ISTANBUL: A CANDIDATE CITY FOR THE GLOBAL INNOVATION LEAGUE?

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ABSTRACT

The main objective of this paper is to explore potential of Istanbul as a city region in the innovation league. There is a growing awareness amongst regional authorities that the economic growth and competitiveness of their cities depends largely on the capacity of indigenous firms to innovate. This paper mainly analyzes the technological and innovation infrastructure of Istanbul and compares Istanbul with some successful global cities. By situating the city in the national and global context, it shows that Istanbul has gained a substantial lead in developing an innovation environment but it still lacks global network and linkages as well as weak in terms of research institutions. Finally, some of key challenges Istanbul face in becoming a global city is pointed out.

Keywords: *Istanbul, Knowledge economy, Innovation, Regional innovation systems, City regions.*

INTRODUCTION

The rise of the knowledge based economy highlights the crucial role technological innovation plays in economic development (Castells, 2000). The major components of knowledge-based economy include: an economic and institutional regime that provides incentives for the effective use of existing knowledge, the creation of new knowledge, and entrepreneurship; an educated and skilled workforce that can create and use knowledge; a dynamic information and networking infrastructure in order to facilitate the efficient communication, dissemination, and processing of information; and an effective innovation system to tap into global knowledge and adapt it to local needs, and ultimately create new knowledge (Wu, 2007). Thus the territorial aspect of innovation as cities and regions becomes more and more important (Crescenzi, 2005)

These regions/cities are expanding vigorously, presenting challenges to researchers and policy makers (Scott et al., 2001). Establishing knowledge-based infrastructures in regions or cities becomes as one of the main tasks for governments in transforming their economies. Accordingly academic interest in clusters, regions and big cities is increased (Faulconbridge, 2007)

The goal of this paper is to explore the potential of Istanbul in becoming an innovative city in the global knowledge economy. The paper has six sections. After this short introduction, theories on innovation systems will be briefly mentioned. Section 3 will focus on studies on cities, followed with the analysis of technological and innovation infrastructure of Istanbul. Section 5 will attempt to compare Istanbul with some successful global cities. The final section, concluding remarks, will lay some thoughts on the challenges Istanbul faces in becoming a global city.

THEORETICAL BACKGROUND

Innovation is one of the key determinants of economic growth (Jolly, 2008; Crescenzi, 2005). In other words innovation itself is a strong competitive strategy to achieve world-class manufacturing status and compete effectively in global networks and markets (Prajogo et al., 2007). The quest for mutual proximity on the part of all manner of economic agents at the present time is in significant degree a strategic response to heightened economic competition which has placed a premium on learning and innovation (Scott et al., 2001). That is why in 2000, the conclusions of the presidency of the Lisbon European Council established the goal of making the European Union (EU) the 'most

innovative and dynamic knowledge based economy in the world', known as the 'Lisbon Strategy' (Crescenzi et al., 2007).

.As a collective learning and socially embedded process, innovation is crucially dependent on tacit knowledge and untraded interdependencies (Crescenzi, 2005). Successful innovation requires not only brilliant scientists; but also everyone from top management to employees in its R&D, finance, production and marketing divisions. It involves high-quality decision-making, long-range planning, motivation and management techniques and co-ordination. Accordingly, the innovation performance of a firm is determined not only by "hard" factors such as R&D manpower and R&D investment, but also by certain "soft" factors such as management practices and governance structures (Fu, 2008). Therefore as stated in the Lisbon strategy, innovations are not generated just by actors being individuals, organizations or institutions but also by complex patterns of interactions between them these actors. Actors and interactions among them form the basis of innovation systems that generate, adopt, and transform innovations into the context (Almeida et al., 2008). Innovation systems are sources of learning and innovation for nations and regions (Berger and Diez, 2006).

Networking/collaboration with local firms and organizations has always played a major role in economic theories (Faulconbridge, 2007). There has been a rapidly growing literature on this topic during the 1990s (Freeman, 2001). A basic idea of the literature on innovation systems is that it is the entire productive system rather than the firm itself that should be considered in order to understand differentiated business performance (Eraydin and Köroðlu, 2005).

Innovation systems are classified in many dimensions. For example, at the macro level, there is national innovation system (NIS). NIS is a set of institutions whose interactions determine the innovative performance of national firms. It is composed of elements and relationships which interact in the production, diffusion and use of new and economically useful knowledge (Godin, 2007). The NIS approach is theoretically rooted in institutional and evolutionary economics (Berger and Diez, 2006).

