MIXED NETWORKS IN BUILDING INNOVATIVE CAPABILITY IN DEVELOPING ECONOMIES: THE TURKISH CASE

by

Yesim Sungu-Eryilmaz

Bachelor of City Planning (BCP), Middle East Technical University,1992

Master of City Planning (MCP) University of Pennsylvania,1997

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This dissertation was presented

by

Yesim Sungu-Eryilmaz

It was defended on

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and approved by

Ilhan Tekeli, Professor, CRP, METU

Phyllis Coontz, Associate Professor, GSPIA

Clyde Mitchell-Weaver, Associate Professor, GSPIA

Dissertation Advisor: Sabina E. Deitrick, Associate Professor, GSPIA

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Yesim Sungu-Eryilmaz, PhD

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This study investigates the networking behavior of innovative firms in two regions in Turkey: Ankara and Istanbul. Specifically, it compares the geographical extent and characteristics of innovation networks between the two regions when firms carry out innovation, i.e. developing new or improved products or processes. Ego-centric networks of 89 firms were studied to investigate the geographical extent and the nature of innovation network ties. Based on these two regional case studies, three conclusions were made: (1) when firms in developing countries introduce technological innovation of products and/or processes, they engage in mixed networks, i.e. local and non-local (interregional and international) networks, (2) while local networks are important, non-local networks are used to access capabilities that are not present locally; these networks are not substitutes for each other but complementary, and (3) innovative firms in both types of regions (new vs. established) engage in mixed networks. However, the characteristics of these networks differ based on the region's development level. It, therefore, makes sense, analytically as well as politically, to distinguish between different types of networks, so that a much broader array of policy implications can be made for building innovative capability from this wider perspective in developing countries.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF MAPS

ABBREVIATIONS

ASO	Ankara Chamber of Industry
BU	Bilkent University
BOUN	Bosphorus University
EUROSTAT	Statistical Office of the European Communities
EUREKA	A Europe-wide Network for Market-Oriented R&D
HU	Hacettepe University
ITU	Istanbul Technical University
KALDER	Turkish Society for Quality
KOSGEB	Small and Medium Industry Development Organization
MAM	Marmara Research Center
METU	Middle East Technical University
OIS	Organized Industrial Parks
SIS	Small Industry Parks
R&D	Research and Development
SMEs	Small and Medium Sized Enterprises
SPO	State Planning Organization
TDZ	Technology Development Zone
TESID	Turkish Electronics and Information Technology Industries Association
TIDEB	Industrial R&D Funding Directorate, TUBITAK
TEKMER	Technology Development Center
TOSYOV	Turkish Foundation for Small and Medium Business
TSE	Turkish Standards Institution
TTGV	Turkish Technology Development Foundation
TUBITAK	Scientific and Technological Research Council of Turkey
TUIK	Turkish Institute of Statistics
TUSIAD	Turkish Industrialists' and Businessmen' Association
UME	National Metrology Institute
YTU	Yildiz Technical University

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CHAPTER 1. INTRODUCTION: INNOVATION AND NETWORKING

This dissertation investigates the distinctive features and networking behavior of innovative firms in the context of a developing economy. In particular, it investigates the networking behavior of Turkish firms in two regions: Ankara and Istanbul. Most of the literature on the geography of innovation has analyzed the patterns of behavior of innovative firms in the context of the advanced economies of Western Europe and North America. Yet, firms in developing economies may have different networking patterns when firms introduce technological innovation of product and/or process kind. This research argues that mixed networks of local and non-local ties play an important role in building innovative capability in developing economies. It is important to distinguish between different types of networks so that a much broader array of policy implications can be made for building innovative capability from this wider perspective in developing countries.

Innovation is widely seen to be the key driver of economic development (Schumpeter 1934; Dosi 1988). Recent literature shows that innovation is a much more complex process than a linear model. The linear model of innovation process is thought of as a series of steps leading directly from basic research through applied research to development and commercialization within a firm.[1] This hierarchical approach became the principal model for innovation and science policies in the 1950s (Nelson 1959). However, recent research argues that innovation is created and sustained by knowledge inputs not only generated within the firm, but also knowledge inputs

[1] Goding (2005) argues that the precise source of linear model of innovation is unknown.

derived from *networking*, i.e. interaction with suppliers, universities and partners, or feedback from customers (Lundvall 1992). Furthermore, proximate or local ties play an important role in facilitating knowledge exchange among firms and local organizations, which in turn facilitate innovation (Camagni 1991; Storper 1997; Audretsch 1998). However, it may be possible that emphasis on local networks fails to take account of other forms of networking in which firms engage. Some researchers argue that there now exists a very complex web of such arrangements extending beyond their immediate locality (Amin 1999; Markusen 1999; Oinas 1999).

The aims of this dissertation are: 1) to investigate the networking behavior of innovative firms and the geography of these networks; 2) to examine the characteristics and understand the role of networks at local and non-local levels; and 3) to analyze the differences in the networking behavior between regions.

This research is important for two reasons. First, it addresses a topic of great importance for regional and industrial development in developing economies, namely the role of local and non-local (interregional and international) networks in building innovative capabilities. While models of local networking have emerged in policy agendas of developing countries (Altenburg and Meyer-Stamer 1999; Cooper 1991; Bell and Pavitt 1992), these models fail to identify potential benefits that peripheral regions could collect from non-local (i.e. interregional and international) linkages. This weakness may hinder an effective implementation of innovation policies in regions of developing countries (Ernst 2002). Second, in developed countries there is a large volume of empirical data and studies available that describes the innovation activities of firms, as well as the results which confirm the links between innovation and networking. This is not so in developing countries, where the characteristics and scope of innovation processes and networking behaviors are still largely unknown.

The complex phenomenon of innovation processes, the shortcomings of existing research in developing countries, and a wish to gain a fine-grained understanding of networks have led this research to pursue a mixed qualitative and quantitative methodology. Both case studies and statistical methods are used to analyze two regions, Ankara and Istanbul. The viewpoint in this study is comparative. The comparison of the two case studies will serve to identify common innovation network features and differences with respect to each regional environment. In particular, this research tries to answer the following questions:

1) To what extent do innovative firms in developing countries interact with other firms and organizations in order to introduce innovations of the product and process kind? What is the geography of these networks?

2) To what extent are local ties important relative to non-local ties for innovative firms? What are the characteristics of local and non-local ties?

3) Does the networking behavior of innovative firms differ between regions?

1.1 AN OVERVIEW

The dissertation is divided into eight chapters. In Chapter 2, innovation, the changing view of the innovation process and its spatial implications are examined. This chapter emphasizes the role of networking in the innovation process. Moreover, it reviews the role of the region and compares different territorial models of innovation. It identifies the gap in the literatures and discusses the relevancy of these debates for regions in developing countries.

Chapter 3 explains the research method and design undertaken in this work. Given the problems associated with innovation measures and evaluation of innovation networks, this chapter reviews the methodological approach used in the literature to perform such an analysis at the regional level. Moreover, it describes the research design applied to this work. The aim is to understand innovation activities and networking in a different context.

Chapter 4 discusses the national context and describes the profile of the case study regions. In the national context, historical economic, industrial, and innovation policy is given emphasis. The second section describes the two regions. The two regions contrast with respect to their location, economic trajectories, and industrial structure.

Chapters 5 and 6 discuss the findings from the empirical study of the two case-studies. In order to facilitate the comparison and analysis, chapters 5 and 6 are structured identically with respect to the table of contents and the types of analysis done. In particular, the emphasis is placed on three subjects. First is the characteristics of the interviewed firms. Here the emphasis is given to the spatial distribution, entrepreneurship, and market structure. Second is the level of innovation activities, including the historical development production and innovation capabilities of firms. The third element is the networking behavior of the firms. In relation to the research questions presented in chapter 3, these chapters try to answer these questions.

Chapter 7 draws out some results from the interregional comparison. In the first part, interregional comparisons are analyzed by innovation activities. The second part discusses the interregional comparison of innovation networks.

The final chapter draws conclusions based on the research. The theoretical and policy implications are emphasized and possible future directions for research are presented.

CHAPTER 2. INNOVATION, NETWORKING, AND TERRITORIAL DYNAMICS

This chapter provides a review of the literature. First, the definition of and the role of innovation in economic development are introduced. Innovation is considered as the main source of economic development. Second, the sources and processes of innovation are examined. The roles of different types of knowledge in the innovation process are briefly summarized. Specifically, the dichotomy between the tacit vs. codified knowledge dichotomy is emphasized. Next, the interactive notion of innovation processes is explained. Recent research argues that innovation is created and sustained by knowledge inputs not only generated within the firm, but also knowledge inputs derived from *networking*, i.e. knowledge inputs from suppliers, universities and partners, or feedback from customers. The fourth section focuses on the spatial dynamics of the innovation process and introduces territorial innovation models in the literature. Finally, gaps in the current literature on network relations are addressed with respect to peripheral regions in developed and developing countries.

2.1 INNOVATION AND ECONOMIC DEVELOPMENT

Innovation can be defined as the introduction of new or improved products or the introduction of new methods that have economic impact directly or indirectly (OECD 1997). For example, the introduction of a new product that creates a new branch of industry; or a new process of manufacturing the changes the production costs of an existing product; or a new organizational structure that makes a company more competitive.

Economists have always recognized the importance of innovation in economic development.[2] However, it was Schumpeter who gave a central place to the role of innovation in his theory of economic development (Schumpeter 1934). Schumpeter defined economic development as a qualitative change in the nature of production rather than quantitative changes in savings or investment patterns (Schumpeter 1934). Schumpeter described this qualitative change as *innovation*, and made the important distinction between inventions and innovations, which has been generally incorporated into economic development theory later. Schumpeter argued that:

> ....Invention suggests a limitation which is most unfortunate because it tends to veil the true contours of the phenomenon. It is entirely immaterial whether an innovation implies scientific novelty or not. Although most innovations can be traced to some conquest in the realm of either theoretical or practical knowledge that has occurred in the immediate or the remote past, there are many which cannot. Innovation is possible without anything we should identify as invention and …..Invention does not necessarily induce innovation, but produces of itself… no economically relevant effect at all.…. Stressing the element of invention or defining innovation by invention would, therefore, not only mean stressing an element without importance to economic analysis, but it would also narrow down the relevant phenomenon to what really is but a part of it. (Schumpeter 1939, p88)

In other words, Schumpeter argued that invention is a new idea or scientific novelty while innovation is the commercialization of these new ideas. It is innovation which creates new opportunities and cost advantage for a firm (Schumpeter 1939).

[2] Adam Smith, in his book *Wealth of Nations*, discusses the importance of improvement in machinery. Similarly, Marx assigns a central role to technical innovation in his analysis of capitalist economy. Lastly, Marshall describes “knowledge” as the chief engine of growth.

Schumpeter suggested two models of innovation (Simmie and Kirby 1998; Marshall 1987). His first model emphasized the role of entrepreneurs. In this model, entrepreneurs take the risk of turning inventions into innovations. These create new opportunities for profits, create competition between entrepreneurs for creating new innovations, and attract imitators. Schumpeter argued that these innovations are not continuous but cyclical (Schumpeter 1939), following Kondratieff's long waves in describing these cycles. He argued that each long business cycle can be explained by the qualitative change in the economy due to innovation. He characterized this as a process of *creative destruction,* which occurs when innovation makes old ideas and technologies obsolete. His later, second model emphasized the role of endogenous R&D in large firms (Schumpeter 1947). In this model, Schumpeter argued that large firms could become more successful in innovation compared to small and medium size enterprises (SMEs) since large firms have more resources to induce innovation. SMEs, on the other hand, Schumpeter argued, would not have the ability to spend resources on R&D in a competitive environment (Schumpeter 1947). This model gave rise to debate in the literature later about the significance of SMEs and large firms.

The significance of innovation in economic development was rediscovered in the 1970s. The main reasons behind that were the recession of the 1970s and the slow growth of the world economy. In general, Schumpeter inspired three main ideas in subsequent research. First, Schumpeter distinguished the concept of innovation from invention. His definition of innovation is defined in a number of different ways. These include 'new products, new processes, new markets, new sources of raw materials, and new forms of organization' (Schumpeter 1934, p66). Second, innovation is the main source of economic development, whereas neo-classical economics stresses the significance of price competition. Third is the importance of links among organizational, managerial, social and technical innovations (Dosi 1988). The social and institutional structures influence technical change. Innovation is not merely technical change but collection of interdependent technical, organizational, and managerial innovations (Freeman 1991).

Subsequent research has extended Schumpeter's theory and addressed several issues. The basic dichotomy of product and process innovation continued to inform the empirical research agenda. Empirical studies show that firms usually have a portfolio of R&D projects. Some are targeted at process innovation, some at product innovation, and some at both. It is argued that while both product and process innovation provide innovating firms the advantage of first mover, process innovations provide cost advantages to the innovators (Rosenkranz 2003). Product innovations are in fact usually associated with the creation of new markets or the quality enhancement of existing products, whereas process innovations are typically introduced to reduce costs and/or increase the flexibility and performance of production processes (Edquist, Hommen, and McKelvey 2001; Simonetti, Archibugi, and Evangelista 1995). However, recent management studies criticize the conventional idea that a trade-off exists between market creation and the reduction of the production cost. These studies have shown that successful companies invest simultaneously in different innovative activities, aiming at improving the existing product and at decreasing the cost of production (Mantovani 2006).

There are several reasons mentioned in the literature for different types of composition of innovation activities among firms. One is that the type of innovation activity differs across industries (Cohen and Klepper 1996). For example, Cohen (1996) gives the example of petroleum refining and pharmaceutical industry. He argues that the petroleum refining industry is dedicated to process innovation, while product innovation is dominant in the pharmaceutical industry. Industry-level conditions play a role that differentiates the returns to one sort of innovative activity versus other. The second reason cited is the cultural distinctions at the international level (Stahl-Rolf 2003; Tidd, Bessant, and Pavitt 2001; Mansfield 1988). For example, Tidd et al (2001) and Mansfield (1988) observe the differences between American and Japanese firms. While American firms mostly engaged in product innovations, the success of the Japanese automobile firms during the late twentieth century was mostly derived from process innovations (Tidd, Bessant, and Pavitt 2001; Mansfield 1988). A third reason cited is the differences in patent policy (Eswaran and Gallini 1996). Eswaran and Gallini (1996) argue that the incentives provided by the market and the constraints imposed by patent policy are critical determinants of the extent to which product and process innovations are undertaken. Another reason cited is the differences in firm size and market structure (Acs and Audretsch 1991; Yin and Zuscovitch 1998). Research showed that process innovation increases relative to product innovation as the size of the firm increases (Yin and Zuscovitch 1998). In addition, firms have heterogeneous portfolios depending on the market phase of the respective product or technology. Initially, when market needs for a new technology are ill-defined but the market potential is large, product innovation tends to predominate (Yin and Zuscovitch 1998). The emphasis changes from product to process innovation when performance criteria is standardized and prices become the new critical factor of success (Sahal 1981; Abernathy and Utterback 1982).

However, these explanations fall short in explaining differences among firms of similar sizes within one country, i.e. regional differences. For example, Kaufmann and Todtling (2000) found differences in the type of innovation pursued among firms in different regions. They argued that high product innovation activity in a region was due to the need to diversify product base and to open up new markets while high process innovation activity in a region was attributed to the old industrial regions where mature and traditional industries were concentrated (Kaufmann and Todtling 2000).

In addition to the scope of innovation, the scale - new (radical) vs. improvement (incremental) - innovation was also researched. Dosi et.al (1988) provided four categories of innovation: incremental innovations, radical innovations, changes of technology system, and changes in techno-economic paradigm:

> 1. Incremental innovations: These occur more or less continuously in any industry or service activity although at differing rates in different industries and countries, depending on a combination of demand pressures, socio-cultural factors, technological opportunities and trajectories… Although their combined effect is extremely important in the growth of productivity, no single incremental innovation has dramatic effects, and they may sometimes pass unnoticed and unrecorded. However, their effects are apparent in the steady growth of productivity.

> 2. Radical innovations: These are discontinuous events and usually the result of a deliberate R&D activity in enterprises and/or university and government laboratories… Whenever they may occur, they are important as the potential springboard for the growth of new markets and for the surges of new investment associated with booms. They may often involve a combined product, process, and organizational innovation. Over a period of decades radical innovations… may have fairly dramatic effects… but in terms of their aggregate economic impact they are relatively small and localized unless …… radical innovations are linked together in the rise of new industries and services, such as synthetic materials industry or the semiconductor industry.

> 3. Changes of technology system: Far reaching changes in technology, affecting several branches of the economy, as well as giving rise to entirely new sectors. Based on a combination of radical and incremental innovations, together with organizational and managerial innovations affecting more than one or a few firms…An obvious example is the cluster of synthetic materials innovations, petrochemical innovations, machinery innovations in injection molding and extrusion.

> 4. Changes in techno economic paradigm: Some changes in technology systems are so far reaching in their effects that they have a major influence on the behavior of the entire economy…. A vital characteristic of this fourth type of technical change is that its pervasive effects throughout economy…. The changes involved go beyond engineering trajectories for specific product or process technologies and affect the input cost structure and conditions of production and distribution throughout the system…. Once established as the dominant influence on engineers, designers and managers become a technological regime for several decades (Dosi et al. 1988,p.45).

According to several firm level empirical studies, both radical and incremental innovation prove to be important (Cohen and Levinthal 1990; Nonaka and Takeuchi 1995; Porter 1990). Tushman and Nelson (1990) observe that continuous incremental innovation and a combination of both incremental and radical innovations are essential in economic development. Audretsch (1995) suggests that almost 90% of commercially significant innovations in the US are actually incremental in nature, involving the development, application and re-application of existing knowledge with little or no scientific advance.

In the context of developing countries, research has built up a body of knowledge on innovation, industrialization, and economic development. During 1950s and 1960s, there was no mention or interest in understanding innovation in developing counties, partly because innovation was assumed absent in developing countries. Another reason is that innovation was considered to be embodied in durable, capital goods or, in other words, in machinery (Solow 1957). Therefore, innovation was seen as the development of new kinds of machinery. The developed countries were the producers of the capital goods. In the context of developing countries, on the other hand, the issue was viewed as the acquisition and installation of new machinery which had already been developed elsewhere (innovation as technology diffusion). Any problem about achieving technological change and economic growth for developing countries was largely seen as a problem about generating the level savings (Domar 1957) and capital accumulation (Solow 1957) through international capital flows needed to acquire externally sourced capital goods. Thus, the local industry in developing countries was essentially seen as passive, involving only the adoption and routine operation of externally supplied technologies. Consequently, policy concerns about innovation tended to focus on the choice of appropriate technology, technology transfer, financial and informational gaps that hindered the flows of capital embodied technology.[3]

This view changed at the end of 1980s. Innovation was viewed as part of 'technological capabilities,' referring to "the ability to make effective use of …knowledge in efforts to assimilate, use, adapt, and change existing technologies."(Kim 1997, p.4) In other words, technological capability is not only to develop the capability to use a given technology, it implies the capability to adapt, change or create technologies in response to changing needs. The term 'technological capability' also indicates the level of organizational capability at a point in time (ibid.). There are four common main categories of technological capabilities (Dahlman, Ross-Larson, and Westphal 1987; Lall 1992; Kim 1997; Mytelka and Ernst 1998; Westphal, Rhee, and Pursell 1984):

1) Production capabilities involve the knowledge and skills needed to operate production facilities. These capabilities include the day to day, shop floor activities such as monitoring raw materials, production, output quality, and maintenance.

2) Investment capabilities relate to the knowledge and skills that enable firms to extend existing facilities and to establish new production facilities. These capabilities include feasibility analysis, evaluation and selection of technology as well as, setting up equipment.

[3] Please see the special issue of *World Development* (March 1974) on the subject of the choice of appropriate technology and technology transfer.

3) Innovative capabilities refer to a firm's ability to sense the changes in the environment and use knowledge, skills and existing resources to change or create technology. The term covers a wide range of activities including incremental vs. new and product vs. processes and organizational innovation. Incremental or minor innovation involves the ability to adapt and improve existing products or processes. Incremental innovation is argued to be key both for developed and developing countries (Kim 1997; Forbes and Weild 2000). Several studies show that domestic firms in developing countries are involved in incremental innovations. It is argued that these innovations add value, especially if they are continuous (Evenson 1995; Dahlman 1987; Tushman and Nelson 1990). Asian developing countries, in particular, succeeded in developing a considerable technological capability and industrial expertise and export success via incremental innovation such as imitation and reverse engineering (Bell and Pavitt 1992; Ernst, Ganiatsos, and Mytelka 1998; Kim 1997; Nelson 1993). New or major innovation involves the ability to create new products or production processes and to develop patentable ideas (Ernst, Ganiatsos, and Mytelka 1998). It could be new for a firm or the market it serves.

4) Marketing capabilities refer to the ability to create new market; to keep track of changing market demand; to understand user needs; to establish distribution channels; and to provide customer services.

Forbes and Weild (2000) examined the differences in the nature of innovative activity in developed countries as technology leaders and developing countries as technology followers. They identified the following basic similarities and differences between them: 1) Incremental innovation is key for firms in both developed and developing countries. "As the technology-leader continues to improve the technology, keeping up requires incremental innovation, catching up requires incremental innovation at a faster pace than in the leader. Incremental innovation is thus the primary source of long-run competitiveness in technology-followers" (Forbes and Weild 2000, p.1099). 2) New or radical innovation can be a new technological paradigm for developed countries but for developing countries, this could be new to the firm. 3) Both product and process innovation are important for developing and developed countries. However, product and process innovations are different at different stages in industrial development. Wong (1999) suggested that firms in developing countries deliberately choose to focus on either product or process side while some firms may focus on both simultaneously. They may switch from one strategic route to another over time, i.e. from process to product. 4) Shop-floor innovations, occurring in day-to-day operation, contribute significantly to the competitiveness of developing countries in cost-sensitive markets. These types of innovations are the major source of cost-saving. However they are not captured by formal innovation indicators (Forbes and Weild 2000).

In summary, the basic dichotomies (product vs. process innovation and new vs. incremental innovation) informed empirical research in both developing and developed countries. The next section describes the innovation processes.

2.2 INNOVATION PROCESS

This section discusses different models of the innovation process and the shift observed in the thinking of innovation process since 1950s. There have been two approaches to innovation process: linear and interactive models of innovation process.

In the 1950s and 1960s, linear models dominated the thinking about innovation. These models are called science-push and demand-pull and are complementary. The science-push model assumed that innovation is a linear process and it was thought of as a series of, sequential steps leading directly from basic research, through to applied research, to development and commercialization.[4] This hierarchical approach emphasizing basic research became the principal model for innovation and science policies in 1950s (Nelson 1959). The demand-pull model, on the other hand, stressed the importance of the demand side and markets as the source of ideas for innovation (Schmookler 1966). In this model, the emphasis shifts from researchers to users. Users/customers define the problems and ask researchers to conduct research to specific to certain problems (Weiss 1979). In both views, innovation was seen as machinery. Another implication of this view was reflected on 'learning' models. Learning is defined as the ability to acquire knowledge for innovative capability. It was assumed that production implied technology mastery through 'learning by doing' (Arrow 1962). Arrow (1962) also argued that production costs decrease as productive experience increases. It almost assumed that learning was an automatic process. The policy implications of the linear view and learning models for developing countries were to decrease the gap between developed and developing countries by promoting technology transfer through purchase or through foreign firms locating in a country (Stewart 1973). It was assumed that the main external sources of technology were limited to machinery suppliers.

By the mid 1980s and 1990s, the linear innovation model and learning type was questioned in search for new ways of conceptualizing innovation studies and development. First, case studies in developing countries revealed that 'learning' was not an automatic process. Learning was a conscious, systematic, and frequent effort made by the concerned actors (Bell and Pavitt 1992; Cooper 1991; Mytelka and Ernst 1998; Westphal, Rhee, and Pursell 1984). In

[4] (Godin 2005)argues that the precise source of linear model of innovation is unknown. However, it can be argued that in his second model, Schumpeter argued that innovation process had become endogenous with the emergence of R&D departments.

addition, machinery suppliers and MNCs were not the only sources of technology change (Bell and Albu 1999). Customers also played an important role for developing countries. Second, the linear model put an overemphasis on research as the only source of innovation (Smith 1994). Consequently, the innovation policies were based on introducing internal, formal R&D-based products and processes. But these policies could not reach small and medium-sized enterprises (SMEs), which have relatively fewer financial and human resources compared to larger firms. Nonetheless, research showed that SMEs were able to develop new products or processes and kept up with larger firms in the field of innovation (Noteboom 1994; Rothwell 1989; Acs and Audretsch 1988). Similarly, the case studies of developing countries showed that R&D was not the only source of innovation. Developing countries' innovative capabilities have been gained mainly through incremental processes (Westphal, Rhee, and Pursell 1984; Amsden 1989). Third, innovation did not have to be sequential and had to start from basic research in academia (Nelson and Winter 1982). Consequently, it was argued that linear conceptualization of the innovation process and R&D only represented a portion of the entire set of activities that firms had to take to innovate (Malecki and Oinas 1999) and the problems in the learning process that created innovation meant that 'feedback and trials are essential'(Kline and Rosenberg 1986). Based on these criticisms, the interactive innovation model was developed. According to this model, innovation is a non-linear and independent process (Kline and Rosenberg 1986). It may stem from many sources, both inside and outside of the firm. Innovation is created and sustained by knowledge inputs not only generated within the firm, i.e. the feedbacks across all stages of the production chain (Kline and Rosenberg 1986), but also knowledge inputs derived from *networking*, i.e. knowledge inputs from suppliers, universities and partners, or feedback from customers (Lundvall 1992). Wissema and Euser (1991) argue six reasons for networking: 1) to share costs, 2) to share risks, 3) to gain additional market knowledge, 4) to gain technical and market knowledge which complement each other, 5) to serve an international market, and 6) to develop industry standards together.

In summary, innovation does not happen in isolation. R&D only represents a portion of the whole set of activities that firms have to do to innovate. The most important feature of the innovation process is the continuous and numerous interactions among the great variety of economic actors and the feedbacks across all stages of the production chain. The next section intends to elaborate on concepts such as knowledge and networks as form of interactive innovation to highlight the role played by these two concepts in the modern economy.

2.3 INTERACTIVE INNOVATION PROCESS: KNOWLEDGE AND INNOVATION NETWORKS

Knowledge is increasingly regarded as the critical source and 'at the core of production and innovation activities' (Archibugi and Michie 1995). Two forms of knowledge are discussed in the literature: tacit and codified (explicit) knowledge (Nonaka and Takeuchi 1995; Nonako, Toyama, and Nagata 2000).

Tacit knowledge refers to intuitive, unarticulated, and implicit knowledge. The notion of tacit knowledge was first introduced by Micheal Polanyi (1967). Polanyi argued that tacit knowledge cannot be easily articulated and formalized "as we always know more than we can tell." (Polanyi 1967, p.4-6) In most of the innovation studies, tacit knowledge is identified as an important component of the knowledge used in innovation (Dosi et al. 1988; Kline and Rosenberg 1986; Howells 2002). It is argued that the growing complexity and rapid change in the knowledge and scientific base has made tacit knowledge ever more important in the process of learning and knowledge accumulation (Lundvall and Johnson 1994). Tacit knowledge is embedded in a person or organizational routines (Johnson and Lundvall 2001). Tacit knowledge is difficult to transfer, communicate, and assimilate (Cohen and Levinthal 1990) since it is personal and context specific -temporal, spatial and social (Lam 1998). Sharing tacit knowledge between individuals requires social interaction, shared understanding and trust (Lam 1998; Gertler 2003; Lundvall and Johnson 1994; Maskell and Malmberg 1999b; Storper 1997). Therefore, learning procedures entail co-presence and co-location between the transmitter and the receiver (Noteboom 1999). Individuals can make one-on-one visits to other firms or have on-the-job training. Groups of people can gather at meetings or conferences, or at one firm or another or at a third location.

Codified (explicit) knowledge refers to knowledge that can be organized and codified by its holder so that it can be easily saved, communicated, and understood by others. Codified knowledge is transmittable in a formal and systematic way (Nonaka and Takeuchi 1995). Examples of codified knowledge include software, databases, operating manuals, patents, best practices, and procedures. Some of this knowledge can be purchased in the market place. Some channels of communicating codified knowledge are the exchange of messages between individuals, such as by telephone, e-mail, fax, or memo, and the dissemination of documents and materials to a wider audience, such as software, newsletters, and papers (Nonako, Toyama, and Nagata 2000).

Tacit and codified knowledge are not dichotomous but should be seen rather as a continuum (Howells 2002). Research shows that firms may depend on both tacit and codified knowledge, which may be obtained from a variety of sources (Nonaka and Takeuchi 1995; Nonako, Toyama, and Nagata 2000; Lawson and Lorenz 1999). Both types of knowledge are context specific and relational (Nonaka and Takeuchi 1995). The main mechanisms for sharing both types of knowledge entail interrelationships of networking with and between organizations, such as suppliers, customers, competitors, and universities. But there is a distinction between how sharing and channeling occurs when one type of knowledge is used. It is argued that sharing tacit knowledge requires spatial proximity while codified knowledge can be acquired both from local (proximate) and decentralized networks (Amin and Cohendet 1999).

From the definition and description of knowledge outlined above, does geography matter? Geography is important to our understanding of knowledge sharing and innovation process for two reasons. First, it is argued that tacit knowledge comes into existence in local networks of firms and the proximity of other agents in regions (Audretsch 1998). Second, regions matter because differences in social and institutional infrastructure influence the type and intensity of local networks (Storper 1997; Amin 1999; Visser and Boschma 2004), and its mixture with external, codified knowledge (Amin and Cohendet 1999; Asheim 1996). The next section discusses and compares different territorial innovation models.

2.4 TERRITORIAL INNOVATION MODELS

While it is recognized that differences in innovative capability among firms are in part attributable to the organizational capabilities of a firm (Cohen and Levinthal 1990), it is also argued that it is in part attributable to properties of the local economies of which they are a part (Storper 1997; Porter 1990; Maskell and Malmberg 1999b; Camagni 1991). This local dimension is of particular interest in this dissertation that attempts to test this hypothesis, specifically the use of knowledge at the regional level.

Different territorial models promoted the region in the last fifteen years as the best level for the occurrence and diffusion of innovation. These models were labeled in a variety ways in the literature: the recently revived model of *Industrial Districts* (Brusco 1982; Pyke, Becattini, and Sengenberger 1990; Piore and Sabel 1984), the European model of *Innovative Milieu* (Aydalot and Keeble 1988; Camagni 1991), the US model of *New Industrial Spaces* (Scott 1988; Saxenian 1996), and recently *Regional Innovation Systems* (Braczyk, Cooke, and Heidenreich 1997; Morgan 1997; Kaufmann and Todtling 2000). This section presents these different models, especially with respect to the role of region in innovation process.

2.4.1 Industrial districts

The theory of the industrial districts, originating with Marshall, stresses the innovative capacity of SMEs belonging to the same industry or closely-related industries in close geographic proximity. The phenomenon of industrial districts has been observed historically as well as internationally. Evidence of well-performing SME clusters has been extensively reported in literature such as Emilia-Romagna in Italy (Pyke, Becattini, and Sengenberger 1990; Piore and Sabel 1984; Rabellotti 1997), Baden-Württemberg in Germany (Herrigel 1993), and regions in some developing countries (Nadvi 1995; Schmitz 1990; Rabellotti and Schmitz 1999).

The industrial districts are characterized by a strong division of work between SMEs specialized in different steps of production. The presence of one or several lead firms in the same sector also significantly influences agglomeration. Multiple relationships exist between the firms and the local environment. These relations can be grouped as static and dynamic agglomeration economies.

Static agglomeration dynamics emphasize the associated benefits of externalities and agglomeration economies in flexible specialization and inter-firm networks to reduce transaction costs due to spatial agglomeration. External economies of scale are realized when firms and related organizations co-locate and share common pools of factors of production (labor, capital, and infrastructure). As the common pools expand, productivity increases since the supply of factors of production are improved and factor prices are lower. The unit costs of local firms will be lower in the presence of such common pools than if producers had to develop these factors for themselves.

Recent analyses of industrial clusters recognize the dynamic agglomeration effects which are characterized by the importance of the knowledge spillover, learning, and the social and institutional basis of geographical clusters (Brusco 1982; Harrison, Kelley, and Gant 1996). The dynamic view highlights that industrial clusters are more than simply a collection of firms co-located in close proximity. It is argued that the concentration of SMEs within a specific geographic region facilitates knowledge spillovers across firms and therefore facilitates innovative activity (Audretsch 1998; Maskell and Malmberg 1999b) Geographical proximity reduces the cost and increases the frequency of personal contacts facilitating a higher probability of tacit knowledge spillover across individuals within the population. Social and institutional basis of districts were emphasized as central to the functioning of district. Understanding economic behavior requires consideration of the social, cultural, and institutional structures in which economic actors are embedded (Granovetter 1985). Embeddedness refers to the fact that economic action and outcomes are affected by actors' relations and by the structure of the overall network of relations (Granovetter 1985). The embeddedness perspective stresses the role of personal relations and networks of such relations in generating trust and reciprocity. The social ties that bind small firms in geographical clusters enable the sharing of tacit knowledge and ideas that lead to innovation (Brusco 1982; Maskell and Malmberg 1999b).

However, the observation that collaboration and innovation in geographical clusters are facilitated by personal relations and trust brings a further question of how strong social ties among firms in such regions come into existence in the first place? Along these lines, researchers have suggested that regional institutions, such as local government bodies, universities, business associations, and technical assistance organizations, encourage the development of shared understanding, collective identities, and interpersonal trust which help to promote collaboration and innovation among local firms (Rabellotti 1997; Piore and Sabel 1984).

In some ways, industrial districts are similar to innovative milieu. Both of them emphasize the role of the socio-economic community, and cooperation among the functionally specialized actors. The next section will introduce the innovative milieu model.

2.4.2 Innovative milieu

The theory of innovative milieu, initiated by Groupe de Recherche European sur les Milieux Innovateurs (GREMI) group in France (Aydalot and Keeble 1988; Camagni 1991), parallels the agglomeration economies mentioned above. However, two elements are considered to be different from other approaches: the "collective learning" process and the reduction of the elements of dynamic uncertainty.

In the theory of the innovative milieu, the firm is not an isolated agent but part of a local milieu which plays a fundamental role in the innovation process (Perrin 1991). Local milieu is defined in three spatial-functional spaces (Ratti 1991): production, market, and support space. It is the support space that facilitates innovative capability. The support space consists of three types of relationships: 1) the qualified relationships at the level of organization of the production factors (capital, information source, technological know-how, specific human ties; 2) the strategic relationships at the level of organization of the enterprise concerning its partners, marketing agents or customer (privileged information exchange, cooperation, partnership, alliance); and 3) the relationship with institutions in the locality (public institutions, private and semi-public association). It is argued that those relationships generate a dynamic process of collective learning, that act as an uncertainty reducing mechanism in the innovation process. Such local networks rely partly on factors that are not traded directly for money in the market place but which nevertheless make significant contributions to innovation (Camagni 1991). Consequently, the collective learning process and density of the relationships stimulate creativity and innovation capability.

However, it is further argued that the innovative milieu needs linkages from outside the locality in terms of new opportunities. Its international integration and its capacity to access the global market is particularly significant. Therefore, the process of networking is taking place both at the intra-regional and international level (Bramanti 1991). In essence, innovative milieu focuses on proximity, territorial social relationships and local factors that are not traded directly in the market place.

2.4.3 New industrial spaces (NIS)

The new industrial spaces (NIS), suggested by Storper and Scott in 1988, have insights from the literature on Industrial Districts (Brusco 1982) and flexible production systems (Piore and Sabel 1984). Flexible production system emerged as the antithesis of fordist system of mass production. Fordist production refers to an entire production system which is internalized in one enterprise (vertical integration). Flexible production system, on the other hand, is based on vertical disintegration, i.e. subcontracting and small batch production. The main firm controls only the final product and technology. Storper and Scott (1988) observed that the flexible production system occurred in craft, design intensive and high-tech industries and flourished in new places with no previous fordist production histories such as Third Italy and Silicon Valley. The main factors underlying this spatial agglomeration emphasized the local labor market, inter-industrial transactional networks, and the efficiency of the flexible production system that was characterized by an ability to shift promptly from one process and/or product configuration to another in the short run without any harmful effects on levels of efficiency (Storper 1987; Storper 1995; Scott 1986; Scott 1988; Scott 1990).

