.

² *The term 'entrepreneur'* was first introduced by the early 18th century Irish/French economist Richard Cantillon, defining the entrepreneur as the "agent who buys means of production at certain prices in order to combine them" into a new product (cited in Schumpeter, 1951). Before long, the French economist J.B. Say added to Cantillon's definition by including the idea that entrepreneurs had to be leaders. Say claimed that an entrepreneur is one who brings other people together in order to build a single productive organism (cited in Schumpeter, 1951).

"undeliberate learning" (Kirzner, 1985, p.10). Thus, the necessary characteristics of the entrepreneur are recognised as attentiveness, innovativeness, and recognising opportunities.

Other economists in the innovation school are more with Mill and Marshall than with Kirzner; and they claimed that the process of innovation happens because entrepreneurs have special skills. Along this line, Leibenstein (1995) claimed that the dominant, necessary characteristic of entrepreneurs is that they are gap-fillers as they have the ability to perceive where the market fails, how to develop new goods or processes, and which product will supply the market demands. Thus, Leibenstein regarded entrepreneurs as those with the extraordinary ability to connect different markets, make up for market failures and deal with the deficiencies. For Leibenstein, 1995, this is why entrepreneurs have the ability to combine various inputs into new innovations in order to satisfy unfulfilled market demand. In recent years, more and more studies followed this view and emphasised that only a person who founds a new company on the basis of a new idea, or leads teams and organisations to introduce innovations, can be called an entrepreneur³. The definition of entrepreneur used in this article is on the same lines as Schumpeter, Kirzner and Leibenstein, and classifies entrepreneurs as creative leaders, who continuously engage with innovation at every level.

In today's business world, innovation has become one of the key factors for businesses since competition for customers and resources has become more and more intense, and currently innovation has expanded its roots to all areas of operation – production, finance, planning, human resource management and marketing – in the hands of an entrepreneur. In a much wider context, Drucker (1985) defines this type of innovation as “the specific tool of entrepreneurs” (p.32). Drucker in his definition clearly sees an entrepreneur as someone who creates new wealth, or endows existing resources with enhanced potential for creating wealth. Therefore, for entrepreneurs, seeking to gain a competitive advantage in the market place and increasing their capacity to generate wealth is more than an invention and does not have to be only technical as there are numerous examples of social and economic innovations (Drucker, 1994). A more recent, similar evaluation of innovation as a process has been done by Buggie (2001). Buggie argues that the process – which will successfully attain innovation and hence future organisational growth – consists of four stages: strategy development, ideation, evaluation and implementation, which he calls “four phases of innovation”⁴. As Herbig et al. (1994) observed

³ (see more Grupp, 2001; Arora et al; 2002; Stoneman, 1995; Sundbo 1998; OECD, 2003, 2009; Johnson, 2001; Legge and Hindle, 1997; Kanungo, 1998; Zhao, 2001).

⁴ Hargadon and Sutton (2000) refer to innovation a process, which can be characterised as the “knowledge-brokering cycle”. The cycle consists of four interlinked work practices: capturing good ideas, keeping ideas alive, imagining new uses of old ideas, and putting promising concepts to the test. Some other researchers have categorised innovation into technological and administrative innovations. Technological innovation is about “the adoption of a new idea that directly influences the basic output processes, [whereas] administrative innovations include changes that affect the policies, allocation of resources, and other factors associated with the social structure of the organization” (Daft, 1978, cited in Cooper, 1998, p.497). Indeed, entrepreneurship is also now viewed as a creative act and entrepreneurs continue to seek opportunities, and innovations provide the instrument by which they might succeed.

“Innovation requires three basic components: the infrastructure; the capital; and the entrepreneurial capacity needed to make the first two works” (p. 37). The definition of innovation used in this article is the mixture of Herbig et al.’s (1994); Drucker’s (1985); and Hargadon and Sutton’s (2000) definitions and we can describe innovation as: the identification, application and exploitation of a new product, process or marketing opportunity by an entrepreneur for the business to increase its capability to generate wealth and strengthen its competitive position. Thus, we believe that, for a firm to engage in innovation requires the ability of the entrepreneur to access new information, have the capability to turn this information into knowledge, and have processes, procedures and resources to apply this knowledge to exploit the opportunity or opportunities arising. That also means that the capability of a firm to innovate will change as it grows and develops.