Another level where innovation systems are built upon is regions or clusters, whereby the borders of regions differ from a city to cross-border geographical units such as Kyongbuk-Taegu in South Korea and Santa Catharina in Brazil (Crescenzi, 2005). While much of innovation literature insists on the central importance of national systems; sub-national entities, such as provinces, industrial districts, cities or "Silicon Valleys" are conceived as more important than the nation-state (Freeman, 2001). Kyongbuk-Taegu in South Korea and Santa Catarina in Brazil are a few examples of successful innovative regions (Cooke, 2001).

Considering that territories with their social, cultural, and institutional realm are fundamental for successful innovation, some researchers claimed the end of the nation state and the rise of the regions (Ohmae, 1995). Even though these claims seemed exaggerated, they have stimulated strong research interest in various regions. In the field of innovation research, this led to the formulation of the concept of 'Regional Systems of Innovation' (RSI) (Berger and Diez, 2006; Crescenzi, 2005).

Often four criteria are mentioned to define a region: (I) a region must not have a determinate size; (II) it is homogeneous in terms of specific criteria; (III) it can be distinguished from bordering areas by a particular kind of association of related features; and (IV) it possesses some kind of internal cohesion (Cooke, 2001).

To define a region from an economic perspective, sometimes the concept of industrial cluster is used (Porter 1998). Clusters can be characterized as a dense network of economic actors, who work together very closely and who have intensive exchange relationships. On the other hand regional cluster defined as a spatial and industrial concentration of firms (Bresnahan et al., 2001). Indeed RSI is a cluster; dedicated to create inventions in which there is high geographic concentration. However regions can have more than one economic cluster. For instance, Silicon Valley is a large complex including ICT and biotechnology clusters, if we define it economically (Niosi and Bonik, 2005).

Proximity plays a major role on networks and interaction density within RIS context; this fact is in general attributed to the tacit nature of a relevant part of knowledge. Tacit knowledge "is best shared through face-to-face interactions between partners who already share some basic commonalities: the

same language, common "codes" of communication and shared conventions and norms…" (Asheim and Gertler, 2005: 293). Although knowledge is a non-rival public production asset, which can generate positive externalities or spillovers to others; knowledge spillovers are geographically or regionally localized (Fu, 2008). As a set of economic, political and institutional relationships within a given geographical area, RSI (Asheim and Coenen, 2005; Niosi and Banik, 2005):

I.   creates dispersed interactions among heterogeneous agents
II. generates a collective and interactive learning process
III. offers a regional production structure or knowledge exploitation subsystem which consists mainly of firms, especially where these display clustering tendencies
IV. provides a supportive infrastructure or knowledge generation subsystem which consists of externalities and market channels such as public and private research laboratories, universities and colleges, technology transfer agencies, vocational training organizations and foreign direct investment (FDI)
V.   leads to the rapid diffusion of knowledge and best practice.

Eraydin and Köroğlu (2005) highlight the additional benefits of a RIS: unique labor market conditions, flexibility through specialization and inter-firm co-operation, collaboration instead of competition, and subcontracting relations among vertically disintegrated firms specialized in different stages of production.

As it attracts FDI; labor market conditions is perhaps the most important feature of RSI. Foreign direct investment contributes to regional learning and innovation in four ways. First, research and development (R&D) and other forms of innovation created by foreign firms and R&D labs of multinational enterprises (MNEs) raise the innovation outputs in the region directly. Second, spillovers emanating from foreign innovation activities may affect the innovation performance of small and medium size enterprises (SMEs) in the region in which they operate. Third, FDI may have an effect on regional innovation capacity through competition effect. Finally, in addition to greater R&D investments by MNEs and their affiliates, FDI may contribute to regional innovation capabilities by means of advanced practices and experiences in innovation management and thus greater efficiency in innovation. However, it is important to remind that host regions effectively benefit from the advanced technology embedded in FDI if and only if the region has capability to identify, assimilate and develop useful external knowledge (Fu, 2008).

CITIES

Cities have been always important since the beginning of civilization. Even though Adam Smith's book was entitled "The Wealth of Nations" and his main concern was to investigate "the different progress of opulence in different nations", he nonetheless included a long discussion part of "The rise and progress of cities and towns since the fall of the Roman Empire" (Freeman, 2001). Globalization has affected the social and spatial changes in large cities and city regions. The concept of city-regions can be traced back to the "world cities" idea of Hall (1966) and to the "global cities" idea of Sassen (1991). The major cities all over the world are now facing pressures to rethink the impacts of policies for competitiveness and integration with the global economy on their socio-spatial structures, after a period of entrepreneurial policies shaped by the notions of globalization (Eraydin, 2008).