NIS also emphasizes a 'social regulation system' that facilitates innovation and learning. It is argued that firms are embedded in networks of social and institutional relationships. They learn from one another through the flow of information, ideas, and know-how (Storper 1995). The question of what sustains these firms is explained by the role of "untraded interdependencies" in the form of complex institutional and social relationships (Storper 1997). Regional institutions play a central part in constructing and maintaining a network of supportive social relationships between groups with economic and non-economic interest (Saxenian 1996). They provide the coordination of inter-firm innovation and learning and the dynamics of entrepreneurial activity. For example, in her study of Silicon Valley and Route 128, Saxenian (1996) emphasizes the role of local institutions and culture as well as industrial structure and corporate organization for economic performance. The 'social regulation system' shows some similarities with the support space in the innovate milieu approach.

2.4.4 Regional innovation system (RIS)

The theory of regional innovation system (RIS) follows the evolutionary theory of technical change (Nelson 1982; Nelson 1993) and the theory of national innovation system (Lundvall 1992). The national innovation system consists of a set of interacting private and public firms, institutions, and organizations. Innovation performances of national economies cannot be explained only by looking at the strategies and performances of firms. Other factors and actors play a role in favoring the diffusion and economic use of knowledge such as the presence of networks among firms, financial and educational institutions, and R&D infrastructure (Braczyk 1997).

These ideas of national innovation system is generalized to a regional context (Cooke 2001). Similarly, RIS consists of a set of interacting private and public firms, institutions and organizations. The region is viewed as a collective learning environment (Braczyk, 1997; Kaufmann 2000). The innovative behavior of a firm is affected by the environment in which they operate (Lorenzen 2001; dePropris 2002). Not only firms, but also non-firm organizations, such as universities and public organizations, produce and disseminate knowledge (Cooke 2001). The functioning of a regional system is based on the relationship among the various elements of a regional system. Interactions between firms and their networks of organizations shape the functioning of the RIS. The argument is that the firms' propensity to interact within the innovation system reinforces innovation performance (Heraud 2003; Braczyk, Cooke, and Heidenreich 1997). It was also argued that the mix of competition and co-operation characterizes the regional system (Maskell and Malmberg 1999b). There are several commonalities among these four models mentioned above. The next section will describe these similarities.

2.4.5 Commonalities in territorial innovation models

Territorial innovation models in the previous section share common concepts and elements with each other. The common elements among the theories of territorial development can be grouped under four headings.

First is the emphasis on region or *endogenous development*. Endogenous development emphasizes region as important level for economic development which is based on mobilization of the resources available or generated regionally. Regional or endogenous resources include social, economic, technical and political resources, such as regional entrepreneurship, human capital, existing industrial structure, R&D infrastructure, and existence of professional associations. An essential characteristic of endogenous development is the broad involvement of regional groups and individuals in the planning and policy process (Moulaert and Sekia 2003; Friedmann and Weaver 1979; Coffey and Polese 1984). The success of cases of high technology clusters, such as Silicon Valley, and places making traditional products, such as Emilia-Romagna, emphasizes the use of local assets for competitiveness.

The second common element among the territorial innovation models are the *agglomeration economies*. All models acknowledge externalities and increasing return associated with spatial clustering of firms. Two viewpoints exist regarding externalities. One is the Marshallian or localization economies which refer to the agglomeration economies of the similar industries (Brusco 1982). The second one is the Hooverian reformulation of urbanization economies. Urbanization economies reflect externalities associated with the presence of complementary firms and organizations in a variety of relevant industries and services (Harrison, Kelley, and Gant 1996; Scott 1990). Harrison (1996) suggested that innovation is not systematically related to the density of clusters of similar industries but urbanization economies with relatively large number of industries were more important for promoting innovative capability. This is particularly relevant for some SMEs that undertake little R&D themselves, yet contribute considerable innovative activity in newly emerging industries such as the biotech and computer software (Audretsch 1998). SMEs make use of universities, trade associations, and other knowledge-generating institutions. The knowledge spillover from the firm conducting R&D or the research lab of a university stimulates innovative capability in region.

Third is the emphasis on *networking*. All territorial innovation models use network concepts as key characteristics. The industrial district literature stresses the role of personal relations and networks of such relations in the innovation process. Similarly, innovative milieu refers to networking that firms innovate through the relationships with other agents of the same milieu. NIS argues inter-firm transactions and culture of networking and social interaction as the characteristics of new industrial spaces. Lastly, RIS sees the innovation and learning process as an interactive process and the network as an organizational mode of interactive learning.

Lastly, all territorial innovation models emphasize that firms are embedded in local networks. These local networks constitute a valuable resource in the conduct of economic activity and for innovation activities. What are the characteristics of local networks? First, it was argued that local networks are dense (Storper 1997). The density of interactions implies the number of interactions and its level changes through time (Torre and Gilly 2000; Staber 2001). Second, local networks contain diverse set of organizations including firms, customers, suppliers, universities, financial, research institutions and professional associations (Kaufmann and Todtling 2000; Perrin 1991). However, customers and suppliers are specifically emphasized. It is argued that while a flow of incremental innovations is generated through localized interaction with customers (Von Hippel 1988), embodied technologies are imported into the firm through the exchanges with suppliers, as knowledge spillovers (Audretsch 1998). Third, tacit knowledge was given importance and it was considered to be highly spatially localized. Tacit knowledge in firms and organizations comes into existence in local networks of firms and organizations. Hence, more rapid diffusion of tacit knowledge is arguably more likely to occur in spatial proximate relations (Storper 1997). Fourth, various forms of interactions can be distinguished. They can be formal or informal, market or non-market (Torre and Gilly 2000). The informal or personal relationships depend on trust while the formal relations are based on contractual agreements. The informality of interrelationships is viewed as being a potential strength rather than a weakness of local networks. Because of trust-based relationships, firms are willing to undertake risky co-operative and joint ventures and to act as a group (Gordon and McCann 2000). Fifth, following the discussion of diffusion of tacit knowledge, the duration of networks is argued to be longer in local networks (Oerlemans, Meeus, and Boekema 2000). Duration is defined as the number of years relationship existed. It is argued that long duration of a tie enhances mutual understanding and trust (Nooteboom and Gilsing 2004). Lastly, it is argued that tacit knowledge is best transferred via frequent face-to-face interaction which can be managed best in local proximity (Audretsch 1998).

In a discussion of the territorial innovation models, it can be concluded that there is a general agreement on the importance of spatial proximity for innovation. Emphasis is placed on regional resources, agglomeration economies, and networking. Especially, it is argued that networks are based on social and economic relationships which enable or constrain economic action in general and innovation in particular. The importance of tacit knowledge and the interactive character of the development of innovation are stressed. The basic assumption in the literature is that geographical distance affects the ability to receive and transfer knowledge. In general, innovation is assumed to be more dependent on local ties. This local networking pattern has been closely linked to the best examples, those which built their competitive advantage from localized learning. These include Silicon Valley and Emilia-Romagna in Italy. However, these examples are unique and non-transferable although policymakers try to do so both in developed and developing countries. What is missing in these models is the role of non-local networks. The next section introduces the discussion around non-local networks.

2.5 NON-LOCAL DIMENSION IN TERRITORIAL INNOVATION MODELS

While the phenomenon of local networking has excited considerable interest in academic and policy circles, there are also important weaknesses that need to be addressed to broaden the acceptance of network theory and to improve its policy relevance in developing regions. An important weakness is the neglect of the non-local dimension. Historically, Pred (1973) and Thorngren (1970) studied how large cities influenced one another's growth. They argued that a city's growth was highly correlated with intensive communication and knowledge. The interurban knowledge flow contribute to the growth of cities (Thorngren 1970; Pred 1973). Several authors argue that the importance of proximate relationships may be overstated by failing to take into account the forms of networking in which the firms engage that extend beyond their immediate locality (Alderman 1999; Amin 1999; Oinas 1999; Hendry 2000; Markusen 1999; Malecki 1999; Harrison 1994; Simmie 1998; Simmie, 1999; Amin 1992; Amin 1999; Ernst 1999; Staber 1996; Amin 2005). Non-local network relationships have been mentioned by the GREMI and new industrial districts literature, which state that local systems are not self-contained but are linked to the outside world by various sorts of connections. The role of these non-local connections in innovation, however, has not been emphasized. These counter debates and evidence can be grouped under three headings.

1. The d*ichotomy of knowledge*: The network theory identifies tacit knowledge as an important component of the knowledge used in innovation. Local networks are hypothesized to be of particular importance in innovation due to the production and diffusion of tacit knowledge, requiring proximate relations. However, research shows that the simple tacit vs. codified dichotomy and its local and global implication are problematic (Bathelt, Malmberg, and Maskell 2004). Tacit and codified knowledge are not alternatives but complements for competitive advantages at different stages of a firm's or product's life cycle (Amin and Cohendet 1999, 2005; Gertler 2003; Howells 2002; Lawson and Lorenz 1999). Firms depend on different knowledge types and adopt different approaches to learning (Amin 1999; Nonaka 1995; Polanyi 1967). The relative importance of tacit vs. codified knowledge and their role in learning and innovation can vary greatly between firms in a different societal context (Nonaka 1995). Moreover, accepting superiority of tacit knowledge over codified knowledge would be at the expense of denying not only the role of global codified knowledge but also denying the role of local sources based on formal research, and the development efforts within firms, universities, and research institutions (Amin and Cohendet, 1999). Malmberg and Maskell (2002) argue that in some cases the process explaining spatially concentrated innovation has less to do with tacit knowledge per se and more to do with local opportunities to share and monitor codified knowledge (Malmberg and Maskell 2002).

Empirically, Lawson and Lorenz (1999) explored the relationship between codified and tacit knowledge in the innovation process. They showed the importance of regional capability of combining and integrating diverse knowledge, based on a case study of Minneapolis, USA, and

Cambridge, UK (Lawson and Lorenz 1999). They observed that the cycling between tacit and codified knowledge seems to be crucial for product development in both regions. Similarly, in the case of developing countries, Ernst (2002) showed the need to blend diverse international and domestic sources of knowledge to compensate for initially weak national production and innovation systems (Ernst 2002). He further argues that the key to success is to facilitate the concurrent leveraging of multiple and diverse sources of knowledge—the global production networks of buyers and suppliers of both foreign and domestic origins, as well as the diverse carriers of national innovation systems (Ernst, 2002).

2. Lock-in vs. stay tuned: Local networks are hypothesized to be of particular importance in enhancing interactive learning due to the frequent, face-to-face, and durable local ties. However, local networks may be harmful for interactive learning and innovation because it may create spatial lock-in situations. The lock-in situations are when 'the local structures becomes so narrowly focused on a particular economic activity (technology, market organization and technology) that is unable to shift to another development track' (Malmberg and Maskell 1997, p.38). Amin and Cohendant (1999) argued that business networks that are largely dependent on local tacit knowledge may be inadaptable in the face of radical shifts in markets and technologies. For example, research on Italian districts showed that they were not well-equipped to cope with radical changes in product or the technological trajectory and their preference towards local tacit knowledge hindered districts' performance (Amin and Cohendet 1999). Similarly, Glasmeier (1999) argued that local networks may create a lock-in situation in small areas with a limited inflow of external knowledge and a resistance to change and a delay in generating response to changing economic conditions (Glasmeier 1999). In that case, spatial lock-in situations may be prevented by establishing non-local ties. Non-local ties help firms and organizations to stay tuned with what happens in the market, what happens among producers (both competitors and collaborators), and among consumers (Britton 2004). Of course, the requirement is that local firms have the capabilities to absorb the non-local knowledge and that requires organizational proximity (Gertler 2003; Oinas 1999; Malecki and Oinas 1999).

In the case of developing countries, Ernst (2002) argued that local linkages may not be sufficient in developing countries. This is because most newly industrializing countries and second-tier OECD countries have an incomplete set of domestic linkages (Lall 1990, 2000; Mytelka and Ernst 1998; Mytelka 1999). Therefore, the ability of firms to select and connect to relevant local, regional or international ties become increasingly critical.

3. *Beyond locality*: It is argued that most of firms' network ties – personal or business - are not only embedded within social relationships (Uzzi 1997; Granovetter 1985), but also embedded in their *local environment* (Storper 1997; Braczyk, Cooke, and Heidenreich 1997; Brusco 1982; Cooke 2001). However, some research argue that many local economic actors have relationships outside the region rather than within it (Markusen, Lee, and Digiovanna 1999; Britton 2004). Empirical studies have identified a variety of types of regions. Markusen (1996, p.296), for example, has identified four which are:

> 1) Marshallian industrial districts where the business structure is dominated by small, locally-owned firms, there is substantial intra-district trade among buyers and sellers, long-term contracts and commitments between local buyers and suppliers, and low degrees of cooperation or linkage with firms external to the district.
>
> 2) Hub-and-spoke districts where the business structure is dominated by one or several large, vertically integrated firms surrounded by suppliers, core firms are embedded non-locally, with substantial links to suppliers and competitors outside the district, substantial intra-district trade among dominant firms and suppliers, long-term contracts and commitments between dominant firms and suppliers, high degrees of cooperation, linkages with external firms both locally and externally,

> low degrees of cooperation among large competitor firms to share risk, stabilize market, and share innovation, and a high degree of public involvement in providing infrastructure.
>
> 3) Satellite industrial platforms where there is minimal intra-district trade among buyers and suppliers, the absence of long-term commitments to local suppliers, high degrees of cooperation, linkages with external firms, especially with the parent company, and low degrees of cooperation among competitor firms to share risk, stabilize market share, and share innovation.
>
> 4) State anchored industrial districts where the business structure is dominated by one or several large, government institutions such as military bases, state or national capitals, large public universities, surrounded by suppliers and customers, substantial intra-district trade among dominant institutions and suppliers but not among others, high degrees of cooperation, linkages with external firms for externally headquartered supplier organizations, low degrees of cooperation among local private-sector firms to share risk, stabilize market share, and share innovation, and a high degree of public involvement in providing infrastructure. (Markusen 1996)

Research on other places such as Silicon Valley (Harrison 1994), Baden Wuerttemberg (Staber 1996), Hertfordshire (Simmie 1999; Simmie 1998) has also indicated that firms have networks outside the region. These studies showed that local ties are less effective in the later stages of growth due to increasing competition. In addition, findings from research in the UK, Germany and USA suggest that the role of international and national relationship is found to be much stronger than local ones (Henry et.al., 2000). Also, Alderman's (1999) findings from research in engineering in three regions argued that local networks for technical development are not important. In fact, in many instances they appear to be irrelevant. In his analysis of manufacturing establishment from the electronics cluster in the Toronto region, Britton (2004) concluded that firms do not constrain their knowledge inputs to opportunities found in their industrial cluster. Rather firms developed strong non-local ties to meet their input and output requirements (Britton 2004). Doloreux (2004) showed from the case studies of the Ottowa and Beauce regions of Canada that firms make use of regional, national and international knowledge sources to sustain innovation (Doloreux 2004). Similarly, Asheim (2002) studied three regional clusters in Norway dominated by shipbuilding, mechanical engineering and electronics industry. His findings supported the claim that non-local ties were crucial in innovation process (Asheim and Isaksen 2002). In their case study of three industrial districts in Germany, Grotz and Braun (1997) showed that while local networks are important for general business issues, non-local networks are important for innovation and technology-oriented information (Groties 1997).

In the case of developing countries, empirical studies show that substantial networking takes place between technology related actors in regions in developing countries (Fromhold-Eisebith 1999; Razavi 1997). However, these ties include not only local ties but also non-local ties with machinery suppliers, customers (Katz 1987; Lall 1987; Bell 1999), the state, and other international linkages (Markusen, Lee, and Digiovanna 1999; Fromhold-Eisebith 1999; Ernst 2002). The state sets the political framework for development by a wide range of instruments regarding industrial and regional policy, science/technology policy, and educational policy (Fromhold-Eisebith 1999). In the case study of Korean firms, Dahlman et.al. (1987) show that it is the co-evolution of international and domestic knowledge ties that explains Korea's extraordinary success.

This section discussed the limitation of local networking and the role of non-local ties both in developed and developing. In the next section, I summarize the findings in the literature within the context of peripheral regions in developed countries and regions in developing countries.

2.6 CONCLUSION: TOWARDS A NEW NETWORK COMPOSITION

The contribution of this study is three fold: 1) this research assesses the relative importance of local versus non-local networks in the innovation process; 2) it provides characteristics of local and non-local networks. 3) it reveals the networking behavior of innovative firms in a developing economy context.

Are the regions the best and only unit for understanding innovation process? Territorial innovation models highlight the local dimensions of networks, but these models have not assessed the non-local dimension and have not considered the relative importance of local versus non-local innovative networks. It is true that interactions have spatial nature, but they also have an organizational nature. Non-local networks might represent organizational proximity (Malecki and Oinas 1999; Oinas 1999). Similarly, local networks are important due to production and easy diffusion of tacit knowledge, which both require proximate relations. However, tacit and codified knowledge are complements for competitive advantages in different stages of a firm (Bathelt, Malmberg, and Maskell 2004).

Local networks may not be effective in places where resources and knowledge inflow are limited. In those cases, local networks should be complemented by non-local resources. Therefore, this study addresses this gap and develops a more complete model of networking behavior of innovative firms by combining local and non-local networks.

Are these non-local networks similar or different to the local networks? This is unclear in the literature. As it was mentioned before, all territorial innovation models consider networks as a central concept in their research. Networks are seen as important characteristics of territorial innovation models. However, beyond the general reference to dense networks as a characteristic of industrial agglomerations, many researchers don’t look at the structure and characteristics of innovation networks (Staber 2001). This is especially true when the issue is the role of local and non-local networks. Table 2-1 summarizes the main characteristics of local and non-local networks mentioned in the literature.

Table 2-1: The Structure of Local and Non-local Networks in Innovation

Characteristics	Local Networks of Innovative Firms	Non-local Networks of Innovative Firms
Boundary	Spatial proximity, co-location (Pyke, Becattini, and Sengenberger 1990; Storper 1997; Ratti 1991; Cooke 2001)	Decentralized, i.e. interregional and international relations (Amin and Cohendet 1999) Organizational proximity (Oinas 1999; Malecki and Oinas 1999)
Size	Dense, as in the higher number of interactions (Torre and Gilly 2000; Staber 2001)1)	
Diversity	Emphasis on customers and suppliers (Von Hippel 1998; Audrestch 1988) Diverse networks including firms, customers, suppliers, universities, research organizations and other (Kaufmann and Todtling 2000; Perrin 1991)	Customers and suppliers, state organizations, universities
Type of Resources	Emphasis on tacit knowledge (Storper 1997)	Emphasis on codified knowledge (Amin and Cohendet 1999; Maskell and Malmberg 1999a; Asheim and Isaksen 2002)
Stability (Duration)	Longer duration of ties, i.e. the number of years relationship existed (Oerlemans, Meeus, and Boekema 2000)	Shorter duration of ties (Nooteboom and Gilsing 2004)
Formality	Formal and informal relations, market and non-market (Storper 1997; Torre and Gilly 2000; Gordon and McCann 2000)	Formal relations, regulated by market
Communication frequency and media	Face to face and frequent relationships (Storper 1997; Torre and Gilly 2000; Gordon and McCann 2000)	Communication media including phone, e-mail, fax Less frequent

A more empirical problem in the literature is that the majority of regional studies have a tendency to focus on finding data at the local level, and consequently neglect the importance of non-local networks. This has implication when discussing how territorial innovation policies could be tailored and transposed to suit varying regional conditions. This problem is relevant for regions in both developed and developing countries. In that sense, this study contributes to the general literature concerning the role of different spatial networks. Specifically, it addresses a topic of great importance for regional and industrial development in developing economies, namely the role of local and non-local (i.e. interregional and international) networks in building innovative capabilities. While models of local networking have emerged in policy agendas of developing countries (Altenburg and Meyer-Stamer 1999; Cooper 1991; Bell and Pavitt 1992), these models fail to identify potential benefits that peripheral regions could collect from non-local (Inter-regional and international) linkages. Moreover, in developed countries there is a large volume of empirical data and studies available that describes the innovation activities of firms, as well as the results which confirm the links between innovation and networking. This is not so in developing countries, where the characteristics and scope of innovation processes and networking behaviors are still largely unknown.

In order to answer these questions above, innovation and networking behavior of firms in two regions were studied in a developing country context. Comparative analysis of two regions sheds light on the differences of innovation and networking behaviour in two different regions. The next section describes the research methodology used in this study.

CHAPTER 3. RESEARCH METHOD

This chapter discusses the methodological issues of the dissertation and describes the research design that links the data to be collected and the conclusions to be drawn to the initial questions of the study (Yin 1994). The research method is based on a qualitative case-study approach to investigate the networking behavior of innovative firms in two regions in the context of a developing economy. The viewpoint in this study is comparative. Case studies and statistical methods are both used to analyze the selected cases. The discussion that follows describes the methods, constraints, variables, and data analysis techniques. This chapter is structured into four sections: purpose and hypotheses of the study; selection of case regions; data collection method; and data analysis.

3.1 OBJECTIVES AND HYPOTHESES OF THE STUDY

The objectives of this dissertation are 1) to investigate the networking behavior of innovative firms and the geography of these networks, 2) to examine the characteristics and understand the role of these networks at a local and non-local level and; 3) to analyze the differences in the networking behavior between regions.

Most of the literature, as mentioned in chapter 2, has analyzed the networking behavior of the innovative firm in the context of the more advanced economies of Western Europe and North America. These studies have emphasized the local networking patterns. Such local networks have been typically argued to be the strong networks when it comes to information transfer and learning mechanisms (Camagni and Capello 2000; Maskell and Malamberg 1999). Yet, innovative firms in developing economies might have different networking patterns. It is hypothesized that *when firms in developing countries introduce technological innovation of products and/or processes, they engage in mixed networks, i.e. local and non-local (interregional and international) networks*.

The second hypothesis relates to the relative importance of local vs. non-local networks for innovative firms. It is hypothesized that *local and non-local networks are equally important in innovation activities. These networks are not interchangeable but complementary*. Local and non-local networks can be characterized as below:

- *Local networks are larger in size, heterogeneous in terms of the type of organizations, multiplex, longer in duration of ties and have a higher number of informal ties, and have frequent and face to face interaction. They create strong ties.*
- *Non-local networks are smaller in size, homogenous, uniplex, and have a shorter duration, fewer number of informal ties and less frequent face to face interaction. They create weak ties.*

The third hypothesis refers to the similarities and differences between innovative firms in two metropolitan regions that are at different stages of industrial development, i.e. a newly industrializing region vs. a core industrialized region. It is hypothesized that *innovative firms in both types of regions engage in mixed networks*. However, r*egional characteristics determine the degree of mixedness and the characteristics of innovation networks.*

3.2 RESEARCH METHOD: COMPARATIVE CASE STUDY

In the case of the subjects of interest here – innovation and innovation networks- they have been analyzed applying both statistical and qualitative methods in the literature. Both methods may be claimed to have advantages as well as limits. The quantitative analysis of innovation process may help to draw conclusions of statistical generalization, but such studies can only deal with a few dimensions of the innovation process. Qualitative research, especially case studies, can in this way best help to understand a complex phenomenon like the innovation process (DeBresson 1996). A case study has been defined *as an empirical inquiry that investigates a contemporary phenomenon within some real life context* (Yin 1994). Eisenhardt (1988 p. 534) also provides the following definition for a case study as a '*research strategy which focuses on understanding the dynamics present within a setting'* (Eisenhardt 1988). An important limitation of the case study methodology may be that it is not possible to draw general conclusions because the case study provides an insufficient basis for statistical generalization which is based on sampling units (Yin 1994). However, case studies are useful for teasing out theoretical insights and extending the existing theory (Eisenhardt 1989; Yin 1994). Therefore, the case study approach is selected for this study for the following reasons. First, it provides a rich framework for understanding complex social phenomena such as the innovation process and networking in a developing economy context. Second, networks and innovations are not completely new research areas but innovation networks in a developing economy context are a less developed theoretical area.

In order to increase the chances of obtaining a better understanding of the innovation networks in a developing economy, this study focuses on innovation networks in multiple cases as a comparative study. Comparative case study provides cross-case comparison. Yin states that *if two or more cases are shown to support the same theory, replication may be claimed* (Yin, 1994 p.31). Other studies also point out that multiple case study methods generally provide better understanding of various types of firms, regions, business characteristics, and network types (Arndt and Sternberg 2000). To this end, two regions were selected, Ankara and Istanbul in Turkey. The next section describes the details of the selection of cases.

3.2.1 Selection of cases

Studying the innovation process can be done in different ways. One approach is the analysis of the innovation process within a vertically integrated corporation. This is a focused, single firm case study methodology. However, the task becomes more complex where the innovation process is interactive through relationships with other firms and organizations, as is the case in the innovative network model mentioned in Chapter 2. In addition, an important aspect of the theoretical discussion in Chapter 2 was concerned with the role of the region in the innovation process. Understanding regional economies as networks of relationships cannot be fully revealed by a case study of a single firm. Therefore, a region is chosen to be investigated by using the case study method. Previous studies of regional innovation studies also used regions as case studies (Kaufmann and Todtling 2000; Doloreux 2004; Staber 2001).

Istanbul and Ankara are chosen as the case regions. In the case study methodology, cases are chosen for theoretical reasons and not for statistical reasons – to replicate previous cases, extend emerging theory or to fill theoretical categories (Strauss 1987; Yin 1994). The following dimensions motivated the selection of these regions:

1) Both regions are highly urbanized. Istanbul is the biggest city in Turkey, and Ankara is the second biggest.

2) Both regions have well-known, large universities and research institutions. This is important since universities and research institutions are usually considered as innovation partners in the literature

3) Both regions are considered to have good innovative capacity (Saral and Celebi 2002).

However, there are also some differences between these two regions. The regions are at different stages of industrial development. Istanbul is the core, established industrial metropolitan region of Turkey and it has a well developed and dynamic manufacturing capacity. On the other hand, the capital, Ankara is important mostly in terms of administrative functions. Recently, however, it has become identified and studied as a new high-tech industrial agglomeration having emerged in 1990s (Dede 1999; Tekeli 1994).

These two regions allow us to question whether the similar networking pattern can be observed in two regions in the same country and whether the regional context influences the type and intensity of networks.

3.3 DATA COLLECTION

In this section, I describe the unit of analysis, i.e. firms and the way firms are selected. Also, the gathering of the empirical material and variables are defined.

3.3.1 Unit of analysis and selection of establishments

This dissertation employs the conceptual approach outlined by Markusen (1994; 1999) which is *studying regions by studying firms*. This approach considers firms as major actors and decision-makers in a region. Markusen argues that 'the connection between private sector firm behavior and regional development has been a central and fruitful avenue of inquiry for regional planners, economists and geographers for decades' (Markusen, 1999, p. 43). Methodologically, the unit of analysis in this research focuses on the study of *innovative* firms. The logic of the study's procedure lies in the fact that regions are constituted of actors: firms, universities, research labs, government agencies and so on. Insight into the behavior of these actors, particularly firms, is therefore a key towards a better understanding of the dynamism of regions (Markusen 1994). Consequently, regional innovativeness ultimately results from innovation decisions made by firms.

In deciding upon the selection of firms, it was necessary to create a directory of firms which are known to be *innovative*. While there does not exist a single, exhaustive reference directory for this, it was possible to create a substantial list of firms in Ankara and Istanbul by combining lists from several sources. The firms identified were engaged in one or more of the following activities: assigning financial and organizational resources to activities with explicit R&D content, completed innovation survey of Turkish Institute of Statistics (TUIK); or received national R&D awards. For the first criterion, the firms awarded the R&D grant by the Scientific and Technological Research Council of Turkey (TÜBITAK) were used.[5] TÜBITAK runs a program that organizes and regulates the state support to encourage research and technology development activities in the industry. A certain portion (up to 60 %) of the R&D expenditures of the industrial companies is reimbursed throughout this program. It includes small and medium size enterprises (SMEs) as well as large companies. TÜBITAK Industrial R&D Funding Directorate (TIDEB) runs this program as well as the University-Industry Cooperative Research Centres' program and EUREKA projects. The second criterion could not be fulfilled because the TUIK could not provide the names of the firms due to confidentiality reasons. Therefore, the

[5] Please see www.tubitak.gov.tr for the list of firms which were awarded R&D grant.

second criterion was dropped. For the last criterion, the firms that received national R&D awards given by Turkish Industrialists' and Businessmen' Association (TUSIAD), KALDER (Turkish Society for Quality), TUBITAK and TESID were used.

TUBITAK's list contained 600 firms in various sectors. In order to control for sectoral differences, three most representative sectors were matched for regional comparative purposes. The firms chosen were drawn from the mechanical (some in automotive components), electronics (some in telecommunications) and software sectors. The result was a total of 142: 45 firms in Ankara and 97 firms in Istanbul (see appendix 1).

All 142 firms on the compiled list were contacted by phone (often numerous times) and invited to participate in the study. Telephone calls were followed up by a one page informatory letter, fax or e-mail outlining the objectives and rationale of the research and a repeated invitation to participate in the study. TUBITAK also sent a letter to each firm extending an invitation to participate in the study.

A refusal to participate along with a few number of closed firms resulted in a total number of 89 firms (Table 3-1 and Table 3-2). Of the 45 firms contacted in Ankara, 48% (22) were interviewed. Of 97 firms contacted in Istanbul, 69% (67) were interviewed. The high refusal rate could be explained by two reasons. First was survey fatigue. When I started my field research, TUIK was already conducting its nationwide innovation survey (TUIK 2002). Several firms, that I contacted, mentioned that they did not want to participate in another innovation study. Second, some firms simply refused to participate since they did not want to reveal their innovation process.

Table 3-1: The Number of Firms Contacted and Interviewed in Ankara

Sector	Total Contacted	Refused	Firm closed	Interviewed	%*
Software	15	5	1	9	**60**
Electronics	23	13	1	9	**39**
Mechanical Manufacturing	7	3	0	4	**57**
Total Contacted	**45**	**21**	**2**	**22**	**48**

* Percentage of total firms contacted

Table 3-2: The Number of Firms Contacted and Interviewed in Istanbul

Sector	Total Contacted	Refused	Firm closed	Interviewed	%*
Software	30	5	0	25	**83**
Electronics	31	6	2	23	**74**
Mechanical Manufacturing	36	15	2	19	**53**
Total Contacted	**97**	**26**	**4**	**67**	**69**

* Percentage of total firms contacted

3.3.2 Data sources

Since a case study research strategy relies on *multiple sources of evidence, with data needing to converge in a triangulation fashion* (Yin, 1994), multiple data sources were used. For a firm level analysis, a field study became necessary in order to examine the innovation activities and the network behavior of firms in Ankara and Istanbul because available firm level dataset provided aggregate, broad-brush characteristics of innovation activities and did not provide regional pictures and networking patterns. Therefore, data were collected through semi-structured, face-to-face interviews.

Secondary sources were also used in order to complement the information gathered by the semi-structured interview. These sources included country and regional reports and benchmark studies by TUIK and State Planning Organization (SPO), innovation studies by

TUBITAK, and firm briefs by the Technology Development Foundation of Turkey (TTGV). In addition, company reports and corporate websites were consulted for detailed information about individual firms.

The semi-structured, face-to-face interview survey was chosen for several reasons. First, this study depended on a design that facilitated the collection of data that are appropriate to study relationships among firms and other organizations and their underlying structure. Existing firm level aggregate data available through TUIK provided broad-brush characteristics of innovation activities and not regional pictures and networking patterns. Second, interview data are considered to be more sensitive to the historical and institutional dynamics that make it more suitable in studying the behavior of firms (Schoenberger 1991). They reveal insights into complex processes that evolve under changing internal and external constraints (Healey and Rawlinson 1993; Markusen 1994; Schoenberger 1991). Third, semi-structured interviews have more flexibility in the interview but still have the advantages of a structural approach. It is also useful where broad issues may be understood, but the range of respondents' reactions to these issues is not known or suspected to be incomplete (Healey and Rawlinson 1993). This type of interview is mostly applicable in situations where both qualitative and quantitative feedback are required. Moreover, since this is a comparative study of two regions, the study needed structure and flexibility. Fourth, the mail-out survey approach has been frequently used as a tool to investigate the significance of inter-firm relations. However, in this research face-to-face interviews were necessary in order to obtain information of a proprietary nature, since entrepreneurs may be unwilling to document such information on a mail survey (Schoenberger 1991).

To develop a realistic interview instrument, three pilot studies and many interviews were conducted with professionals from the Technology Development Institute at Middle East Technical University (METU), TUBITAK, TUSIAD and the Ankara Chamber of Industry (ASO). The same semi-structured interview protocol was administered to manufacturing firms in both regions (See appendix 2). The interviews were carried out with personnel from a variety of different positions within the companies. These included CEOs, presidents, general manager, R&D department manager, R&D department engineer, production managers and project team leader. Frequently, CEOs or presidents were not the most informed of the innovation process within the company, particularly within large and medium enterprises. While CEO or president or founder was often the key respondent of the small size firms, in medium to large firms, a general manager, vice president of R&D, manager of R&D, project team leader or R&D engineer was most often the key informant. In order to gain a perspective on the interaction between the R&D and manufacturing departments, production managers were also interviewed where possible and appropriate. However, in most cases, R&D and production departments generally were not separate.

3.3.3 Data and variables

The same semi-structured interview was administered to firms in both regions, with the intention of collecting information on the following: (1) the characteristics of firms (2) the innovation activities and (3) network ties.

Owing to the differences between developed and developing countries, the concepts used in this semi-interview guide are broad. The theoretical ideas developed in developed countries naturally reflect the experience of these countries. It is easy to imagine the potential difficulties that arise if the concepts developed for these countries were arbitrarily applied to developing countries, where most firms are facing different institutional, economic, and political environments. Therefore, the discussion below clarifies a number of concepts to which this study was subject.

3.3.3.1 Firm characteristics

The following information was collected:

1) Size, measured by the number of employees

2) Location of firms within the region

3) Entrepreneurship characteristics:

- Year established
- Ownership type of a firm: domestic (family, holding, joint-stock company), joint-venture, or foreign.
- Founders' Background: education and place of training

4) Geographic distribution of sales.

Here it is important to clarify the firm size. *Firm size* is measured by the number of employees. In order to compare SMEs and large firms, these terms needed to be defined. There is no one definition of SMEs in Turkey. It changes from organization to organization. Seven different organizations used six different definitions of SMEs (Table 3-3). For the purpose of this study the definition of TUIK and SPO were used so that data collected by these organizations could be used for comparison purposes.

Table 3-3: Different Definitions SMEs in Turkey

Institution	Definition of SMEs, the number of employees
Turkish Institute of Statistics (TUIK)	1-9 very small 10-49 small 50-99 medium
State Planning Organization (SPO)	1-9 very small 10-49 small 50-99 medium
KOSGEB (Small and Medium Industry Development Organization)	1-50 small 51-150 medium
Undersecretariat of Treasury	1-9 very small 10-49 small 50-250 medium
Undersecretariat of Foreign Trade	1-200
TOSYOV (Turkish Foundation for Small and Medium Business)	1-5 very small 5-100 small 100-200 medium
EUROSTAT (The Statistical Office of the European Communities)	1-9 very small 10-49 small 50-249 medium

3.3.3.2 Innovation activities

The *innovative* firms for data collection were defined as: firms assigning financial and organizational resources to activities with explicit R&D content and firms which received national R&D awards. The data were collected in three areas: 1) the historical development of internal capabilities of selected firms in investment, production, innovation and marketing, 2) the level of innovation activities today, and 3) the internal organization of the innovation process today.

Historical Development of Internal Capabilities: Information was gathered on the historical development of firms' capabilities in investment, production, innovative, and marketing capabilities (Westphal, Rhee, and Pursell 1984; Lall 1992; Ernst, Ganiatsos, and Mytelka 1998; Mytelka and Ernst 1998). A firm's capabilities are defined as the firm's ability to integrate and reconfigure internal and external resources to address rapidly changing environments given the market and macro-economic conditions of the region and country (Teece 1997). A firm's capabilities are considered to be inherently systemic and cumulative over time (Lall 1992). Firms with experience in a particular production activity are considered to have an advantage in successfully incorporating exogenously generated technical progress and adapting it to technical and economic conditions (Teece 1997). This information provides a picture of development of internal capabilities over time. How did the firms start their business? How did they adapt to technical and economic conditions of the region and the country? What were their turning points?

Level of Innovation Activities: In order to determine the level of innovation activities for a firm and the region, an innovation activities index was constructed. The index includes seven activities. The reasons for selecting these seven activities are explained below. The innovation index included the following activities:

a) introduced new products.
b) improved existing products.
c) introduced new production process.
d) improved production process.
e) applied for a patent.
f) invested in new technologies.
g) hired technically skilled people.

The index was formed by adding '1' if a firm performed the activity, '0' if a firm did not perform the activity. The innovation index ranges from 1 to 7, where 7 signifies greater or more innovation activities.

$$\text{Innovation Index (INNO)} = X_a+X_b+X_c+X_d+X_e+X_f+X_g$$

where $X_a = 1$ means activity performed
$X_a = 0$ means activity not performed

Table 3-4 presents the interview questions asked (See appendix 2). The answers to these questions, however, are subjective and the final judgment rest with respondents. Interviewees were considered informants not respondents (Maxwell 1998).