In many Small and Medium-Sized Enterprises (here after SMEs) basic operational functions are carried out by the owner or manager, and not by the innovative entrepreneur, and thus this challenge often leads to a lack of realisation of the processes needed to implement innovation within the SME. Furthermore, globalisation, economic changes, decreasing product lifecycle, increased technological capabilities, changing consumer needs and increased competition add to this challenge⁵. In order to overcome these challenges, small businesses actually need entrepreneurs in order to transfer their knowledge and their information into very successful practices throughout continuous innovation at every level (OECD LEED Programme, 2009). So that, without any doubt, innovation should be intrinsically linked to the entrepreneurial operation within SMEs wherever they operate. In the literature, small entrepreneurial firms are generally credited with introducing several radical innovations (Utterback, 1994), especially in industries characterised by skilled labour and low capital intensity (Acs and Audretsch 1988). For the SME entrepreneurs the key advantage relating to innovation is their entrepreneurial dynamism, their internal flexibility and responsiveness to changing circumstances i.e. their behavioural advantages. However, according to Mosey et al., (2002), SMEs must be even more responsive in adopting innovative organisational structures, process technologies and culture to help sustain or establish competitive advantage in the new and innovative market place.

In addition to the challenges mentioned earlier, several studies (Davidsson 1989, Hakim 1989; Storey, 1994) also showed that most small firms are, in fact, not very entrepreneurial or innovative; and these firms experience difficulty in acquiring external capital for rapid growth and managerial skill to cope with the increasingly complex organisational process; they often

⁵ In peripheral regions, external innovation infrastructures are usually less developed than in central regions (Gatrell, 2001), and skills and market access are more difficult to obtain (Anderson et al., 2001). Especially this final point reflects one of the main difficulties when discussing innovation in relation to its application to small businesses – what exactly do we mean by innovation in SMEs? If innovation is used merely as a one dimensional function, as it very often is within the small business, there is a real chance that innovation will only be sought through major technological breakthrough or as an output of one-off events or difficulties to be overcome. However, if innovation is used as a continuous process of improvement and change for businesses seeking competitive advantage, there is more to consider it as the introduction of new or significantly improved products, processes or methods of production and a key driver of economic growth.

lack the time and resources to identify external sources of information and technical expertise; they have difficulty attracting risk capital; and they have difficulties in responding properly to their markets. Therefore, these disadvantages of SMEs in relation to innovation are often called barriers to innovation. Keegan et al. (1997) and Cooney et al. (1996) have focused on barriers to innovation in European SMEs and found that some of these barriers are shared across countries and some of them are country-specific. Nevertheless, common barriers, according to Keegan et al (1997), are as follows; ‘high costs associated with innovation’, ‘too long pay-off period for innovations’, ‘lack of government support for business’, ‘low availability of venture capital’, ‘innovations are too easy to be copied by competitors’, ‘high rates of income tax and social insurance’, the ‘small size of the domestic market’, ‘national tendency towards jobs with security’, an ‘education system that influences people to get a job’, and a ‘national tendency to recent successful entrepreneurs’. This high number of innovation barriers proves that there is a need for a clear strategy for SMEs to deal with these basic barriers to their position and to implement innovation practices within the firm (Teece, 1996). Irrespective of the scenario of the strategy adopted by the small business it is crucial to know that the small business entrepreneur should implement the best policy to implement their innovation decisions.

Despite the interest in improving knowledge about barriers to innovation, until now there has been little research in the field of main innovation barriers for entrepreneurs from the economic literature perspective. The main aim of this paper is to understand the innovation barriers for Turkish SME entrepreneurs from the economic perspective. We believe that once barriers to innovation are removed that would increase innovation and growth in the small firm sector, and consequently boost economic growth. To do so, we need to identify some formal and informal, as well as skill and environmental barriers perceived and experienced by SME entrepreneurs in Turkey through a survey questionnaire, in order to comprehend what prevents entrepreneurs being more innovative. Our research question is ‘What are the perceived innovation barriers for SME entrepreneurs?’, the dependent variable is dichotomous and the applicable analytical model should come from the binary-choice genre of models, namely a Logit model, as it takes the value 1 if the SME entrepreneurs have perceived some important barriers to innovation, and 0 for those who did not display any pattern in their responses.

This paper is structured as follows: Section 2 provides the theoretical background of innovation barriers for SME entrepreneurs; Section 3 discusses the Turkish SMEs and country specific barriers; Section 4 looks into research methodology and data in detail and presents empirical findings on questionnaire survey. Findings and policy implications form the conclusion in Section 5.