City regions are major drivers in the global economy and they are themselves transformed by globalizing forces. Özdemir (2002) observes the technology based transformation economy, in which finance and producer services have an important share. City centers have become the key sites where the results of these transformations are apparent. Moreover as production becomes more science based, advantages such as developed research infrastructure, a highly qualified workforce or an innovative culture are becoming more important than natural resources, which means that a supportive environment for innovative companies can deliberately be created (Cooke, 2001).

Eraydin and Köroğlu (2005) also states that labor market conditions receives special attention in the context of clusters and innovation systems. Knowledgeable and qualified people are not evenly distributed in geographic area; they are placing greater demands on the city infrastructures that deliver vital services such as transportation, healthcare, education and public safety. Adding to the

strain are ever-changing public demands for better education, greener programs, accessible government, affordable housing and more options for senior citizens. For example a report from the IBM Institute for Business Value titled as "A Vision of Smarter Cities" declares that cities symbolize and centralize so many aspects of what will make for a better education, better healthcare, better water and energy use, better public safety, better transportation, and better government and so on. In the report, Vancouver (Canada), Melbourne (Australia) and Vienna (Austria) is ranked as the smartest cities in World. Accordingly these cities appear as important centers for qualified labour and migration.

In a multi-region open economy with high levels of population mobility, the map of human capital is being restructured by labor migration (Storper and Scott, 2009). For instance, the proportion of migrants in the population of the three provincial-level cities of China (i.e. Beijing, Shanghai, and Guangzhou) is around 17 to 20 percent of the total population (Cartier et al., 2005). Besides, human capital is in part created by means of education, training, on-the-job learning and broad processes of socialization. Human capital may also be created via interactions between appropriately matched or complementary individuals. In turn, the resulting stock of human capital of a city affects its economic performance in many ways (Storper and Scott, 2009).

Another reason why the highly skilled labor appears in large cities is that skilled workers may be more productive when surrounded by their peers (Noise and Blank, 2005). Thus, 'cities exist in part to facilitate learning between individuals who come into contact with one another' leading in turn to an urban wage premium (Storper and Scott, 2009). This constitutes another aspect of cities as innovation centers.

There are numerous studies showing how regions and cities outperform in terms of growth to their counterparts. Eraydin (2008) asserts that territorial cities have grown faster and have been able to increase their relative shares in the world economy. Niosi and Banik's (2005) study also shows that companies located in three largest provinces (Toronto, Montreal, and Vancouver) of Canada definitely perform better. Cooke (2001) discusses the successful regions of Massachusetts and California in creating their biotechnology and ICT clusters as well as Hollywood, Los Angeles and 'Silicon Alley' in New York in developing new media. Faulconbridge (2007) categorizes New York and London as 'learning and knowledge intensive cities'.

In fact it is the globalization; technologic transformation and migration of labor that result with the rise of the city regions. Moreover information technologies allow the formation of new forms of social organization and social interaction along electronically based information networks within city regions (Castells, 2000). Accordingly different types of city regions with different characteristics appear. Also on the basis of the intensity of their technology production, as measured by the R&D intensity, of technology use, intangible investments and human capital, industry categorization under the auspices of the OECD takes part in these different city region definitions and categorizations. Based on her comprehensive literature review, Eraydin (2008) categorizes the city territories into six dimensions as shown in Table 1. There are global cities, learning regions, informational cities, traditional industrial districts, high technology industrial districts, challenging cities and platforms of cheap labor. A brief definition of each category is given below:

I.   Global cities: Global cities emphasize increasing attraction of cities due to increasing global functions, massive migration, and employment for both skilled and unskilled workers. As mentioned above the labor force is an important competitive asset as its size, characteristics and quality determine the level of competitiveness of a certain city and its integration within the global economy.

II.   Learning regions and informational cities: This kind of city regions stresses increasing knowledge and innovation capacity, specialization, increasing opportunities for skilled manpower and people with talents.

III.   Traditional industrial districts: Main features include production for external markets, increasing flexibilities and the use of social capital, networking among local actors and increasing employment opportunities.

IV.   High technology industrial districts: Technological capabilities and innovation become the basis of production and thus require highly skilled manpower. There is specialization in high-tech activities.

V.   Challenging cities: These cities integrate into the global economy by both traditional and new/high-technology economic activities. Challenging cities use mixed strategies.