Table 3-4: Innovation Activities and Survey Questions

Innovation activities	**Survey Question**
New products	Over the last five years, has your firm introduced new products technologically different in use and character?
Improved existing products	Over the last five years, has your firm redesigned or significantly improved any of its products?
New process	Over the last five years, has your firm developed new production processes?
Improved existing production process	Over the last five years, has your firm significantly improved its production processes?
Patent application	Over the last five years, has your firm invested in new technologies (machine, equipment, software, etc)?
Investment in new technologies	Does your firm have any patent applications?
Hired technically skilled people	Have you hired technically skilled people over the last five years?

Why were these innovation activities selected? As discussed in chapter 2, innovation is usually defined with a distinction between activities related to the *products* manufactured and the manufacturing *processes* employed. The scale of innovation is often described as either new or significantly improved, i.e. incremental innovation (Dosi et al. 1988; Fransman 1985, Katz, 1987 #61). In each case, the words new or improved apply to a firm (Johannessen, Olsen, and Lumpkin 2001). In filling out the questionnaire, participants were instructed that a product should be classified as 'new' if it was new in their firm's product program. This relatively broad definition of a new product clearly does not rule out imitation. Even if a firm introduces a technique that is already used by other firms, this still represents innovation for that firm.

This two-way distinction – scale and scope of innovation- is also used in other studies. In the Oslo manual by OECD, product and process innovation have been defined as following:

> A new product is a product whose technological characteristics or intended use differs significantly from those of previously produced products. An improved product is an existing product whose performance has been significantly enhanced or upgraded. A simple product may be improved in terms of better performance or lower cost through use of higher use of components or materials (OECD 1997).

> A new process innovation is the adoption of new production methods, including methods of product delivery. An improved process innovation is an existing process whose performance has been significantly enhanced or upgraded (OECD 1997).

Similarly, TUIK uses the same two-way distinction. One of the intentions of this dissertation interview data is to facilitate data collection and make comparisons with similar studies. Therefore, for items a to d, this two-way distinction was selected for theoretical and empirical reasons.

Another measure of innovation activity used in many empirical studies is the number of patents generated by a firm (see Acs & Audretsch, 1989; Griliches, 1990 for the signifcance of this indicator). Patents are considered to provide direct, public and verifiable evidence of the existence of a new and non-trivial invention (Jaffe 1999; Jaffe and Trajtanberg 2002). However, some authors criticize the use of patents as innovation measurement since they only indicate inventions or technical activity but not improvement in process or products (DeBresson 1996). Also, the most significant technological advances may not even be patented since companies use other methods to protect their competitive advantage or it is an industrial secret (Archibugi and

Pianta 1996). Still, the number of patents has been widely used by economists because of reasons ranging from their ease of use to availability of associated information in aggregate form (Pavitt, 1985; Trajtenberg, 1987). Patent data are helpful indicators for analyzing corporate behavior in developing countries (Fransman 1985, Katz, 1987 #61). Anderson (2001) used patent data as a proxy for the underlying pattern of corporate technological specialization which in turn reflects the distribution of technological competence across firms. Consequently, a patent question was included to analyze corporate behavior. Because the duration of the patenting procedure may differ, participants were not asked the number of patents that were granted but for the number of patents applications.

Buying technology from other firms is also considered as a key aspect of a firm's innovation strategy (Rogers 1998). A firm that purchases machinery and equipment can be considered innovative in the context of a developing country (Goedhuys 2005). Firms, in their quest for innovation, see investing in machinery and equipment as the best strategy (Arocena and Sutz 2000).

Another measure used for innovation activities was the hiring of technically skilled people. It is argued that innovative firms in developing countries have a comparatively important number of qualified technicians and that in such a situation, the hiring behavior or their number was a good indicator related to level of innovation performance that surveys can capture (Arocena and Sutz 2000). This measure replaced R&D expenditure, because industrial innovation is highly informal in developing countries (Arocena and Sutz 2000). Even when firms perform product and process innovation, R&D activities are not clearly and formally articulated with the enterprise strategy. It becomes difficult to capture innovation by R&D

expenditure. For this study, hiring technically skilled people was used as one of the measures of the innovation activities.

Reasons to innovate and internal organization of the innovation activities: Firms were asked to rate on a scale from 1 (low importance) to 4 (high importance) of how important were the different reasons that led them to introduce new or improved products and processes (innovations). See Appendix B for the list of thirteen reasons included. These reasons can be grouped under six groups: product, production, market, regulations, employment, and environmental (Lall 1993). Innovation may be motivated either by a desire to advance an existing technique which is a technology push or to satisfy a specific market need which is a market pull or government push. The goal of this is to identify the motivation behind of firms' innovation activities.

As to the internal organization of the firm, the existence of an R&D department was investigated. This section, especially, looked at whether innovation activities were informal in the Istanbul and Ankara regions, whether or not clearly and formally articulated R&D strategies existed within the firm (Arocena and Sutz 2000). Firms were asked whether or not they have an independent R&D, production engineering, and fabrication departments.

3.3.3.3 Innovation networks and their characteristics

Seven types of network characteristics were used to compare local and non-local networks. These were selected based on the literature (Please see Table 2-1). These characteristics include:

1) Network size, i.e. the number of ties
2) Diversity, i.e. types of organizations
3) Multiplexity, i.e. a network providing more than one type of resources
4) Stability, i.e. measured by the duration of ties
6) Formality
7) Communication frequency and media

Before explaining the definition and the reasons for selecting these characteristics in detail, the network framework and the data collection strategies should be explained. The network framework developed in this study builds on social network analysis. The reason for this is that the focus of this study is the relationships which require a methodology that differs from the traditional methods of statistics and data analysis that are not capable of incorporating relational concepts (Wasserman and Faust 1994). Network analysis methods seem appropriate for the study of relationships among firms and organizations and on the patterns or regularities in these relationships (Wasserman and Faust 1994).

A network is defined as a collection of ties linking a set of persons, organizations, or events (Knoke and Kuklinski 1982). Ties are the building blocks of the network analysis. Two assumptions guide the network analysis. First, any actor participates in a social system and this social system influence actor's behavior (Knoke and Kuklinski 1982). Second is about the structure of this social system. The core theoretical problem in the network analysis is to explain the occurrence of ties and the network structure and variations in relations or linkages (Knoke and Kuklinski 1982).

Typically, analysts approach social networks in two ways (Wasserman and Faust 1994; Valenta 2003). One approach considers a whole network based on some specific criterion of population boundaries such as formal organization, department, club or kinship. This approach considers both the occurrence and non-occurrence of relations among all members of a population. The second approach, which is used in this study, considers the relations reported by a focal individual/actor (ego). This is called an ego-centered network, which provides views from the perspective of the focal actor (egos) at the centers of their network (Wellman 1982; Marsden 1987, 2006). The ego-centered approach is particularly useful when the population is large or the boundaries of the population are hard to define (Wellman 1982). Ego-centered network data measures relational properties of the social context in which the focal unit is situated. Most ego-centered analyses have studied only the direct ties that ego (respondent or focal actor) has with the members of their networks. For example, Wellman et.al (1982, 1988) used ego-centered network analysis to explore how a sense of community is maintained through ties, both local and non-local, among Toronto residents. An ego-centric approach was also used by Granovetter (1973) to explore what types of actors in people's network provided information for finding new jobs (Granovetter 1985). A few analysis have studied the links that network members have among themselves, and a very few have studied a focal individual's indirect ties, such as their ties to the friends of friends (Muller, et.al 1999).

In this study, ego-centered network analysis is used to identify the occurrence of ties when firms innovate in Ankara and Istanbul and to explain variations in the network characteristics which might affect the ability of firms to innovate. This study only analyzes the direct ties that an innovative firm (ego) has with the members (alters) of its networks.

In order to identify the ties of the innovative firm, the data collection strategy needed to be decided. There are two basic strategies of data collection for ego networks: person-based and relation-based (Borgatti 2006). The person-based data collection strategy uses a set of open-ended questionnaire items known as 'name generators'. Typically, it is unlimited in scope. The respondent may name anyone from any sphere of life: neighbors, kin, friends, coworkers, etc. For example, Lauman (1973) asked his respondents to name of the three closest friends and whom they see most often (Laumann 1973). Similarly, Wellman (1979) asked for the names of six persons 'outside of your home that you feel closest to". After obtaining a list of names, the interviewer typically goes over each name, asking the respondent about the nature of their relationship with that person (what social relation) and asking about attributes of that person (sex, race, income, etc.). Here, respondents need to make a judgment about whom they would consider friends or being close (Ruan 1998). The subjective nature of these name generators is a cause of concern. For example, studies have shown differences in the definition of friendship among different social groups and cultures (Chown 1981; Allan 1977), and networks of friends may not be comparable across different data sets.

The second strategy is to overcome the problems associated with the first strategy. The relation-based strategy asks about others who might be linked to an individual in terms of specific activities. The relation-based strategy starts with a relation of interest, such as emotional support and then asks all the people that the respondent has this particular relationship with (Borgatti, 2006). Because of the specificity of the relation, more than one name generator is normally needed in order to generate the part of a personal network (Ruan 1998; Knoke and Kuklinski 1982). If appropriate, this is then followed by attributes of the tie, such as duration, intensity, frequency, strength, and so on (Borgatti, 2006). The limitation of this strategy is that it may take more interviewing time, but it is much less subjective than the person-based strategy (Marsden 1987; McCallister 1978; Marsden 2003). In addition, the person-based strategy tends to collect information on certain sectors of networks at the expense of the rest. For example, it has been argued that asking for “friends” tends to undersample significant associates who are kin (McCallister and Fischer 1978).

In this study, the relation-based strategy was used. Network analysis suggests that more than one analytically distinctive type of tie should be investigated. Therefore, in order to determine the network ties of the innovative firms, two main types of relations were identified (see appendix 2 for interview questions): transactional and support resources. Transactional resources (Knoke and Kuklinski 1982) were measured on two dimensions: material and non-material (Storper 1997). For this study, material resources include borrowed machines and equipment, funding, or financing. Non-material resources consist of exchange of technical knowledge, formal R&D collaboration, consulting, and know-how. Support resources consisted of help in finding technically skilled employees, technical lab needs, and training services (Kaufmann and Todtling 2000). Once the resources were identified, the firm was asked about all the organizations with which it had this particular relationship (Borgatti 2006). Once the tie was identified, then the attributes of the tie were collected. These included their location, types of organization, duration, formality, frequency, and communication media. Then aggregate procedure was used to obtain local and non-local network characteristics (Muller, Wellman, and Marin 1999). These characteristics include size, diversity, multiplexity, stability, formality, and communication frequency and media. This multi-measure provides a better picture of comparison between local and non-local networks. The characteristics of ties and networks are described in detail in the following section.

Geography of Ties: Once the ties were identified, the location was determined to classify the tie as local or non-local. Informants were asked about the location (city) of each tie. Local and non-local network ties were defined if the network member was located in the same "provincial" boundary of the region. All out-of-province ties were referred to as the non-local ties. All ties were categorized by their location according to following criteria:

<u>Local</u>: if a tie was located in the provincial (administrative) boundary of the selected region
<u>Non-local:</u> if a tie was located in one these followings*:*

National, if a tie was located in another city in Turkey.
European, if a tie was located in European countries.
Global, if the tie was located in a country other than Europe.

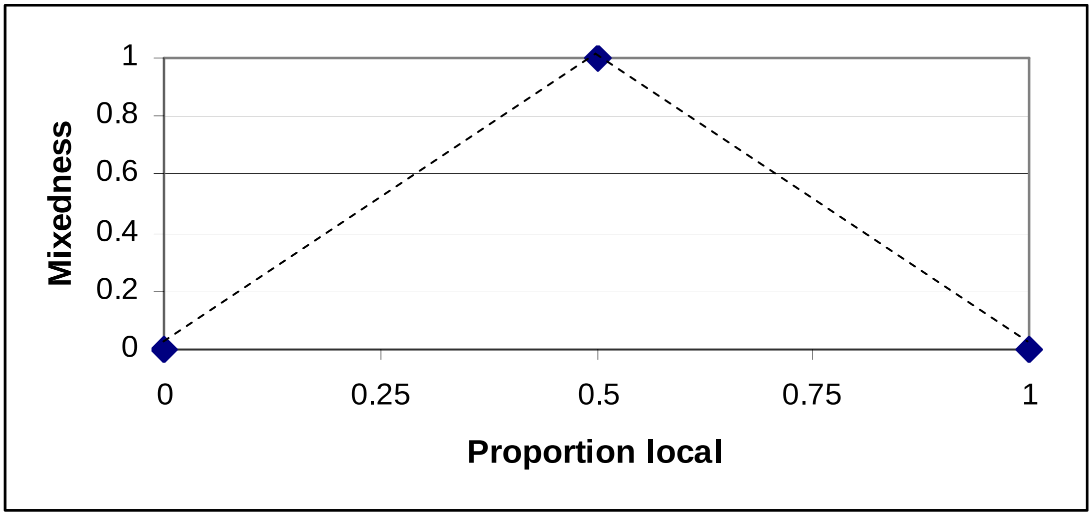
Network Size: Most researchers refer to 'dense' local innovation networks (Saxenian 1996; Storper 1997), however, they assign different meanings to the concept of density. Some mean by density the presence of links or number of ties (Staber 2001). In this study, the concept of network size was used instead of density. The network size was measured by the number of ties (Marsden 1987). Network size is considered to provide a reasonably direct measure of social integration (Marsden 1987).

Network size was calculated both for the local and non-local networks in each region. In order to calculate the degree of local and non-local composition for each region, the *mixedness* score was used. Figure 3-1 shows the plot of the mixedness score as a function of local network size. The score ranges from 0 to 1 and measures how much of the total network of an innovative firm is composed of local and non-local ties. A score of 1 means maximum mixedness (50% local and 50% non-local network size). The mixedness score is 0 when the total network all local or non-local, i.e. no mixedness. If the mixedness score is larger than zero, then the total network of a firm is considered mixed. The *mixedness* score is calculated as follows:

$$\textit{Mixedness Score} = 1\text{-}2^* \, |p - 0.5|$$

where:
p = proportion of local network size in the total network size of a firm.

Figure 3-1: Description of Mixedness Score



Network Diversity: This measure is the most direct indicator of the diversity of the network members that firms can contact within their environment (Marsden 1987). A standing hypothesis or guiding principle is that firms with heterogeneous networks are better off (Marsden 1987, 2006). This is particularly relevant for entrepreneurs.

For each tie, the informants were asked to identify the type of organization. The following categories are used for network members (Kaufmann and Todtling 2000):

1) Partners within the value chain (suppliers and customers)
2) Competitors
3) Knowledge creators (universities and research organizations)
4) Service firms offering innovation related consultancy
5) Providers of finance (private risk capital, public funds supporting innovation projects)
6) Government agencies which are involved in R&D, innovation and technology policy
7) Trade and professional associations
8) Institutions offering training programs

In order to calculate network diversity, the index of qualitative variation (IQV) was used (Mueller and Costner, 1970). The index ranges from 0 to 1 and measures the chance that two randomly selected network members belong to different categories. An index of 1 equals maximum heterogeneity, an index of 0 shows maximum homogeneity. For example, if a firm's network has five ties and all of the network members are suppliers, IQV score is 0. It means that the network members are homogenous and there is no diversity in the total network. IQV is calculated as follows (Agresti & Agresti 1978):

$$IQV = 1- \Sigma p_i^2 / (1-1/k)$$

where:
IQV = Index of qualitative variation
p = proportion of cases in a given category
k = number of categories of the variable

Multiplexity: An indicator of network multiplexity is defined as the degree to which ties are multidimensional (Ibarra 1995). In other words, it is the numbers of resources that are exchanged by the ego and alter (Staber 2004). In the literature, the assumption is that the degree of dependency increases with the multiplexity, i.e. multiplexity of relational content. Moreover, it is presumed that multiplex relations are particularly intensive, trusting ties. Uniplex ties, on the other hand, are used more for instrumental and material aid (Jackson, Fischer, and Jones 1977).

In this study, multiplexity was constructed from the number of types of resources the respondent had with each organization. In this study, resources will be categorized under three headings: material (Knoke and Kuklinski 1982), non-material (Storper 1997) and support resources (Table 3-5). Material resources include funding or financing and borrowed machines and equipment. Non-material resources consist of exchange of technical knowledge, information regarding sectors and projects (keep them in the loop), as well as formal R&D collaboration, consulting and know-how. Support resources consist of help in finding technical skilled employees, technical lab needs, and training services. Based on these categories, organizations or firms were identified that provided more than one resource for the interviewed firms. Multiplexity ranges from 1 (only one type of resource) to 10 (ten types of resource).

Table 3-5: Type of Resources

Type of Resources
Non-material resources
Exchange of technical knowledge
Being in the loop
Formal R&D collaboration
Consulting
Know-how
Support resources
Personnel help
Technical lab needs
Training
Material resources
Borrowed equipment
Funding/Financing

Stability: Stability is measured by the duration of a network tie, i.e. how long the ego (firm) and alter (network member) have known each other (Andersen 2001; Wasserman and Faust 1994; Wellman 1982). In the network literature, it is argued that the longer the duration is more stable the network because long duration enhances mutual understanding and trust (Andersen 2001; Wasserman and Faust 1994; Wellman 1982). In the context of innovation networks, it is argued that the duration facilitates learning and also spillover of knowledge. Local ties are argued to be better in this because they have longer duration. This is because local ties require less investment in mutual understanding and that investment requires less time compared to non-local ties (Nooteboom and Gilsing 2004).

However, it is also argued that the long duration of local ties may yield a problem of insufficient flexibility and variability for innovation. For example, in the case of the Netherlands, a local network of durable ties was complemented with the non-local network of more variable ties with universities abroad. In other words, local and non-local networks have compensating strengths and weaknesses.

In this study, the duration measure is calculated as follows:

DR= Number of years/Age of the firm

Since the ages of the firms differ in the sample, duration was normalized by the age of the firms. The duration measure tells how long a firm and its tie have existed since the firm was established. For example, if the score is 0.80, this means that the firm has had a relationship with the institution during 80% of its lifetime. The score 0 tells that firms had a relationship with the institution one time and they do not maintain these ties. Two types of duration score were calculated. First, a duration score was calculated for each tie. Second, in order to compare local and non-local networks, the mean duration of a firm's network (overall, local, and non-local) was calculated by averaging duration score of every tie of a firm.

Formality: Network ties involve the interaction of human beings; therefore many of these relationships have some degree of social relationship. Network ties can be more or less informal (Uzzi, 1996). At one extreme is the administration of ties via formal market mechanisms, i.e. written contracts, non-disclosure agreements. Formal linkages are considered to be easier and faster to establish (Nachum 2001). They may not require the close interaction, but typically over a long period of time, this interaction may lead to the development of the trust necessary for the creation of successful informal links. Furthermore, Freeman (1991:503) argues that "behind every formal network of relationships are usually various informal networks". The other extreme is the administration of ties, basing entirely on informal mechanisms such as friendship or long term relationships which lead to the development of trust. A number of other studies have indicated the importance of informal relations to the innovation process (Hippel, 1987; Schrader, 1991; Kreiner and Schultz, 1991; Conway, 1994). In reality there are all types of variations between and combinations of these extremes (Uzzi 1997). A review of ties suggests that a variety of social characteristics influence dyadic relationships. Literature furthermore argues that local networks allow the development of a personal, trust based, and informal relationship.

The formality, in this study, was also measured by the existence of written contracts between a firm and network member. Furthermore in order to get a clearer picture of formality, further questions were asked, like what is the nature your relationship with this organization? How would you describe your relationship with this organization? Dyadic ties are coded as informal or personal when interviewees described these ties as "knows personally or knows well".

Communication Frequency and Media: Significance in the social network is usually measured by the frequency of contact between ego (firm) and alters (network members) rather than the self-defined relationships of the importance of ties (Wellman, 1990). The argument is that the more frequent the contact, the stronger the tie (Granovetter 1985). However it is important to include the frequency of contact with communication media (Wellman 1982). For example, in his study of the 29 Toronto residents, Wellman (1982) found that 23% of the 344 ties were to contacts (alters) who lived within one mile of the respondent. These were local ties of neighbor. However that proportion doubles (to 42 percent) in face-to-face meetings with active network members who live within 1 mile of the respondent. Telephone contact peaks at a radius of 1 to 5 miles from the respondent and local calls happen twice as frequently as those at a distance of 5 miles or more. In the territorial innovation literature, face-to-face contact was also thought of as strong tie (Storper 1997).

In this study, communication frequency is measured by how often the firm and network member have contact (Wasserman and Faust 1994; Wellman 1982; Davern 1997). Frequency was measured as: very frequent (daily), frequent (weekly) and infrequent (less than weekly). The mode of communication was measured by whether the communication media was face-to-face, phone, e-mail, or fax.

3.4 DATA ANALYSIS

Both case studies and statistical methods were used to analyze the data. This approach is influenced by the belief that qualitative and quantitative methods are complementary (Jick 1979) and should be used in research efforts in order to overcome the limitations of individual methods (Creswell 2003; King, Keohane, and Verba 1994).

In this study, within-case analysis, as well as cross-case analysis was utilized. The 'within case analysis' is a detailed description of each case and themes (Miles and Huberman 1984; Yin 1994; Strauss 1987; Eisenhardt 1989). For 'within case analysis', each case started with a brief list of the characteristics of the firms, including spatial distribution, entrepreneurship characteristics, and the geography of sales. The second section considered the level of innovation activities. This section started with a brief historical development of innovative capabilities of the firms. This subsection was followed by the type of innovation activities and the innovation strategies of firms. The third section in the study looked at the networking behavior, the geographic boundary of their networks and the characteristics of these networks. For within-case analysis, the following firm numbering system was established. For the firms in Ankara, firms were numbered as AN-#. The number changes from AN-1 to AN-22. For the firms in Istanbul, firms were assigned IS-1 to IS-67. Thematic analysis across the cases was carried out and similarities and differences were highlighted in the cross case analysis. In some cases, quantitative analyses were performed to test the differences between two regions.

In terms of network analysis, SPSS was used to store the network and ties data. In this analysis, the several different types of information to be stored and analyzed are (Muller, Wellman, and Marin 1999; Valente and Vlahov 2001):

1) Characteristics of a firm (such as firm size, year established, innovation activities of firms, etc).

2) Characteristics of the ties between a firm and its network members. These included relational characteristics (frequency of contact, duration, communication frequency), relational contents (extent of network member provides material, non-material or support resources) or relational types (informal vs. formal ties).

3) Characteristics of network members (its location, i.e. local or non-local; whether a network member is a supplier, university, etc.)

4) Aggregated network structure characteristics of a firm and its ties in each ego-centered network (local and non-local network size, diversity, multiplexity, stability)

In studying the first order ego-centered network analysis, i.e. direct ties between focal individuals and their network members, this study followed Muller's et.al (1999) basic procedure. The data was stored in the following way:

1) Network member and tie data in one TIEWISE data set.

2) Firm and network structure data in a separate NETWISE data set.

3) The same NETID variable and values in the two data sets to identify firm.

4) Use SPSS's AGGREGATE and MATCH files procedures to link the data.

This procedure was repeated for the Ankara and Istanbul regions. The next section gives an overview of these two regions, as well as the national context.

CHAPTER 4. RESEARCH SETTING

This chapter introduces the research setting relevant to the study. It describes the national and regional contexts in which innovative firms are situated. First, the national context is described on the basis of literature. The discussion in this section focuses on innovation, industrialization, and regional development policies in Turkey since 1923. The second section describes the regional profiles. The discussion goes on to describe the economic profile and innovation environment of these two regions. The purpose of this chapter is to provide the context for the behavior of innovative firms to be analyzed in the next chapter.

4.1 NATIONAL CONTEXT: INNOVATION AND INDUSTRIALIZATION POLICIES SINCE 1923

Today, Turkey is the largest economy in Eastern Europe, the Balkans, the Black Sea basin and the Middle East and it is the world's 17th most industrialized nation (World Bank, 2001). In addition, it is the European Union's sixth biggest trading partner (Loewendahl and Ertugrul-Loewendahl 2001).

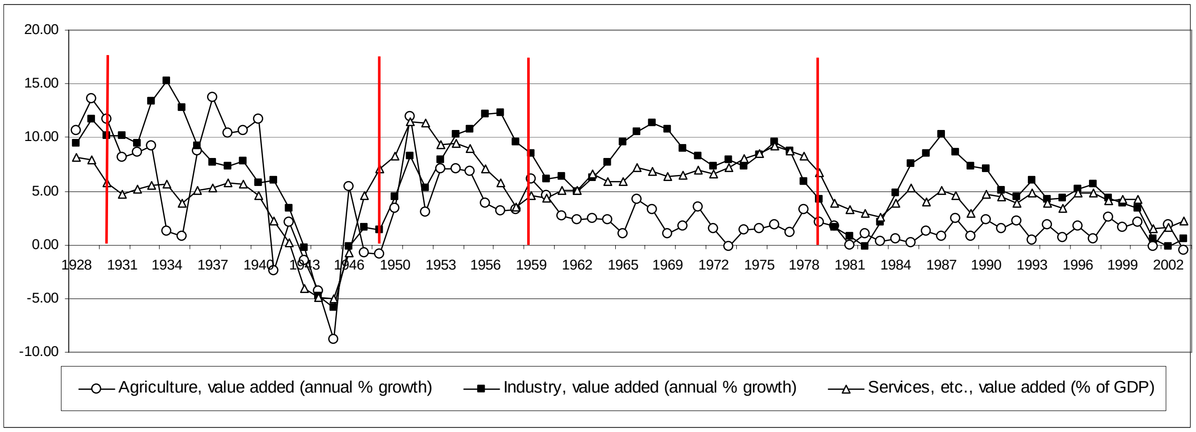
Since the establishment of the Turkish republic in 1923, five main eras can be distinguished (Table 4-1). These periods are characterized by a distinct economic policy paradigm, which influenced the industrialization and innovation policies of each particular period. In the first years of the Republic upto 1930, both the industry and the service sector grew rapidly until 1929. After 1930, the growth rate slowed down due to the Great Depression and it dropped enormously during World War II. In this period, the state emerged as the main entrepreneur. After it picked up in the early 1950s, industrial growth started to decline by the end of 1950s. This period was followed by the import substitution policies of 1960s. Consequently, Turkey's terms of trade deteriorated following the oil shocks in 1973-1974 and 1979 (see Figure 4-1). After that, Turkey adopted export-oriented policies in 1980s. Each period influenced the innovation and industrialization policies and each period deserves further explanation.

Table 4-1: Dominant Industrialization Policies in Comparative Perspectives

Year	**Dominant Industrialization Policies**
1923-1929	Liberal Era. Industrialization is the main state policy. Emphasis on industrialization and trade policies. Supportive of FDI. Measures to encourage private sector industrialization.
1930-1949	Etatism. State emerged as a main entrepreneur and the dominant agent in the industrialization process. First five year plan developed in this period. Import substitution was the industrial policy in 1930s.
1950-1959	Liberalization of trade and the foreign investment regime. Emphasis on agricultural development. The major focus of state shifts to infrastructure development
1960-1979	Import substitution industrialization. Restrictive attitude toward FDI. The primary focus of state is industrialization via production in intermediate and capital good industries.
Post 1980	Export-oriented industrialization. Progressive liberalization of trade regime. Liberal approach to FDI. Focus of state activity shifted away from manufacturing to infrastructure development.

Source: Adapted from Onis, 1996

Figure 4-1: Growth in Agriculture, Industry and Services, 1924-2002 (Five year average)



Source: Central Bank of Turkey and World Development Indicators, World Bank

4.1.1 Liberal era: 1923-1930

This period is known as the repair period (Tekeli 2006) or liberal era (Onis 1996). During this time, the government encouraged the private sector to take charge of industrial development, while the state took the role of building the infrastructure of highways and railroads. Innovation was not a policy issue on its own. Investment and production capabilities were weak.

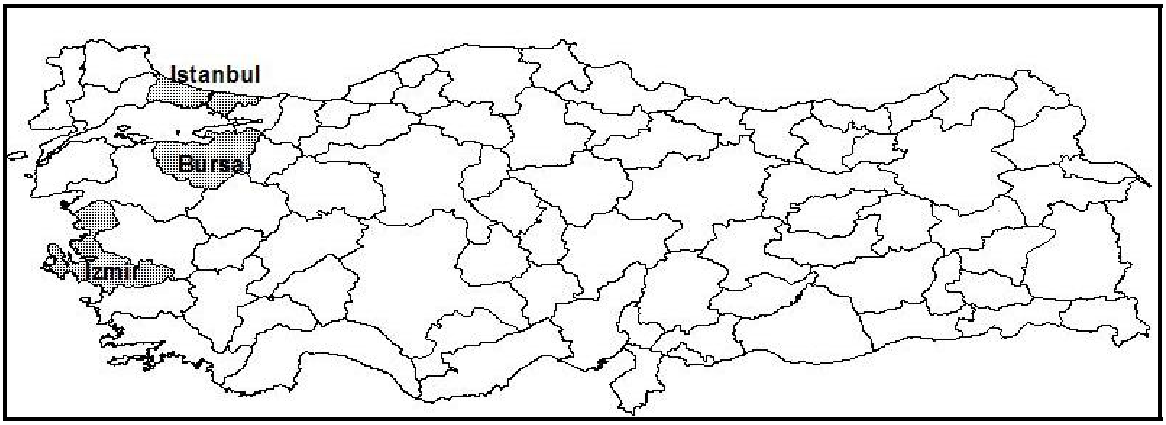
There were major impediments to industrialization and innovation in this period such as the lack of infrastructure and the absence of an entrepreneurial class (Bugra-Kavala 1994). The weakness of the Turkish entrepreneurial resources during this time was the result of social and economic conditions inherited from the Ottoman period (Bugra-Kavala 1994). The Turkish people were almost entirely peasants. During the Ottoman Empire, business and commercial activities were taken up by the Greeks, Jews, and Armenians (Bugra-Kavala 1994). After the Ottoman Empire fell apart, a large number of them left Turkey leaving this non-existent entrepreneurial base. Another impediment during this period, which is rather external, was the Great Depression of 1929. This affected the Turkish economy a great deal.

The state provided several direct and indirect subsidies to overcome these impediments, to promote industrialization, and to create a private sector. Direct subsidies included a tax exemption on the import of machinery and equipment. Tariffs were established in 1929 to protect the local industry. Two other important institutional changes were the establishment of the State Industrial and Mining Bank in 1925 and the enactment of the law for the Encouragement of Industry in 1927. The goal of the industrial and mining bank was to provide credit to the private sector and to increase public private partnership in the industrial sector.

According to the 1927 industry census, the industrial sector consisted of 65,000 industrial firms; 44% of which were processed agricultural products, 24% were in the sector of textile and 23% were in mining, machine production and the repair service sector (Kepenek and Yenturk 1997). Few (13%) of raw materials were obtained from outside of Turkey (Kepenek and Yenturk 1997). During the time, foreign direct investment (FDI) made up 43% of the total investment capital, which was mostly textiles, food, cement, and the electric industry. More than half of the establishments were located in Istanbul and its vicinity (Map 4-1). Half of the remaining ones were in Izmir followed by Bursa, another important industrial center (Bugra 1994). Ankara had a small industrial sector at this time but some state investment in defense industry.

In general, this period can be characterized as the repair period. Not only internal but also external problems such as the Great Depression of 1929 affected the economic and industrial policies in Turkey. This was one of the reasons for switching to Etatism in the following period.

Map 4-1: Industrialized Regions in 1920s



4.1.2 State involvement in the 1930-1949

Changes in economic policies began in the 1930s and lasted almost two decades. Incentives from the previous years were successful in the development of trade and banking sectors, but did not create enough private industrial investment to provide for local markets. Etatism was seen as a response to the social and economic conditions of that time rather than an ideological commitment (Kepenek and Yenturk 1997; Onis 1996).[6] The conditions included the lack of entrepreneurial class and lack of private capital. In addition, the state limited the entrance of FDI into the country to protect and promote local industries. Therefore, industrialization was taken up by the state, rather than private enterprise.

The state started many enterprises from scratch and operated many factories within the guidelines of five year plans (FYP) in the sectors of mining, paper, chemistry, ceramic, cement, textile and iron and steel. Factories were located near raw materials and existing labor markets within the guidelines of FYPs. Investment and production capability was increasing. By 1935,

[6] Turkish etatism had its own peculiar characteristics and was interpreted in many different ways including a third way, outside of capitalism and socialism, or as an intermediate regime and a path of independent development in the periphery somewhere between capitalist and Soviet models of development. For different interpretation of Etatism in Turkey, see (Hale 1980)

80% of textile and 100% of sugar demands were met domestically (Kepenek and Yenturk 1997) and Turkey began exporting cement. State establishments (SEs) were furnished with state of the art technology of the day (Kepenek and Taymaz 1998). Technology and know-how were acquired from different sources. First, the main technology transfer policy was to acquire technology from different countries, rather than one country (Tekeli 2006). For example, sugar production technology and know-how were from the west and textile technology and know-how were from Russia (Tekeli 2006). Second, several students were sent to abroad to receive training in different areas of science. For example, Mehmet Ali Kagitci, who received his chemistry education in France, established the first paper factory. Since the scale of the paper factory was small, he came up with a new production process (Tekeli 2006). Finally, several German and Austrian scientists migrated to Turkey because of political conditions in Europe at that time, and were appointed to be chairs at universities and other institutions. These emigrants, supported by the Turkish administration and assisted by young Turkish academics who had studied in Germany in the 1920s, succeeded in building science and technology in Turkey (Tekeli 2006; Yucel 1997).

In addition to SEs, several private textile factories were founded in the Marmara, Aegean, and Mediterranean regions in this period. In 1932, 1,473 private enterprises were established through the use of government incentives (Kepenek and Yenturk 1997). The most industrial investment were made in sectors related to consumer products, such as textiles and food production, rather than capital goods, like machinery production. In addition, the defense related investments had started to some extent in Ankara (Tekeli 2006).

As to the status of production and 'innovative' capabilities at that time, researchers argued that production capacity, product quality and production process were efficient (Kepenek and Yenturk 1997). One proxy for technological development was the use of motor power (Table 4-2). From 1933 to 1939, the usage of motor power had increased (Kepenek and Yenturk 1997).

Table 4-2: Average Usage of Motor Power in Manufacturing 1933-1939, in Horse Power

	1933	**1935**	**1937**	**1939**
Mining	1448	1414	1013	3366
Agricultural industry	79	103	122	141
Textile	57	140	192	384
Forestry related products	76	109	22	266
Paper products	31	30	439	359
Chemical	30	17	15	15
Other industry	115	234	259	187

Source: Kepenek and Yenturk, 1997

In this period, other changes followed. The Central Bank was established. The expansion of higher education was pursued as an integral part of the FYPs. The numbers of universities were increased from one, the University of Istanbul, to three (with the addition of the Istanbul Technical University and Ankara University). Comprehensive protective tariffs were introduced during the 1930s, establishing a pattern of import-substitution industrialization that would continue for many years. The main instruments for the finance and management of the new factories were the Sumerbank (Sumerian Bank) and EtiBank (Hittite Bank). While Sumerbank was responsible for manufacturing industry, Etibank's major fields of investment were mining and power supply. The establishment of state enterprises and the legal basis of their management system were considered as legal innovation by the famous commercial jurist Hirsch (Tekeli 2006).

While the first major investment projects were implemented successfully under the first FYP, the second plan was interrupted by the Second World War. Despite this, many consider this government-led industrial policy to have been quite successful in mobilizing resources, generating growth, and creating structural change in output (Kepenek and Yenturk 1997; Celasun and Rodrik 1989).

4.1.3 Liberalism in 1950s

The mid 1940s saw the end of etatism and also the policy shift from industrialization to agriculture. According to the 1947 FYP, the distribution of the total current investment was as follows: 44% to transportation especially highways and telecommunication, 16% to agriculture, 15% to energy, and 8% to manufacturing (Kepenek and Yenturk 1997).

Internal and external changes influenced the reorientation of the economy from etatism to a more liberal path and from industrialization to agriculture and infrastructure investment such as highways and energy. Internally, there were political changes in Turkey. During the etatist period, a single party ruled Turkey. In 1950, a multiparty system was established and elections were held that same year. Among the supporters of the new party were landowners, peasants, and commercial groups. Consequently, the agricultural sector gained importance under the new political party whose main constituency was essentially rural. This required a change in industrial development policies as it had been enacted under etatism. Though not directly involved in the war, Turkey felt the effects of external change as all nations did. Faced with economic problems in 1940s, Turkey had to depend on aid programs, like many other European countries. Under Marshall Aid in 1948, Turkey was given the new role in the international division of labor. The goal was to increase production to the point where food and raw materials could be supplied to Western Europe from Turkey (Balkir and Williams 1993).

