Innovation and Organized Industrial Areas in Turkey: To What Extent Does Location Matter in Developing-Country Context?

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Abstract

Manufacturing industries in developing countries typically emerge as import substituting ones, or low-cost exporters, who utilize locally available cost-advantageous inputs, such as cheap labour. Yet the capability of such industries to become innovative is crucial for further economic and societal development. Thus, these days nearly every country with even modest industrial resources seeks to support innovation, and traditional low-cost countries as well as peripheral economies are no exception to this.

What enables innovation has been studied in great detail in Europe and North America, the traditional industrial powerhouses of the world. Both the innovating firm and its environment have been subject to intense research efforts. Innovation inputs, such as research and development spending, personnel, and government incentives have received great attention, as have outputs such as patents. The location of innovation actors in relation to each other, whether they are firms, universities or other producers of new knowledge, has been a particularly popular subject of study. There appears to be a widespread consensus on that it is beneficial for innovation to have such actors located close to each other. The importance of this is highlighted in industrial policy making as well, where a belief in innovative clusters characterizes the actions of decision-makers.

However, innovation in developing countries has received little attention, despite the rapidly growing manufacturing industries in East Asia and elsewhere in the past decades, and the importance of innovation to further development. This paper seeks to bring more light into the issue by studying innovation in metal and engineering industries in Turkey. The focus is on the impact on the so-called Organized Industrial Areas (*organize sanayi bölgeleri, OSB*) on innovation. Patenting by companies located in OSBs and outside of them in Istanbul, Bursa and Ankara is analysed. It is shown that companies in OSBs are indeed more active innovators that those outside them. However, their total share of innovation in metal and engineering industries is still smaller than those companies located outside OSBs.

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1. Introduction

In recent years, the role of new growth economies in the global economy has increased prominently, the best known of those being the so-called BRICS (Brazil, Russia, India, China, and South Africa). Following these, then, are what O'Neill (2001, 2007) has labelled as "the Next Eleven" or N-11 (Bangladesh, Egypt, Indonesia, Iran, Mexico, Nigeria, Pakistan, Philippines, Turkey, South Korea, Vietnam). However, innovative activities in these countries have received little academic attention, despite the widely recognised centrality of innovation in growth and development. Indeed, as Chudnovsky et al. (2006, 267) point out:

> [T]he relevance of the innovation process in firms doing business in developing countries is not always properly acknowledged, especially by mainstream economists, who tend to assume that openness and easy access to foreign technology sources is all that matters in terms of fostering firms' productivity.

It is easy to see these views following the structural reforms undertaken in many developing countries in the 1990s, which stressed the liberalization of foreign trade and investment. Thus, developing countries are predominantly considered as receivers rather than producers of technology, merely adopting innovations that were generated elsewhere. Numerous attempts to classify countries beyond the old "first world – third world" dichotomy (e.g. Hoeschele 2002, Önsel et al. 2008) see that true innovators are found in the most developed of countries. Thus, the capability to innovate is a sign of "graduation" in a country's development process.

Yet countries do not develop innovative capabilities all of a sudden: more often than not, it is a long learning process, which takes place across the sectors and industries of the national economy unevenly. One way to describe this process is elaborated by Önsel et al. (2008, 225), who see countries moving from factor-driven (e.g. based on cheap labour) to investment-driven and finally to innovation-driven economies:

> Finally, at the innovation-driven stage, the ability to produce creative products and services using the most advanced methods becomes the dominant source of competitive advantage. To succeed in a high-income economy, it is necessary to move to the innovation-driven stage. Deep-cluster development, the quality of the regulatory environment, the sophistication of both demand conditions and of the local fiscal market, and the quality of management education are important distinguishing factors for most successful high-income economies.

Indeed, there are no masters without beginners, regardless of whether one looks at the issue at a firm, regional or national level. With rapid industrialization being witnessed

in a number of countries outside North America, Europe and Japan, there is no doubt that new innovation-driven economies will emerge in due course and challenge the existing top players. This, in turn, will undoubtedly have a lasting impact in the global economy and politics. Consequently, innovation activities in developing countries, such as Turkey, matter and they warrant the attention of researchers.

From the viewpoint of developing countries, the matter is of no less interest, as the capability to innovate is a key to sustained economic growth and higher standards of living. Therefore it is reasonable to expect developing country governments as well to support innovation, inasmuch as their resources allow. Indeed, examples of successful development in this respect serve as an inspiration and encouragement to firms and political decision-makers alike.

2. Literature survey

The academic literature discussing innovation in developing countries largely focuses on case studies, with a few of them concerning Turkey as well. When it comes to economic geographers, Yeung and Lin (2003) pointed out already ten years ago how little attention this field has paid to the world outside Europe and North America in general, not to even mention innovation. They criticize economic geographers for seeing the mainstream Anglo-American theories as universal, despite their "inherent limits in relation to their analytical focus on historically and geographically specific industrial transformations" (Yeung et Lin 2003, 109). They see the development of various Asian economies such as China so peculiar and unique to traditional economic geographers that most practitioners of the field have simply not even attempted to study them (Yeung et Lin 2003, 122). For those who wish to tackle this challenge, Yeung and Lin give the following guideline:

> There is thus no singular economic geography of Asia but, rather, multiple pathways and diversities. By the same token, there should be many models and theories of these transformations in economic geography (2003, 108).

Thus, many questions can be asked to challenge the traditional theories of economic geography. For instance, can innovative clusters emerge only in developed countries? Does innovation follow a path-dependent route in developing countries as well?

Before formulating the particular research questions this study seeks to answer, it is first necessary to review the predominant theories of innovation in economic

geography critically, and then assess to what extent the existing empirical literature has discussed the issue of innovation in a developing country context.