2. SME Entrepreneurs and Innovation Barriers

Even in industrialised countries, SMEs are expected to face relatively more barriers to innovation than large firms. As SMEs have comparatively more inadequate internal resources and lack of expertise, the interactive character of innovation in their case becomes even more intense than in large firms (Rothwell, 1991). This is one of the reasons that higher importance is attached to barriers. It is generally believed that once SME entrepreneurs identify their innovation barriers, study their impacts and take actions to eliminate them, then the natural flow of innovation will be re-established and maintained. Because innovation is not an automatic or spontaneous process it requires entrepreneurs to provide motivation, effort and risk acceptance to proceed (Tidd et al., 1997).

Piatier (1984) carried out research for the Commission of European Communities, under the title "Barriers to innovation in SME" in eight countries of the European Economic Community, and differentiated barriers as external to the firm (supply, demand and environment related)⁶ and internal to the firm (resource related and human nature related)⁷. For Rush and Bessant, 1992 these barriers may act on one or more points of the innovation process. In his study, Piatier (1984) found that impacts are mainly on finance, manufacture and manpower. General government action, which is estimated to cause about half of the difficulties experienced, has its strongest negative impact upon the downstream end of the innovation process (i.e. distribution and exports).

After Piatier (1984) barriers to innovation in SMEs have been the object of investigation in a large body of national and international studies, and among them; Acs and Audretsch (1990) for the US; Ylinenpää (1998) for Sweden; Hadjimanolis (1999) for Cyprus; Mohnen and Rosa (2002), Baldwin and Lin (2002) and Baldwin and Gellatly (2004) analyzed the obstacles to innovation in a sample of service and manufacturing firms for Canada; FES (2004) for Germany; Mohnen and Röller (2005) studied the complementarities between barriers to innovation with a sample of the CIS1 data from Ireland, Denmark, Germany and Italy; Galia and Legros (2004) investigated the complementarities between obstacles to innovation using CIS2 data for a sample of manufacturing firms for France; Freel (2005) observed the barriers to product innovation in a sample of small manufacturing firms in the West Midlands for the West Midlands area; March et al. (2002) analysed empirically the barriers to innovation in a small sample of SMEs located in the Valencia region of Spain. These can be counted as pioneer studies.

⁶ Supply barriers include difficulties in obtaining technological information, raw materials, and finance. Demand barriers have to do with customer needs, their perception of the risk of innovation, and domestic or foreign market limitations. Environmental ones include various government regulations, antitrust measures, and policy actions.

⁷ Resource related, e.g. lack of internal funds, technical expertise or management time; culture and systems related e.g. out-of date accountancy systems; and human nature related, e.g. attitude of top manager to risk or employee resistance to innovation

In a more recent study, Madrid-Guijarro et. al (2009) examined barriers to firm innovation among a sample of 294 managers of SMEs in Spain, and evaluated the relation between product, process, and management innovation; and 15 obstacles to innovation, which can limit a firm's ability to remain competitive and profitable. Findings of the study show that barriers have different kinds of impact on the various types of innovation. For example, product, process, and management related innovations are affected differently by the various barriers. The most significant barriers are associated with costs, whereas the least significant are associated with manager/employee resistance. Additionally, the results demonstrate that the costs associated with innovation have proportionately greater impact on small than on larger firms. They suggested that the findings can be used in the development of public policy aimed at supporting and encouraging the innovation among SMEs in Spain.

Another very recent study published by Segarra-Blasco et al in 2008 is for Catalonia. The data set used in this research was based on the 2004 official innovation survey of Catalonia and used a sample of 2,954 Catalan firms in manufacturing industries and knowledge-intensive services. For these researchers, managers and owners of firms considered these obstacles to innovation as external and internal factors. External barriers become visible when the firm has difficulties accessing technological information, or when it lacks external finance, or skilled personnel, or when there are factors related the market conditions. A firm has internal barriers when it lacks internal funds and when the firm's members feel that the risks and costs of innovation are too high.