These new policies also suggested reducing the role of the state in economic affairs predominantly by privatizing state establishments. However, the privatization polices were not carried out. SEs were given the supportive role of producing intermediate, capitals goods, and key infrastructural activities, while the private sector produced consumer goods like textile and food sectors (Yucel 1997). To encourage private investment in industrialization, the government innovatively encouraged public-private partnerships in many sectors including food, textile, mining, and transportation (Cakmakci 1999). In addition, the American management approaches were adopted in this time (Tekeli 2006). In order to provide the credit needs of the private sector, the Industrial Development Bank of Turkey was established in 1950 with the support of the World Bank, and the Central Bank of the Republic of Turkey. However, the export earnings alone from agriculture were insufficient to supply the foreign exchange needs. The shortage of foreign exchange restricted the import of machine and equipment (Yucel 1997). However, the private industry overcame this problem by improving the methods of production or switching to new or substitutes products (Tekeli 2006; Yucel 1997). This was mostly established by the help of the local networks (Tekeli 2006).

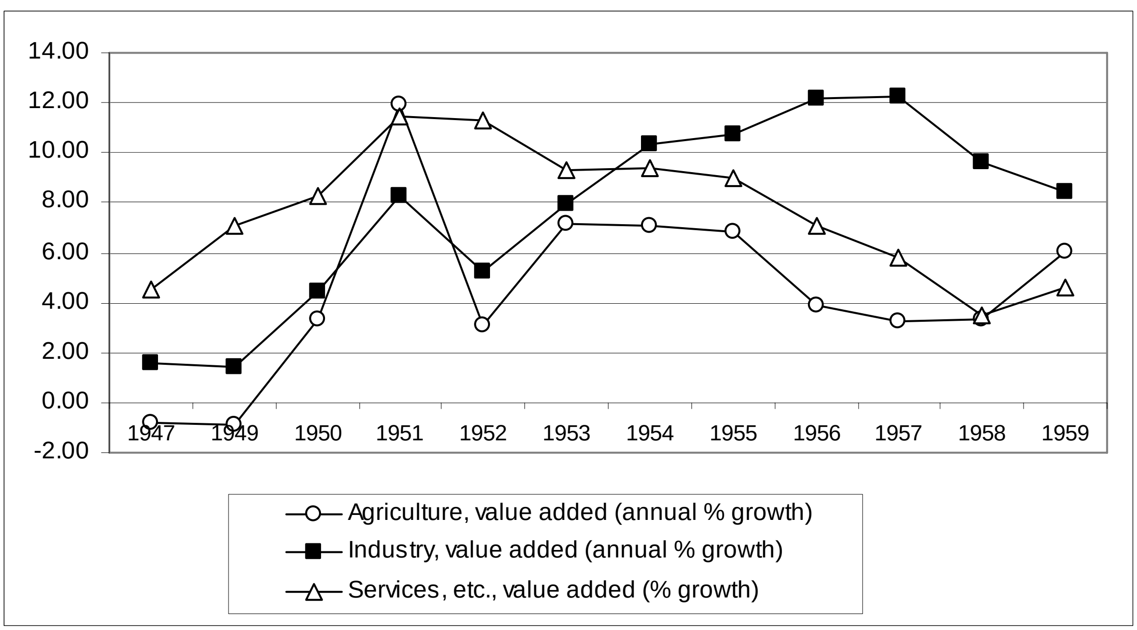
The expansion of higher education continued in this period. Three new universities, Middle East Technical University (METU), Karadeniz Technical University (KTU), and Ataturk University, were established in order to improve the science and technology education and infrastructure.

FDI was also encouraged through several incentives, which were effective until 1980s. Most (95%) of FDI was in the manufacturing sector which was made up of 26% plastics, 25%

chemical, 13% electrical products and 11% food sector (Kepenek and Yenturk 1997). One of the most important structures of the FDI at that time was that most of the intermediary inputs were imported from abroad and FDI did not create backward sectors (Kepenek and Yenturk 1997).

Although the economic policy shifted from industrialization to agriculture, the value added of manufacturing did continue to increase in this period (Figure 4-2), especially in the consumer goods industry, like textile and food sectors. While the production increased in the intermediate sectors of chemical and plastics, the production level stayed the same in durable and capital goods sectors. In terms of technological capability, SEs performed better than the private sector (Kepenek and Yenturk 1997). This was due to the low level of private capital in the manufacturing industry.

Figure 4-2: Growth in Agriculture, Industry and Services 1947-1950 (Five year average)



Source**:** Central Bank of Turkey and World Bank , World Development Indicators

4.1.4 Import substitution industrialization: 1960-1980

The main economic development strategy of Turkey centered on import substitution policies during the 1960s and 1970s, as in many developing economies in the world. The economic policies returned to etatism and import substitution because of the low economic growth, a persistence balance of payment crisis, and high inflation in 1950s.

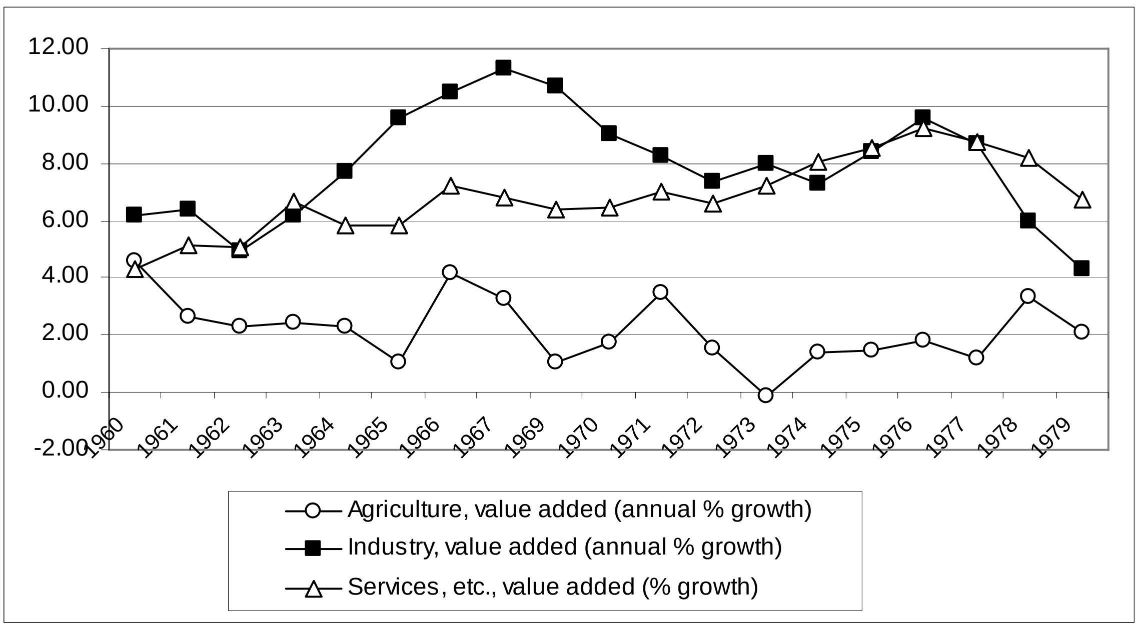
The import substitution era gave priority to industrialization between 1960 and 1980 (Figure 4-3). The huge public investment programs aimed to expand the domestic production capacity in heavy manufacturing and capital goods, combined with FYPs intended to institute planned and controlled industrialization. A common characteristic of the FYD plans was the provision of considerable incentives to private sector. While SEs produced intermediate and capital goods, private sector and foreign companies were given incentives to produce consumer products and durable goods. For example, the first domestic car, "Anadol", was produced between 1966 and 1986[7]. The establishment of holding companies was also an organizational innovation at that time (Tekeli 2006).

Twelve new universities were established in this period along with TUBITAK in 1963. The mission of TUBITAK was to "develop scientific and technological policies in line with national priorities and in cooperation with all sectors and related establishments; contribute to establishment of infrastructure and instruments to implement policies; support and conduct research and development activities; and to play a leading role in the creation of a science and technology culture with the aim of improving the competitive power and prosperity of the country" (TUBITAK 2005). The foundation of the Marmara Research Center (MAM) followed in 1966. MAM was formed "to carry out activities in basic and applied research in the fields of

[7] The Anadol was discontinued in 1986 when the factory turned to making a version of the Ford Taurus.

physical science, to encourage such activities and to practice in these fields" (MAM 2005). However, the concept of "technology policy" and its integration into the industry, the employment and investment policies were introduced for the first time in the Fourth Five Year Development Plan covering the period 1979-1983 (DPT, 1979).

Figure 4-3: Growth in Agriculture, Industry and Services 1947-1950 (Five year average)



Source: Central Bank of Turkey and World Bank, World Development Indicators

Another important development was the Assembly Industry Decree in 1964, which initiated an important restructuring in the assembly industry (especially automotive industry at that time) in Turkey. Its goal was to protect local industry to make it competitive in external markets over the years. This law was a vital step in creating SMEs and the supplier industry. Basically, the main objective of the decree was to set the rules for the production of the then-imported parts within the country. With the Assembly Industry Decree, Organized Industrial Parks (OIEs) and Small Industry Parks (SISs) were also given importance. The goal of these parks were to provide technical infrastructure for industrial enterprises in Turkey, to create synergy by bringing horizantal sectors together, to reduce regional inequalities; to contribute to the planned development of urban areas, and to alleviate environmental problems. Since the 1960s, 386 SISs and 77 OISs have been built across the country.

With the introduction of the planned development era, regional development also became a priority, after much neglect. This caused the agglomeration of industry and services in a few cities in the western part of the country. Regional development policies were created in the 1960s to reduce the negative consequences of regional disparities such as infrastructure, and social and environmental problems in the urban areas of industrial concentration. In this period, regional development and the industrial decentralization policies were implemented to mobilize the local private capital and to facilitate its investments in their region of origin. The most significant of the regional development policies were the integrated regional development plans (IRDPs), Priority Development Areas (PDAs) and the investment incentives policies. Organizaed Industrial Sites (OIS) and Small Industrial Sites, as well as medium-term loans also contributed to the mobilization of the local industrial capacity by means of providing suitable environment for local SMEs in some areas, but they fell short in eliminating regional inequalities across the country (Ozaslan 2006).

It was also during this time Turkey applied for participation in the European Economic Community (EC) with designs on full membership by 1959. Turkey became an associate member of the EC, following the signing of association agreements in early 1963. Given Turkey's low per capita income and limited industrial development, even by EC standards, the association agreements recognized the need for an adjustment period before full participation in a customs union and then eventually full membership. After signing the additional protocol in

1973, the EC manufactures market, with the exception of textiles, was opened up to Turkish exports. This was the critical change in Turkey's relations with Europe (Onis 1999). In addition, the arms embargo in 1974 on Turkey facilitated the development of defense industry.[8]

Researchers argue that this period contributed to a process of industrial learning, which led to local production of some mechanical and electrical capital goods both in the private and public sectors (Kepenek and Taymaz 1998; Taymaz 2001). Although high rates of growth were established under the ISI regime, they could not be sustained in the long term because of the neglect of exports (Taymaz 2001). The import substitution strategy also heavily relied on imported raw materials. Consequently, Turkey’s terms of trade deteriorated following the first oil shock in the 1973-1974. Because of the shortage of funds, the manufacturing industry could not use its full capacity to produce goods. From 1977 onwards, inadequate measures taken to overcome the problems, as well as the negative effects of the second oil shock in 1979 deepened the crisis.

4.1.5 Macro economic reforms and structural adjustment policies after 1980

Strongly backed by the IMF, OECD, and the World Bank, Turkey adopted a comprehensive set of economic stabilization programs and structural adjustment measures in the beginning of 1980. The economic stabilization program and structural adjustment measures had three primary purposes: to curb inflation, to improve the balance of payments, and to create an export-oriented economy in the long run. In conjunction with the industrial policy, trade reforms were established to shift the focus from domestic market production to accumulations through exports. There were new subsidies for investments and exports, while subsidies like petroleum products

[8] The embargo was due to Turkish intervention subsequent to the Greek coup in Cyprus.

and fertilizers were discontinued (Kepenek and Taymaz 1998). Export promotion incentives included commodity specific direct payments, export credits, tax and duty allowances for the industrial exports. In the 1990s, the legal, institutional framework and export policies were reorganized to accommodate the international framework by limiting the direct export support devices by the WTO and increasing the extent of the indirect ones. Tax rebates and cash premiums were eliminated, and subsidized export credits became the dominant way of supporting exports. Specific credits were also given to SMEs, companies having more than a specified amount of export, and to big foreign trade companies (Yildirim, 1998).

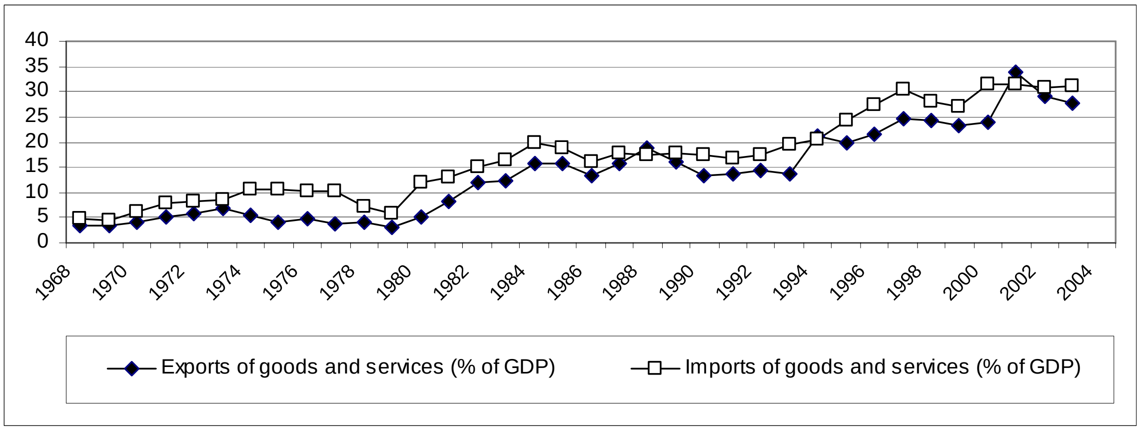
Increased exports were clearly the most prominent characteristic of this time. The percentage of exports in GDP increased from 3% in 1979 to 15% in 1985 and 27% in 2004 (see Figure 4-4). The manufacturing sector was the engine behind the export boom.[9] While manufactures exports made up of only 27% of merchandise exports in 1979, this number increased to 61% in 1985 and 84% in 2003 (Figure 4-5). The export expansion in the 1980s is argued to be based on the utilization of existing production capacity, instead of the creation of new capacities (Kepenek and Taymaz 1998). Researchers argued that the export support created a process of learning resulting in the emergence of a new export-oriented entrepreneurial group and a growing confidence in exporting (Senses 1990; Kepenek and Taymaz 1998).

Private investment in industry also increased with the economic measures of the 1980s and 1990s. It became even more competitive for private sector once Turkey signed a Customs Union (CU) agreement with the European Union (EU) in March 1995, effective January 1996.

[9] Turkey's rather impressive manufacturing export is extensively surveyed theoretically and empirically. Please see Senses (1990 and 1994), Celasun (1994), Krueger and Aktan (1992), Togan and Balasubramanyam (1996), Taskin and Yelda (1996).

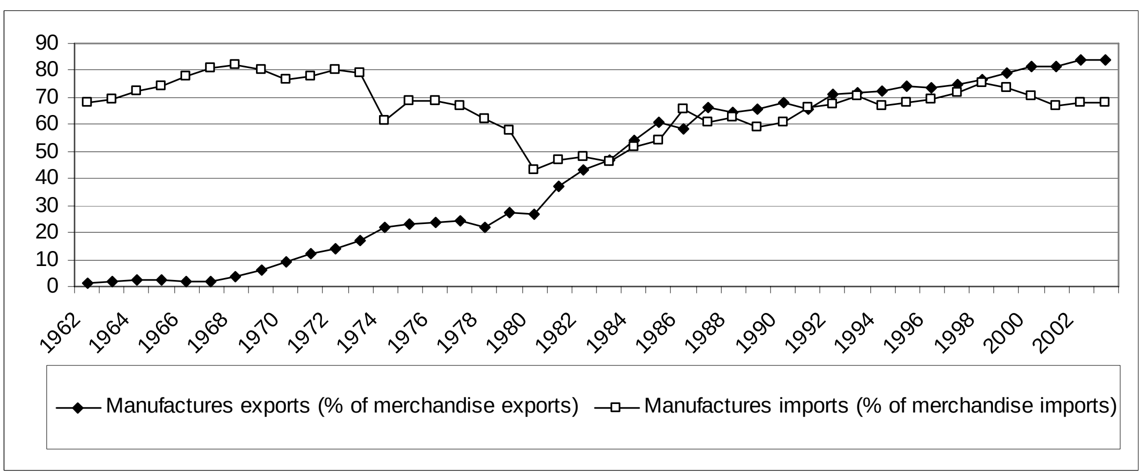
The importance of expanding and diversifying its export base, particularly in high technology products, has risen with its free trade agreement with the European Union in 1996.

Figure 4-4: Exports and Imports of Good and Services, Percent of GDP, 1968-2004



Source: World Development Indicators, the World Bank

Figure 4-5: Manufactures Exports, 1962-2002



Source: World Development Indicators, The World Bank

At the same time, Turkey has continued the transfer of technology both through the import of machinery and equipment and through foreign direct investment (FDI). Manufactures import made up 76% in 1970, 54% in 1985 and 68% in 2003 (Figure 4-5). As to the FDI, many analysts claimed that Turkey was under-performing relative to Central and East European Countries and other countries at the same level of development in attracting FDI (see, for example, Loewendahl and Ertugall-Loewendahl, 2000) (Table 4-3). However, an analysis of foreign firms' share in gross domestic fixed capital formation suggested that FDI played a substantial role in Turkish manufacturing industries. In 2003, 45% of FDI was in manufacturing, 54 % of FDI was in services, and 1% of FDI was in agriculture (Hazine Mustesarligi 2003). Some analysts argue that the transfer of technology was realized without any well-defined policy framework (Kepenek and Taymaz 1998; Kepenek 1997; Taymaz and Saatci 1997).

Table 4-3: Inward FDI as Percent of Gross Domestic Fixed Capital Formation

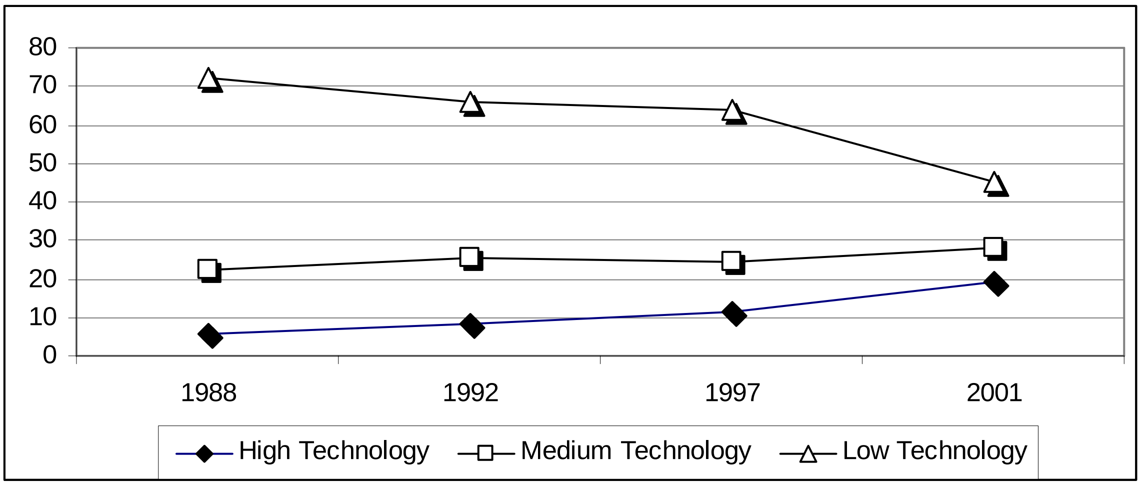
Year	**Turkey**	Singapore	Korea	Taiwan	Indonesia	Malaysia	Thailand	China	India
1980	0.2	25.9	0.1	1.2	1.2	12.2	2.1	0.1	0.2
1985	1	14	0.8	2.9	1.5	7.5	1.6	2.2	0.2
1990	2	46.8	0.8	3.7	3.4	17.9	7.5	3.5	0.3
1995	2.2	41.3	0.6	2.4	7.6	15	3	15.4	2.4
2000	2.2	62.8	5.4	6.8	-13.9	16.4	12.4	10.3	2.3
2001	12.4	60.1	2.6	7.8	-9.7	2.5	14.4	10.5	3.2
2002	3.4	25.6	1.9	2.9	0.4	14.5	3.7	11.5	3
2003	1.6	45.7	2.1	0.9	-1.8	10.8	5.2	12.4	4

Source: UNCTAD, World Investment Report

Recently Turkey has begun experiencing the drive of technology-oriented industrialization or high-quality innovative products manufactured with the help of new technologies and a highly skilled workforce. However, the manufacturing industry is still dominated by low technology products, or standard products as an outcome of low-skilled mass production (see Figure 4-6). As Lall, (2000, p.1) put it:

Since Turkey is a relatively high wage economy compared to India and Asian countries, it confronts of competing with low-wage countries in low technology products. As a technologically lagging economy, Turkey has to compete against high technology European firms in the most sophisticated segments of manufacturing. In intermediate segments, Turkey has to compete with advanced Asian countries where they have developed substantial domestic capabilities, and integrated themselves as global suppliers within multinational networks

Figure 4-6: Structure of Manufacturing Industry in Turkey, Percent of Total Manufacturing Production, 1987-2001



* Production in producers' prices, billion Turkish Liras
** Technology classification is based on OECD definition[10].
Source: Industrial Statistics Database, UNIDO and TUIK

Although it can be said that Turkey entered the S&T policy era in the early 1960's, with the establishment of TÜBİTAK, science and technology policy has only been given significant importance in the late 1980s and 1990s. The most important innovation and technology

[10] High technology includes some machinery and equipment, nec; Office, accounting and computing mach.; Electrical machinery and apparatus, n.e.c.; Medical, precision and optical instruments, watches and clock; Aircraft and spacecraft; Pharmaceuticals.
Medium technology includes chemicals excluding pharmaceuticals; rubber and plastic products; basic metals, non-ferrous; some machinery and equipment manufacturing.
Low technology includes food, beverages and tobacco; Textiles, textile products, leather and footwear; wood and products of wood and cork (excluding furniture); pulp, paper, paper products, printing and publishing; coke, refined petroleum products and nuclear fuel; other non-metallic mineral products; Fabricated metal products; Building and repairing of ships and boats

development policy was the foundation of the Supreme Council for Science and Technology (BTYK) in 1983. BTYK produced the first Turkish Science and Innovation policy, the first serious attempt regarding the technology and innovation policies (1983-2003), but was not able to implement it.

During this time, the emphasis given to SIS and OIS increased to provide technical infrastructure for industrial firms in Turkey and to create synergy by bringing horizantal sectors and other institutions together. To this date, 386 SISs and 77 OISs have been built across the country. In addition, SMEs were also emphasized. KOSGEB, a non-profit, semi-autonomous organization responsible for the growth and development of SMEs, was established in 1990. The goals of KOSGEB were to provide subsidized training; help SMEs with research and development and local and international marketing; and offer help in developing and maintaining international quality standards. KOSGEB provides several instruments, like training centers, consulting and quality improvement services, common facility workshop and laboratories, and technology development centers (TEKMERs). TEKMERs are located on university campuses and were established to support innovation activities and entrepreneurship, to promote cooperation between university and industry, to stimulate technology transfer and to support marketable R&D projects. The first TEKMER was launched in 1992. The number of these centers has already reached 12, spreading all around the country.

Another initiative was Technoparks. The goal of this initiative was to create a cluster of technologically advanced companies and research institutions. There were two technoparks in Turkey before the enactment of the new Technology Development Zone (TDZ) Act (which provides rather generous financial incentives to the innovative industrial firms located in these zones) in 2001, METUTECH and TUBITAK-Technopark. These two previously established technoparks were automatically granted the status of TDZ. The METUTECH was established at Middle East Technical University (METU) in Ankara. There are 152 companies in METUTECH. The TÜBİTAK-Technopark Complex (The Technology Development Zone, and the Technology Free Zone) was located in TÜBİTAK's Gebze Campus near Istanbul. There are presently 33 firms at TÜBİTAK-Technopark Complex. Today there are twenty-two technoparks initiatives in different cities in Turkey.

University-Industry Joint research Centers (USAMP) is another initiative launched by TÜBİTAK in 1996. The goal of USAMP is to meet sectoral needs by prioritizing sector-specific research areas. TÜBİTAK and the participating firms could jointly fund the centers. At least three companies or an umbrella organization (association, chambers of industry, etc.) must collaborate with a university. The participating university provides research infrastructure, working space and human resources. The technical committees of experts from both industry and university determine the research topics. There are currently five active centers. These include a ceramic center in Eskisehir, a textile center in Izmir, an automotive center in Istanbul, a biomedical center and a micro electro mechanical systems centers in Ankara.

Two additional institutions were established to promote innovation. The Turkish Patent Institute (TPI), established in 1994, performs procedures related to industrial and intellectual property rights. Turkey has been a full member of the European Patent Office (EPO) since 2000. The second institution is the National Metrology Institute (UME), established in 1992 by TUBITAK. UME's main objectives were to establish and maintain national standards for all measurements carried out within the country and to calibrate the measurement standards and devices of second-tier laboratories. UME has been providing services in calibration, testing, training, consultancy, repair and maintenance, and providing specialized measurement equipment for high level laboratories.

Beginning in the early 1990s Turkey also adopted systematic innovation finance programs. There are two finance/funding programs. The Technology Development Foundation of Turkey (TTGV) provided the financing program. The funding program was provided by TÜBİTAK. These two programs together were argued to be instrumental in doubling the share of the private sector in R&D activities in less than ten years, raising it to about 40 percent (Taymaz 2001).

TTGV is a non-governmental and nonprofit organization, established in 1991. It has been providing loans for industrial projects since 1992. The initial budget of TTGV was provided by the Undersecretariat of Treasury from the resources of World Bank obtained via a loan agreement. TTGV supported R&D activities in the form of R&D loans. In the early years of the program, TTGV provided conditional loans (subject to successful commercialization), but this practice was replaced by interest-free loan financing. TTGV has been supporting projects for a maximum of two years. The support amount cannot exceed 50 percent of the project budget. R&D loans have to be repaid over three to five years after a one-year grace period (TUBITAK 2005).

A special division, TIDEB, has been in charge of the TUBITAK program. This program was initiated in 1995 for industrial projects. TÜBİTAK-TIDEB serves as the referee institution to evaluate the applications, while the Under Secretariat of Foreign Trade provides funding. R&D expenditures are paid up to 60% in Turkish liras. This program has received considerable interest. The number of project applications increased from 121 in 1995 to 3537 in 2005. The number of firms supported increased from 23 in 1995 to 1153 in 2005.

Most of the projects supported by TTGV so far are in the areas of telecommunications and electronics. SMEs made up 73% of the companies supported by TTGV. A similar tendency was also observed in the projects supported by TÜBİTAK-TIDEB: Thirty percent of all projects supported since 1995 are in the area of information technologies and electronics, and almost as equal amount was in the field of manufacturing. The firms in Istanbul and Ankara regions mostly used these two programs. The next section provides an overview of these two regions.

4.2 OVERVIEW OF THE STUDY REGIONS

This section provides an overview of the two regions, Ankara and Istanbul. These regions exhibit different profiles. They are different in terms of economic trajectories and structures. The distinction is important, particularly when discussing the role of the region in the innovation process. The goal of this section is to provide the regional context in which the interviewed firms are situated. The first section describes the industrial geography of Turkey. In the following section, population structure is analyzed. The third section investigates the economic trajectories and profiles. Last section investigates the innovation profile of the regions.

4.2.1 Industrial geography in Turkey

Industrial activities are relatively concentrated in certain core metropolitan centers in Turkey. This industrial geography is the outcome of the national and regional economic policies implemented since the beginning of Turkish Republic in 1923 discussed in the previous section of national context.

These core centers include the Istanbul metropolitan area, the Izmir metropolitan area, and the Adana region. Almost 50% of GDP was produced in six cities in 2001: Istanbul, Ankara, Izmir, Bursa, and Adana (Table 4-4). Except Ankara, these five metropolitan areas were always considered as industrial core regions. However, the industrial geography changed in recent years. Some new industrial regions (NIGs) emerged out of these core metropolitan areas. The most notable NIGs in the literature included Ankara, Denizli, Gaziantep, and K.Maras (Eraydin and Armatli-Koroglu 2005) (Map 4-2). NIGs are the outcome of the economic and spatial transformation of the liberal economic policies since the 1980s (Eraydin and Armatli-Koroglu 2005).

Table 4-4: Share of Gross Domestic Product by Provinces, 2001

Provinces	Total value (000)*	Share % l
Turkiye	178,412,438,499	100
Istanbul	38,009,832 512	21.3
Ankara	13 536 639 054	7.6
Izmir	13 382 809 692	7.5
Gebze	9 160 148 390	5.1
Bursa	6 510 049 421	3.6
Adana	5 312 206 659	3

* Current prices, Turkish lira
Source: TUIK

4.2.2 Population size and change in Ankara and Istanbul

The two regions differ in location and population size. Ankara is located in the central Anatolia region (Table 4-5). With the 2000 population, Ankara accounted for about 6% of Turkey's population, making Ankara the second largest urban area in Turkey after Istanbul. Istanbul, on the other hand, is located in the Marmara Region, which is the northwest part of Turkey.

Istanbul accounted for about 15% of Turkey's population (Map 4-3). Table 4-5 shows that since 1980 the population of Ankara has increased by about 29%. The Istanbul shows a population increase of about 53% between 1980 and 2000. In this period, Istanbul diverges from the overall trend in Turkey than Ankara. However, the growth rates of both cities were larger than national average between 1990 and 2000.

Map 4-2: Core Industrial Regions in Turkey

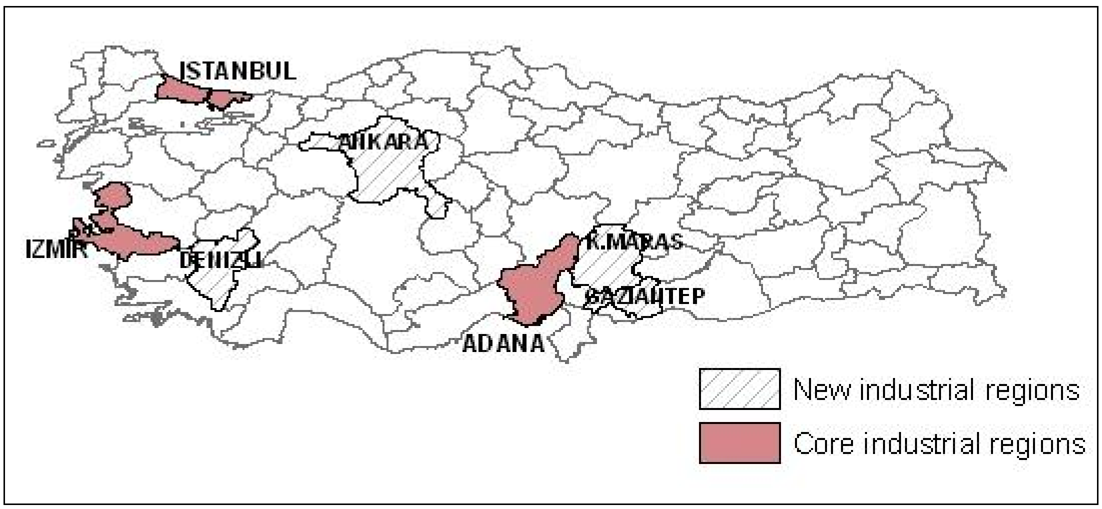
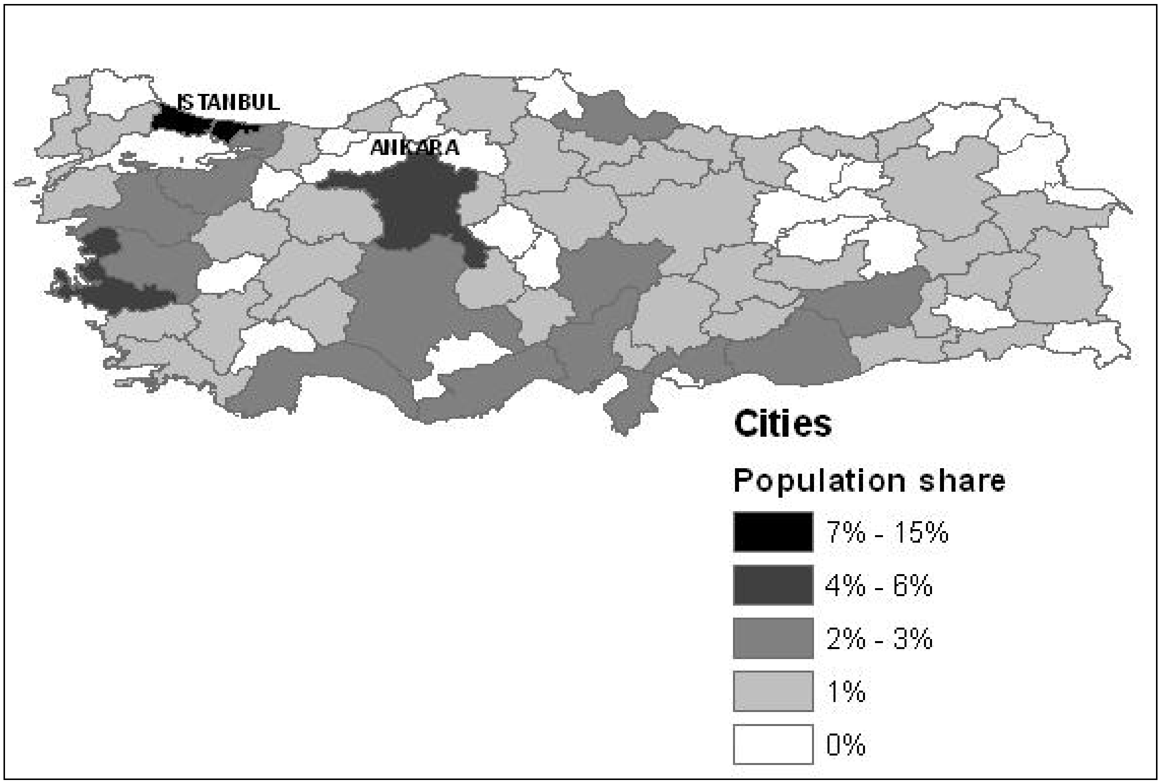


Table 4-5: Population and Population Change in Ankara and Istanbul

Year	Ankara	Istanbul	Turkey
1980	2,854,689	4,741,890	44,736,957
1985	3,306,327	5,842,985	50,664,458
1990	3,236,626	7,309,190	56,473,035
2000	4,007,860	10,018,735	67,803,927
Change 1985-80	13.66%	18.84%	11.70%
Change 1990-85	-2.15%	20.06%	10.29%
Change 2000-1990	19.24%	27.04%	16.71%
Change 1980-2000	28.77%	52.67%	34.02%

Source: TUIK

Map 4-3: Distribution of Population in Turkey, 2000

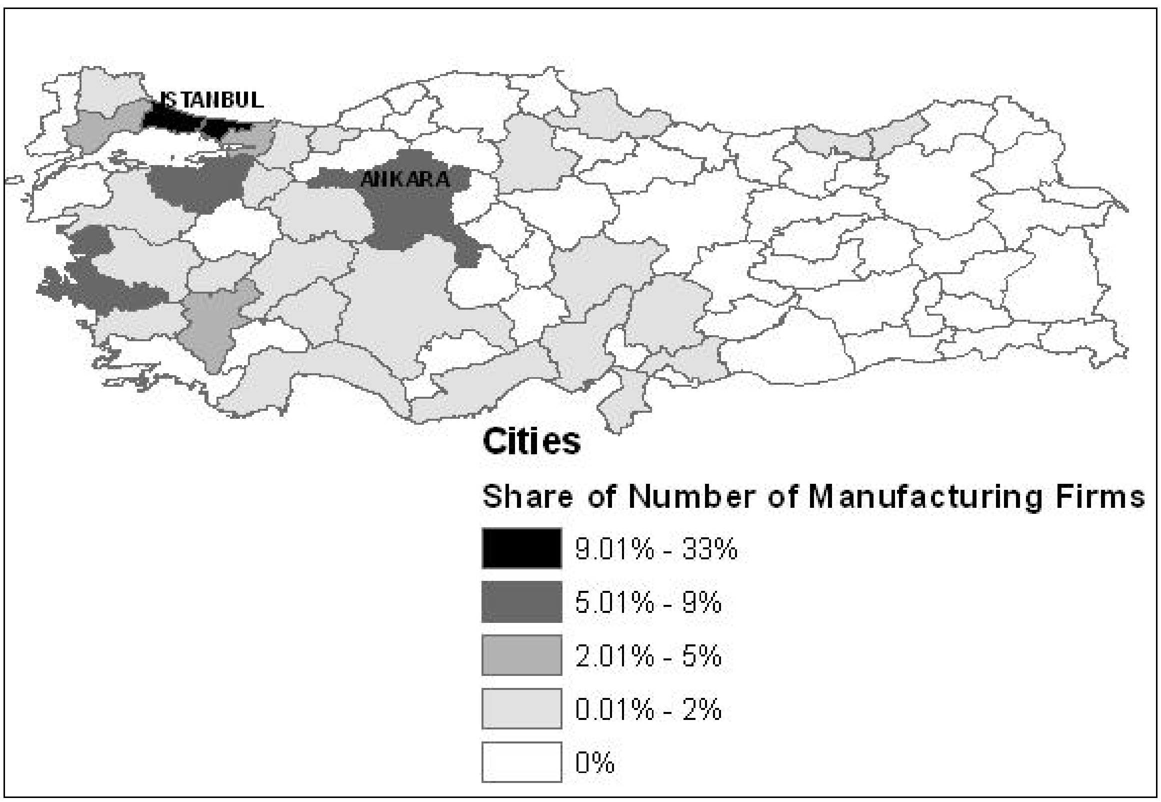


4.2.3 Economic trajectories and profiles

The Ankara and Istanbul regions exhibit different industrial profiles. Ankara is the capital city of Turkey and encompasses a massive presence of government departments and other institutions since the foundation of the Turkish republic. The manufacturing sector has played a secondary role in Ankara because of its economic specialization in the government services. However, in recent years, the number of manufacturing firms in machinery, defense, electronic, and software have increased (Dede 1999; Tekeli 1994; Eraydin and Armatli-Koroglu 2005). There are two organized industrial parks (OIS): OSTIM and Sincan. These provide the technical infrastructure for industries located there. Istanbul, on the other hand, is one of the most dynamic and industrious regions in Turkey. It has a diverse industry base and a wide variety of institutions favoring innovation and technology transfer that characterize the region.