2.1 Theories of Innovation in a Geographical Context

The idea of spatial-bound innovation is an old one. Since Marshall (1890), the emergence and existence of innovative actors, regions and even countries have been studied extensively. Agglomeration of firms in a region has been assumed beneficial for innovation because of so-called knowledge-spillovers: information on new commercial and technical developments moves from one firm to another easier, when they are located next to each other. In the traditional Marshallian industrial district, the firms were specialized in the same field. According to Jacobs (1969), then, the most innovative agglomerations of firms are diverse in their specializations. The existence of these knowledge spillovers is normally taken as granted and has seldom been subject to any attempt of verification. In their review of empirical studies of agglomeration economies, Beaudry and Schiffauerova (2009, 320) put it bluntly:

> In fact, there is no direct proof of the existence of knowledge spillovers and there probably never will be.

With Porter (1990, 1998, 2003), industrial agglomerations called clusters have become a key word for development efforts all over the world, and also renewed interest in spatial theories of economic development. In Turkey, the government has actively encouraged companies in the same industries to locate next to each other in special industrial areas (*Organize Sanayı Bölgeleri, OSB*), which are the focus of this study. This follows Marshall's original idea of industrial districts, and indeed in their review of 67 empirical studies, Beaudry and Schiffauerova (2009) see that specialization benefits innovation in low and mature technology industries and regions, whereas firm diversification benefits high technology industries and regions.

With clusters so much enthused by academic, business and political circles alike, it is easy to be carried away by it and assume that clusters would be innovative by default. However, one should remember that the mere fact that companies are located close to each other tells nothing of their capability or even willingness to innovate. Indeed, voices critical to agglomerations and clusters appeared already decades before Porter made the idea so popular. As Akerlof (1970) points out, particularly in countries that follow ISI policies [typically developing countries such as Turkey], a lack of

exposure to global technological developments, combined with industrial agglomeration, may rather result in "concentrations of mediocrity" than innovative clusters.

More recently Boschma (2005) saw that proximity may also hinder innovation, due to lock-in. In other words, clusters may suffer from a lack of openness to new ideas influences and be less flexible to adopt them into their own innovation processes, often as a result of corporate or regional culture. Especially successful companies and regions may develop an unrealistic sense of superiority and fail to see competing developments elsewhere. (Indeed, the current public discussion of the demise of Nokia and the rest of the ICT sector in Finland touches the issue frequently.)

The concept of lock-in is part of evolutionary theories of economic development. Clusters are widely seen as following a path-dependent route, where development is locked in a certain way, for instance only one type of industry prospers in a region but others do not, and this can be disrupted by external shocks only. In the words of Neffke et al. (2011, 237), "the rise and fall of industries is strongly conditioned by industrial relatedness at the regional level." Regional diversification, then, is also conditioned by history. However, as Martin (2010) points out, this tells nothing about how and why such clusters emerge in the first place:

> There is thus a curious contradiction in the model, in that path dependence seems to matter only *once* a new industry or technology has emerged but plays *no* part in shaping that emergence or *where* it takes place" (6, emphasis in the original).

Maskell (2001) also criticizes the contemporary theories of the geographical cluster for their failure to account for the birth of cluster. Perhaps it is indeed the focus of empirical work on roughly similar economies of the developed world, pointed out by Yeung and Lin (2003), which has led some economic geographers and other cluster enthusiasts to see the conditions behind the birth of clusters as taken for granted, and not worth a further scrutiny. Thus, any empirical work studying clusters in developing countries should also make valuable theoretical contributions to the field.

2.2 Studies on Government Measures to Promote Innovative Clusters

There are numerous studies on the impact of various government measures, such as R&D funding, on corporate innovation. Studies on successful innovative clusters also investigate how government policies (if any) helped shape them. In one of the first

pieces of broad comparative research on the subject, Bresnahan et al. (2001, 836) point to the difficulties that both scholars and policy-makers have in trying to understand clusters:

> [I]nternational comparison of Silicon Valley imitators has suffered the difficulties of comparing a roaring success to some bitter failures. Where Silicon Valley is entrepreneurial, decentralized, and only loosely and flexibly connected to broader national institutions, many efforts at imitation have been government sponsored, top down or tightly linked to established firms, perhaps 'national champions'. This wide divergence makes an analytical approach difficult, for one cannot easily investigate success drivers for getting over the positive feedback hump by looking at places that have been a roaring success or at places where so little of the logic is right.

What further complicates the matter is that quite often, governments start noticing and supporting innovative clusters only after they have emerged (Menzel et Fornahl 2009, 220). Thus, political rhetoric seeking to take credit of the entire cluster formation process retroactively may give an all too positive view of the consequences of government action, and other governments too may then start believing in the omnipotence of public measures in advancing innovation in a geographical context. In their conclusions, Bresnahan et al. (2001) particularly warn governments against too detailed cluster-building efforts, such as hand-picking a certain industry to enjoy their tutelage. Instead, governments should focus on improving the general conditions for entrepreneurship and innovation, for instance through the promotion of education and the open market. Even in Nordic countries, whose success is often understood to be the result of heavy government influence, the main government action the innovative ICT clusters that grew around Ericsson and Nokia in the 1990s can thank is the European-wide mobile telephony standard (GSM), which created a sizeable demand for their products (Bresnahan et al. 2001, 857).

2.3 Case Studies of Innovation in Developing Countries

Innovation has received scholarly attention in certain developing countries, and case studies exist at firm, regional and national levels. However, innovation in geographical clusters has received very little attention here.

At a firm level, a number of studies in economic geography are focused on the multinational corporation (MNC) and their innovation activities in different countries. The main questions asked by this literature are to what extent is innovation

activity assigned to foreign subsidiaries and what kind of activities are subsidiaries in less developed countries assigned or allowed to undertake. A typical example of this strain of research is Pavlínek's (2012) study of the automotive industry's R&D activities in Eastern and Central Europe, with a focus on the Czech Republic. According to him, the increase of automotive production in the Czech Republic has not been followed by a similar increase in R&D activities in the country. Most automotive companies have chosen to keep strategic R&D work in the home bases, while development work related with the implementation of technologies developed at home may take place in foreign production subsidiaries.