In addition to all those general problems mentioned above, SMEs in less developed countries face further barriers, such as; lack of technological and policy infrastructure, the low degree of innovativeness, bad location and inappropriate firm size for the market. In addition to these, comprehensive studies on barriers to innovation in such countries are relatively rare. There are limited but still some studies for less developed countries to examine barriers to innovation. For example, Levy (1993) examined barriers to growth and Lall et al. (1994) studied technological development in less developed countries. Governments in those countries make serious efforts to reduce these barriers in order to improve innovation activities for SMEs and to increase their international competitiveness, but still the number of regulations or lack of technology policy of governments can be counted among the most important barriers for SMEs and their entrepreneurs. In addition, internationalisation activities of developing countries expose SMEs to a more complex and risky business environment compared to larger firms. SMEs are also relatively unprepared for competition and less well-resourced in those countries. Another very important reason might be that there are so many formal and informal barriers to innovation in less developed countries⁸. For the creation of a more business friendly innovation environment, and for a more integrated economy at the international level it is obvious that governments in

⁸ Some of these risks, barriers and complexities have been already addressed by some economists (such as; Stewart, 1977; Lall, 1983; Fransman, 1985; Kumar and Sagip, 1996; Evanson and Johnson, 1998; Johnson et. al. 2000; Glas et. al., 2000; Pissarides et.al., 2000; Woodward, 2001; and Anderson et. al., 2004).

less developed countries should harmonise their regulatory, administrative and policy environments to world standards. Table 1 shows some of the literature on innovation barriers in SMEs in developed and developing countries.

Table 1 Literature on Barriers to Innovation and SMEs

Authors	External	Internal	Environment	Skill
Piatier (1984)	<ul style="list-style-type: none"> • Technological information, raw materials, and finance • Customer needs, their perception of the risk of innovation, and domestic or foreign market limitations 	<ul style="list-style-type: none"> • Lack of internal funds, technical expertise or management time, culture and systems related, 	<ul style="list-style-type: none"> • Various government regulations, antitrust measures, and policy actions. 	<ul style="list-style-type: none"> • Attitude of top manager to risk or employee resistance to innovation
Acs and Audretsch (1990) Baldwin and Gellatly (2004)	<ul style="list-style-type: none"> • Technological information, raw materials, and finance 	<ul style="list-style-type: none"> • Financial bottlenecks 		
Ylinenpää (1998)				Shortage of and hindered access to qualified personnel
Ylinenpää (1998)		<ul style="list-style-type: none"> • Missing market know-how 		
Acs and Audretsch (1990) Hadjimanolis (1999) Rammer et al. (2006)			<ul style="list-style-type: none"> • Bureaucratic hurdles • Excessive bureaucracy 	
Baldwin and Gellatly (2004)			<ul style="list-style-type: none"> • Lack of intellectual property rights 	
Silva and Leitão (2007) Tourigny and Le (2004)	<ul style="list-style-type: none"> • The lack of financing • The lack of information about technology • Organisational rigidities 	<ul style="list-style-type: none"> • High cost of innovation • High economic risk • The lack of customers' responsiveness 	<ul style="list-style-type: none"> • Government regulations 	<ul style="list-style-type: none"> • The lack of skilled personnel
Rush and Bessant (1992) Hadjimanolis (1999)	<ul style="list-style-type: none"> • The lack of customers' responsiveness • Lack of tech information • Lack of finances • Risk of innovation • Market limitations 	<ul style="list-style-type: none"> • Lack of internal funds • Lack of accountancy system 	<ul style="list-style-type: none"> • Government regulations • Policy action issues 	<ul style="list-style-type: none"> • Lack of technological expertise • Lack of technological education
	<ul style="list-style-type: none"> • Technological 	<ul style="list-style-type: none"> • 		

Lall et al. (1994)	barriers			
Segarra-Blasco et al. (2008)	<ul style="list-style-type: none"> • Insufficient tech information • Lack of external finance • Bad market conditions 	<ul style="list-style-type: none"> • Lack of internal funds • staff perception on risk and cost of innovation 		<ul style="list-style-type: none"> • Lack of skilled labor
Madrid-Guijarro et al. (2009)		<ul style="list-style-type: none"> • Cost of innovation 		

Source: Own study

3. SMEs in Turkey

In Turkey, SMEs are the dominant form of business organisation, representing 99.8% of business organisations; 76.7% of total employment; 46% of business turnover; 38% of capital investment; 26.5% of value added; 10% of exports and 5% of bank credit (OECD, 2004). For many years Turkish governments have carried out a variety of programmes to support SMEs and to increase their competitiveness. In particular since the 1960s, these programs have focused on promoting exports, improving technology, providing technical assistance and promoting investment for SMEs, and have even intensified since the 1980s when the full European Union membership debates for Turkey took place. When Turkey joined the Custom Union with the EU on the 1st of January 1996⁹, the international pressures also increased as Turkey ratified the European Charter for Small Enterprises in April 2002.