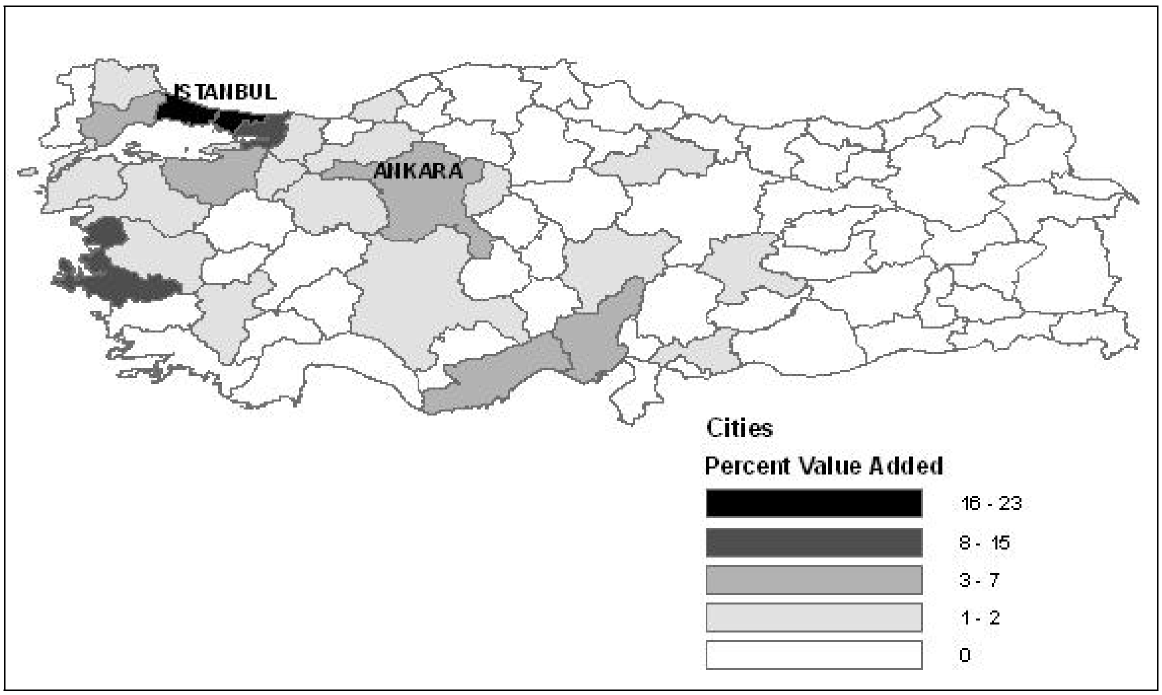
Map 4-4 represents the distribution of manufacturing establishments in 2002 in Turkey. Thirty regions make up 91% of all manufacturing establishments in Turkey. Istanbul had the highest share, 33%, of all manufacturing establishments in Turkey, while Ankara is ranked fourth, 7% of all manufacturing establishments in Turkey.

Map 4-4: Share of Number of Establishments in Manufacturing Industry, 2002, Percent of Total Number of Manufacturing Establishment in Turkey



The value added of manufacturing industry and the export level also resembles the same trend. The manufacturing value added is concentrated in the number of cities. Among these thirty regions, Istanbul had the highest manufacturing industry value added in Turkey, 23% of value added in manufacturing. Ankara, on the other hand, had only 4% share of value added in manufacturing in 2002 (Map 4-5). As to the manufacturing export, Istanbul is clearly the most dynamic region. Almost half of the manufacturing export originates from Istanbul. This is followed by Izmir and Kocaeli. Ankara is in the third ranked group.

Map 4-5: Share of Value Added of Manufacturing Industry, 2002



Istanbul had 7% of manufacturing value added increase between 1980 and 1985. Similarly Ankara had an increase during the same period. However, both regions experienced a decrease between 1985 and 1990. Between 1995 and 2002, Istanbul continued to experience 3% decrease while Ankara had 8% increase in its manufacturing value added (Table 4-6).

Map 4-6: Distribution of Export in Manufacturing Industry, 2004

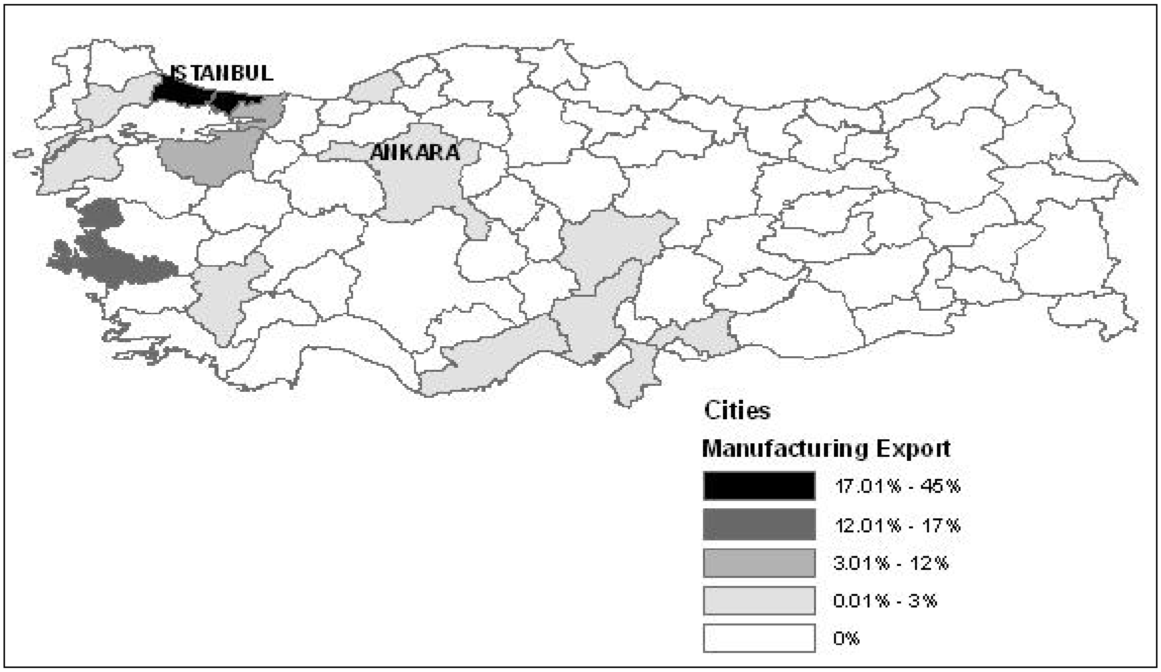


Table 4-6: Share of Manufacturing Industry Value Added in Turkey, % of Total

	Ankara	Istanbul
1980	3.78	27.59
1985	4.51	29.62
1990	2.9	27.52
1995	3.65	23.84
2002	3.94	23.05
1985-80 Change	19%	7%
1990-85 Change	-36%	-7%
1995-90 Change	26%	-13%
2002-1995 Change	8%	-3%
1980-2002 Change	4%	-16%

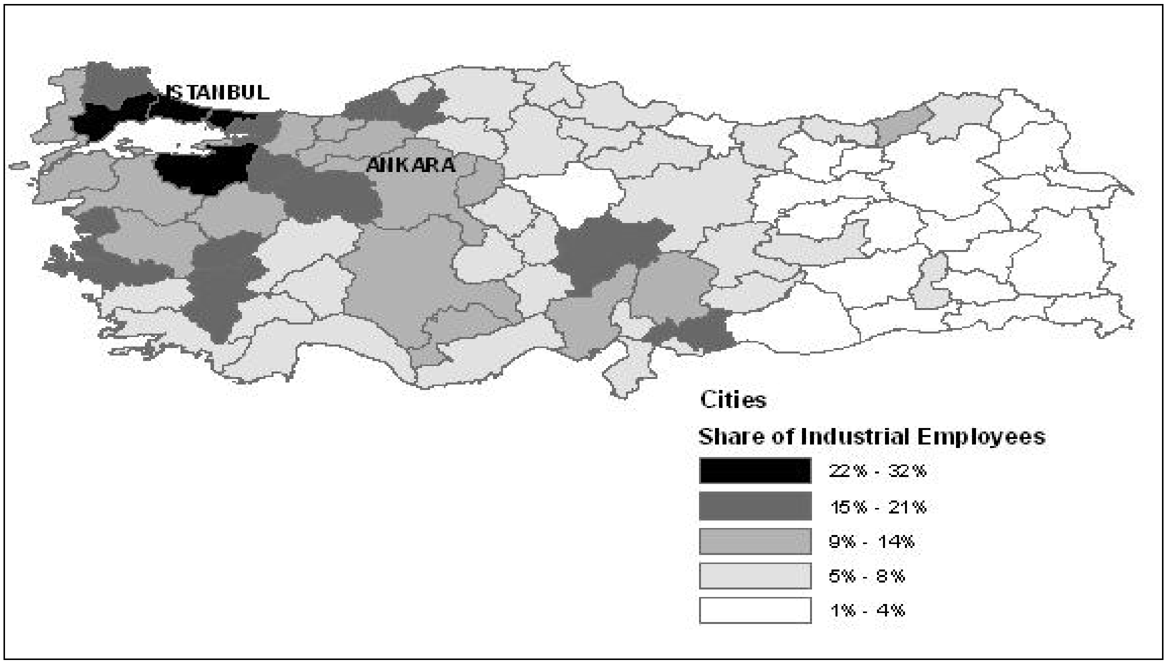
Source: TUIK

Another important indicator of development is the level of employment in industry[11] and manufacturing. Map 4-7 shows that employment in industry is concentrated across Turkey.

[11] Industry includes mining and quarrying, manufacturing, and electricity, gas and water.

Istanbul had 32% of employees of the total employed population in industry. Ankara, with its 13% share, ranked sixteenth in the share of industrial employment in total employed population.

Map 4-7: Share of Industrial Employees in Total Employed Population, 2002



Manufacturing employment shows different picture. The manufacturing employment is concentrated across Turkey but it seems more concentrated than industrial employment. Istanbul had the highest share of employment in the manufacturing sector. In 2002, Istanbul had the 28% of all manufacturing employment in Turkey. Ankara, however, had only 5% (Map 4-8).

The share of Istanbul's manufacturing employment has been decreasing since 1980 while Ankara's share increased almost 20% between 1995 and 2002 (Table 4-7). At the end of the 1990s and in the 2000s, economic growth revealed a different composition due to the economic crisis in Turkey. Between 1995 and 2002, the employment decreased by 15% in the country. Total manufacturing employment also decreased. On the other hand, Ankara along with some other regions, such as Denizli and Gaziantep, were able to sustain their employment growth levels.

Map 4-8: Share of Manufacturing Employees in Total, 2002

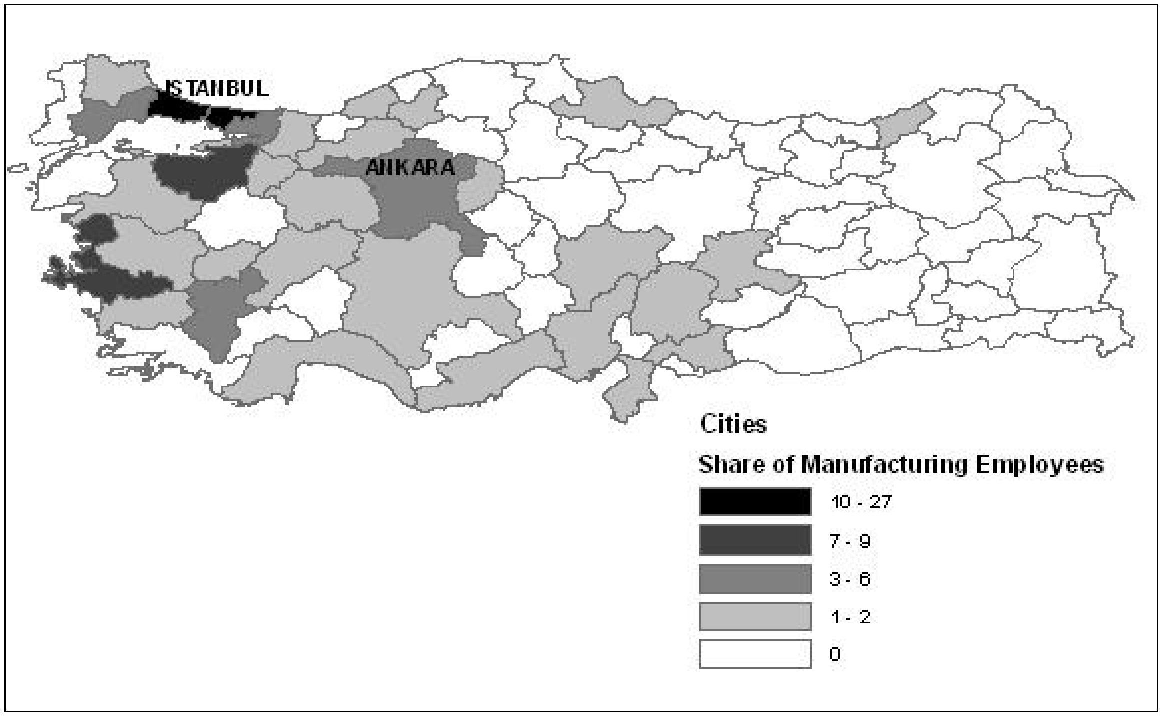


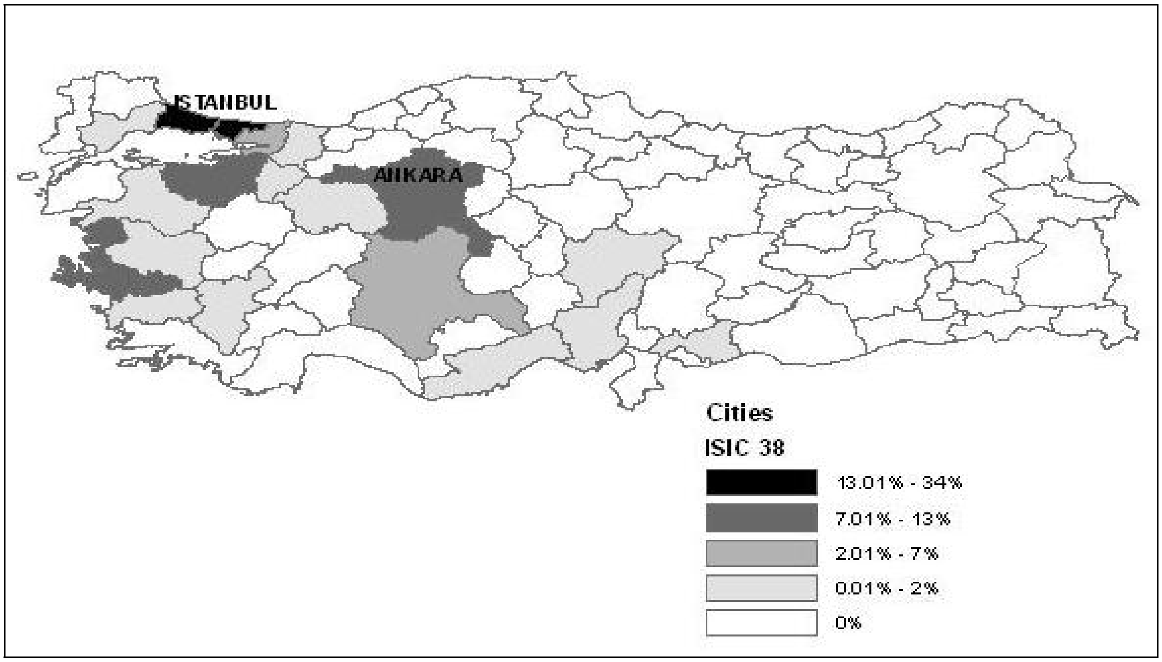
Table 4-7: Change in the Share of Manufacturing Employees in Turkey, 2002

	Ankara	Istanbul
1980	5.28	30.82
1985	5.82	30.42
1990	4.2	30.61
1995	4.27	28.84
2002	5.09	27.43
1980-85 Change	10.23%	-1.30%
1985-90 Change	-27.84%	0.62%
1990-1995 Change	1.67%	-5.78%
2002-1995 Change	19.20%	-4.89%

Source: TUIK

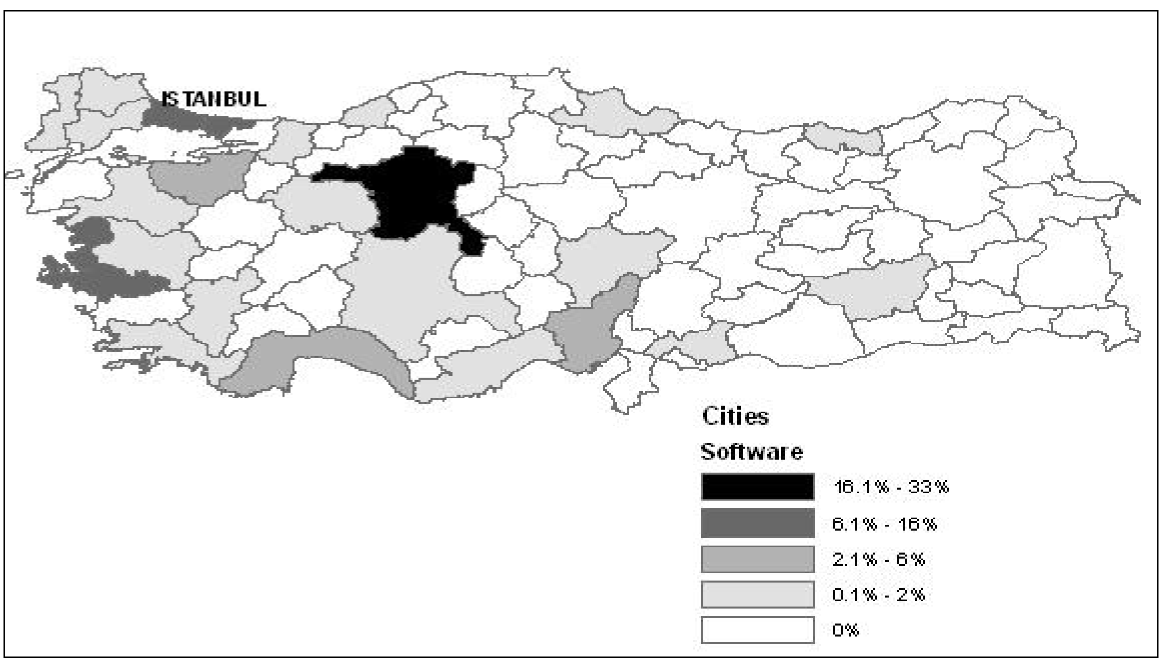
Engineering is one of the most important sectors in the Turkish economy. Map 4-9 shows that the engineering industry (ISIC 38) was mostly concentrated in Istanbul in 2002. Istanbul represented 34% of all establishments in engineering sector. However, Ankara ranked second and contained 13% of establishments in this sector. Other important and dynamic regions, such as Izmir and Bursa, have also high engineering capacity. These cities are historically industrial cities in Turkey. This data shows that Ankara has an important engineering capacity along with other industrial cities in Turkey. In Ankara, it can be argued that public investment, such as Mechanical and Chemical Industry Corporation (MKEK), played an important role and increased the share of engineering sector. Similarly, it is argued that the defense industry is the driving force behind engineering and electronic industry in Ankara. The most important investments in the defense industry are located in Ankara because it is the capital of Turkey. For example, TUSAS Aerospace Industries (TAI), the largest defense industry project in Turkey, was established in 1984 by a Turkish and American cooperation. The other important example is ASELSAN, an establishment of Turkish Armed Forces Foundation, was located in Ankara in 1975 to produce defense electronic systems for Turkish Army. Similarly, HAVELSAN, established by Turkish Armed Forces Foundation in 1982, was located in Ankara to produce specialized software development. Similarly, Ankara had an important capacity in the software industry. Actually, Ankara had 52% of all establishments in the software sector (Map 4-10). This was followed by Istanbul and Izmir.

Map 4-9: Share of Number of Establishments in Fabricated Metals, Machinery and Electrical Equipment (ISIC 38), 2002



Source: TUIK

Map 4-10: Share of Number of Establishments in Software, 2002



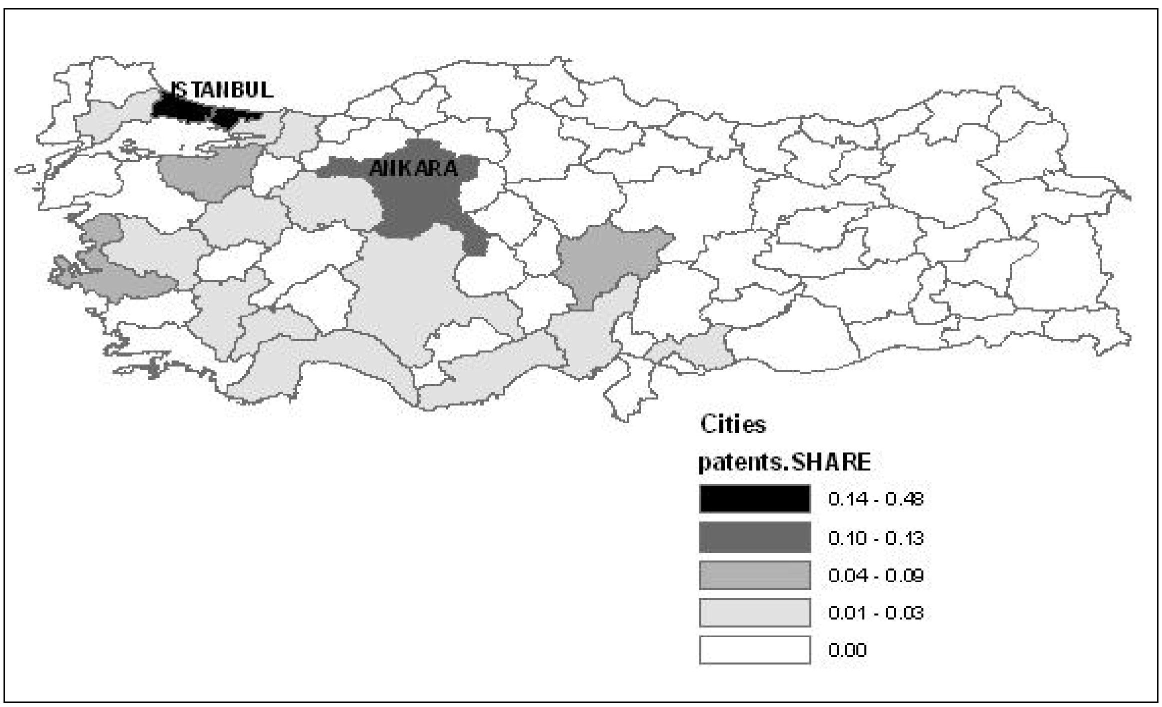
Source: TUIK

4.2.4 Innovation profiles

The previous section showed that regions are contrasted in terms of economic characteristics. This section examines the geography of innovation in Turkey and the profiles of Ankara and Istanbul. In order to analyze geography of innovation, two variables are used, patents and R&D activities.

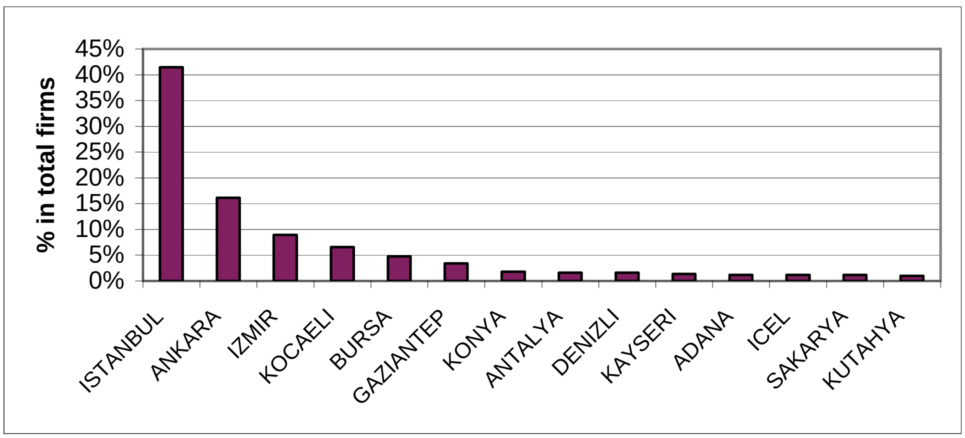
In several studies, the patent has been used as a proxy for innovative capacity of firms and regions (Arndt and Sternberg, 2000, Freel, 2002). Map 4-11 illustrates that in 2005, Istanbul had the largest of share of patent application among cities. The second largest is Ankara followed by Izmir.

Map 4-11: Share of Patents, 2005



As a proxy for the R&D activities, this study used the number of firms applied for R&D grant to TUBITAK (Figure 4-7). The distribution of applications among cities showed that Istanbul has the highest number of applications (41%), followed by Ankara (16%) and Izmir (8%).

Figure 4-7: R&D activities by region



Source: TUBITAK, 2000

Both Ankara and Istanbul regions are endowed with prominent universities. Besides universities, there are many other institutions that provide consultancy and financial support for innovation and technological progress in Ankara and Istanbul. TUBITAK, Patent Institute, TTGV, and KOSGEB are some of the important institutions in Ankara, which support and finance innovation activities and projects of the firms. Similarly, Istanbul has MAM-TUBITAK, KOSGEB and branches of other governmental institutions. Both regions contain Chamber of Industry and Commerce.

4.3 CONCLUSION

The regions studied present different economic and innovation profiles. On the one hand, Istanbul demonstrates that it has a strong regional innovation system potential, based on its technological trajectories, the role, and the function of the actors and organizations and technological landscape. It is a dynamic and diverse region with its industrial and technological infrastructure.

On the other hand, Ankara is recently industrializing. Comparatively, it lacks good industrial structure. There are good signs, though. The number of manufacturing establishments has increased in Ankara since 1980s. Especially, the number of electronic, software and hardware establishments has increased. Similarly, numbers of manufacturing firms and number of employees have increased in Ankara region. In addition, Ankara has several well-known universities, research institutions and skilled labor.

The next section explores the innovation activities and networking behavior in these two regions, and through this interregional comparison, shed light on how the region affects innovation dynamics. The next chapter details the findings about innovation activities in the Ankara and Istanbul region.

CHAPTER 5. INNOVATION ACTIVITIES AND NETWORKING IN THE ANKARA REGION

This chapter analyzes the innovation activities and the networking behavior of manufacturing firms in the Ankara region. Specifically, the goals of this chapter are to: 1) to analyze the networking behavior of innovative firms in Ankara, especially the geography of these networks; 2) to examine the characteristics and importance of local and non-local networks; 3) to analyze the differences in the networking behavior between firm types defined by size. Evidence presented in subsequent sections is derived from interviews conducted with twenty-two firms. The total twenty-two firms comprise 48% of innovative firms identified in the Ankara region.

The rationale behind focusing on this region is to understand the innovation process in a newly industrializing region. The Ankara region hosts fewer manufacturing companies than other industrialized regions in Turkey but more newly established, high-tech firms, especially in defense industry, than other industrialized regions in Turkey (Dede 1999). Generally, the emphasis in the literature is placed on core regions, such as Silicon Valley, Route 128, Emilia-Romagna and Baden-Wurttemberg that are known as successful innovation systems or ‘learning regions’. However, lessons learned from these regions are seldom applicable to newly industrializing or peripheral regions. It is, therefore, necessary to understand the innovation process in a region like Ankara in order to develop innovation policies adapted to suit varying local and regional conditions.

The existing literature on the Ankara region is limited. As it was mentioned in Chapter Four, many researchers have studied the national innovation system (Taymaz 2001; Taymaz and Saatci 1997; Taymaz and Lenger 2003) without noting the regional innovation process in Turkey. However, one study showed that informal local linkages based on trust and existing of government organizations play an important role in development of electronics sector in Ankara, which compromises 50% of all electronics firms in Turkey (Dede 1999).

This chapter is organized as follows. Section one gives a profile of the interviewed firms. This section focuses on the firm characteristics including size, age, location, entrepreneurial background, and market structure of the interviewed firms. Section two is dedicated to an analysis of the historical evolution of the interviewed firms, their innovation activities, and the reasons for and internal organization of innovation activities. This section also analyzes the differences in the innovation activities between SMEs and large firms. Section three reveals the networking behavior of interviewed firms. In addition, it also looks at the differences in the networking behavior between SMEs and large firms. It presents the results regarding the local/non-local composition and the characteristics of local and non-local networks.

5.1 WHAT ARE THE CHARACTERISTICS OF INNOVATIVE FIRMS IN ANKARA?

This section examines the formation, spatial distribution, and contemporary industrial organization of innovative firms in the Ankara region. It presents the broad company characteristics, including age, entrepreneurial background, location, size, ownership and the geographic distribution of sales. The diverse characteristics of interviewed firms provide a broad perspective of the innovation system, in particular revealing valuable insight on the local resources available to different firms, regional institutional linkages, and potential for network growth.

The total twenty-two firms in Ankara represent a cross-section of the electronics, software and mechanical manufacturing industries, comprising 48% of innovative firms identified in the Ankara region (Table 5-1). Software (41% of all firms) and electronics (41% of all firms) industry dominate the sample. The mechanical manufacturing is limited in the sample (18% of all firms). Twenty-three percent of firms are specialized in defense industry; 50% of electronics firm operate in professional, scientific, measuring and control equipment. The sectoral analysis is not performed in the subsequent sections because of the small sample size and under representation of firms in the mechanical manufacturing.

Table 5-1: Sectoral Distribution of Interviewed Firms in Ankara

Sectoral Distribution	Number of firms	% of total
Software Industry	9	41%
Electronics Industry	9	41%
Mechanical Manufacturing	4	18%
Total Interviewed	**22**	**100**

Source: Interview data

The twenty-two firms are diverse sizes. However, the sample shows the strong presence of SMEs. Majority (68%) of the interviewed firms are SMEs - firms with fewer than 100 employees (see Table 5-2). Table 5-3 shows the sectoral distribution by firm size. In the electronics and software industry, 70 % of the interviewed firms are SMEs. The mechanical manufacturing firms are either medium or large size firms. The strong presence of SMEs in

Ankara is also reflective of Turkey in general. In 2003, 98% of all manufacturing firms in Turkey are SMEs (TUIK 2004).

Table 5-2: Firm Size Distribution of Interviewed Firms in Ankara

Firm Size*	Number of firms	% in total
Very Small (1-9 employees)	2	9%
Small (10-49 employees)	10	45%
Medium (50-99 employees)	3	14%
Large (100+ employees)	7	32%
Total Interviewed	**22**	**100**

Source: Interview data

Table 5-3: Sectoral Distribution by Firm Size in Ankara, Number of Firms

Sector	Large	SMEs	**Total number**
Software Industry	3	6	**9**
Electronics Industry	2	7	**9**
Mechanical Manufacturing	2	2	**4**
Total	**7**	**15**	**22**

Source: Interview data

The high percentage of SMEs in the sample, the Ankara region and Turkey is not surprising. It manifests the restructuring of industrial organization after 1980s. As empirical research in Italy (Piore and Sabel 1984) and elsewhere (Scott 1988) showed, many SMEs have been extremely successful to challenges of volatile economic environment and competition. In addition, the recent literature emphasized the role of SMEs in the diffusion of innovation. It is argued that flexibly specialized SMEs are the key actors of the innovative clusters (Acs and Audretsch 1988; Herrigel 1993; Humphrey and Schmitz 1995; Kaufmann and Todtling 2000).

The twenty-two firms locate in different agglomerations that have developed in Greater Ankara region. The spatial distribution of interviewed firms is covered in the next section.

5.1.1 The Spatial distribution of firms in Ankara

There is discernable agglomeration activity in three areas: exurban, suburban and downtown (see Map 5-1). The exurban locations can be described as semi-rural areas outside of urban and suburban zones and are characterized by low density. Exurban locations include several industrial parks built by the state since 1960s. Of the 22 interviewed firms, three mechanical manufacturing and two electronics firms are located in exurban areas. All of them were originally established in Ankara but five firms relocated within the Ankara region. None of these firms cited local synergies except the existence of administrative functions as an influence on their location decision in Ankara.

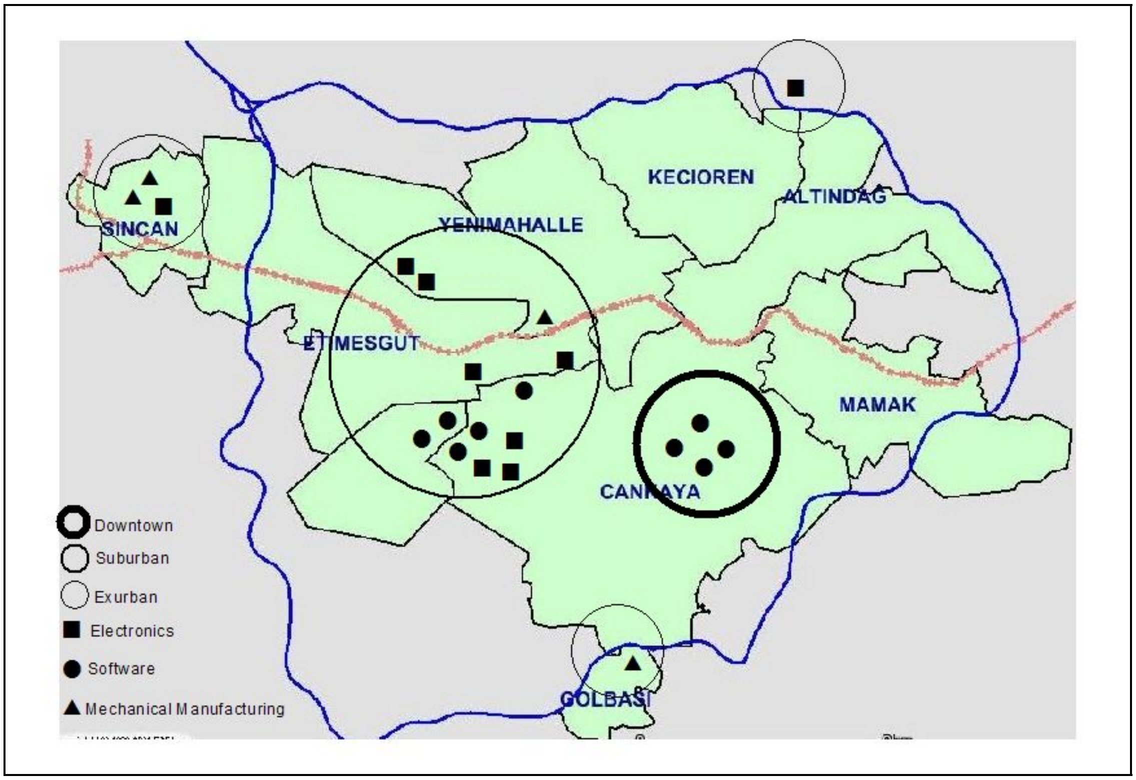
Companies stressed good transportation and amenities of space. As one respondent reported:

> We located here for the space and good transportation. This site is large and good for the type of production we do. Land is cheaper here. It is a bit far but we operate shuttle service for our employees (R&D Manager, Firm AN-16).