Studies on the benefits of R&D at a firm level in developing countries have outcomes similar to those undertaken in developed countries, for instance that innovation activity increases productivity. Here, purely domestically owned companies do not necessarily perform any worse than local subsidiaries of MNCs, which supposedly have greater resources at their disposal (Chudnovsky et al. 2006). Thus, domestic companies are not necessarily as much handicapped when it comes to innovation as the more pessimistic views on the role of MNCs in developing countries would suggest.

Yet it cannot be denied that technologically more advanced MNCs can drive local firms out of business if the latter do not respond to competition with the right measures. Examples of these abound, which again highlight the importance of innovation in developing countries as well. Trade and investment liberalization means that return to ISI policies is no longer possible. Competition of this kind concerns not only individual firms but regions as well in developing countries. Some research has been done on how such regions cope with new competition by encouraging local innovation. For instance, Lahorgue and da Cunha (2004) study how small and medium sized enterprises (SMEs) in the Brazilian region of Porto Alegre were assisted to upgrade their technological capabilities. The authors do not use the term cluster at all, but they describe a novel way of creating knowledge links between local universities and firms, thus hinting at one possible way of creating an innovative cluster in developing country setting.

The possibility and capabilities to learn is highlighted by a number of studies, which are concerned with innovation in developing countries. Bernardes and da Motta e Albuquerque (2003) discuss the interaction between science, technology and economic growth and maintain that it is not even possible for developing countries to adopt technologies from abroad without some scientific capabilities of their own. Yet they warn that increase in scientific production (as measured in scientific publications

does not necessarily increase technological production (as measured in patents). Thus, knowledge linkages between academia and the corporate world are not generated automatically in a developing country setting either.

2.4 Studies of Innovation in Turkey

Innovation in Turkey has been of interest to a limited number of researchers. Due to the country's fast economic development in recent decades, some have even pondered whether Turkey can be considered a developing country any more (Hoeschle 2002). Indeed, Turkey is widely seen as a rising manufacturing power and certainly the most industrialized country in the Middle East. Yet in broad competitiveness and innovativeness surveys, Turkey has made it to the medium level at best (Önsel et al. 2008). Thus, in terms of innovation, Turkey should still be considered as a developing country yet, in the terminology of Önsel et al. (2008), in transition from efficiency to innovation driven economy.

Since the establishment of the Republic of Turkey in 1923, industrialization has remained a key strategic objective for the country's successive governments. In Turkey, industrial development followed a pattern witnessed in many other developing countries as well. The foundations of manufacturing industries were laid with import substitution policies, and exports were first encouraged by devaluations of the Turkish currency and export subsidies. Technological development was not encouraged and thus did not accompany development in the same way as in South Korea, for instance (Özçelik et Taymaz 2004, 414). In fact, Turkey appears remarkably similar to former communist countries when it comes to technological development: domestic production relied on imported (licensed) technologies, copying and reverse engineering.

In Turkey, indigenous technological development began to be encouraged in the 1990s. Yet the country's national innovation system has been considered weak until recently (Özçelik et Taymaz 2004, 414), and the country's economic system still maintains peculiarities which make it, in the words of Akkermans et al. (2009), a "Mediterranean/Mixed Market Economy:"

> The 'Mediterranean' variety of capitalism features strong reliance on nonmarket mechanisms in corporate finance and a focus on market mechanisms in labour relations (183).

Akkermans et al. (2009) suggest this form of economy is not ideal innovation, mentioning that in all industries only about 100 US Patents were issued to investors located in Turkey 1970 – 1995.

In the light of the above, the results of the first Innovation Survey conducted in Turkey by the country's statistical institute in 1998 (covering innovation activities 1995 – 1997) are of particular interest to researchers, and have provided data for a number of studies, such as those by Uzun (2001) and Özçelik and Taymaz (2004). Turkey entered in a customs union with the European Union in 1995, which created both new export opportunities to Turkish manufactures and intensified competition in Turkey's domestic market. Since then, Turkey's exports have continued to grow rapidly, and a few studies seek to answer to the question whether the increasing innovativeness of Turkish companies has something to do with this success.

Using the 1995 – 1997 data, Uzun (2001, 191 – 192) discovers that than 40% of machinery companies in Turkey were involved in innovation activities and that the main technologies were acquired from outside, in the form of imported machinery for instance. This supported by findings by Pamukçu (2003), who uses data from a 1994 survey, and by Meschi et al. (2003), who use data on Turkish manufacturing industries 1980 – 2001. Uzun (2001) further points out that only 19% of Turkish firms applied for patents and even fewer were approved, but still new and improved products accounted for more than 60% of the sales of machinery and equipment industries (193 – 194). The author admits the limitations of the source data and maintains that "more detailed surveys over longer periods are needed to gather data for exploring the mainstream of the technological activities in Turkey" (Uzun 2001, 195). To date, the 1998 survey indeed appears as one of the most comprehensive overall studies of innovation in Turkish industries, despite its age and limited coverage in time.

Özçelik and Taymaz (2004) use the 1995 – 1997 data to study the export performance of Turkish manufacturing industries. The authors study the connection between innovativeness and export performance, taking into account firm features such as size and foreign ownership. Interesting results include the observation that with non-innovators, foreign ownership correlated positively with exports. This suggests that foreign companies use Turkey as an export base for products manufactured with technologies developed elsewhere. The authors also find some positive correlation with regional innovation intensity and export performance, thus suggesting the existence of innovative and successful clusters. However, this issue is not elaborated in any detail. For instance, the data did not include any measures of

inter-firm communication beyond the normal supplier-customer relationships, which would have indicated "classical" cluster behaviour.