According to Statistical Institution of State (SIS) 2002 data, 94.4% of total firms in Turkey are micro enterprises (1-9 workers), 3.1% of total SMEs are small enterprises (10-49), and 0.48% of total SMEs are medium enterprises (50-250), out of a total of 1,721,000 enterprises (TESK 2005 Report). Although the ratios of SMEs to the total number of enterprises in the manufacturing sector are quite similar in various countries, Turkish SMEs significantly under-perform in their share of investment, exports and the loan pie, and their contribution to total output ranges from 11% to 15% (OECD, 2004; IKED, 2004).

It is surprising to know that only small shares of SMEs are in the manufacturing sector. According to SIS data in 2001, there were around 210,000 SMEs, in 2002 there were around 246,000 SMEs and in 2003 there were around 250,000 SMEs (1-250 workers) in a total 1,720,000 enterprises were in the manufacturing sector. In geographical terms, the distribution of SMEs reflects that of the population as a whole. They are concentrated in the coastal regions

⁹ Turkey's participation in the first OECD Conference on SMEs at Ministerial level, held in Bologna in June 2000, and the second OECD Conference of Ministers Responsible for SMEs was hosted jointly by the Turkish Ministry of Industry and Trade, and the OECD in June 2004 in Istanbul, Turkey, with the intention to focus on entrepreneurship, innovation and the main problems facing Turkish SMEs.

along the Marmara and Aegean Seas, with 38% and 17% of the enterprises respectively, and in Central Anatolia, with 16%. The Mediterranean coastal region (11%), the Black Sea region (9%), South-Eastern Anatolia (6%) and Eastern Anatolia have far less organised formal economic activity.

In addition, the size of the informal sector in Turkey is another barrier that needs to be mentioned here. According to OECD (2004) estimates there are more than four million in total registered-unregistered SMEs in Turkey, and the informal economy could represent about 50% of the activity of SMEs. In order to reduce the size of the informal sector in Turkey, Turkish governments have implemented very detailed programs but it still stands as one of the most important barriers for SME entrepreneurs to be more innovative. In addition to the informal sector, financing is also another handicap to improve or to develop the innovation culture in SMEs. As the Turkish banking system is not well equipped and prepared to provide investment funds to SME entrepreneurs, Turkish governments have created a number of targeted investment credit programmes in support of SMEs. However, this support is not enough for SMEs to overcome their basic problems. Beside the lack of funding:

Turkish SMEs also appear to suffer from a lack of industrial space, a lack of information and efficient production technology, scant use of management and control systems, an inability to access consulting services, a lack of computer knowledge and related deficiencies. Most countries experience these shortcomings to varying extents, but they seem especially significant in Turkey (OECD, 2004, p.19).

Following the literature as summarised in Table 1 there are four types of barriers to innovation for SME entrepreneurs, in addition to firm specific determinants. These are formal barriers (such as government's weak R&D policy, instability of tax policies, too much business legislation, insufficient property rights, and too many regulations and standards); informal barriers (corruption, impact of informal economy, misleading cultural attitudes and a lack of transparency); environmental barriers (excessive perceived economic risks, the high cost of innovation, high inflation and interest rates and the lack of appropriate sources of finance); and skill barriers (lack of qualified personnel, lack of information on markets and the lack of information on technology). These barriers will be examined empirically in more detail in section 4.

4. Methodology

4.1. Survey, Data, Hypotheses

To examine the determinants of barriers to innovation among manufacturing SME entrepreneurs in Turkey, a survey questionnaire was prepared in 2005. First of all, the four-page questionnaire containing a total of 25 questions was sent to 15 Turkish SME participants as a pilot study in