VI.   Platforms of cheap labor: This kind of city regions involves integration in the global economy with cheap labor resources. There are increasing employment opportunities in low-wage and informal work.

Eraydin's classification concerning the city regions is a useful guide to determine the current position of a city and to make a roadmap for future. Similar to Shangai that is a leading production, commercial and financial center, Istanbul is economic and technological locomotive of Turkey. The following section analyzes Istanbul on the basis of Eraydin's classification.

Table 1. City Types and their Sources of Competitiveness, Economic Growth and Restructuring (Eraydin, 2008)

	The sources of competitiveness	Economic growth and restructuring
Integration with command functions		
Global cities	The intersection of different types of global networks Global command functions Centres of capital accumulation Concentration of specialized producer services	Increase in high value-added services; banking and finance, legal and accountancy services, consultancy, telecommunications, R&D and higher education
Territories integrating with knowledge and innovation capacity		
Learning regions	Medium of interaction for knowledge creation Learning infrastructure Institutions and networks that facilitate the circulation of ideas and creative knowledge	Specialisation in new fields and competitive activities Increasing relations between business and universities
Informational cities	Acting as a source of information and dissemination of information to the whole world by global Networks	Increasing importance of storage and dissemination of information Building new external networks
Integrating with production capacities		
Traditional industrial districts	Flexible production organization, local production networking, collaborative relations Social networks and social capital Quick response to changing demand conditions	Increasing specialization and clustering Innovativeness based on both tacit and codified knowledge
Integration with technological capabilities		
High-technology industrial districts Technopolis, technoparks	Infrastructure that facilitates innovation Proximity to R&D centres Clusters of high-technology firms Networks of knowledge dissemination and creation Availability of human capital	Development of innovation-oriented business Following successful firms Labor market recruitment and knowledge carriers
Integration with both traditional and new functions		
Challenging cities	Dualistic economic structure and labor market Sustained importance of mature and labor-intensive manufacturing	Increase in new (high-tech) manufacturing activities and producer services
Integration with cheap labor and natural resources		
Platforms of cheap labor	Cheap and abundant labor	Expansion of the economy Rise in foreign direct investment

ISTANBUL

Istanbul is the biggest city in Turkey in terms of economic development and urban population growth. It has always been the centre of the national economy and, at the same time, an important international node within a large hinterland extending from Eastern Europe to the Middle East and from the Black Sea region towards central Asia. Moreover, after the disintegration of the Soviet

Union in 1989, Istanbul has become the centre of the large hinterland formed by the countries bordering the Balkans, Caucasia, Turkic Republics, Middle East and the Black Sea (Berkoz and Eyüboðlu, 2007). But which competitive assets make Istanbul attractive for becoming an innovative city? A brief background on Istanbul's competitive assets will consist of five dimensions: labor force, industrial and trade structure, FDI, technological infrastructure, and firm level technological competence.

Labor Force

The total population of Istanbul was seven million in 1990 and 12.7 million in 2008, the most crowded city among 81 cities in Turkey (TÜÝK, 2008). This large population is highly diversified and well educated: 93 percent of its population is literate and almost 12 per cent of its graduates are university-graduates. 10 per cent of all university students in Turkey are in Istanbul. In addition, Istanbul has attracted migrants from several countries as well as from different parts of Turkey. On the average, the city intakes 400 thousand people every year (TÜÝK, 2000). The migration of scientific and technical personnel from different regions of Turkey and abroad, on the other hand, made the city attractive to foreign investors due to its supply of qualified labor. Considering that the main characteristics of cities is the availability of qualified labor (Niosi and Blank, 2005), Istanbul has a strong asset.

The first study that compares the competitiveness of Turkish cities is conducted in 2007 to create a Turkish urban competitiveness index (EDAM, 2009). EDAM uses six dimensions in measuring the competitiveness of cities in Turkey as follows: I) Human capital, II) Physical infrastructure, III) Social capital, IV) Economic efficiency index, V) Labor market index, VI) Creative capital index. Among all Turkish cities, except creative capital index, Istanbul is ranked as the first city.

Following EDAM, International Competitiveness Research Association (URAK) created another Turkish urban competitiveness index in 2008 using four major criteria; human capital index, branding capability and innovation index, commercial ability and production potential index and accessibility index (URAK, 2008). Except human capital index, Istanbul is ranked as the first city among all Turkish cities. It is interesting to see Istanbul as the second city following Ankara in human capital index (URAK) or in creative capital city (EDAM). Both indexes have similar components such as technical staff per 1000 people, the ratio of R&D expenditure over R&D output for public, the ratio of R&D expenditure over R&D output for private sector, academic publishing per head.