The suburban areas include small industrial parks and technoparks in university campuses. There are thirteen firms located in the suburbs: seven electronics, five software firms and one mechanical manufacturing firm. All of them were originally established in Ankara. Two electronics firms relocated within the Ankara region. One of the software firms and two electronics firms were multi-plant operations and located their R&D department in technopark at

Middle East Technical University (METU). Companies located in industrial parks explained their location as a conscious decision to stay close to the suppliers and subcontractors.

Map 5-1: Spatial Distribution of Interviewed Firms in Ankara



Source: Interview data

The suburban area contains two technoparks: METU-Technopolis at METU and Cyberpark at Bilkent University (BU). Technoparks in Turkey were promoted by the new Technology Development Zone (TDZ) Act in 2001, as described in Chapter 4. Two software firms are located at Cyberpark, BU and two software, two electronics firms are located at METU-Technopolis. The Cyberpark was established as a Technopark jointly by Bilkent University and its affiliate Bilkent Holding in 2002 and it contains more than 40 companies, mostly in information technology and electronics sectors. METU-Technopolis was initiated by the university in 1996 but started its activities in 2000. After the enacting of the new Technology Development Zone (TDZ) Act in 2001, METU-Technopolis was automatically granted the status of TDZ. More than 100 electronics and software companies operate in METU-Technopolis by 2004. The METU-Technopolis is managed by Teknopark Inc. which was founded in 1991. Shareholders of Technopark Inc. are the Middle East Technical University Development Foundation, Ankara Chamber of Industry (ASO), Bileda Inc., EBİ Inc., and Ortadoğu Software Inc. Both technoparks are multi-tenant facilities. The buildings were designed specifically for high-technology activities and include high-speed internet access and conference rooms. Other technopark services also included an incubation center, consultancy services regarding financial and venture capital sources, EU center for SMEs.

While companies located at Technoparks cited proximity to university research and resources, interviews also revealed that incentives and tax exemption played an important role in their decision to locate at Technoparks:

> We are located here for business synergies. Most of us are graduates of here and we already have relations with the academic faculty. We work in parallel with the academic faculty, and industry's needs. We come up with several ideas. Two months ago, we started a project with an academic faculty. There is also another idea with another department but we don't have financing for that project yet. Too many ideas but not enough funding. Also, in this building we are located next to other firms in the same sector. Communication is easier. Rents are higher but we get tax incentives by locating here (R&D Manager, Firm AN18).

> Since we are a Technopark company, we have a tax incentive. We have easy access to university resources and academic expertise. However, we are far from manufacturing industries so we located our factory in an industrial park but our R&D department is here. (R&D Manager, Firm AN-10).

The downtown area has four software firms, all originally established in Ankara. Except one of them, all firms relocated their offices within Ankara region. One firm performs research at METU-Technopolis but their management offices are located in downtown. Another firm was able to buy a sizeable land in downtown in 1997. The building was designed according their needs with good infrastructure and parking facilities. In this case, a downtown location was chosen only for the suitable premises at the right price, prestigious and not for other agglomeration advantages. In contrast, the other two firms leased their office spaces. For these two firms, a downtown location is prestigious location and offers location advantages primarily proximity to business services such as financial and legal services.

In summary, the analysis shows that innovative firms mention factors that may be understood in terms of traditional agglomeration economics. The innovative firms in Ankara mentioned highly urbanization effects such as government services, the amenities and cost of premises, professional labor, regional transportation systems, general and specialized business knowledge and information, general financial and training knowledge. Localization effects were also mentioned but not as much as urbanization effects. Some of the most mentioned factors were proximity to suppliers and universities. These findings seem to confirm the results of previous research on innovation (Simmie and Hart 1999; Decoster and Tabaries 1986; Perrin 1988; Harrison 1996). In addition, policy measures such as tax incentives were also cited for locating in technoparks. These data tend to support the proposition that innovative firms in metropolitan areas, like Ankara, are gathered together there because they are making use of the multiple possibilities provided by the government services as being the capital city and urbanization effects of urban agglomerations. These findings may be contrasted with those of much of the literature on new industrial districts and innovative milieu (Becattini 1990; Porter 1990).

5.1.2 Entrepreneurship and incubation

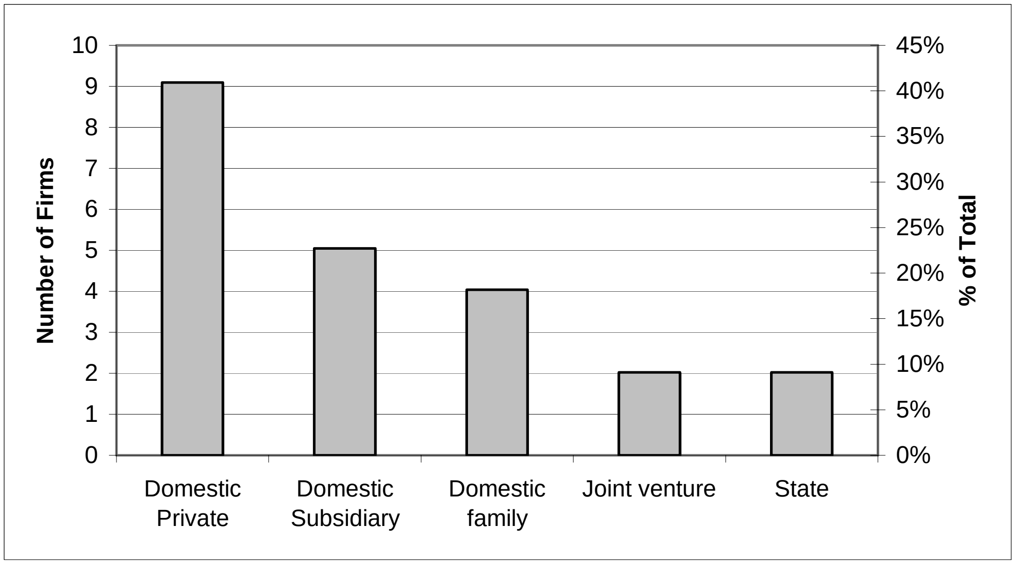
Interview evidence suggests that most of the innovative firms (86%) in Ankara were established by domestic capital (Table 5-4). In fact, only three (14%) firms in Ankara were established as joint ventures with foreign capital. The two foreign companies had joint ventures with the state and one foreign company with a domestic company. Two of them established as defense companies in 1980s. The other firm was established in 1945. Among domestic firms, five firms (22%) were established as a subsidiary of a holding or a joint-stock company. More than half of the interviewed firms in Ankara began as independent start-ups by an individual, a group of individuals, or family shareholders. The ownership type has not changed except for two joint venture companies with the state. Both firms were established with the government shares. One of them was privatized in 1990s and the other one became a state company in 1985 (Figure 5-1).

Table 5-4: Ownership at the Time of Establishment in Ankara

	Number of firms	% in total
Only domestic capital	19	86%
Private (individual or group of individuals)	9	41%
Subsidiary of holding or joint-stock	5	22%
Family	4	18%
State	1	5%
Foreign capital	3	14%
Joint Venture, state & foreign	2	9%
Joint Venture, private & foreign	1	5%
Total	22	100

Source: Interview data

Figure 5-1: Ownership Type Today in Ankara



Source: Interview data

Table 5-5 shows the educational and training background of founders for the thirteen private companies that are still domestically owned and operated. All of the founders are university graduates; mostly (89%) engineers (Table 5-5). The principal founders for three firms held academic positions at local universities, upon establishing their business venture. Most (89%) of the founders were graduates of a local university (mostly METU). One of the remaining four principal founders was trained in a university outside of Turkey but held an academic position in a local university in Ankara when he started his business venture. The others were trained in Istanbul.

Respondents frequently mentioned the absence of a critical mass of manufacturing companies compared to Istanbul, Bursa, and Izmir but the role of founder being from Ankara. As one of the respondent reported:

> We are located here because the founder is from Ankara but Ankara was not the best place for industry 15 or 20 years ago – not enough subcontractors- but it is

improving. Now, most firms in defense industry and related services are located in Ankara. (Firm AN-4, R&D Manager)

Table 5-5: Background of Founders in Ankara

	Number of founders	% of total
Majors		
Engineering	32	89%
Industrial Design	1	3%
Medical doctor	2	5%
Physics	1	3%
Degree		
Master's	4	11%
PhD	8	22%
Undergraduate	24	67%
Place of training		
Ankara	32	89%
France	1	3%
Istanbul	3	8%

Source: Interview data

As it was depicted in Figure 5-2, majority (86%) of the interviewed firms were established after 1980s. It is observable from the figure that two periods played an important role in the formation of interviewed firms, 1980-89 and after 1995. The average age of firms is 18 years. Another interesting finding is that the firms established before 1980, was state or joint ventures, large size firms (Table 5-6). It may be claimed that state-anchored firms played and still play an important role in the industrial development of Ankara region.

Figure 5-2: Distribution of Age of Interviewed Firms in Ankara

Source: Interview data

Table 5-6: Formation of Firms in Ankara

	Before 1970	1970-1979	1980-1989	1990-2004
Firms established	2	1	7	12
Ownership	State, joint venture, private	State	Joint venture, private	Private
Firm Size	Large and SMEs	Large	Large, SMEs	SMEs
Sector	Mechanical manufacturing, electronics	Electronics	Electronics, software, mechanical manufacturing	Software, electronics

Source: Interview data

In summary, the high percentage of domestic capital among innovative firms in the Ankara region manifests that domestic firms are not passive. Data also suggest that Ankara started to attract corporate spin-offs or individual entrepreneurs, mostly since 1980s. However, Ankara is still limited in attracting firms in the sense that only two companies were established in Ankara region by entrepreneurs trained outside of the region. In both cases, the attraction was due to government services or defense industry-related factors and the existence of large firms.

5.1.3 Geography of markets

The market distribution of sales of interviewed firms was found to be highly diverse, with customers in Ankara, Turkey, and in other countries. This aggregate market distribution was illustrated in Figure 5-3. At least three observations were made regarding the distribution of sales for firms in Ankara. First, around 36% of firms mentioned that their products were sold mostly in the Ankara region. None of the firms sold their products only or mostly in the Central Anatolia.[12] The market in Ankara was found to be more important than bigger region of Central Anatolia. This is because firms had sales to government institutions located in Ankara. Second, majority (64%) of the firms had sales nationwide. In addition, around half (50%) of the firms stated that they also operated in an international market, essentially in Europe, Middle East, and Central Asia (see Figure 5-4). Europe was the most important international market. There might be two reasons for this orientation to the European market. First, Europe is one of the closest markets. Second and perhaps the most significant reason is the custom union agreement in 1995 along with tearing down of barriers. This is a surprising finding since Ankara is not characterized as an industrial city and its export performance was not good as compared to other industrialized cities in Turkey.

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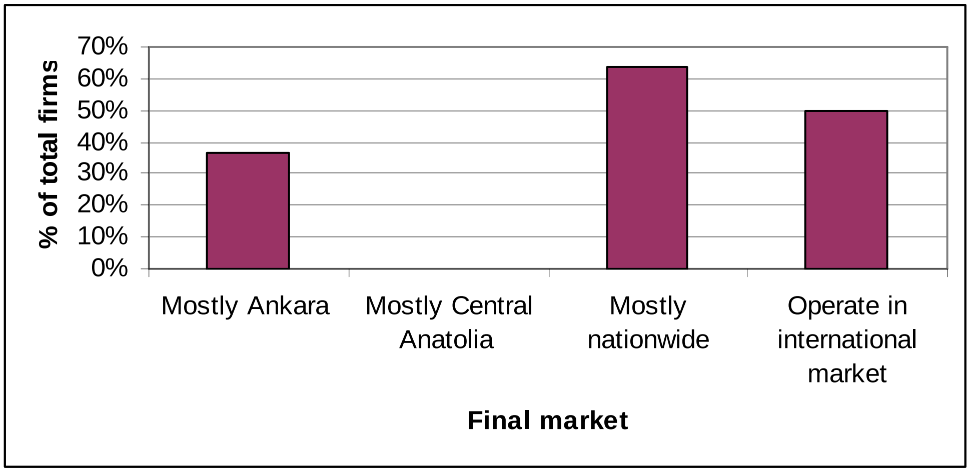
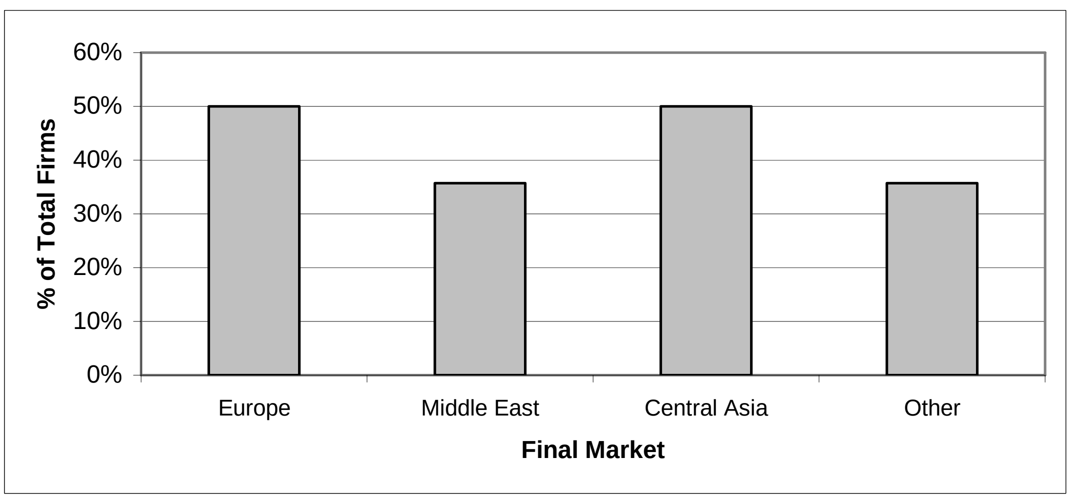
[12] After the 1st Geography Congress held in Ankara in 1941, Turkey was divided into seven regions. These geographical regions were separated according to their climate, location, agricultural diversities, transportation, topography and so on. At the end, 4 side regions and 3 inner regions were named according to their neighborhood to the four seas surrounding Turkey and positions in Anatolia. Most of the cities' borders are within the territory of a single region. Ankara is located in the Central Anatolia. The Central Anatolia is less industrialized compare to Marmara where Istanbul is located and Aegean Region where Izmir is located.

Figure 5-3: Geographic Distribution of Sales, Ankara



Source: Interview data

Figure 5-4: International Distribution of Sales, Ankara



Source: Interview data

In summary, among interviewed firms the most important markets are the national and local market due to government sector and defense related industry. Almost half of the firms also operated in international markets. The defense related local market as well as, international and national market orientations may give rise to critical demand for better products and processes.

5.2 THE LEVEL OF INNOVATION ACTIVITIES IN ANKARA

This section investigates the innovation activities of the firms in Ankara. Specifically, it focuses on the types of innovation (product vs. process; new vs. improved) and the internal innovation strategy of the firms. This section begins with a brief account of historical development of capabilities of the firms in Ankara, followed by the types of innovation activities and an investigation of internal corporate strategy, with particular attention paid to the innovation process and the reasons for innovating.

5.2.1 Historical development of interviewed firms in Ankara

This section provides an overview of historical development of the interviewed firms in the Ankara region. It specifically provides a brief account of how they adapted to changing technical conditions and economic environment. The ability to integrate and reconfigure to these changes is one of the proxies for innovative capability as mentioned in Chapter 2.

Interviewed firms in Ankara were influenced by internal and external factors inside and outside of the region over time. It is possible to identify four periods in which firms showed different capabilities: before 1970, 1970-1980, 1980-1990 and post-1990 (Table 5-7). In each period, four functional/organizational capabilities were investigated: investment, production, innovative, and marketing (Westphal, Rhee, and Pursell 1984; Lall 1992; Ernst, Ganiatsos, and Mytelka 1998; Mytelka and Ernst 1998).

Table 5-7: Historical Development of Interviewed Firms' Capabilities in Ankara

	Before 1970	1970-1980	1980-1990	1990-2004
Firms Established	2	1	7	12
Ownership	State, joint venture, private	State	Joint venture, private	Private
Firm Size	Large and SMEs	Large	Large, SMEs	SMEs
Sector	Mechanical manufacturing, electronics	Electronics	Electronics, software, mechanical manufacturing	Software, electronics
Investment Capability	State firm- full ability to identify, prepare new projects Private firm- importer	Full ability to identify, prepare new projects	Full ability to identify, prepare new projects	Full ability to identify, prepare new projects
Production Capability	Partial capacity	Full capacity	Full capacity	Full capacity
Innovative Capability	Investment in technologies	Investment in technologies; modernization	New and improved products and processes; R&D depts.	New and improved products and processes; R&D depts.; Quality certificates
Marketing Capability	Local market	Mostly local market, limited international market	Local and international market	Local and international market

Source: Interview data

Before the 1970s, horizontal sectors were not well developed and production capabilities were not fully used in Ankara. Production technology was imported and only two of the interviewed firms were established before 1970s. This period was mostly characterized by companies either established by the state, as joint ventures, or low and individual capital. Products were aimed at local demand following import substitution policies. For example, Firm AN-21 was a joint venture with the state and some technical personnel recruited from abroad.

This was the first factory in Turkey that produced tractors in Turkey. In 1956, only 25% of the tractors were being produced in the factory, the rest were imported from abroad due to limited existence of horizontal sectors. This increased to 43% in 1961 and 45% in 1967. It was in this period that the foundry was also established. Also management-related issues such as the standard cost accounting and matching reporting system were established.

Although general economic hardship with the oil crisis hindered most industrial activity, the decade of 1970-1980 may be characterized by the increasing number of domestic firms, domestic production, and upgrading. In addition, the presence of government institutions as major customers played an important factor in the location choice of the firms in Ankara. For example, AN-22 which is a defense related company started its operations in 1970s. Once an importer of medical and lab equipments, the firm AN-4 started its production line and it was the first firm in its sector in Turkey. Another example is the firm AN-21 which started an expansion and renovation process in 1970s. This renovation project was driven due the aging equipment and the rivalry inside and outside of the country. By 1979, the number of tractor producers reached 10. In this year, this firm also started exporting.

The period 1980-1989 can be characterized as a period of increasing entrepreneurship both in the private and defense sectors in Ankara. Strong support for exports created a process of learning which resulted in a growing confidence in exporting (Senses 1990). Most of the interviewed firms founded before 1980 were exporting to the Middle East and Northern African countries in the mid 1980s. For example, Firm AN-21 established a trade company. In that period, the company was conducting the foreign marketing activities of the products belonging to its holding companies. In 1975, contact offices were established in the Netherlands and Germany. Firms also started to produce new products due to the changes in the conditions both inside and outside of the country. For example, firm AN-21 produced a new model of tractor since the number of tractor producers increased in Turkey. Similarly, Firm AN-20 also started as an electronics company in 1983 and contributed to the production of the first local computer in the 1980s. Another important characteristic of this period was that not only production but R&D also started to become the focus of the firms. Firms began collaborating with international and local organizations to accelerate the learning process. Firm AN-18 was established as a R&D company of a domestic holding. The first three years activities included training, testing the systems, and gaining know-how. This firm worked with a US based company in the first three years. The firm AN-10 which is the first private firm started its operation with cooperation of a local university and KOSGEB in 1989.

After 1990, private entrepreneurship grew in Ankara. Twelve firms were established in this period and all of them were established by domestic capital. R&D and quality control activities increased. All of the firms have the ISO-9001, the international quality control certificates. Almost all firms update their products and/or processes every three to five years to compete in domestic and international markets. For example, in 1990, due to the Gulf crisis, two tractor firms survived the crises. The firm AN-21 is one of them.[13] This was because the firm AN-21 adopted new products and process systems. For example, in 1993, the company started to produce motors and started a 'Total Quality Management' project. In 1994, 'computer aided drawing' in product engineering was started. Computerization accelerated with the contract made with Oracle. According to EFQM (European Foundation of Quality Management), 'Self Evaluation' studies started. Latin America and Asia were added to the export list. After 1990, privatization activities also accelerated in Turkey and the firm AN-21 became completely private.

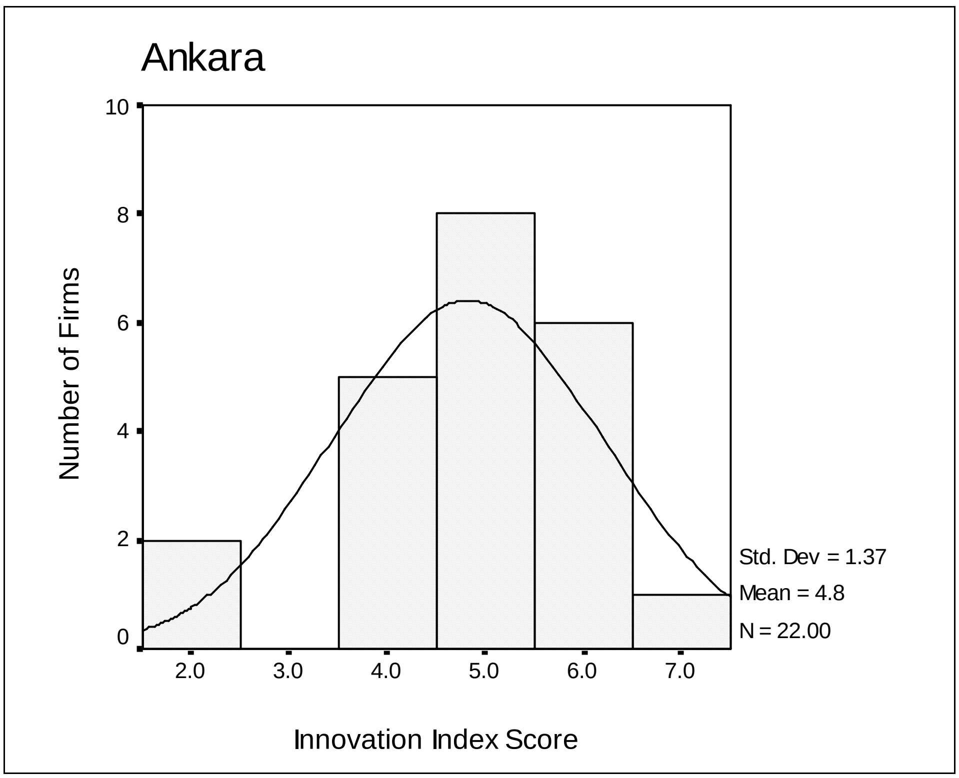
[13] The other tractor firm is located in Istanbul and it was covered in the next chapter.

In summary, the capabilities of Ankara firms were influenced by the inside and outside dynamics of the region. At the beginning, the region did not have horizontal sectors. It can be argued that firms had different technological strategies, based on the regional and economic conditions of the region and Turkey. Following Wong (1999) classification of different technological strategies, firms had two different technological strategies: reverse product cycle innovation strategy and reverse value chain strategy. First one is reverse product cycle innovation strategy. In this strategy, firms started producing mature products such as a tractor. Then they pursued product and process technological learning simultaneously. Then this was followed by making products of higher sophistication and involving technologies that were closer to the leading edge. In the second strategy, reverse value chain, firms first pursued developing process capabilities by investing in training, know-how. Later, they extended into product capability and branding strategies. This difference in strategy could be explained by the sectoral differences. In both cases, firms were able to integrate and reconfigure their internal and external strategies to address changing environments given the market and macro economic conditions of the region and country. The next section discusses the innovation activities of interviewed firms today.

5.2.2 The Level of innovation activities in Ankara

How extensively do the interviewed firms in the Ankara region engage in innovation, i.e. developing or improving new products and processes, applying for patents, investing in new technologies and hiring skilled labor? The overall innovative capability index of firms was calculated as mentioned in Chapter 3. Firms are scored between 1 and 7, where 7 means higher innovative capability (Figure 5-5). In Ankara, the index ranges 2 to 7. The mean innovation index in Ankara is 4.8. The innovation indexes of firms vary from the mean index of 4.8 by 1.37. The majority (86%) of interviewed firms have the score between 4 and 6. The two firms with low innovative capability scores (2) are both software firms.

Figure 5-5: Innovation Index in Ankara



Source: Interview data

How innovative are the firms in Ankara with respect to product and process innovation? Table 5-8 shows the kind of innovations introduced by the interviewed firms in Ankara. We defined six broad categories of innovations which are explained in detail in Chapter 3.

In Ankara there was an emphasis on product innovation in general without the degree of considering the novelty, i.e. improved or new. As far as firms that introduced process innovation, 86% the firms asserted that they introduced process innovation. Although this is a higher number, it is less than product innovation. This difference is statistically different at 10%

level. In empirical analysis of 11 European regions, Fritsch (2000) found a similar result where product innovation was higher than process innovation.

Table 5-8: Innovations in Ankara, Number of Firms

	Num	%	t-value	p-value
Product	22	100%	1.821	0.083*
Process	19	86%		
Product improvement	21	96%	2.324	0.03**
New Product	15	68%		
Process improvement	19	86%	6.708	0***
New Process	4	18%		

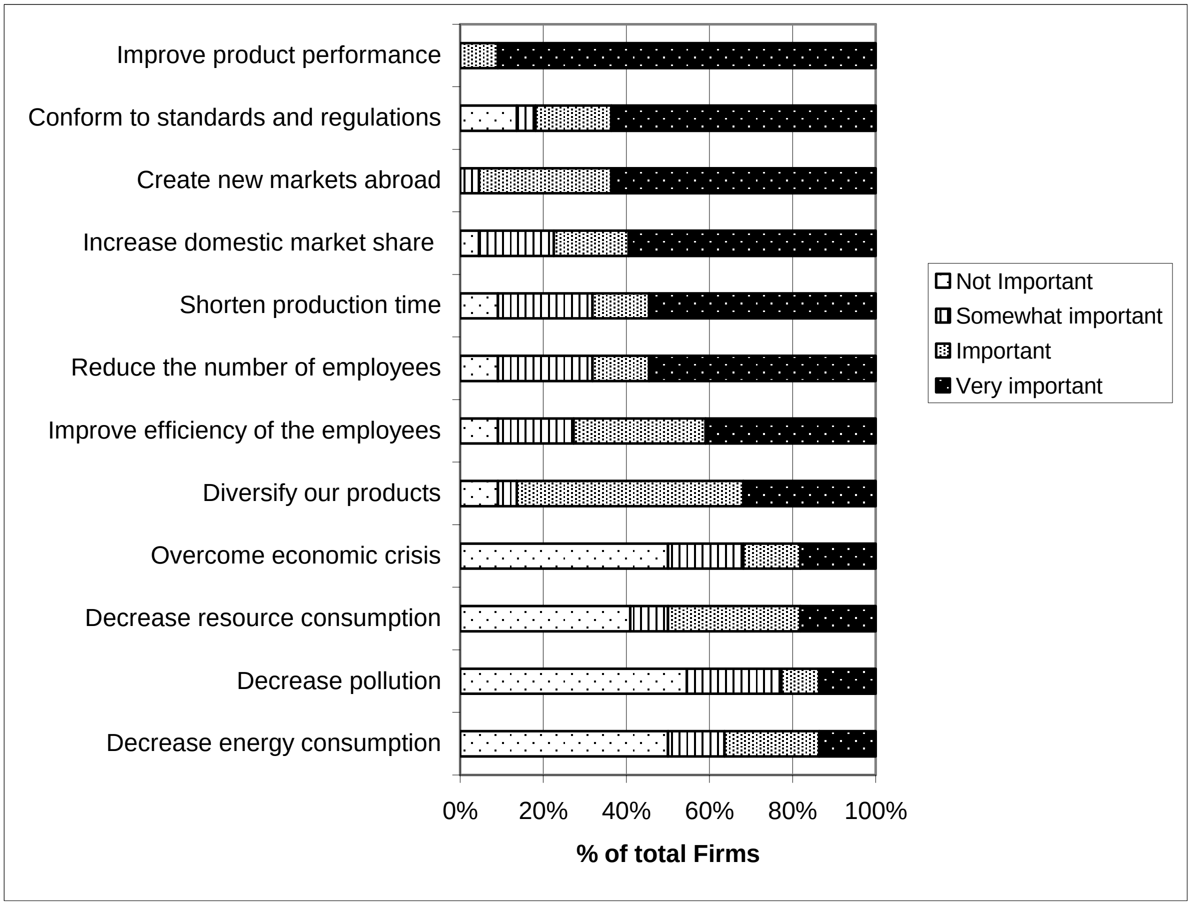
* Significant at 10% level
** Significant at 5% level
***Significant at 1% level
Source: Interview data

As to the novelty of the innovation, incremental innovation in terms of improvement in product and process innovation was higher than products or processes new to the firm or market. While most firms improved their products (96%), 68% of the firms introduced new products (Table 5-8). The difference between improved and new product innovation is statistically significant at 5% level. Similarly, while the majority (86%) of the firms improved their production processes, very few (18%) firms introduced new processes. The difference between improved and new process is statistically different at 1%. This is not a surprising finding since it is claimed in the literature that most of innovation activities in developing countries were based on incremental innovation (Kim 1997; Forbes and Weild 2000). Another finding is that a large part of these innovations seems to be based on improvement of existing production processes. The new process innovation was low in the Ankara region. This may restrict the potential for more radical innovations (Kaufmann and Todtling 2000).

The high product innovation activity of interviewed firms in Ankara can be explained by the need to improve the quality of the product and open up new markets. Figure 5-6 shows the reasons for innovation activities by the interviewed firms. The strategies related to products are most important motivations for innovation activities. Most (90%) firms innovated to improve the performance of their product. The majority (64%) of firms stressed the role of standards and regulations. The market strategies are also important reasons for innovation activities. The majority of firms (62%) stated that creating new markets abroad and increasing the domestic market share were very important motivations. Productivity related reasons such as shorter production time and less number of employees were stressed by the half of the firms. These results are in line with the literature. It was argued in the literature that product innovations are in fact usually associated to the creation of new markets or to the quality enhancement of existing products, whereas process innovations are typically introduced for reducing costs, rationalizing or increasing the flexibility and performance of production processes (Edquist, Hommen, and McKelvey 2001; Simonetti, Archibugi, and Evangelista 1995).

While SMEs and large firms did not differ in product innovation in general and in terms of novelty, a comparison between SMEs and large firms showed differences in process innovation. Data provided evidence to conclude that, in Ankara, the percent of SMEs which introduced process innovation is smaller than the percentage of large size firms which introduced process innovation (Table 5-9). This is statistically significant at 10% level. This different is also valid for the type of process innovation, i.e. new vs. improved, at the 5% level. This finding is in line with the literature. Research argued that process innovation increases relative to product innovation as the size of the firm increases. A large firm invests more in process innovation than a small firm (Yin and Zuscovitch, 1998). It is argued that the composition of a firm's R&D portfolio (process vs. product innovation) depends on the firm's initial market share and on the subsequent effects of R&D on the post-innovation market structure ((Acs and Audretsch 1991; Yin and Zuscovitch 1998).

Figure 5-6: Reasons for Innovation, Percent of Total Firms in Ankara



Source: Interview data

Table 5-9: Type of Innovation Activities in Ankara

	SME (15)		Large (7)		t	p
	Num	**%***	**Num**	**%****		
Product innovation	15	100%	7	100%		
New product	10	67%	5	71%	0.213	0.833
Product improvement	14	93%	7	100%	0.674	0.508
Process innovation	12	80%	7	100%	1.871	0.082***
New process	1	7%	3	43%	2.173	0.042****
Process improvement	12	80%	7	100%	1.871	0.082***
Investment in new technologies	13	87%	7	100%	1.468	0.164
Patent application	4	27%	3	43%	0.734	0.472
Hired technical staff	13	87%	7	100%	1.468	0.164

Source: Calculated from survey data
* % in Total Number of SMEs
** % in Total Number of Large firms
***At the 10% significance level
****At the 5% significance level

5.2.3 Internal organization of innovation activities

This section reveals the internal organization of innovation process and the technological strategy, i.e. adaptation, applied research or basic research. For some firms, this entailed the functional division of the innovation process into independent R&D, production engineering, and fabrication departments. For other firms in developing countries, there were no R&D departments (Arocena and Sutz 2000).

Firms were asked whether that had the functional division of the innovation process into an independent R&D department. Majority of the firms (82%) had separate R&D departments (Table 5-10). This is a rather surprising finding since literature emphasized that firms in developing countries do not have clearly and formally articulated R&D strategies within the firm based on separate R&D department (Arocena and Sutz 2000). This result shows that firms in Ankara had clear incentive to introduce innovations.

Table 5-10: Innovation Process in Ankara, Number of Firms

Innovation Process	R&D Dept	No R&D dept	Total
Customer demands drive innovation	2	2	4
Production and marketing together	16	2	18
Total	18 (82%)	4 (18%)	22

Source: Interview data

Of the twenty-two firms interviewed, four firms (18%) stated that customer demands drove their innovation decision (Table 5-10). Of these four firms, two firms didn't have a R&D department. Production and R&D were performed together. The innovation process was hierarchic and led by the general manager. The customer needs were passed down to development and production. The other firms, on the other hand, had R&D departments. In both cases, customer needs drove the innovation process. In firm AN-13, customer demands were evaluated in the R&D departments with the production department and passed up to the top. However, Firm AN-16, which is a joint venture, stated that innovation process was top-down:

> Our innovation process is mostly centered on customer demands. Customer drives our innovation process. One time the R&D department came up with a project idea but we had to force the top management to implement our ideas (AN-16).

Eighteen firms (82%) stated that the combination of in-house ideas and market analysis together influenced their decision to innovate (Table 5-10). Of these eighteen firms, sixteen of them had R&D departments. Six of these firms were established only for R&D purposes. Three of these firms are located in a Technopark on a university campus and the R&D departments of the other two firms are located in a Technopark. In most cases, firms stated that R&D departments or "project team" (in the case of no R&D departments) interacted closely with their marketing and production department. In all firms, the innovation process included production managers, production engineers, management and marketing from the very beginning of the project. The R&D manager worked alongside the marketing department to perform business analysis regarding the market potential of the product. Once it was submitted to the management for their approval, at the applied research stage, where in-house innovation typically begins for all of these firms, a project team was assembled with R&D and production engineers, and R&D manager. In most cases departmental boundaries between R&D and production were blurred. At the prototype and production phase, firms work with other organizations as it will be explained in the next section. As respondents explained:

> The firm has an application procedure called *design process*. In each project we have 52 people. They are all engineers with Masters or PhD degree. We use concurrent engineering method which includes engineers from R&D and production department and this shortens the production time (Firm AN-22).

> We come up with new projects. For example, we took one of our project ideas to another firm in Ankara that we wanted to work with. We have project teams and developed this project with some faculty member but internally we did the prototype. But customers also come up with ideas and we develop those projects too (Firm, AN-18).

These findings confirm the argument in the literature that innovation was non-linear and did not have to start from basic research. Innovation was created and sustained by the feedbacks across all stages of the production chain (Kline and Rosenberg 1986). Although majority of the firms had separate R&D departments in Ankara, feedbacks from other department were gained in product or process innovation process.

The platform technology on which the main product based was licensed in 36% (8) of firms. In-house innovation was initiated at the prototype development and adaptation stage. For example, firms AN-16 and AN-21 both licensed in their products from a partner foreign company. However, full scale production and marketing was performed in house. Firm AN-21 was selected as the research, development, and production center of the two products within their partner's global network in 1999. In Firm AN-5 and AN-15, again the platform technology was transferred to the local facility but prototype development, full scale production and marketing performed in-house. Despite the importance of external sources for basic research, in the case of firm AN-15, the collaboration due to licensing was not supportive but cumbersome. Indeed, firm AN-15 stated that licensing in technology had a negative effect on future innovations project. This issue was recognized by the general manager of Firm AN-15:

> One of our turning points is the end of our partnership with the licensee firm. Although we received the basic technology, we could not add or change it. This was an obstacle for our development. Four years after the end of partnership, we came up with our own product which was the turning point for our firm. (General Manager, firm 49)

For the remaining 14 firms, in-house innovation started at the applied research and product development phases of the innovation process. For most firms, this involved reverse engineering, or developing products according to customer needs or adopting new standards.