order to capture the key barriers for entrepreneurs to innovate in the manufacturing sector. Then, based on responses, some important adjustments were carried out and the final questionnaire was randomly sent to 500 SME entrepreneurs selected from the state statistics and KOSGEB's list. Out of 500 SMEs, 275 SMEs responded to the survey giving a 55% response rate of which 224 SMEs were selected from as the intention was to select SMEs only in the manufacturing sector for this study. These 224 manufacturing SMEs and their characteristics can be seen in Table 2, and are mostly concentrated in the coastal regions along the Marmara and Aegean Seas. The subjective responses of SME entrepreneurs provide us with insights into the actual barriers and it is a valuable technique for understanding the key issues concerning barriers. However, this survey has its own merits; it has also its own limitations. Firstly, it is a static study and so captures at best "certain aspects of reality at a moment in time" (Johnson and Loveman, 1995). Second, it is also possible that a percentage of respondents did not express their true opinion when filling in the questionnaire. Nevertheless, it is assumed that this percentage is small and does not change the overall results, and it is still the best technique to obtain primary data for our research question. In this research all variables were measured on a five-point Likert type scale; except for few open ended questions. Then, logit models have been estimated using the Eviews software programme.

The general characteristics of manufacturing SME respondents can be seen from Table 2.

Table 2 General Characteristics of SME respondents

Characteristics of SME entrepreneurs(n =224)	Category	Percent
Sex	Male	72
	Female	28
Education	PhD	3
	Post graduate	12
	University	25
	High school	35
	Secondary	25
Sector	Manufacturing	78
	Man. related	22
Turnover	Up to 49bTL	37
	More than 50bTL	63
Location	Big cities	64
	Medium Cities	25
	Small Cities	11

Characteristics	Mean	SD
Number of employees	10.11	7.78
Years in business	6.24	3.41

As can be seen, most of the respondents are male (72%), and 40% of them have higher education; 78% of the respondents engage in direct manufacturing and 22% are in manufacturing related sectors. Almost two thirds of SMEs have more than 50 billion TL turnover and are located mostly in the big cities in the West of Turkey.

The research question of the present paper is: What are the barriers to innovation faced by Turkish manufacturing SME entrepreneurs? To address this research question, we formulate hypotheses to be empirically tested through the use of a logistic regression. The hypotheses presented below aim to identify the significant barriers to innovation on the innovative capability of Turkish SME entrepreneurs in relation to product innovation and process innovation.

Hypothesis 1: Formal barriers are *negatively related to the entrepreneur's propensity for innovation decision in Turkey.*

Hypothesis 2: Informal barriers are *negatively related to the entrepreneur's propensity for innovation decision in Turkey.*

Hypothesis 3: The environmental barriers are *negatively related to the entrepreneur's propensity for innovation decision in Turkey.*

Hypothesis 4: The lack of skill, technology and information related barriers is *negatively related to the entrepreneur's propensity for innovation decision in Turkey.*

4.2. Logit Regression Model

Because we would like to know what the main barriers to innovation for SME entrepreneurs are, the dependent variable will be dichotomous and the applicable analytical model should come from the binary-choice genre of models (Judge et al. 1985; Pindyck and Rubinfeld, 1991), namely a Logit model, as the dependent variable, Y_i takes the value 1 if the Turkish SME entrepreneurs innovate, that is, when the entrepreneur carried out product or process innovation during 2003–2005. The value 0 is for when the firm does not do this.

$$Y_i = \begin{cases} 1 & \text{if } Y_i^* > 0 \\ 0 & \text{if } Y_i^* < 0 \end{cases} \quad (1)$$

$$Y_i = \mathbf{B}\mathbf{X}_i^* \quad (2)$$

where $\mathbf{B} = [\beta_1 \beta_2 \dots \beta_k]$ and $\mathbf{X}_i^* = [1 \ X_{i1} \dots X_{ik}]$

If the innovative status is adopted for the period 2003–2005 when the SME entrepreneur produces or starts the innovation process, the binary logit model equation (2) can be written as:

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_k X_{ik} + u_i > 0 \quad i = 1 \dots N \quad (3)$$

where the innovation decision of the firm i is a function of a set of explanatory variables X_{ik} that explain the barriers to innovation that an entrepreneur perceives; β_i are the corresponding coefficient vectors, and u_i is the usual error term, which we assume to be iid $N(0, \sigma^2)$, and $\sigma^2=1$.

In the literature, the probit and logit models are quite comparable and give qualitatively similar results. According to Griffiths et al. (1993) “because the logistic CDF is not in integral form, that makes the logit model somewhat easier to work with” (p.751). Gujarati also points out that “the logit model is generally used in preference to the probit” Gujarati (2002, p.67). Similarly, Pindyck and Rubinfeld consider “the logit model to be somewhat more appealing than the probit model” (Pindyck and Rubinfeld 1991, p.256). In particular, logit regression is an approach used in studies of manufacturing firms (Kaufmann and Tödtling, 2001; Silva and Leitão, 2007). Therefore, we also utilise the logit model in this paper.