Istanbul outperforms other cities in Turkey, however in order to determine the potential of Istanbul on a global innovation league, it is necessary to explore where Istanbul is ranked among global cities. In Beaverstock et al.'s (1999) study in terms of world-cities with values ranging from 1 to 12; Istanbul is a world city with 4 points along with other international cities of Atlanta, Barcelona, Berlin, Buenos Aires, Budapest, Copenhagen, and Hamburg. Indeed Beaverstock et al.'s (1999) study is a remarkable research investigating cities' global capacity or world cityness using four basic criteria:

I.   Cosmopolitan characteristics and the multinational corporate economy

II.   World cities and the new international division of labor

III.   The internationalization, concentration and intensity of producer services

IV.   World cities as international financial centers.

Furthermore the world city index of Beaverstock et al.'s (1999) is updated by Globalization and World Cities Study Group and Network in 2008. Istanbul seems to go up into a higher class from gamma world city with 4 points to alpha world city + a higher degree than Los Angeles.

To find the relative position of Istanbul within the world cities, Taylor's (2001, 2003) comprehensive research would also be a useful guide. In his study concerning the global city networks, Taylor (2001) collected data from 100 global service firms across 316 cities world wide.

Global service firms are defined as having offices in at least 15 different cities with at least one in each of the prime globalization arenas; northern America, Western Europe, and Pacific Asia. Firms so identified were from the following sectors: 18 in accountancy, 15 in advertising, 23 in banking/ finance, 16 in law, 11 in insurance, and 17 in management consultancy. Service values were allocated to cities in the range of 0 to 5 where '0' indicates no presence of a firm in that city and '5' indicates the city to be the most important location for that firm (i.e. its headquarters). From this data, the global network connectivity of a city is computed from the products of its service value for each firm with that firm's service value for each other city. Summing these products over all firms in a city produces a gross value of its global network connectivity. Istanbul is ranked as the 35th city in global network connectivity in 2000 (Taylor, 2001) and 29th in 2008 (Derruder et al, 2009).

Industrial and Trade Structure

Istanbul generates 27,5 per cent of total Turkish value added and its gross domestic product (PPP) per capita is 10352 dollars in 2008 that is nearly 50 per cent higher than the corresponding value for the country (TÜÝK, 2010). Istanbul creates 3.3 million jobs, 15 per cent of total employment in Turkey. Agricultural employment is almost non-existent (0.35 % of total agricultural employment in Turkey). Industry is the main employee sector, corresponding 28 per cent of total Turkish industrial employment; while services constitute 20 per cent of employment in services sector in Turkey (KOSGEB, 2005). In terms of both services and industrial employment, Istanbul ranks first among 81 cities.

Manufacturing industry still generates almost one-third of employment opportunities in Istanbul, although there has been a slight decrease in this ratio from 1980 to 2000 (in 1980 it was 35.8 per cent), which indicates the importance of the manufacturing industry in the economic base of Istanbul, like many European cities (Kazepov, 2005). The industrial structure of Istanbul lays in mature industries such as textile, mechanical and chemical industry. According to TOBB reports for Istanbul (2005, *www.tobb.org.tr*), textile with 275 thousand employees ranks first; and it is followed by mechanical industry with 146 thousand employees, chemical industry with 78 thousand employees. Textile is the main sector, corresponding 34 per cent of total Turkish textile employment. The employment regarding the scope of business are given below

Table 2. Employment regarding the scope of business. (TOBB, 2005)

SCOPE OF BUSINESS	ISTANBUL	TURKEY	ISTANBUL (%)
Food Industry	42.220	382.180	11,05
Textile Industry	274.682	807.610	34,02
Furniture Industry	10.024	75.513	13,31
Paper and Printing Industry	23.891	65.854	36,28
Chemical Industry	78.480	270.268	29,04
Non Metal Industry	16.327	138.251	11,81
Metal Industry	19.445	106.387	18,28
Mechanical Industry	146.036	496.764	29,40
Other Manufacturing Industry	15.959	24.494	65,15
TOTAL	627.064	2.367.321	26.049

Among service sectors, Istanbul is the leading city in banking and accounting sectors. As Taylor (2003) declares that Istanbul ranks as 21st city at banking network connectivity in the whole world. Istanbul provides 45 per cent of total Turkish bank deposits and uses 43 per cent of total Turkish bank credits. Moreover Istanbul has the potential to be banking and finance center not only for Turkey but also for the region. There are five main topics to consider a city as a finance center: the size of the economy, qualified labor, legal regulations, the development of banking and finance sector, and physical infrastructure.