Table 5-9 (see above) shows the use of patents in the investigated firms. Thirty-two percent (7) of firms applied to patent their innovations. Among these seven firms, only four of them patented their innovation in Turkey, while the rest applied for patents in Europe and USA.

68% had no patented products or processes. Two points are of significance in this regard. The first is that most of the software firms stated that they could not patent their products because Turkish Patent Institute (TPI) does not give patents to the software products in Turkey. Second, some firms expressed their lack of trust in this instrument:

> When you apply for a patent you release more information in the process than you would have otherwise. So we don't prefer doing that. (R&D manager, Firm 40)

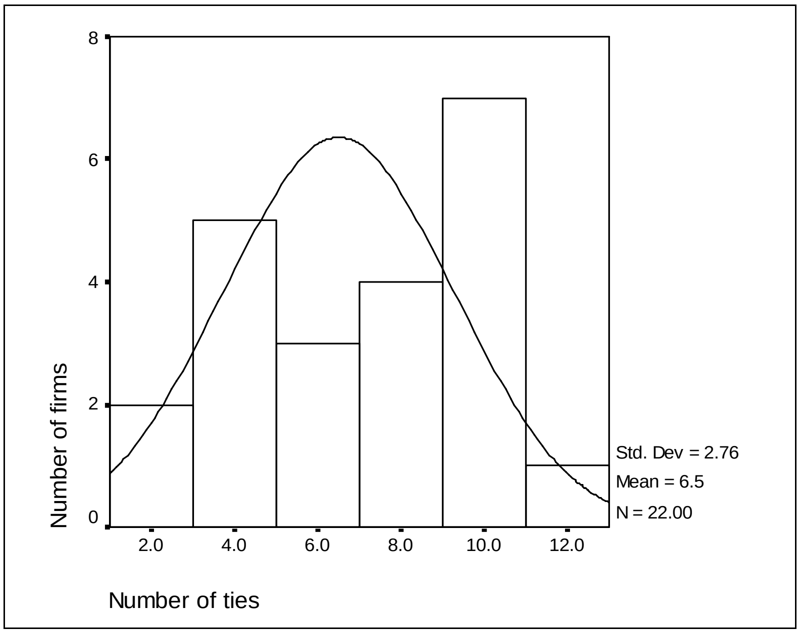
5.3 NETWORKING: EXTERNAL ORGANIZATION OF THE INNOVATION PROCESS IN ANKARA

Empirical research has shown an association between networking and innovation as previously discussed in the chapter two, however, little is known about the networking patterns and the composition of these networks in developing countries. This section investigates the networking behavior of firms in Ankara. This first part examines the existence of and geographic extent of innovation ties. The second section compares the characteristics of networks at the local and non-local level in order to analyze whether the region can be considered a nurturing environment for the innovation process.

5.3.1 Innovation networks in Ankara and their geographic boundaries

To what extent do innovative firms in Ankara interact with other firms and organizations? Figure 5-7 shows that the firms in Ankara had ties when they introduced product or process innovations. Collectively, twenty-two firms mentioned a total of 143 significant innovation ties. The mean network size is 6.5 in Ankara, with a standard deviation of 2.8. The smallest group had one firm with a network size of 12, while the largest group had seven firms, with a network size of 10. The results clearly show that the firms in Ankara had ties when innovating. This finding confirms the claim that innovation does not happen in isolation. Innovation is created and sustained by inputs not only generated within the firm, but also knowledge inputs derived from *networking* (Lundvall 1992).

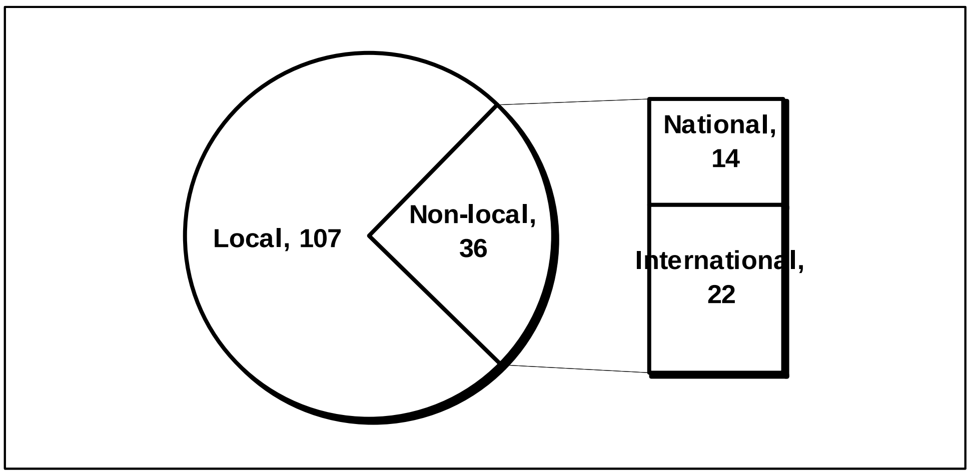
Figure 5-7: Overall Number of Network Ties When Firms Innovate



Source: Interview data

What is the geography of these innovation networks in Ankara? The networks draw mostly on local ties in Ankara. Of 143 total ties, 107 of them (75%) were in the Ankara region (local), and 36 (25%) were to outside of the Ankara region, i.e. non-local (see Figure 5-8). Of these 36 non-local ties, 14 of them were to another city in Turkey, mostly to industrial cities of Istanbul, Bursa, Gebze, and Izmir. Twenty-two of these non-local ties were to ties in another country. The larger existence of local ties in Ankara corroborates the findings and the discussion in the territorial innovation models where the importance of local networking for innovation was emphasized (Storper 1997; Porter 1990; Maskell and Malmberg 1999b; Camagni 1991). In Ankara we can argue that innovation assumed to be largely dependent on local ties. However, we cannot dismiss that 25% of ties were to non-local resources. Did all the firms have local and non-local ties?

Figure 5-8: Geography of Innovation Network Ties, Number of Ties by Geography



Source: Interview data

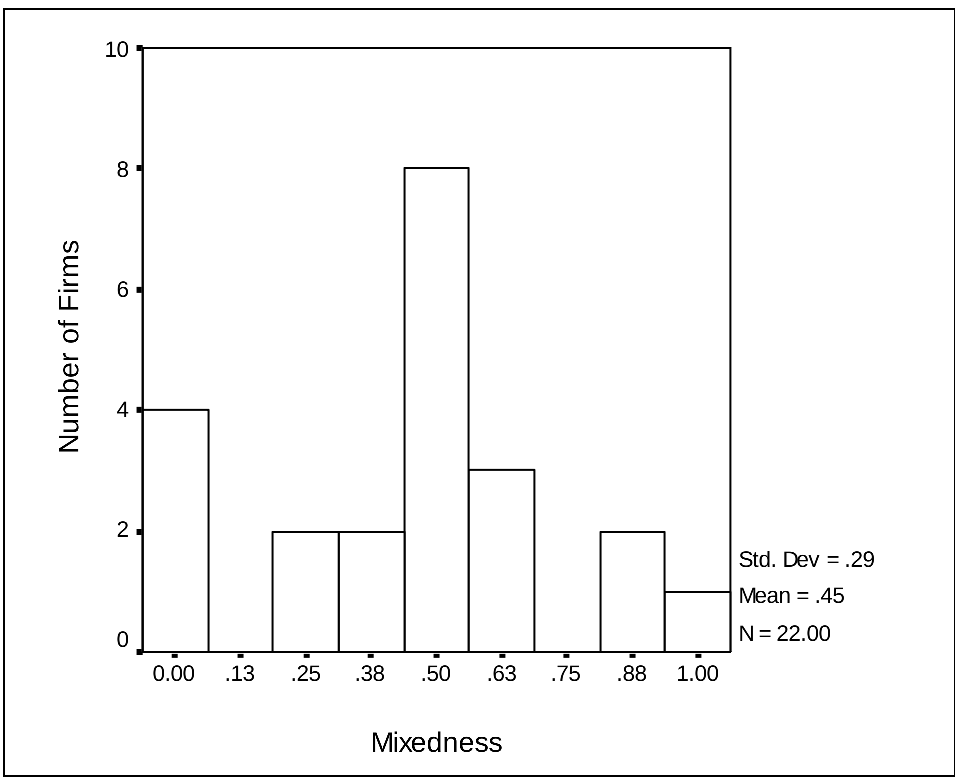
All firms had local network ties, while the majority (82%) of the firms had non-local ties (see Table 5-11). The mean local network (5) size is higher than non-local ties (2). This difference is statistically significant at 1% level. In order to calculate the degree of local and non-local composition, the mixedness score was used as was described in Section 3.3.4. Figure 5-9 shows that the mixedness score of 18% (four firms) was zero. This means that these four firms had one type of network ties either local or non-local. In this case, it was local ties. However, the remaining 82% of firms had mixed ties, both local and non-local ties.

Table 5-11: Distribution of Network Ties in Ankara, All Firms

Number of Ties	Ankara firms			
Local ties	Number of firms	% of total number of firms	Tie statistics	p-value
0	0	0	Mean = 5 S. deviation = 2	0.000*
<5	10	46%		
5-9	12	55%		
Non-local ties				
0	4	18%	Mean = 2 S. deviation= 1	
<2	9	41%		
2-5	9	41%		

* Significant at 1% level.
Source: Interview data

Figure 5-9: Mixedness (local and non-local ties) of Networks in Ankara



Source: Calculated from interview data

The network size and the geographic composition of ties differ across the subgroups of firm size. From the results in Table 5-12 and Table 5-13, following observations can be made. First, local network was larger than non-local network both for SMEs and large firms in Ankara. This difference is statistically significant for SMEs at 1% level and for large firms at 5% level. Second, network size dropped with the size of the firm in Ankara. Large firms interacted with more number of firms and organizations. This was true both for local and non-local network relations. The nmber of non-local ties fell in SMEs. Four of fifteen SMEs did not have any non-local networks. These results are statistically significant at 1% and 5% level. Third, while all large firms had mixed ties, i.e. local and non-local innovation ties, majority (73%) of SMEs had mixed ties (Table 5-13).

Table 5-12: Distribution of Network Ties in Ankara, by Firm Size

Number of Ties	**SMEs**			**Large**			**p**
All ties	**Number of SMEs**	**%**	**Tie statistics**	**Number of Large firms**	**%**	**Tie statistics**	
0	0	0%	Mean=5 SD=2	0	0%	Mean=9 SD= 1	0.00*
<5	7	47%		0	0%		
5-9	8	53%		6	86%		
10-14	0	0%		1	14%		
Local ties		%		Number	%		
0	0	0%	Mean= 4 SD=2	0	0%	Mean=6 SD= 2	0.03**
<5	9	60%		1	14%		
5-9	6	40%		6	86%		
Non-local ties		%		Number	%		
0	4	27%	Mean =1 SD=1	0	0%	Mean= 3 SD= 1	0.00*
<2	9	60%		0	0%		
2-5	2	13%		7	100%		

* At the 1% significance level
** At the 5% significance level

Table 5-13: Comparison of Mixedness Score by Firm Size

	SMEs	Large	t	p**
Total firms	15	7		
Number of firms, Mixedness > 0	11 (73%)	7 (100%)		
Mean Mixedness	0.34	0.62	2.425	0.026
S. deviation	0.27	0.21		

** At the 5% significance level

Why did firms engage in local and non-local networks? Interviewed firms mentioned several reasons for ties with local and non-local organizations and firms. The reasons for the non-local ties are listed in Table 5-14. Three most cited reasons for the ties with non-local organizations were responsiveness, being best in their area, and goal congruence. Firms mentioned that non-local partners were able to react quickly to address their concerns during their innovation activities. They also mentioned that these were the best organizations in their area. Similarly, respondents also stated that they had agreement upon mutual goals for interaction on their R&D projects. These were either customers or R&D partners.

Table 5-14: Main Reasons for the Ties with Non-local Organizations in Ankara

	Number of times mentioned
Responsiveness	8
Best in its area	7
Goal congruence	7
Technological compatibility	3
Utilize the capabilities we lack and need	3
Group firm	3
Satisfaction	2
Familiarity	2
Obligation	1

Source: Interview data

Interviewed firms mentioned several reasons for ties with local organizations and firms. The reasons for the local ties are listed in Table 5-15. Three most cited reasons for the ties with local organizations were helpful, proximity and knows personally.

Table 5-15: Main Reasons for the Ties with Local Organizations in Ankara

	Number of times mentioned
Helpful	23
Proximity	17
Knows personally	13
Best in Turkey	10
Obligation	9
Lack of choice	9
Satisfaction	6
Utilize the capabilities we lack and need	4
Responsiveness	4
Goal congruence	3
Familiarity	3
Low prices	3
Technological compatibility	1

Source: Interview data

What do these results mean? First, results from the Ankara region confirm the claim that innovation does not happen in isolation. Innovation is created and sustained by inputs not only generated within the firm, but also knowledge inputs derived from *networking* (Lundvall 1992).

Second, all territorial innovation models mentioned in Chapter 2 emphasized the local networking as an organizational mode in the innovation process(Storper 1997; Porter 1990; Maskell and Malmberg 1999b; Camagni 1991). The results in Ankara region are in line with the literature in the sense that innovation assumed to be largely dependent on local ties. The reasons for local ties were based on proximity and personal knowledge of these organizations. This was true both for SMEs and large size firms. Especially, the results support the previous research that the existence of local networks is vital for SMEs (Maillat 1990). SMEs in Ankara region had more local ties than non-local ties. Four of fifteen SMEs did not have any non-local networks. However, results from the Ankara region also revealed some existence of non-local ties both for most SMEs and all large size firms. Therefore, this study extends the local networking hypothesis by adding the existence of non-local networks. In other words, the results from the Ankara region confirm the study hypothesis that *when firms in developing countries introduce technological innovation of products and/or processes, they engage in mixed networks, i.e. local and non-local (interregional and international) networks*. The reasons for non-local networks were the need to access capabilities not available locally.

Third, network size dropped with the size of the firm in Ankara. Large firms interacted with more number of firms and organizations. This is true both for local and non-local network size. The citation of non-local ties fell in SMEs. Therefore, the results from Ankara region confirm the study hypothesis that SMEs *have fewer non-local network ties than large firms.* These results corroborate those of prior research which indicated that large domestic firms were skilled at building long distance, non-local ties. Large firms do have advantages in non-local networks since it is much harder for an SME to update its technical knowledge than for a large firm which is also to send people to conferences and seminars all over the world (Rothwell and Zegveld, 1982). Another reason could the regional structure, since firms emphasized the government services for locating in Ankara.

5.3.2 What are the characteristics of local and non-local networks?

Networks are seen as an important defining characteristic in the territorial innovation models. Specifically, the phenomenon of local networking has been emphasized in academic and policy circles. While the prior section reflected the existence of the local network ties in Ankara, it also showed that firms (both SMEs and large firms) had non-local ties when developing products and processes. This section examines the characteristics of local and non-local networks. Are the local networks more important than the non-local ones? Five indicators are used to assess the strength of the local and non-local networks: diversity, multiplexity, stability, formality, and the communication frequency and media.

5.3.2.1 Diversity and type of organizations in local and non-local networks

This section examines the diversity of the local and non-local networks and the partners which provided relevant inputs to firms' innovation activities. Network diversity (D) describes variability of types of organizations in a firm's network. The organizational types are measured using the index of qualitative variation (IQV) (Agresti and Agresti, 1978). This was explained in detail in the Section 3.3.4.

Before we enter into the details of the partner pattern, we will analyze the diversity of firms' local and non-local networks. The goal of this diversity index is to assess whether firms contact with one of type of organizations. In the literature, there is sometimes emphasis on customers and suppliers (Audretsch 1998).

Table 5-16 shows the results for local and non-local networks and how it differs between SMEs and large firms. The following observations can be made from the table. First, in Ankara, local networks contained diverse set of organizations than non-local networks. The mean local network diversity is 0.69, while the non-local network diversity for all the interviewed firms is 0.29. This difference is statistically significant at 1% level. Second, this is also true for SMEs. SMEs had diverse set of organizations in their local networks than non-local networks. The mean local diversity for SMEs is 0.64, while the mean non-local diversity is 0.11. This is also statistically significant at 1% level. [14] On the other hand, large firms were different. Their local and non-local networks both contained different types of organizations.[15] Third, SMEs and large firms did not differ in terms of local network diversity. The mean local network diversity is 0.64 and 0.78 for SMEs and large firms respectively. There is no statistically significant difference. Lastly, non-local network diversity dropped with the firm size. Large firms had more diverse set of organizations in their non-local networks than SMEs. This result is statistically significant at 1% level.

Table 5-16: Mean Network Diversity by Firm Size

Diversity	Firm Size	Mean	S. Deviation	p-value Firm size	p-value All firms
Local Network	All Firms	0.69	0.22		0.000*
	SMEs	0.64	0.23	0.165	
	Large	0.78	0.11		
Non-local Network	All Firms	0.29	0.34		
	SMEs	0.11	0.25	0.003**	
	Large	0.57	0.28		

**Significant at 1% level
Source: Interview data

These findings suggested that the organizational composition of network members was more diverse in local networks than non-local networks. Both SMEs and large firms had similar

[14] SMEs local and non-local network diversity p=0.001
[15] Large firms local and non-local network diversity p=0.163

diversity level in their local networks, but their non-local networks differed in terms of diversity. Large firms had a more diverse non-local networks.

Overall and locally, government agencies were the most cited organizations by the interviewed firms (Table 5-17**)**. This is not surprising considering that interviewed firms emphasized the existence of government institutions as the reasons for locating in Ankara. Overall and locally, universities ranked second (see Figure 5-10 and Figure 5-11). Ankara has a well developed scientific infrastructure – METU, Bilkent University and TUBITAK and several other universities and research institutions. Interview reveled that most of the employees were graduates of local universities. Therefore, as graduates, they kept their relationship with these local universities. The result that local universities were innovation partners is not surprising. It corresponds to the results of other studies (Breshci and Lissoni 2000; Audretsch 1998). Overall, suppliers ranked third. However, in this case, non-local suppliers, especially international ones, were more important then local ones. Considering that Ankara does not have a well-developed supplier base compared to other industrial cities of Istanbul, Izmir, this is not a surprising finding. The interesting finding was the role of professional association which ranked fourth. Most firms stated that professional association helped them “to be in the loop” in terms of getting information about changing standards, and possible projects and partnerships in their sector. In addition, some professional associations such as Turkish Electronics and Information Technology Industries Association (TESID) encouraged technological creativity among their member firms by organizing innovation award. Ties with competitors and customers were of lesser importance.

Table 5-17: Types of Organizations by Local and Non-local Networks in Ankara

Types of organization	Number of ties			
	Local	Non-local		Total
		National	International	
Government agencies	28			28
Universities	23	1	1	25
Suppliers	10	2	11	23
Professional associations	17	1	1	19
Research institutions	7	3	2	12
Competitors	7	1	3	11
Customers	4	4	1	9
Providers of funding/financing	7			7
Consultants	4		1	5
Training institutions	1	2		3
Joint-venture partner			2	2
Group firms	1			1
Total	109	14	22	145

Source: Interview data

The following conclusions can be drawn from these results in Ankara. First, local ties involved quite a large variety of organizations including government agencies, universities, suppliers, professional associations, and customers. Second, ties with government agencies were the most cited relations in Ankara. Another reason for this was that several firms were defense related firms. Third, ties with the scientific communities were more confined to the Ankara region. Universities and research institutions were relatively more important at the local level, and were very less so for national and international level. Fourth, suppliers were important innovation partners. However, non-local suppliers were cited more than local ones. These results in this study were similar to the findings reported by TUIK, but the rankings were different. The TUIK's nationwide survey revealed that customers, suppliers, and universities were the first three important partners in innovation. The difference between TUIK's study and this dissertation could be related to the sample. TUIK's sample was not regional but nationwide. This study revealed that Ankara region was attractive for most of the firms because of the proximate relations with government agencies that was also stated by the firms.

Figure 5-10: Type of Organizations in Local Networks in Ankara

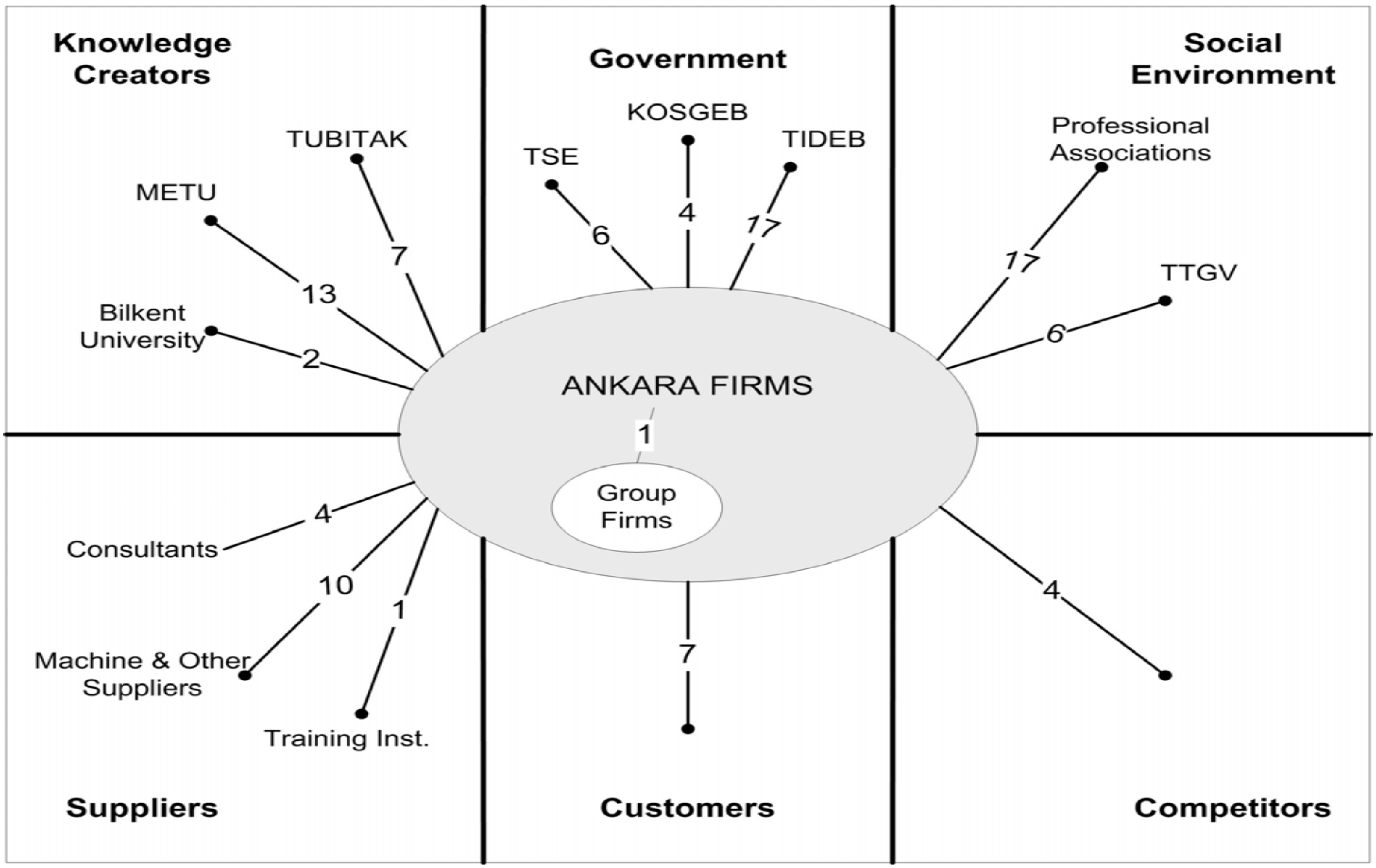
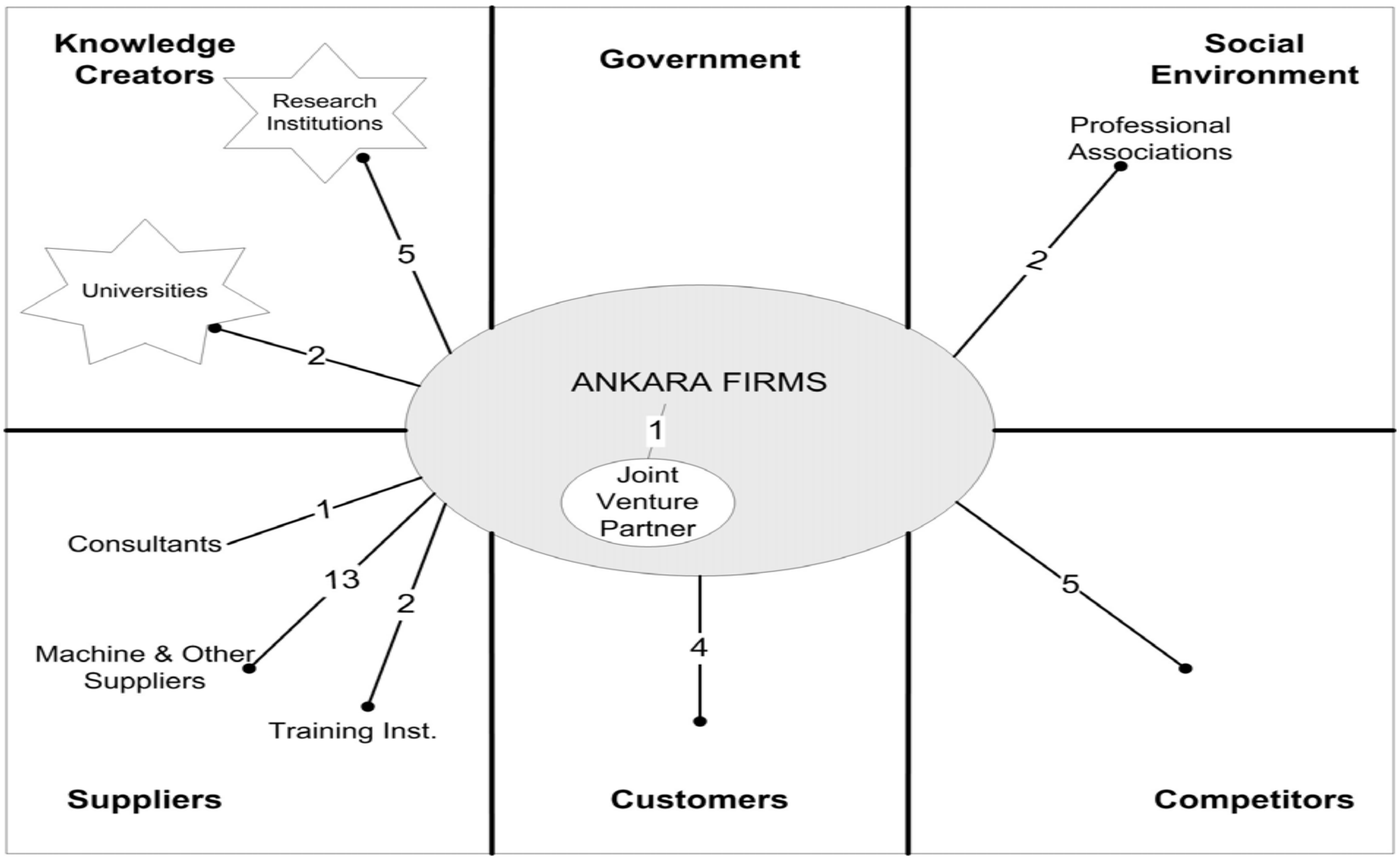


Figure 5-11: Type of Organizations in Non-local Networks in Ankara

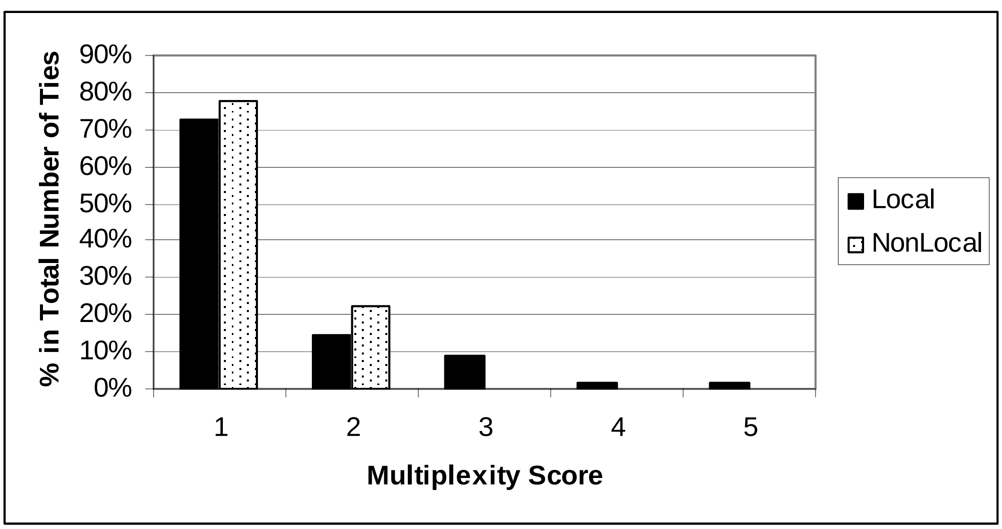


5.3.2.2 Multiplexity and type of resources

Network multiplexity is defined as the degree to which ties provide more than one resource, i.e multidimensional (Ibarra 1995). The goal is to assess whether local or non-local networks are used for more than one type of resources. In this study, multiplexity was constructed from the number of types of resources including material, non-material and support resources. Multiplexity ranged from 1 (only one type of resource) to 5 (five types of resource). This was explained in detail in the Section 3.3.4.

Majority of local (72%) and non-local (78%) ties were uniplex, i.e. provide one type of resource (Figure 5-12). Small number of local ties (15%) and non-local ties (22%) provided two types of resources. Very few (13%) local ties provided more than two types of resources. Type of institutions included mostly universities (METU) and research institutions (TUBITAK). These data showed that multiplexity does not differ between local and non-local networks.

Figure 5-12: Local and Non-local Network Multiplexity in Ankara



Source: Interview data

Table 5-18 shows the distribution of different type of resources locally and non-locally. Within the local networks, all three types of resources were utilized. The use of non-material resources (43%) and support resources (37%) were higher than material resources. Similarly, non-local networks were used to access mostly non-material (60%) and support resources (40%).

Comparison of local and non-local networks shows that the uses of local resources in all resource types were prominent in Ankara. Especially, all the material resources were obtained locally. However, for non-material and support resources, data showed that 32% of all non-material and 28% of all support resources were non-local. Half of the training (52%) needs of the interviewed firms were obtained outside of the Ankara region. Similarly, most of the know-how was obtained from international organizations.

Table 5-18: Type of Resources by Location

	Number of Ties			
		Non-local		
Type of Resources	**Local**	**National**	**International**	**Total**
Non-material resources	**63**	**10**	**19**	**92**
Exchange of technical knowledge	14	2	3	19
Being in the loop	16	1	1	18
Formal R&D collaboration	19	5	6	30
Consulting	13	2	1	16
Know-how	1		8	9
Support resources	**56**	**8**	**12**	**76**
Personnel help	16			16
Technical lab needs	25	3	1	29
Training	15	5	11	31
Material resources	**30**			**30**
Borrowed equipment	4			4
Funding/Financing	26			26
Total	149	18	31	198

Source: Interviewed data

Comparing firms of different size with respect to type of resources, Table 5-19 shows the following results. In the case SMEs, their interaction space was smaller as we discussed above. Local ties were more important for SMEs. However, they had very diverse local networks. These also reflected in the use of resources. The non-material and support resources were cited more frequently by the SMEs. In terms of non-material resources, formal R&D collaboration was ranked first for both SMEs. R&D ties were made up of a diverse set of organizations: competitors, customers, suppliers, and institutions such as universities. The exchange of technical information ranked second among SMEs. Also, SMEs interacted with organizations which provided information about their sector, technological development and available projects. In terms of support resources, training and technical lab were the most used resource type. Most of training relationships were with suppliers and private training institutions.

Large firms, in general, had both local and non-local ties. Again, the non-material and support resources were cited more frequently by the large firms. Within the non-material resources, formal R&D collaboration and consulting were cited more frequently. As to the support resources, training and technical lab resources were used mostly.

In summary, majority of the local (72%) and non-local (78%) ties provided one type of resources. The uses of local resources in all resource types were prominent in Ankara. Within the local networks, the use of non-material resources (43%) and support resources (37%) were higher than material resources. However, non-local networks were also used to access mostly non-material, such as know-how and support resources, such as training. The local, interregional and international resources were used simultaneously. In some cases, non-local resources were used because these resources were not available locally. In other cases, respondents mentioned that the reasons for using for non-local resources were because these organizations were the best in their area.

Table 5-19: Type of Resources by Firm Size in Ankara

Type of Resources	Number of Network Ties		
	SMEs Ties	Large Firms Ties	Total Ties
Non-material resources	**46**	**46**	**92**
Exchange of technical knowledge	13	6	19
Being in the loop	11	7	18
Formal R&D collaboration	14	16	30
Consulting	3	13	16
Know-how	5	4	9
Support resources	**39**	**37**	**76**
Personnel help	7	9	16
Technical lab needs	16	13	29
Training	16	15	31
Material resources	**18**	**12**	**30**
Borrowed equipment	4	0	4
Funding/Financing	14	12	26
Total	103	95	198

Source: Interview data

5.3.2.3 Stability of local and non-local networks

This section presents the stability of local and non-local networks. Stability is measured by the duration of a network tie (DR), i.e. how long a firm and its tie existed since the firm was established (Andersen 2001; Wasserman and Faust 1994; Wellman 1982) (please see the section 3.3.4 for detail definition of duration). The goal is to measure the stability of the local and non-local networks. The higher the duration score, the more stable the network is (Andersen 2001; Wasserman and Faust 1994; Wellman 1982).

Table 5-20 shows the mean duration score of local and non-local networks and also whether it differs between SMEs and large firms. The following observation can be made from the table. First, both local and non-local networks had a similar duration in Ankara. The interviewed firms had a relationship with organizations in their local and non-local networks institution around 60% of their lifetime. While the firms had ties with local institutions during 58% of their lifetime, the mean duration of their ties with non-local institutions was 62% of their lifetime. The mean duration of local and non-local networks does not differ statistically.

Table 5-20: Duration by Firm Size

<table>
<tr><th></th><th>Size</th><th>N</th><th>Mean</th><th>Std. Deviation</th><th>P*</th><th>p**</th></tr>
<tr><td rowspan="3">Overall Network Duration</td><td>Total</td><td>22</td><td>0.58</td><td>0.20</td><td></td><td></td></tr>
<tr><td>Large</td><td>7</td><td>0.61</td><td>0.22</td><td rowspan="2">0.715</td><td></td></tr>
<tr><td>SMEs</td><td>15</td><td>0.57</td><td>0.19</td><td></td></tr>
<tr><td rowspan="3">Local Network Duration</td><td>Total</td><td>22</td><td>0.58</td><td>0.17</td><td></td><td rowspan="6">0.555</td></tr>
<tr><td>Large</td><td>7</td><td>0.57</td><td>0.15</td><td rowspan="2">0.938</td></tr>
<tr><td>SMEs</td><td>15</td><td>0.58</td><td>0.18</td></tr>
<tr><td rowspan="3">Non-Local Network Duration</td><td>Total</td><td>17</td><td>0.62</td><td>0.37</td><td></td></tr>
<tr><td>Large</td><td>7</td><td>0.74</td><td>0.39</td><td rowspan="2">0.443</td></tr>
<tr><td>SMEs</td><td>10</td><td>0.59</td><td>0.36</td></tr>
</table>

* Comparison between SMEs and large firms
** Comparison between Local and non-local networks' duration
Source: Interview data

Second, SMEs and large firms showed similarities. As to the local network duration, both SMEs and large firms had duration of 58% of their lifetime with local firms and organizations. In case of the non-local networks, SMEs had ties with the non-local institutions during 58% of their existence. Large firms, on the other hand, had ties during 74% of their lifetime. However, the difference is not statistically significant.

In summary, the results showed that local and non-local networks did not differ in terms of stability. These results also did not differ between SMEs and large firms.

5.3.2.4 Formality of local and non-local networks

Research in network theory has acknowledged the existence of different types of ties and different forms in which they take place (Brass and Burkhardt 1992). This section focuses on one aspect of this variation – the administration of network ties via formal or informal linkages. In this study, network ties were distinguished as either formal or informal network ties based on the existence of written contracts or based on personal relationship. Dyadic ties were coded as informal when interviewees described these ties as "*knows personally* or *knows well*".