Karaoz and Albeni (2005) study technological learning in Turkish manufacturing firms 1981 – 2000. They also see the change from ISI to export orientation in the 1980s as a major turning point in Turkish industries, but point out that this did not benefit all sectors. For instance, Turkish machinery companies could learn new technologies fast and remain competitive, but chemical companies on the other hand did not.

In the light of Turkey's late start with public policies supporting innovation, there is not yet much research on the effectiveness of such measures. Özçelik and Taymaz (2008) study the impact of Turkey's first governmental R&D loans and grants 1994 – 2001 on private R&D spending and found out that such support even at modest level boost private R&D investment. When it comes to the impact of public support on the geography of innovation, the authors give an interesting remark:

> "Also, there seems to be some regional clustering of the supported firms. Compared with non-supported firms, supported R&D performers account for a proportion of all firms in their provinces (the "Regional share of supported firms") that is twice as high." (266)

Thus, it seems that at least government-supported innovation in Turkey is found in geographical clusters.

There are a few sector-specific studies on innovation in Turkey. Dereli and Durmuşoğlu (2009a) study the patenting activities of various industries in Turkey 1995 – 2006 and more specifically, that of textile and paper industries 1980 – 2006. The authors attribute the increase in patenting in Turkey during those years to the above mentioned incentive programs offered by the Turkish government. Yet the downside of this appears to be the fluctuating nature of those policies, which have followed the country's general macroeconomic conditions. The authors are not interested in the geography of patents o clusters. In another paper, Dereli and Durmuşoğlu (2009b) study the clustering of patents in Turkish textile industry by technology, with an aim to develop a model for following technology trends. To date, these are the most comprehensive studies of innovation in Turkey using patents, and they offer some valuable methodological insights into the use of Turkish patent data, which shall be discussed later in this paper.

Özağatan (2011a, 2011b) has studied the automotive industries in Bursa as part of global value chains, with the aim to discover whether local suppliers to multinational lead firms can gain innovative capabilities. The results appear much in line with

Pavlínek's (2012) findings in the Czech Republic: the most important functions remain firmly in lead company hands. While Turkish automotive industry suppliers have been assigned some design and product development tasks by their multinational customers, this is seen as outsourcing of R&D risks to local companies (Özağatan 2011a, 898). Bursa as an important automotive industry centre is an obvious location for the study, but the author does not discuss the issue of clusters at all.

3. Summary of Existing Knowledge of Innovative Clusters in Developing Countries

Before formulating our research questions, it is useful to provide some concluding remarks on our literature survey. As the bulk of cluster literature is focused on developed countries, there is a potentially vast area of undiscussed issues when it comes to innovative clusters in developing countries. This section will summarize the state of existing knowledge on the subject and point out some major "blank spots."

3.1 What is Known of Innovation in Developing Countries?

Most studies admit that innovation, when defined broadly, in principle exists nearly everywhere. In developing countries, new knowledge is created but often in somewhat different processes than what takes place in developed countries, as a result of resource limitations. Importance of innovation is increasingly realized in developing countries as well, but it is another matter to what extend this is shown in practical policy measures. It is pointed out that indigenous innovation is often not possible without at least some basic scientific capacity, but investment in science alone does not automatically generate new knowledge expressed in innovations.

As for the outcome of innovation processes, there is ample proof that companies located in developing countries apply for and are issued patents, both nationally and internationally (although the latter in much lesser numbers than is the case with companies from developed countries).

The benefits of innovation, where successful are seen similar to developed countries: for instance, increase in innovation results in increase in productivity. These days it has also become increasingly fashionable to see innovation as equal to development when categorizing different countries: when innovation becomes the driving force of economy, a country has moved to the ranks of developed countries

When it comes to actors in innovation processes, the role of MNCs is of great interest here as well. This reflects the long-standing focus on the activities of MNCs in developing countries, which is shared by development scientists and business studies researchers alike. Indeed, with trade liberalization and increasing competitive pressures on native firms since 1990s, MNCs remain a pertinent issue. In contrast, there appears to be significantly less interest in indigenously owned innovation processes, even though they do exist in a number of developing countries, some of which are playing an increasingly important role in the global economy.

3.2 What is Known of Clusters in Developing Countries?

A major weakness of the cluster theory, in its current state, is that the origins of clusters are not well studied. The fact that most empirical studies focus on already existing clusters in developed countries is perhaps related to this shortcoming. A popular view is that cluster development follows a path dependent route in developed countries, but it is not certain whether this would apply to all situations, especially when it comes to the initial typological and regime differences between countries and regions.

Belief in innovative clusters in also shared by governments of many a developing country. However, it has been pointed out that clusters may not be innovative in developing countries in particular. Moreover, it appears very difficult to find any empirical research on innovative clusters in developing countries. Either they do not exist, or they have simply been ignored. Yet it should be remembered that innovation does not necessarily demand high technology. Indeed empirical studies, while not focused on developing countries, point out that innovation takes place in low and medium technology clusters as well, as long as they are specialized. Such clusters would be typical for a developing country.

3.3 What is Known and Not Known of Innovation in Turkey?

Innovation in Turkish manufacturing industries has been studied comprehensively only in the 1990s, despite the country's rapid economic growth since. In the 2000s, there have been a few industry-specific studies touching innovation but with rather limited chronological time range. Existing studies nevertheless reveal that there is indigenous innovation activity in Turkey, as documented in inputs (innovation activity, use of government R&D grants) and outcome (patents, export performance). However, simply importing foreign technology in form of advanced machinery and the like has had a prominent role in technological learning in Turkey, as might be expected of a developing country.

Thus, the existing body of literature leaves many issues open. There is no information of the existence of innovative clusters in Turkey, and thus no information on how they might have possibly developed. While similar industries in Turkey are definitely found in same areas, their possible innovativeness has not been studied in a systematic way using long time series data. To what extent they can be even called clusters could also be questioned.