There are various support institutions in Turkey to support industrial production. Istanbul has eight active industrial zones out of 258 in Turkey and one more industrial zone is under construction (TOBB, 2009). Moreover Istanbul has nine small industrial areas out of 439, which host 2.272 SMEs with a total employment of 21 thousand.

Exports from Istanbul have risen from US$18 billion in 2001 up to US$35.9 billion in 2004, which represents approximately a 2 times increase in 4 years. On the other hand imports from Istanbul have risen from US$ 22 billion in 2001 up to US$ 60 billion in 2004, which represents approximately a 3 times increase in 4 years (TÜÝK, 2008). Istanbul generates 43,2 % of Turkish exports mainly based on manufacturing industry (45,8 per cent of Istanbul`s total exports) and 62.8 % of imports again mainly based on manufacturing industry (49,07 per cent of Istanbul's total imports) (Berkoz and Eyüboðlu, 2007); thus without a doubt Istanbul is highly internationalized.

FDI

As mentioned before FDI is an important channel for transfer of technology to developing countries, since modern and advanced technologies introduced by multinational firms can diffuse to domestic firms through spillovers (Berkoz and Eyüboğlu, 2007; Lenger and Taymaz, 2006). Istanbul ranks high for FDI in Turkey. Turkey attracts US$ 17,5 million foreign direct investment with 9749 firms. 75.39% of Turkey's total capital investment (almost US$ 13,5 million), and 63.29% of the total number of firms (6170) in Turkey are in Istanbul. The distribution of FDI in Istanbul according to the origin of country groups show that more than half of FDI investments come from OECD countries (Berkoz and Eyüboğlu, 2007).

Technological Infrastructure

Istanbul is the capital of high education in Turkey. Out of 100 universities in Turkey, 27 of them are located in Istanbul and each year new universities are established (YÖK, 2009). Almost all high quality universities in terms of research and publications are among these universities.

Besides the existence of high education institutions, Istanbul also hosts a number of well-functioning technology development centers and incubators. Today technopolis, technology development centers and incubators are considered to be important areas for technological progress. For example the most famous technopark Silicon Valley is built around Stanford University in 1950. Many global firms such as Google, Intel, Adobe Systems, Yahoo and VeriSign exist in Silicon Valley (Elitaş et al., 2007). That is why technoparks around the world tries to establish their own Silicon Valley models. Today there are more than 800 technoparks, technopolis and technology development centers in the whole world (Zhang, 2008).

The establishment of the first technopark in Turkey happens to be in Istanbul, established in 1986 as a result of mutual efforts of Istanbul Technical University and Istanbul Chamber of Commerce in 1986. This technopark is still working as Istanbul Technical University Technology Development Center. In 2009, there are twenty technology development centers in Turkey and five of these centers are located in Istanbul around universities namely Bosporus University Technology Development Center, Fatih University Technology Development Center, Istanbul Technical University Technology Development Center, Istanbul University Technology Development Center and Yıldız Technical University Technology Development Center. Moreover 3 of 18 incubators are located in Istanbul: ITU Arı Technocity, Istanbul University Technology and Innovation Center and Yıldız Technical University and Innovation Center. There is a dominance of software firms in these

incubators. For instance 50 of total 59 firms in ITU Arý Technocity are operating in software industry (Elitaş et al., 2007).

Firm Level Technological Capabilities

Considering the firm level technological capabilities Istanbul appears to be the first city in Turkey. According to the URAK's Urban Competitivenes Report, Istanbul has the highest score at trademark capability and innovativeness index.

In terms patents applications and the number of patents issued, Istanbul ranks first as shown in Table 3. The nearest city to Istanbul's patent performance is Ankara but there is a huge gap.

Table 3. Patent numbers, 2008 (Turkish Patent Institute, 2009).

City	Patent application	%	Issued patents	%
Istanbul	1057	47	187	55
Ankara	269	12	33	10
İzmir	122	5	25	7
Bursa	119	5	16	5
Konya	69	3	8	2
Turkey Total	2268	100	337	100

In addition to patents, Istanbul companies are active in "utility model", "trademark" and "industrial design" applications as well. They represent over the half of trademarks (%52) out of 61 thousand trademark applications and again over the half of trademarks (%52) of 36 thousand issued trademarks made in Turkey in 2008. For the utility models Istanbul companies again embody almost the half of utility models (43%) out of three thousand utility model applications and almost the half of utility models (47%) out of a thousand and ninety issued utility models. Further, Istanbul companies represent half of the industrial designs (%50) out of six thousand design applications and again half of the industrial designs (50%) out of six thousand issued designs (Turkish Patent Institute, 2009).