4.3. Variables and Estimation of Model

The choice of variables that were included in the questionnaire was based on a review of the literature¹⁰. The probability of innovating is influenced by the following factors:

¹⁰ Riding and Swift, 1990; Pack, 1992; Brush, 1992; Evenson and Westphal, 1995; Rodrik, 1995; OECD, 1998; Johnson et al., 2000; Glas et al., 2000; Pissarides et al., 2000; Smallbone and Welter, 2001; Barlett and Bukvic, 2001; Muent et al., 2001; and Aidis, 2002).

- a) Those such as firm size, R&D activities and the competitiveness of products are to determine firm specific characteristics.
- b) In order to determine formal barriers, lack of government's R&D policy, instability of tax policies, too much business legislation, insufficient property rights and fulfilling regulations and standards have been selected as variables.
- c) Similarly, corruption, the negative impact of the informal economy on investment, cultural attitudes and a lack of transparency are assumed to represent informal barriers.
- d) For environmental barriers, excessive perceived economic risks, the high cost of innovation, high inflation and interest rates and a lack of appropriate sources of finance are selected.
- e) Finally, for skill barriers, the lack of qualified personnel, a lack of information on markets and the lack of information on technology are identified. The logit estimation results can be seen from Table 2.

Model 1, in Table 2 explains the results of the systematic relations between the entrepreneurial innovative capability and the barriers to innovation in Turkish case.

Since some of the variables associated to the barriers are not statistically significant at a level of 5%, (there are only seven statistically significant variables), we estimate Model 2. In addition to insignificant variables, Model 1 also shows that there is multicollinearity between independent variables, and R square values do show that they are highly correlated. As some of the formal, informal, environmental and skill related hypotheses were not empirically tested, the second estimation of the model, Model 2 in Table 2, was set without considering those insignificant variables.

Table 2. Logit Regression Results for SME Entrepreneurs and Innovation Barriers

Dependent Variable

Yi=1, innovation happens,

Yi=0, innovation does not happen

	Model 1	Model 2
Independent Variables	Coefficients	Coefficients
Constant	0.7789 (-0.4489)	0.6553 (-0.311)

**Firm Specific Characteristics
Determinants to Barriers**

Firm Size (log)	0.0407 (0.6451)	-----
Intensity of R&D/per employee (log)	0.3341** (2.6322)	0.3121** (2.512)
Education of the entrepreneur (dummy)	0.1439** (2.4779)	0.1371** (2.232)
Turnover of the company (log)	-0.2456 (-0.0227)	-----

**Formal Barriers to Prevent
Innovation**

Lack of Government's R&D and technology policy	-1.5551** (-2.4174)	-1.2334** (-2.3155)
Instability of tax policies	2.7510 (-1.5760)	-----
Too much government regulation	1.1276 (-1.0814)	-----
Insufficient property rights	4.8124 (0.0729)	-----
Inappropriate standards	-1.5522 (-1.3180)	-----

**Informal Barriers to Prevent
Innovation**

Corruption	-0.6061 (0.9025)	-----
Informal economy's (-) impact on investment	-1.8145** (-2.9400)	-1.7743** (-2.6491)
Cultural attitudes to bribery	3.0154 (0.7261)	-----
Lack of transparency	-0.8549 (-0.0410)	-----

Environmental Barriers to Prevent Innovation

Excessive perceived economic risks	0.0544 (0.0225)	-----
High cost of innovation	-1.2208** (2.4034)	-1.2016** (2.2132)
Lack of appropriate source of finance	-1.3434** (2.4529)	-1.1137** (2.3319)
High inflation and interest rates	-1.5522 (-1.3180)	-----

Skill Barriers to prevent Innovation

Lack of qualified personnel	-0.8733** (2.4907)	-0.6881** (2.3412)
Lack of staff information on technology	0.3366 (1.0029)	-----
Lack of understanding of the market	-0.0304 (-0.0405)	-----

Diagnostics

Number of Observations	224	224
Log Likelihood Function	-59.3704	-59.1024
Likelihood Ratio Test	25.5452**	25.0012**
Percent Correctly Predicted	0.71	0.68
Madalla R^2	0.1803	1.1764
McFadden R^2	0.1771	1.1601

P value is significant at *** 0.01, ** 0.05, *0.10.