4. Turkey's OSBs

In Turkey, successive governments have made varying efforts at controlling rapid urbanization, which has been a characteristic of the country's development for many decades. The first organized industrial area was established in Bursa in 1962, and for a long time they were used as a tool of urban planning only, seeking to confine manufacturing activities to certain areas in cities that had already experienced industrial development. However, since the 1990s, such areas have also had the function of spreading industrial development all over Turkey. Law No. 4562 of 2000 (*Organize Sanayi Bölgeleri Kanunu)* provides the current legal framework for OSBs. According to the Law, the main purposes of OSBs remain the provision of basic infrastructure at low costs and streamlining bureaucracy that companies operating within OSBs face. Innovative activities are not mentioned in the Law, and thus no

special provisions or concessions towards their advancement are made within the functions of OSBs.

As of 2011, more than 37,000 enterprises with over 800,000 employees were located in 130 OSBs all over Turkey. Yet there has been very little research on the performance of firms located in OSBs. Issues such as the operating costs of companies within OSBs (e.g. Çağlar 2011) and export performance (e.g. Ispir et Kök 2007, Kar et Şimşek 2007) have occasionally appeared in non-academic and academic presentations in Turkey. However, there appears to be no interest in OSBs in or outside Turkey that would have manifested itself in peer-reviewed academic research on the subject in recent years.

In the light of the literature surveyed, Turkey's OSBs can been seen as part of government efforts to improve general conditions for entrepreneurship. Many OSBs are home to diverse industries, and thus agglomeration effects that may follow could be either Marshallian or Jacobs type, depending on the specific OSB.

5. Definitions

A review of the existing body of literature shows that the terms "cluster", "agglomeration" and "industrial district" are often used interchangeably. What is common to all definitions of a cluster is that some kind of proximity, most often geographical, is assumed.

A key feature of a cluster, according to many, is the existence of linkages between various actors within. The classical Marshallian industrial district assumes that companies in the district have direct business relations (e.g. supplier relations), and modern literature assumes these to be small and medium sized companies (e.g. Boix et Galletto 2009). Modern cluster literature also stresses less than obvious linkages, such as exchange of tacit knowledge. In a regional setting, this can be referred to as "region-specific intangible assets embodied in a knowledge and competence base with a high degree of tacitness, which is sustained and reproduced by interaction patterns that are firmly rooted in a particular institutional setting" (Boschma 2004, 1012).

However, when studying clusters in a developing country, one may need to be somewhat generous when defining one. Clusters do not appear all of a sudden from nowhere with all the trappings of a "ready" one in place. If one wishes to delve into the origins of clusters, one must accept them as a focus of study at an embryonic state.

For instance, in a typical developing country context many of the indigenous companies are component or other intermediate product manufacturers, who supply a foreign company which may or may not have presence in the region. Knowledge linkages, as has been pointed out, have been difficult to document even in developed country clusters. Therefore, it is not reasonable to seek to prove their existence in developing countries either.

Therefore, a cluster is simply accepted as a local or regional agglomeration of firms in the same or closely related industry. Innovative clusters, then, are those in which innovation outputs can be documented.

6. Research Questions

Existing cluster studies indicate, as outlined above, that companies located close to each other in same as well as in related industries are more innovative than those, which do not enjoy such geographic proximity. Thus the following questions are asked by this research:

Research Question 1: Do companies located in Turkey's OSBs apply for a higher number of patents in average than companies outside them?

There are industrial companies all over Turkish cities and regions. Thus, companies located in OSBs, which cover relatively small geographic areas, should show a higher rate of innovation than those outside them, even if located in the same city.

Research Question 2: Does patenting by OSB companies grow faster than that of companies outside them?

It should also follow from the above that patenting grows faster in OSBs than outside them.

7. Methodology and Data

This research uses Turkey's domestic patents and utility models as an indication of innovativeness (output). The benefits and drawbacks of patents have been discussed widely in innovation research (e.g. Nagaoka et al. 2010). As this research is focusing on innovation activities in distinct locations, patents have the benefit of clearly telling the physical address of the inventor and inventing firm. Thus, it is possible to distinguish between inventors and patent holding companies located in OSBs and those outside them.

In innovation studies, US patents are most commonly used, due to the concise criteria according to which they are granted and easy availability. US patents are particularly popular for international comparisons. However, literature survey has already shown that the number of US patents applied by and granted to Turkish firms is very low (Akkermans et. al. 2009). Yet one should not conclude from this that there is very little innovation activity in Turkey. When observing innovation in developing countries, domestic patents are often seen as more valuable. The costs of applying for a US patent may be prohibitive to a developing country firm, and much of innovation in such countries may be imitation or minor adaptation, which does not qualify for a US patents (Bernardes et da Motta e Albuquerque 2003, 873; Motta e Albuquerque 2000). Thus, Turkish patents and utility models are accepted as data for this research (hereafter collectively referred to as "patents").

The date of submitting patent application is normally preferred to granting date as an indicator of the actual time of invention, because granting a patent can take several years. When it comes to Turkish patents, Dereli and Durmuşoğlu (2009a, 125) consider 12 – 18 months a normal granting time.

Dereli and Durmuşoğlu (2009a), whose study is the most comprehensive one on Turkish patenting so far, also give other useful insights for interpreting such data. They note during their period of observation 1995 – 2006, less than 20% of Turkish patents were applied by Turkish companies. The majority of applicants were foreign companies, who wanted to get their innovation protected in Turkey as well. Thus,

looking at mere total patent figures in Turkey tells hardly anything about the innovativeness of Turkish companies.