CITIES IN THE GLOBAL MAP

The city rankings do not include innovation and technological capabilities however some cities are well known for their innovativeness. Therefore by studying innovative cities, it might be possible to generate a set of proxy measures that will help to benchmark Istanbul with innovative cities. This explorative attempt might be the base for designing some alternative strategies for Istanbul. Due to space limitations, the paper will mention three examples, one from a developed country and two from developing countries that might be illuminating examples for Turkey.

The Cambridge Region

Considering the rapid growth since the 1960s of a substantial cluster of technology based SMEs covering settlements located up to 15 miles around the city of Cambridge. Cambridge appears as a city region with science base and social networks embodied in Cambridge University (Keeble et al., 1999; Longhi, 1999). Cambridge example seems to have five key mechanisms supporting its innovativeness (Keeble et al., 1999):
I.   *High technology firms from different industries gather in Cambridge region*
II.   *University focused:* The cluster is historically focused on the University of Cambridge with its global reputation for research and scientific activity

III.   *Networking and collaboration:* The cluster exposes the frequency and importance of inter-firm collaboration, networking and interaction,
IV.   *Regional learning:* Regional learning occurs with local movement and spin-off of embodied technological and managerial expertise in the form of entrepreneurs. Moreover there is a flow of research and professional staff between local firms and university.
V.   *In Cambridge region* technology intensive SMEs can perhaps be inferred from the outcome of a high frequency of close inter-firm links.

Cambridge city region emphasizes regional learning and inter-firm networking and collaboration around Cambridge University. It seems that regional learning is an important theme for any region to be ranked as innovative (Lawsen and Loren, 1999).

New York City

In following rounds of economic development, New York slowly secured its dominance over rival metropolises (Batten, 1995). Since 1980s the most innovative city in the US is New York; Approximately 20 %, of the total number of innovations in the country is attributed to firms in the greater New York City area (Longhi, 1999). The major features of New York are given below:
I.   *Center for qualified labor* from both US and the whole world.
II.   *Flexible clusters*: The banking and financial services of New York represent the outputs of clustered flexible production networks that are strongly tied to world markets (Scott et al., 2001). In addition, there is a variety of clusters and sectors in New York such as creative arts, banking and finance and "Silicon Alley" with media companies (Cooke, 2001).
III. *Intensity of learning and knowledge*: the regional practices of learning that influence the competitiveness of firms in New York is deeply supported (Faulconbridge, 2007).
IV.   *Network connectivity* New York is the first city of the US and second city in the the world after London according to the global network connectivity (Taylor and Walker, 2001).
V.   *The presence of external economies arising from inter-firm linkages*: It is the presence of such linkages today which continues to fuel much of New York's growth as a financial services centre. Moreover some researcher suggests that there is a size and innovative capacity linkage in New York City (Batten, 1995).

As Porter (1998) showed that the US's competitive lead in innovation was predicated on the existence of regional innovation systems based in 'clusters', New York is based on effective clusters.

Shanghai

Shanghai has gained a substantial lead in developing an innovation environment with extensive global linkages and leading research institutions (Wu, 2007).

Recent changes in China's national innovation system have affected Shanghai's policy options. For nearly three decades (1949–1979), following the Soviet Union's model there was clear division of labor—public research institutes responsible for conducting the majority of research activities. More specifically Shanghai's efforts to establish a local innovation system mainly began in the 1990s and followed the national lead. The efforts aim to cultivate Shanghai's local innovation system fall into five categories (Wu, 2007):
I.   *Building a support infrastructure to facilitate commercialization of innovation*
II.   *Developing an adequate regulatory and legal framework and attracting great amounts of FDI*
III. *Investing in human capital.*
IV.   *Nurturing universities and R&D institutions and increasing investment in R&D*
V.   *There are a variety of different kinds of industries*

The Shanghai Science and Technology Commission formulate and implements policies related to the city's S and T development. Accompanying the creation of the support infrastructure is a stable rise of investment in S and T. For example, expenditure in R&D has increased extensively, reaching over US$ 2,5 billion in 2004 (Wu, 2007).