In terms of firm specific characteristics, “intensity of R&D/per employee” and “education of the entrepreneur” are the significant variables to innovate for SME entrepreneurs in Turkey.

In Model 2, we identify that all the estimators of the regression parameters are statistically significant up to 5%, and multicollinearity problems from our estimation in Model 2 is eliminated. The predictive capacity of the model is 68%, which results from the comparison between the predicted and the observed values of the answer variable. The log-likelihood statistic, comprising 59.1024, also corroborates the global significance of the model, when compared with the null model. The obtained results show that most of the variables associated with barriers to innovation present a negative signal, for which reason they are considered as restraining factors that may influence entrepreneurial innovative activities and consequently lead to a decrease in the firm’s propensity for innovating.

The results of the model suggest that “lack of government’s R&D and technology policy” as a formal barrier to innovation has a significant effect on the entrepreneur’s propensity for innovating. That means, SME entrepreneur’s propensity to innovate gets smaller with the clear and non existent government R&D and technology policy. That also means that H1 hypothesis is been confirmed. On the other hand that does not mean that government has not got any policy, but it means that this policy has not been perceived by the entrepreneur as an existent policy. The obtained results are similar to other empirical studies (Piatier, 1984; Silva and Leitão 2007; Rush and Bessant, 1992; Hadjimanolis, 1999; Segarra-Blasco et al., 2008; Baldwin and Gellatly, 2004).

“Informal economy’s negative impact on investment” as one of the informal barriers is another variable which has a significant effect on the entrepreneur’s propensity for innovating decisions. That means that when the informal economy becomes larger, then the entrepreneur’s innovative decision probability gets smaller, and consequently the hypothesis H2 is sustained. These obtained results are also on the same line with some studies (Piatier, 1984; Baldwin and Gellatly, 2004).

When we test the null hypothesis, H3, for environmental barriers, we also confirm that “high cost of innovation” and “lack of appropriate source of finance” are two other statistically significant variables which have a significant impact on the propensity of entrepreneur’s innovation decision. Entrepreneurs who consider the innovation costs to be excessive have a smaller propensity for innovating in their decisions (Silva and Leitão, 2007; Tourigny and Le, 2004; Segarra-Blasco et al., 2008; Madrid-Guijarro et al., 2009).

Finally, the results of the model show that “lack of qualified personnel” like Segarra-Blasco et al., 2008; Piatier, 1984; Ylinenpää, 1998; Silva et al.; 2007; Rush and Bessant, 1992; Hadjimanolis, 1999; and Rammer et al. (2005, 2006), have a significant effect in the propensity to innovate. The rejection of the null hypothesis of nonexistent relation amongst variables, allows the confirmation of the H4 hypothesis. Thus, firms that perceive “lack of qualified personnel” show lower propensity to innovate, Therefore, if the entrepreneur perceives the fact that access to qualified personnel is a problem, s/he has no incentive to innovate, and then this consciousness ends up creating a barrier to innovation.

5. Conclusion

The survey results show that entrepreneurs, who know how to innovate, are those who have more perception of the barriers to innovation. However it is observed through the logistic regression model that some of the relations established between the barriers to innovation and the entrepreneurial innovative capacity are not statistically significant. Our analysis shows that eleven variables out of sixteen are statistically insignificant for SME entrepreneurs in Turkey. Our regression results indicate that only five independent

variables are statistically significant among all barriers to innovation groups, therefore, we do not reject our four hypotheses.

The results provide insights that “lack of government’s R&D and technology policy”; “informal economy’s negative impact on investment”; “high cost of innovation”, “lack of appropriate source of finance”; “lack of qualified personnel” have a negative and significant effect on the innovation propensity and the perception of entrepreneurs in Turkey, which are also in line with the findings of Piatier (1984), Keegan et al. (1997), Segarra-Blasco et Al. (2008) and Cooney et al. (1996).

In particular, governments’ R&D and technology policies that encourage and support innovation among all firms, especially small firms, can help countries remain competitive in a global market. Therefore, government should change the perception of entrepreneurs to support their competitiveness in the global market. Public policy that encourages innovation and improves the education of the labour can enable firms to remain competitive and survive, both of which have direct implications for employment and a country's economic viability. The results may also be insightful for entrepreneurs who are attempting to engage with innovation. Understanding barriers can assist entrepreneurs in fostering an innovative culture by supporting new ideas or by avoiding an attitude that creates resistance to new ideas.

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