8. Findings

The online database of the Turkish Patent Institute (*Türk Patent Enstitüsü*, www.tpe.gov.tr) was used to gather patent data. For metal and engineering industries, international patent classification (IPC) classes B04, B06, B09, B21, B22, B23, B24, B25, B26, B27, B28, B29, B30, B31, B66, F01, F02, F03, F04, F15, F17, F22 and F28 were deemed most relevant. It should be noted that the use of these classes only largely excludes Turkey's large vehicle industry from the study. Thus, the focus is on those metal and engineering industries, which produce investment goods such as machinery. Only those patents which are applied by Turkish residents (companies and individual inventors) are taken into account. This excludes Turkish patents granted to foreign companies (though not Turkish subsidiaries of multinational companies), and thus provides a more accurate view of innovation activity taking place on Turkish soil, in comparison to Dereli and Durmuşoğlu (2009a) who also included foreign patent applicants.

Initially patents were gathered from 1980 to 2010, but it turned out patenting by Turkish residents in the classes mentioned above was very minor until the 2000s, as Figure 1 below shows.

Figure 1: Patents issued in Turkey to Turkish residents (companies and individuals) in metal and engineering industries, 1980 - 2010.

Thus, it was decided to focus on years 2000 – 2010, which provided enough data for an analysis. When patents were arranged by regions (corresponding to Turkish provinces), Istanbul, Bursa and Ankara clearly rose above the rest, as Figure 2 below shows:

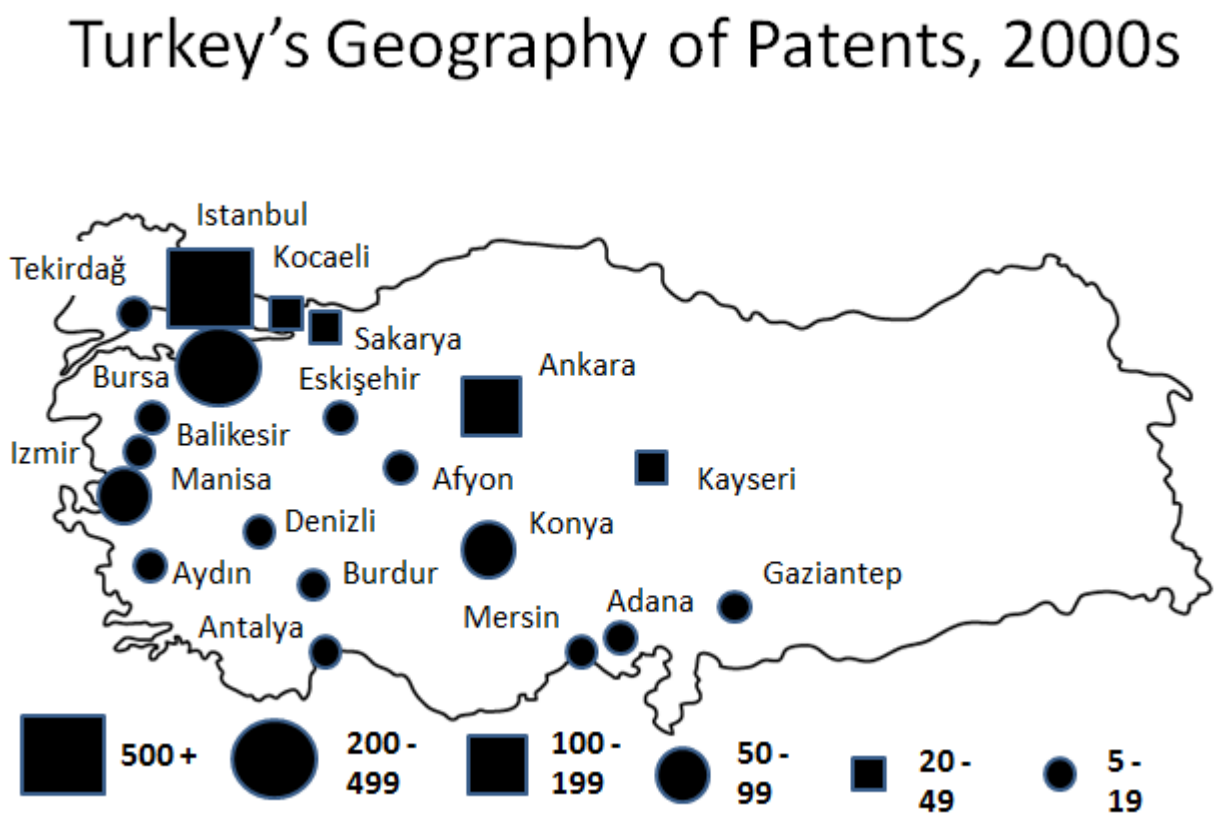

Figure 2: Geographical Distribution of Turkish Patents in Metal and Engineering Industries, 2000 – 2010.

Next, patents applied by individual inventors in Istanbul, Bursa and Ankara were excluded from the database. This left 298 patents in Istanbul, 160 patents in Bursa, and 48 patents in Ankara applied by companies for analysis. These were then arranged by companies and their addresses in order to distinguish inventing firms located in OSBs from others. The results are shown in Figures 3, 4, 5, and 6 below:

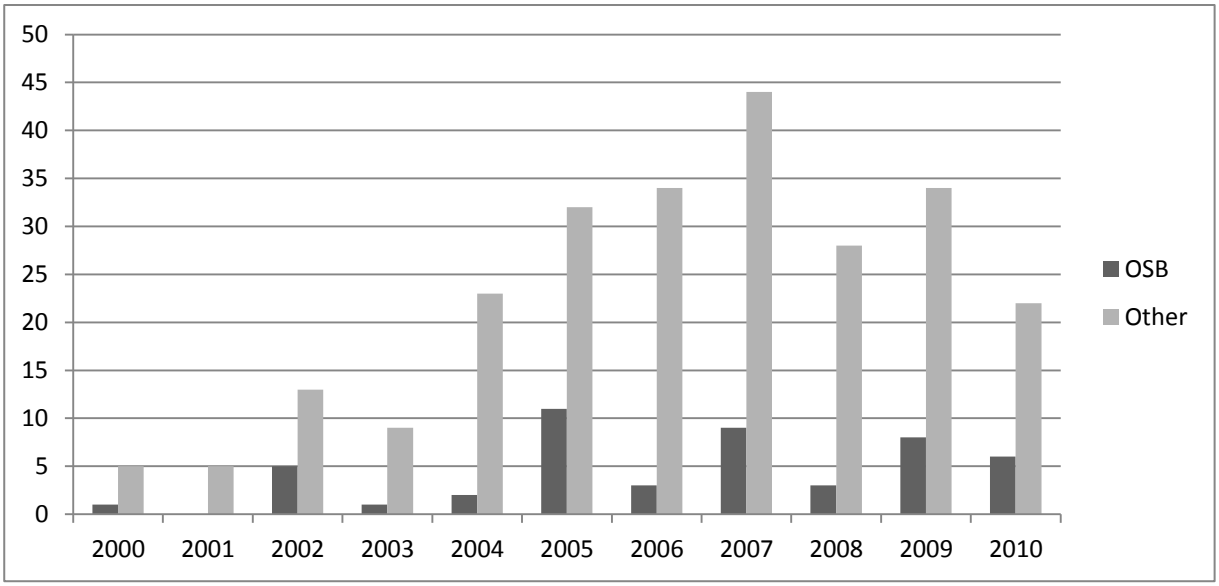

Figure 3: Patents applied by companies in Istanbul 2000 – 2010 by location.

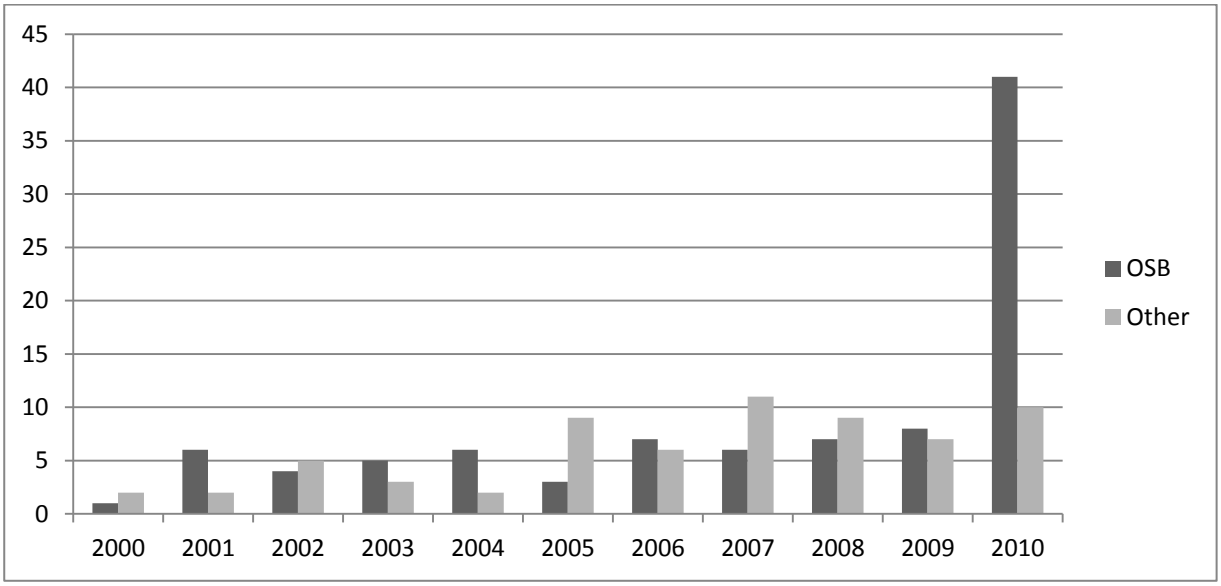

Figure 4: Patents applied by companies in Bursa 2000 – 2010 by location.

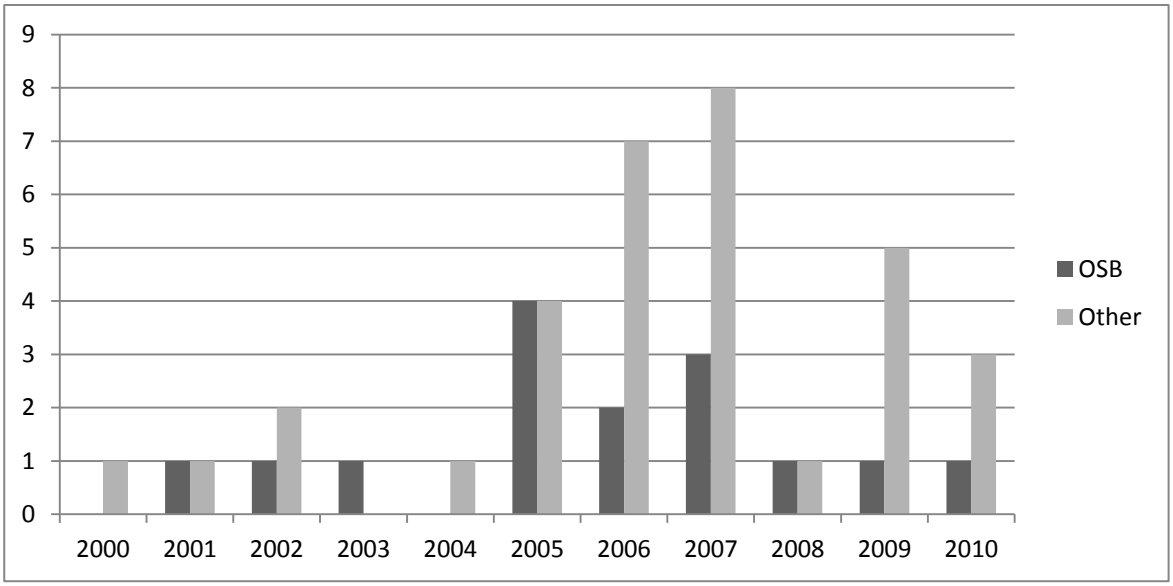

Figure 5: Patents applied by companies in Ankara 2000 – 2010 by location.