Moreover a great number of national S and T programs launched since the mid-1980s have had significant marks on the city. Above all, the designation of high-tech/science parks in Shanghai followed the launching of the national "863" and "Torch" programs, to promote the development of

high-tech industries. 4 Science parks are used as incubators for nurturing such industries and promoting research spin-offs like Caohejing High-Tech Park, Zhangjiang Science Park, Jinqiao Science Park, Shanghai University Science Parks, China International Textile Technology Development Zone and Jiading High-Tech Park. (Wu, 2007)

Important Points from Three Exemplar Innovative Cities

The examples of Cambridge, New York, and Shanghai have five common features that might highlight the critical success factors for cities like Istanbul searching to become innovative listed below:

I.   *Collaboration:* There is a great emphasize for collaboration and learning at regional level. "Cities exist in part to facilitate learning between individuals who come into contact with one another" (Storper and Scott, 2009). For example Cambridge region involves regional learning which is triggered by university based and entrepreneurial spin-offs. In Shanghai learning at regional level is supported by programs such as national S and T program.

II.   *Flexible clusters*: There are highly diverse clusters within these city regions; city regions offer many opportunities and facilities and qualified labor for these different kinds of high tech industries and clusters.

III. *Infrastructure:* An appropriate infrastructure dedicated for innovation supports the region. Particularly, ICT infrastructure, transportation, energy and supporting institutions are very important for city regions. Technoparks and technopolis are also a critical part of any innovation infrastructure. Caohejing High-Tech Park, Zhangjiang Science Park, Jinqiao Science Park, Shanghai University Science Parks, China International Textile Technology Development Zone, Silicon Alley and Cambridge University are some examples. These institutions take part as a bridge and an incubator for supporting the firms operating in city regions.

IV.   *Labor:* These cities attract qualified labor. There are well established universities and employment opportunities within these cities.

V.   *Network:* A strong network is established between local firms, institutions and universities as well as international actors. For instance New York is always ranked as a second city for network connectivity. On the other hand Cambridge in Europe has this recognition and connectivity in many areas. The industrial infrastructures of Cambridge and New York take their roots from very old times (Cambridge in the times of industrial revolution and New York for last two centuries).

CONCLUDING REMARKS: CHALLANGES FOR ISTANBUL

In a global world in which the waves of globalization have forced the introduction of strategies to enhance innovativeness and competitiveness; the role of cities as a regional innovation centers becomes more and more significant. In recent years, there has been increasing concern over the formation and outcomes of cities as global innovation centers. Accordingly this paper investigates the potential of Istanbul in becoming an innovative city?

Istanbul has a chance to take part in the global innovation league. Considering the Eraydin`s (2008) categorization, Istanbul now is a challenging city with a dualistic economic structure and labor market where both traditional industries and emerging new (high-tech) manufacturing activities. If strategies are developed and applied at government and municipality level, Istanbul can increase its position in the hierarchy of global cities. In addition, its central and transit location between Europe, Asia and Africa and the Bosporus coupling Black Sea to Mediterranean Sea might provide Istanbul many other opportunities to become a global center for innovation (Taylor and Walker, 2001).

On the basis of success factors identified by analyzing three innovative cities namely Cambridge, New York, and Shanghai, the position of Istanbul might be summarized as follows: 1) Istanbul has qualified labor force but still low even compared to Ankara in Turkey; 2) collaboration and regional learning exist at moderate level; 3) infrastructure is the best with the Turkish standards but they are not yet world-level/state-of-the-art institutions; 4) networking/connectivity is low in Istanbul, given that it is the 35th city in global network connectivity (Taylor, 2003); 5) diverse industrial and clusters exist in Istanbul.

Istanbul has a good base to become a global innovative city. If so, by following Eraydin's (2008) categorization, an appropriate and feasible strategy for Istanbul could be to follow a two-complementary/mixing strategy: becoming a learning region and becoming a high-technology industrial district. So, the short term strategy is to use the existing base and develop absorptive capacity in companies and institutions. The learning capability will not only increase efficiency and generate confidence in companies' own skills but also it will motivate firms to take the next step for becoming a "creative follower". At the same time, all actors of Istanbul innovation system should try to establish a well-functioning system where the development and use of new technologies will accelerate the transformation of production systems. Based on this short term strategy that is a mixing strategy, it becomes possible to develop the long term strategy whose goal is to build a global innovative city with high levels of connectivity with the rest of the world.

Both short and long term strategies require explicit plans where entrepreneurs, small firms and the government should take part in so that becoming a creative follower becomes possible. This seems a long journey but Istanbul deserves to be in the list of global cities where innovation will be the core.

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