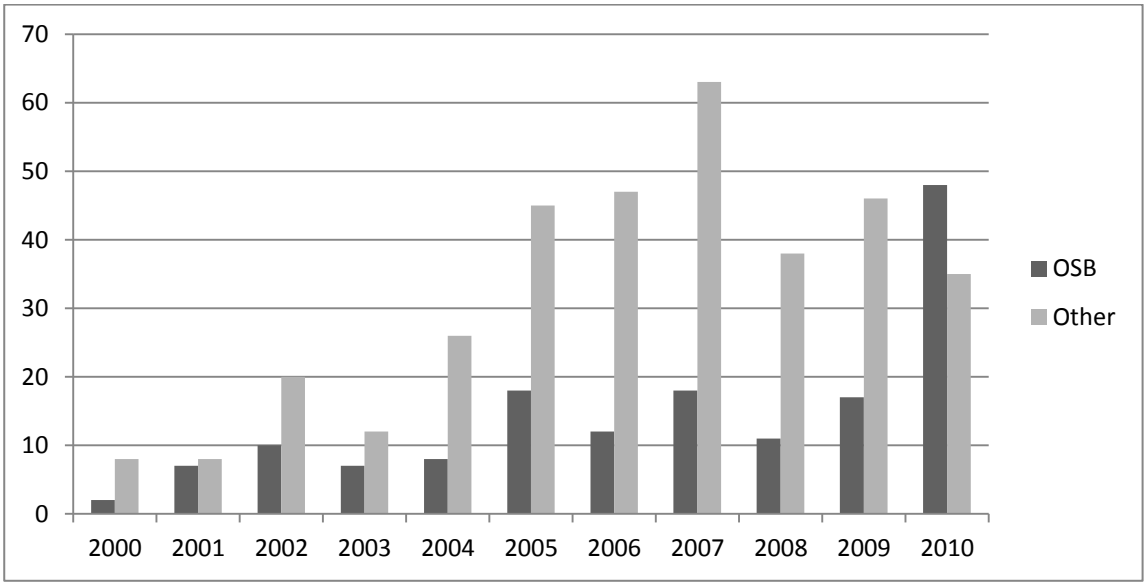

Figure 6: Patents applied by companies in Istanbul, Bursa, and Ankara combined 2000 – 2010 by location.

Next, the performance of OSB and non-OSB companies is analysed in more detail. The Figure 7 below shows a breakdown of patenting companies and patents by OSBs (horizontal) and regions.

ISTANBUL	IKITELLI	MERMERCILER	DUDULLU	BEYLIKDÜZÜ	BOYA VERNIK	OSB TOTAL	OTHER
Patenting companies	17	6	3	2	1	29	151
Patents	22	12	8	5	2	49	249
Average patents per company	1,2941	2,0000	2,6667	2,5000	2,0000	1,6897	1,6490
BURSA	**BURSA**	**NILÜFER**	**KESTEL**	**DEMIRTAS**		**OSB TOTAL**	**OTHER**
Patenting companies	7	5	3	2		17	33
Patents	68	17	4	5		94	66
Average patents per company	9,7143	3,4000	1,3333	2,5000		5,5294	2,0000
ANKARA	**IVEDIK**	**OSTIM**	**ANKARA 1.**			**OSB TOTAL**	**OTHER**
Patenting companies	9	2	1			12	26
Patents	10	4	1			15	33
Average patents per company	1,1111	2,0000	1,0000			1,2500	1,2692
ALL						**OSB TOTAL**	**OTHER**
Patenting companies						58	210
Patents						158	348
Average patents per company						2,7241	1,6571

Figure 7: Breakdown of patenting companies and patents by region and OSB.

It is evident that companies located in OSBs had a significantly higher rate of patent applications in average than those outside OSBs.

Then, Figure 8 shows the difference in growth in patent applications during the period of observation by companies located in OSBs and those outside them.

Growth %	*2000–2001*	*2001–2002*	*2002–2003*	*2003–2004*	*2004–2005*	*2005–2006*	*2006–2007*	*2007–2008*	*2008–2009*	*2009–2010*	*2000–2010*
OSB patenting	250,00	42,86	-30,00	14,29	125,00	-33,33	50,00	-38,89	54,55	182,35	2300,00
Other patenting	0,00	150,00	-40,00	116,67	73,08	4,44	34,04	-39,68	21,05	-23,91	337,50

Figure 8: Growth of patent applications in OSBs and other locations

There appears to be great annual variation in growth (and contraction) of patenting over the years 2000 – 2010 in both OSBs and outside them. However, when it comes to overall performance, patenting by companies in OSBs grew nearly seven times faster than that by companies outside OSBs.

9. Conclusions

This research has shown a rapid increase in patenting in Turkey's metal and engineering industries in 2000s. When patenting by regions is analysed, it is evident that companies located in Turkey's Organized Industrial Areas (OSBs) are more active innovators than other companies in the same industry, as far as average number of patent applications per company and patenting growth rate are considered. However, the majority of patents in these industries are still applied by other companies than those located in OSBs.

From this research it can be thus concluded that simple agglomeration does have some significance even in a developing country context, when innovation at the firm level is considered. However, the fact that most innovation in Turkey's metal engineering industries still takes place outside OSBs begs for further research on individual firm dynamics in order to see how much exactly to OSBs as organizations contribute to innovativeness.

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