Ankara firms had all types of combinations of formal and informal market mechanisms (see Table 5-21). Overall, very few (16%) of ties were cited as informal. The remaining 84% of those ties were formal ties. In the case of local networks, only 21% of ties were cited as informal. However, firms had non-disclosure agreements even within their informal networks (Table 5-22). These contracts were required when they collaborated on R&D projects. As Uzzi (1996) demonstrated that informal or personal network ties may have a variety of social attributes within their dyadic relationships. This is also the case in Ankara. As to the non-local networks, all of them were referred as formal. All the non-local networks had some kind of contracts such as non-disclosure agreements.

Table 5-21: Formal and Informal Ties by Geography

	Formal		Informal		Total	
	Freq	%	Freq	%	Freq	%
Local	84	79%*	23	21%*	107	
Non-Local	36	92%**	0	0%**	36	
Total	**120**	**84%*** **	**23**	**100%**	**143**	**100%**

* % of all Local ties
** % of all Non-local ties
Source: Interview data

Table 5-22: Existence of Written Contracts in Informal Ties in Ankara

Local Informal Ties		
Written Contracts	Freq	%
No	11	48%*
Yes	12	52%*
Total	23	100%*

*% of all informal ties
Source: Interview data

5.3.2.5 Communication frequency and media

This section presents the frequency of contact and media within the local and non-local network ties, i.e., how often the ego and alter have contact and whether the tie is based on face to face relationships (Wasserman and Faust 1994; Wellman 1982; Davern 1997). Significance in the social network is usually measured by the frequency of contact between ego and alters rather than the self-defined relationships of the importance of ties (Wellman, 1990).

Table 5-23 shows that local ties contained more frequent ties than non-local ties, corresponding results of the other studies. However, the frequent ties made up only 21% of local ties. Majority (79%) of local ties were based on need based ties and accessed for problem solving purposes.

Table 5-23: Communication Frequency in Ankara

	Local Ties	Non-local Ties	Total
Very frequent	28	3	31
Frequent	3	1	4
Infrequent	3	4	7
Need based, once	73	28	101
Total	107	36	143

Source: Interview data

As to the communication media, in both local and non-local networks, about 50% of all ties were based on face-to-face contacts (Table 5-24). In both local and non-local networks, the impact of the internet and phone network- on networks was obvious. Computer and telephone extended the relations beyond the locality.

Table 5-24: Communication by Local and Non-local Ties, Number of Ties

	Face to face	**Combination of face to face, e-mail, telephone**	**E-mail, telephone only**	**Total**
Local Ties Total	**55 (50%)***	**39 (35%)**	**15 (13%)**	**109**
Very frequent	17	10	1	28
Frequent	1	2		3
Infrequent	3			3
Need based, once	34	27	14	75
Non-local Ties Total	**16 (44%)****	**16 (44%)**	**4 (11%)**	**36**
Very frequent		3		3
Frequent		1		1
Infrequent		4		4
Need based	16	8	4	28

* % in total number of local network ties
** % in total number of non-local network ties
Source: Interview data

5.4 CONCLUSION

This chapter analyzed the innovation activities and the networking behavior of manufacturing firms in the Ankara region. Specifically, the goals of this chapter were to analyze: 1) the networking behavior of innovative firms, especially the geography of these networks; 2) the characteristics and importance of local and non-local networks; 3) the differences in the networking behavior between firm types defined by size. The rationale behind focusing on this region was to understand the networking behavior in an urban, innovative but a newly industrializing region.

Ankara is a newly industrializing region because the manufacturing sector has always played a secondary role in Ankara, due to its economic specialization in the government services. However, since 1980s the number of manufacturing firms in machinery, defense, electronic, and software have increased (Dede 1999; Tekeli 1994; Eraydin and Armatli-Koroglu 2005). While Ankara ranked fourth in the number of all manufacturing establishments in Turkey, it ranked second in the concentration of engineering industry. In addition, Ankara had an important capacity in the software industry, and contained the 52% of all establishments in the software sector. It can be argued that Ankara has mostly attracted domestic private capital in these sectors in recent years. This was also true for our sample of innovative, interviewed firms that the majority (81%) of them were established by the domestic private capital. However, we can argue that Ankara is still limited in attracting entrepreneurs and spin-offs in the sense that only two companies in our sample were established in Ankara region by entrepreneurs trained outside of the region. It can be argued that government services and public investment, such as Mechanical and Chemical Industry Corporation (MKEK), played an important role in attracting private business sector (Eraydin and Armatli-Koroglu 2005). Similarly, it can be argued that defense industry is the driving force behind engineering and electronic industry in Ankara (Tekeli 1994; Dede 1999). The most important investments in defense industry and the largest defense companies are located in Ankara. We can argue that innovative firms in metropolitan areas, like Ankara, were gathered together there because they were making use of the multiple possibilities provided by the government services as being the capital city, large state-anchored firms and urbanization effects of urban agglomerations. These findings may be contrasted with those of much of the literature on new industrial districts and innovative milieu (Becattini 1990; Porter 1990).

Although large state-anchored firms might dominate the business structure and play an important role in industrial development and innovative capacity, SMEs dominate the region. This was also true for the sample of innovative firms interviewed for this dissertation. This is a worldwide phenomenon, though. As empirical research in Italy (Piore and Sabel 1984) and elsewhere (Scott 1988) showed, many SMEs have been extremely successful to challenges of volatile economic environment and competition. In addition, recent literature emphasized the role of SMEs in the diffusion of innovation. It is argued that flexibly specialized SMEs are the key actors of the innovative clusters (Acs and Audretsch 1988; Herrigel 1993; Humphrey and Schmitz 1995; Kaufmann and Todtling 2000).

Ankara can be characterized as an innovative region. In 2005, Ankara had the second largest share of firms applied for patent and the R&D grant to TUBITAK and TTGV. As to the type of innovation, there was an emphasis on product innovation among the interviewed firms. The most important reasons for innovating were product related strategies, market creation, and standards and regulations. This is in line with the literature. It is argued in the literature that product innovations are in fact usually associated to the creation of new markets or to the quality enhancement of existing products, whereas process innovations are typically introduced for reducing costs, rationalizing or increasing the flexibility and performance of production processes (Edquist, Hommen, and McKelvey 2001; Simonetti, Archibugi, and Evangelista 1995).

The nature of innovation was mostly incremental in Ankara. This is not a surprising finding since it is claimed in the literature that most of innovation activities in developing countries were based on incremental innovation (Kim 1997; Forbes and Weild 2000). Another finding is that a large part of these innovations seems to be based on improvement of existing production processes. The new process innovation was low in the Ankara region. This may restrict the potential for more radical innovations (Kaufmann and Todtling 2000). SMEs and large firms differed in terms of innovation activity. SMEs introduced less process innovation compared to large firms. This finding is in line with the literature. Research argued that process innovation increases relative to product innovation as the size of the firm increases. A large firm invests more in process innovation than a small firm (Yin and Zuscovitch, 1998). It is argued that the composition of firm's R&D portfolios (process vs. product innovation) depends on the firm's initial market share and on the subsequent effects of R&D on the post-innovation market structure ((Acs and Audretsch 1991; Yin and Zuscovitch 1998).

The findings provided interesting insights into the networking behavior and the characteristics of the networks. The results in the Ankara region are in line with the literature in the sense that innovation assumed to be largely dependent on local ties. The reasons mentioned for local ties were proximity and personal knowledge of these organizations. The importance of local networks was true both for SMEs and large size firms. Especially, the results support the previous research that the existence of local networks is vital for SMEs (Maillat 1990). SMEs in

Ankara region had more local ties than non-local ties. This can be explained by the existence of large-state firms and government services to which SMEs had most ties to.

However, results from the Ankara region also revealed some existence of non-local ties both for most SMEs and all large size firms. Therefore, this study extends the local networking hypothesis by adding the existence of non-local networks. In other words, the results from the Ankara region confirm the study hypothesis that *when firms in developing countries introduce technological innovation of products and/or processes, they engage in mixed networks, i.e. local and non-local (interregional and international) networks*. The reasons for non-local networks were the need to access capabilities not available locally.

As to the characteristics of local and non-local networks in Ankara, local networks can be argued as *strong ties* in Ankara based on: 1) larger network size than non-local networks, 2) including more diverse set of organizations than non-local networks, 3) allowing the transfer of non-material or tacit knowledge more, 4) containing more informal ties, and 5) containing more frequent interactions. However, non-local networks ties had similar duration with local networks. Although non-local networks can be considered as weak ties, non-local ties were beneficial as they provided access to novel information and problem solving capabilities. Therefore, we could argue that both local and non-local have qualities that were advantageous for different purposes. Thereby we build on the work of Uzzi (1996, 1997), Hite and Hesterly (2001) and Rowley et al. (2000) who conclude that a key issue in the determination of network benefits is the search for the optimal mix of strong-local- and weak – non-local- ties. In the Ankara case, the optimal mix was more local and fewer non-local ties based on the regional business structure mentioned above.

In the following chapter, I investigate the innovation activities and networking behavior of firms in Istanbul. The interregional perspective should reveal on the ways that innovation relates to space.

CHAPTER 6. INNOVATION ACTIVITIES AND NETWORKING IN THE ISTANBUL REGION

Following the analysis of the Ankara region, the present chapter analyzes the Istanbul region with respect to the innovation activities and networking behavior of manufacturing firms. The Istanbul region is the most developed region and considered as the most innovative region in Turkey (Saral and Celebi 2002). The rationale behind focusing on this region is to understand the innovation process in a core region like Istanbul. The information presented in subsequent sections was derived from interviews conducted with sixty-seven firms in Istanbul. This represents 69% response rate of total ninety-seven firms contacted in Istanbul.

In order to compare the results with the case of Ankara, the analysis undertaken in this chapter follows the same outline in order to provide a reasonable baseline to compare each region's data. Section one focuses on the firm characteristics. The emphasis is given to size, age, location, entrepreneurial background and market structure. Section two examines the innovation activities. Section three reveals the networking behavior of interview firms with an analysis of local/non-local composition and the characteristics of local and non-local networks.

6.1 WHAT ARE THE CHARACTERISTICS OF INNOVATIVE FIRMS IN ISTANBUL?

This section examines the spatial distribution, formation and the market structure of interviewed firms. The sixty-seven firms included firms from three clusters, software, electronics and mechanical manufacturing industries. Table 6-1 shows the sectoral distribution of the interviewed firms. The distribution shows similarities with the Ankara region. The software and electronics firms comprise 37% and 34% of all the interviewed firms. The nature of electronics industry differs between Ankara and Istanbul region. In Ankara, some electronics firms specialize in defense industry, while in Istanbul, some operate in telecommunications industry. While 35% (8) of interviewed electronics firms specialize in telecommunications industry, 40% (10) of electronics firm operate in professional, scientific, measuring and control equipment. The mechanical manufacturing industry comprises 28% of all interviewed firms.

Table 6-1: Sectoral Distribution of Interviewed Firms in Istanbul

Sectoral Distribution	Number of firms	% of total
Software Industry	25	37%
Electronics Industry	23	34%
Mechanical Manufacturing	19	28%
Total Interviewed	**67**	**100**

Source: Interview data

As in the case of Ankara region, the Istanbul sample is dominated by SMEs. Majority (72%) of the interviewed firms are SMEs - firms with fewer than 100 employees (Table 6-2). Table 6-3 shows the distribution of firm size by sectors. SMEs constitute 96% of software and 74% of mechanical manufacturing firms in the sample. However, only 43% of the electronics are SMEs. In general, Istanbul region is dominated by SMEs. Most (90%) of all manufacturing establishments in Istanbul are SMEs (TUIK 2004). The SMEs phenomenon has been observed and documented both in developed and developing countries (Acs and Audretsch 1988; Herrigel 1993; Humphrey and Schmitz 1995; Kaufmann and Todtling 2000).

Table 6-2: Firm Size Distribution of Interviewed Firms in Istanbul

Firm Size*	Number of firms	% of total
Very small (1-9 employees)	8	12%
Small (10-49 employees)	29	43%
Medium (50-99 employees)	11	17%
Large (100+ employees)	19	28%
Total Interviewed	**67**	**100**

Source: Interview data

Table 6-3: Sectoral Distribution by Firm Size in Istanbul, Number of Firms

Sector	Large	SMEs	Total number
Electronics Industry	13	10	23
Software Industry	1	24	25
Mechanical Manufacturing	5	14	19
Total	**19**	**48**	**67**

Source: Interview data

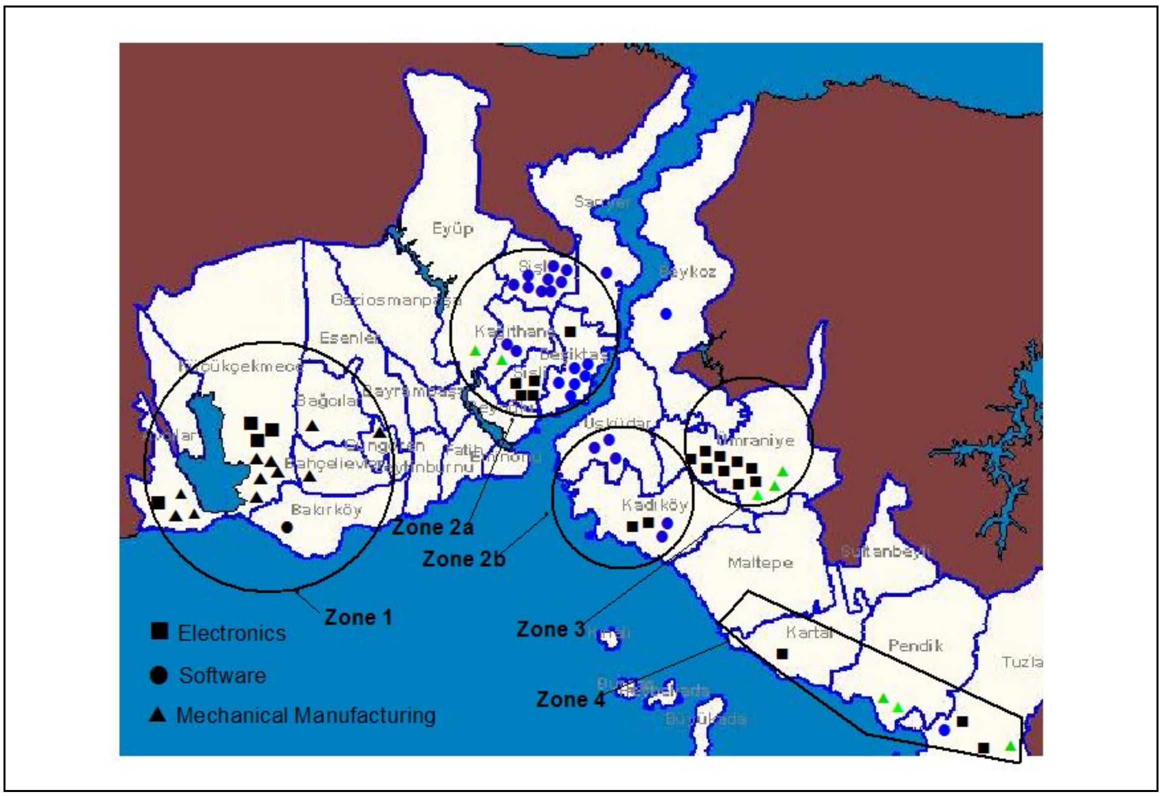
The next section investigates the spatial distribution of interviewed firms in the Istanbul region. The sixty-seven firms are from different agglomerations that have developed in Greater Istanbul region.

6.1.1 The spatial distribution of firms in Istanbul

Of the 67 firms interviewed, sixty-five are located in Greater Istanbul Region **(**Map 6-1). Two firms are located in Gebze but have their offices in Istanbul. Gebze is a town functionally integrated to the Istanbul region. Gebze is a highly industrialized town, containing the important industrial research center of Marmara Research Center (MAM) and several industrial parks established by private and public institutions.

For the firms located throughout the Istanbul region, there is a visible agglomeration activity in four areas: Kucukcekmece-Buyukcekmece-Bagcilar-Bakirkoy-Gungoren-Bahcelievler sub-area (Zone 1); Kagithane-Sisli-Besiktas (Zone 2a) and Kadikoy-Uskudar (Zone 2b) sub area; Umraniye (Zone 3) sub area and linear agglomeration along the Istanbul-Gebze highway that includes Kartal-Pendik-Tuzla cities (Zone 4). Each deserves further explanation.

Map 6-1: Spatial Distribution of Interviewed firms in Istanbul Region



Source: Interview data

The Zone1, Zone 3 and Zone 4 have similar characteristics. All three zones include several industrial parks that were established by state and private industrial associations. Of the 67 firms interviewed in this study, 17 mechanical manufacturing firms, 16 electronics firms and 2 software firms belonged to this agglomeration. The industrial parks in these areas were established in the 1970s and 1980s by the government to relocate industries in the center city such as from Kagithane to sub-urban areas, such as Merter. Zone 1 includes a free trade zone in which one foreign software firm is located. The other software firm is a start-up and a subsidiary of a domestic holding company and located within the campus of the holding. Except for two electronics firms, all of these firms were established in Istanbul originally. Among those 35 firms, twenty-eight firms relocated within Greater Istanbul region. Among the remaining seven firms, only one foreign software firm located in the free trade zone (FTZ) since 2001. FTZs started in 1985 and this particular FTZ was established in 1990. The advantages of the free trade zone were reported as less bureaucracy and tax incentives. Firms in the industrial parks mentioned the local synergies in Istanbul as an influence on their location decision. The availability of infrastructure facilities also attracted many firms. The respondents explained their location in industrial parks as a conscious decision to stay close to the suppliers and subcontractors. The two firms explained their location in Zone 1 and Zone 3 as follows:

> The industrial park had disadvantages during its first years due to the infrastructure problems but now this has changed. We are located next to our suppliers and subcontractors. This is very important for us. (Factory manager, Firm IS-48)

> Communication is easier since other firms and supporting organizations that we need are close. (Assistant General Manager, Firm IS-18)

Other location factors reported by respondents included proximity to major transportation routes, proximity to the Istanbul International airport or port, cheaper land and having all departments in the same location. As two respondents mentioned:

> It is convenient to be located in an industrial zone. We located here for good highway connection. It is close to the airport because we have customers fly in

> and out. Space is large and cheaper. We can expand if we want to. Also, firms in our sector, suppliers and subcontractors are close. (Project Manager, Board of directors president, Firm IS-10)

> It is a new industrial park. The building is just about built and we just moved here. We had two previous locations. Now all departments-production, R&D, marketing, administrative- are located here. By moving here, we have gotten rid of the idle positions. It is a very large space and has an expansion possibility. (R&D Manager, Firm IS-56)

The second sub-regions (Zone 2a and Zone 2b) observable on Map 3 has two different agglomerations. Zone 2a includes two Technology Development Centers (TEKMERs) in two university campuses and a business center. The agglomerations in Zone 2b is in and around the business center. Of the 67 firms interviewed in this research, 23 software firms, 7 electronics firms and 2 mechanical engineering firms are part of these two sub-regions (Zone 2a and 2b). Except for one software and one mechanical manufacturing firm, all other firms were originally established in Istanbul. Twenty firms relocated within Istanbul. Two electronics and one software firms are multi-plant operations. The R&D departments of these firms are located in university campuses, while their production facilities are located in Zone 3.

The Zone 2a contains two TEKMERs in two university campuses – Bosphorus University (BOUN) and Istanbul Technical University (ITU). Five software and two electronics firms' R&D department are located in TEKMERs. TEKMERs are technology development centers located on the university campuses for SMEs, as described in Chapter 4. While ITU-TEKMER was established in 1990, BOUN-TEKMER started its activities in 1997. Both TEKMERs are multi-tenant facilities and managed by the university and KOSGEB. The buildings include good technical infrastructure, such as high-speed internet access, laboratory services and meeting and conference rooms. Interviews revealed that these facilities offered not only cheaper rent and good infrastructure but also the advantage of proximity to university resources including labs, libraries, and students as interns. However, these facilities were leased from the university and not operated as private land. There are, therefore, some limitations for the tenants. As two respondents reported:

> Rent is low. This is a good location for us. We are using the university labs and libraries. We have the advantage of employing graduate students. We have easy access to academic faculty. However, TEKMER is operated by KOSGEB and ITU which a public university so we cannot have our own operation rules. (R&D Manager, Firm IS-19)

> We have all the advantages of being in a university campus: academic expertise, student as intern, libraries, labs, prestigious location but it is far from manufacturing firms located in industrial parks. (R&D Engineer, Firm IS-3)

This sub-region (Zone 2a and 2b) contains two business centers. Istanbul is a polycentric city. Business centers are located in both European and Asian sides of Istanbul. The business center on the European side is Kagithane-Sisli-Besiktas (Zone 2a). The business center on the Asian side is in and around Uskudar and Kadikoy (Zone 2b). Five electronics and eighteen software firms are part of these business center agglomerations. One electronics firm is a multi-plant operation. Its production facility is located in Cerkezkoy. Cerkezkoy is an industrialized, neighboring town which is functionally integrated with Istanbul. Their R&D department is located in this agglomeration.

Evidence suggested that the central location attracts the firms to this area, rather than synergies with other companies. Companies stressed accessibility for their labor force and the need for larger, modern space or prestige of the neighborhood they located:

> We wanted to move our R&D department to our production site in Cerkezkoy. But engineers do not want to leave this location. We could not attract many qualified people when we decided to move to our production site. Most of our employees are local so this is a central location for them. (R&D Manager, Firm IS-43)

> We own this building. It was built recently and designed according to the needs of an IT firm. It is a convenient spot for our workers and customers. It is accessible by public transportation, car, and highway. (General Manager, Firm IS-29)

A small number of firms cited local synergies as an influence on their location. The evidence suggests that they are mostly reliant on producer services, consulting firms or firms in their own sector:

> Although the space is small for us, this site is accessible for our employees. There are many supporting institutions around us and other software firms. (General Manager, Firm IS-31)

In summary, Istanbul has always been the heart of the industrial, financial activities and concentrates social, physical infrastructures and technological activities. Istanbul firms mentioned highly urbanization effects such as being a global city, regional synergies, skilled labor, regional transportation systems, general and specialized business knowledge and information, general financial and training knowledge. Localization effects were also mentioned but not as much as urbanization effects. Some of the most mentioned factors were proximity to suppliers. These findings seem to confirm the results of previous research on innovation (Simmie and Hart 1999; Decoster and Tabaries 1986; Perrin 1988; Harrison 1996). These findings may be contrasted with those of much of the literature on new industrial districts and innovative milieu (Becattini 1990; Porter 1990).

6.1.2 Entrepreneurship and incubation

Domestic capital played an important role in the formation of interviewed firms in Istanbul. As depicted in Table 6-4, most (94%) of the innovative firms in Istanbul were established by domestic capital. As to the type of the founders of domestic firms, the majority (78%) of the interviewed firms began through independent start-up by the owner or a group of individual or family shareholders. 13% of firms (9) were established as a subsidiary of a holding or a joint-stock company. Only 6% of firms (4) in Istanbul were joint ventures with foreign companies at the time of establishment. Three of them started as joint ventures with private domestic firms and foreign companies.

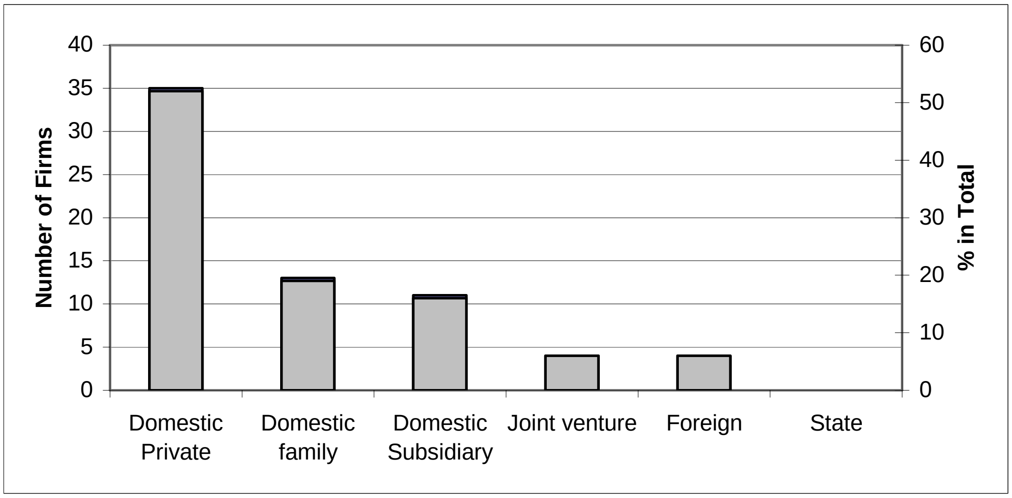
Table 6-4: Ownership Type at the Time of Establishment in Istanbul

	Number of firms	% in total
Only domestic capital	**63**	**94%**
Subsidiary of holding or joint-stock	9	13%
Family	12	18%
Private (individual or group of individuals)	40	60%
State	2	3%
Foreign capital	**4**	**6%**
Joint Venture, private domestic & foreign	3	4%
Joint Venture, state & foreign	1	1%
Total	**67**	**100**

Source: Interview data

Did the ownership structure change? Interview evidence showed that the ownership structure changed in some interviewed firms (Figure 6-1). Two locally founded firms became joint ventures with foreign companies in 1995 and 1998. A state company and two joint ventures were acquired by foreign companies in 2001 and 1998. Lastly, with the transfer of foreign partners' share to domestic firm, one joint venture firm started to operate as a subsidiary of a domestic holding.

Figure 6-1: Ownership Type Today, Istanbul



Source: Interview data

Founders came from diverse backgrounds. As Table 6-5 shows, majority (81%) of all founders had a degree in engineering. 92% of all founders were university graduates. The principal founders of two firms had academic positions at local universities –Bogazici and Yildiz Technical University- before establishing their business venture. Most (73%) of the principal founders were local university graduates. 14% of principal founders are from Ankara, 3% from Izmir and 12% are from other countries. The principal founders of two firms have PhDs and held academic positions at a foreign university before establishing their business venture in Istanbul. One of the founders still holds an academic position at a local university.

Table 6-5: Background of Founders in Istanbul

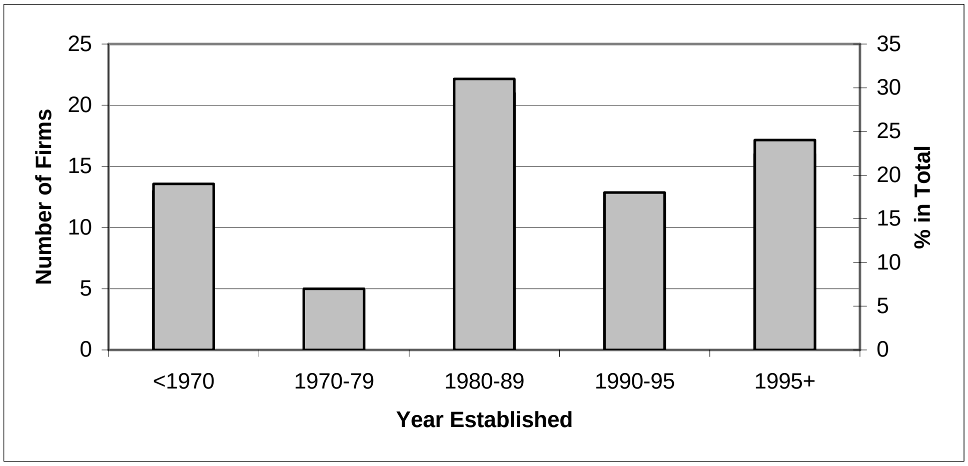
	Number of founders	% of total
Majors		
Engineering	96	81
Business Administration	5	4
Economics	1	1
High School	9	8
Psychology	1	1
Science	6	5
Degree		
Master's	14	12
PhD	8	7
Undergraduate	87	74
High School	9	8
Place of training		
Istanbul	86	73
Ankara	16	14
Izmir	2	2
Other countries	14	12

Source: Interiew data

It is observable from Figure 6-2 that two periods played an important role in the formation of interviewed firms, 1980-89 and after 1995. Five interviewed firms were established during the economic crisis of 1970s. The average age of firms is 22 years. The firms established before 1980, was private firms. It can be argued that private rather state firms played an important role in the industrial development of Istanbul region.

The interview data suggest that Istanbul has been an attractive location for entrepreneurs. The preference of the entrepreneurs to remain part of the Istanbul region served to keep ventures local or attract entrepreneurs from other regions. Contrary to Ankara, respondents frequently mentioned the existence of a critical mass of manufacturing companies and business services as one of the reason to be located in Istanbul.

Figure 6-2: Distribution of Age of Interviewed Firms in Istanbul



Source: Interview data

6.1.3 Geography of markets

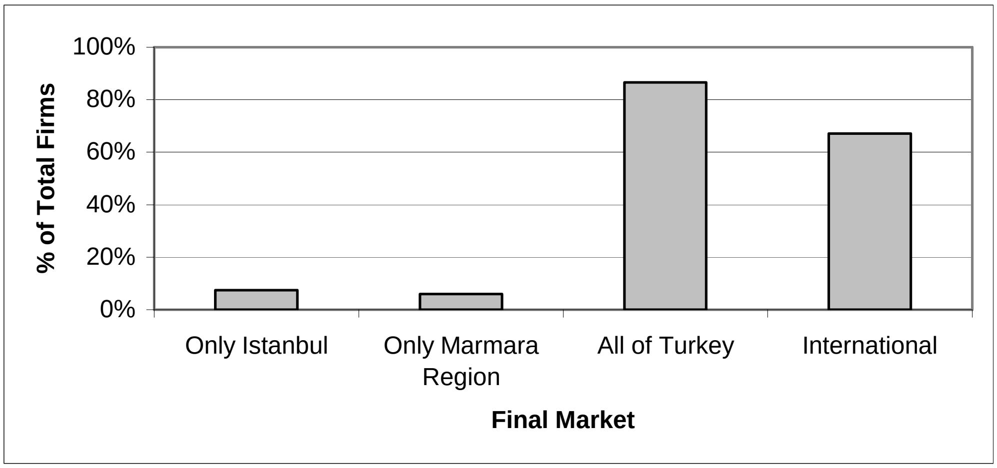
The geographic distribution of sales is illustrated in Figure 6-3. The most important markets for the Istanbul firms were the nationwide and international markets. Majority (87%) of all firms reported sales in Turkey. Istanbul or Marmara as a market orientation was irrelevant for most of the firms. Only five firms (7%) reported sales only in the Istanbul and the Marmara region.[16] All these five firms are software companies.

Similarly, 67% of all firms reported that they operated in international markets. The market distribution of international sales was found to be highly diverse, with customers in Europe, Middle East, and Central Asia. As the Figure 6-4 illustrates, the European market is the most important market for the firms. The same reasons mentioned in Chapter 5 apply to the

[16] After the 1st Geography Congress held in Ankara in 1941, Turkey was divided into seven regions. These geographical regions were separated according to their climate, location, agricultural diversities, transportation, topography and so on. At the end, 4 side regions and 3 inner regions were named according to their neighborhood to the four seas surrounding Turkey and positions in Anatolia. Most of the cities' borders are within the territory of a single region. Istanbul is located in the Marmara Region which is the most industrialized region in Turkey. Please see Chapter 4.

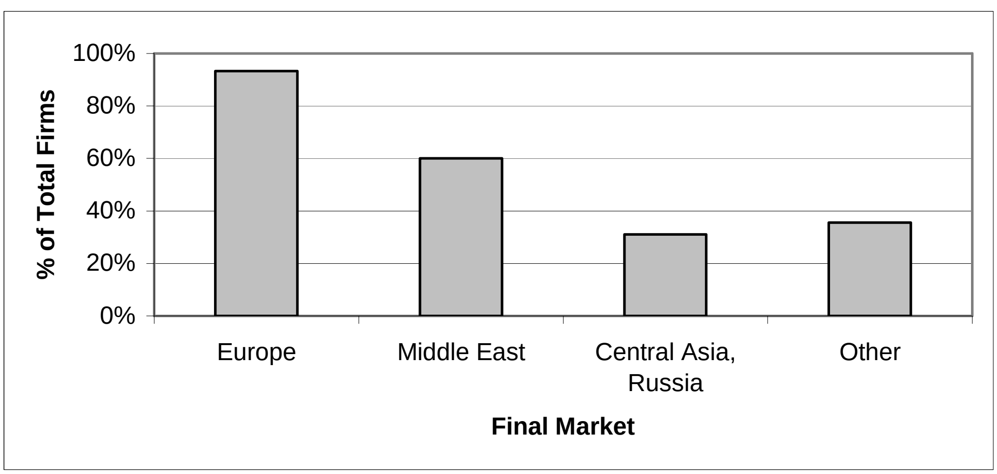
Istanbul region. Not only Europe is the closest markets but also the custom union agreement in 1995 has been an important motivation for most of the firms to enter to the European market.

Figure 6-3: Geographic Distribution of Sales, Istanbul



Source: Interview data

Figure 6-4: International Distribution of Sales, Istanbul



Source: Interview data

6.2 THE LEVEL OF INNOVATION ACTIVITIES IN ISTANBUL

In this section, the innovation activities of Istanbul firms were examined. The section begins with a brief account of historical development of the interviewed firms in Istanbul. This is followed by the examination of type of innovation activities among firms and an investigation of internal corporate strategy, with particular attention paid to the innovation process and the reasons for innovating.

6.2.1 Historical development of firms in Istanbul

This section provides an overview of historical development of interviewed in the Istanbul region (Table 6-6). How did the interviewed firms adapt to changes in technical conditions and economic environment of the region and the country? These changes were analyzed according to four functional capabilities described in Chapter 2: investment, production, innovative, and marketing (Westphal, Rhee, and Pursell 1984; Lall 1992; Ernst, Ganiatsos, and Mytelka 1998; Mytelka and Ernst 1998).

Before 1970s, Istanbul region was mostly characterized by the companies which were private capital or joint ventures. Only two firms, which are private now, were established by the state as the R&D lab in telecommunications. Products were aimed at local demand following import substitution policies in Turkey at that time. Most of the interview firms established in this period can be considered *innovative* for their time, although manufacturing technology was mostly based on licensing agreement with foreign companies. For example, Firm IS-66 was the first producer of household durable goods in Turkey. Firm IS-50 was the first producer of welding electrodes in Turkey. Firm IS-53 was the first producer of plastic injection machines.

All three firms had started as contractors or importers in 1950s. However, by the end of 1950s, all of these companies had built their own factories and started production.

Table 6-6: Historical Development of Interviewed Firms in Istanbul

	Before 1970	**1970-1980**	**1980-1990**	**1990-2004**
Firms established	13	5	21	28
Ownership	Mostly private, some joint ventures, two state firms	Private	Private	Private
Firm size	Mostly Large	Mostly Large	Mostly SMEs	SMEs
Sector	Mechanical manufacturing, electronics mostly telecommunications	Electronics	Electronics, software	Electronics, software, and mechanical manufacturing
Investment Capability	Full ability to identify, prepare new projects	Full ability to identify, prepare new projects	Full ability to identify, prepare new projects	Full ability to identify, prepare new projects
Production Capability	Full capability	Full capability	Full production	Full production
Innovative Capability	Licensing agreement but new products and process for the local market	New products for the local market, investment in technologies, modernization	New products, R&D depts.	New products, R&D depts., quality certificates
Marketing Capability	Local market	Mostly local market, limited international market	Local and international market	Local and international market

Source: Interview data

Although general economic hardship hindered most of the industrial activity in the period between 1970 and 1980, firms established in this period or before expanded their operational size and capital. For example, Firm IS-66 operated multiple plants in this period. Most of the interviewed companies in this period relocated within Istanbul region in order to expand their production facilities. Again, some of these companies produced goods that were new to the Turkish market. For example, Firm IS-43 produced the first black and white TVs in Turkey. Firm IS-61 produced the first power electronics products in Turkey and also started to export by the end of 1970s. Also, it was in this period, most of the interviewed firms started exporting.

After 1980, number of domestic firms increased in Istanbul and Turkey in general. This was the period of which export-oriented and structural adjustment policies were adopted. 31% (21 firms) of interviewed firms in Istanbul were established in 1980s. By the 1980s, all firms established before 1980 had started exporting activities. Because of the changes in the conditions both inside and outside of the country, most of the firms established before 1980 were making organizational changes to become competitive in domestic and international market. The most important ones were changes in their marketing organization and the expansion in their products line and establishment of R&D departments in these companies. The intention was to improve their products while establishing different marketing strategies. For example, Firm IS-30 set up a nationwide distribution network for the coordination of sales and post-sales servicing of tractors. Firm IS-43 exported colored TVs. It was also in this period the software sector grew.

Domestic capital was again dominant in the interviewed firms established after 1990. R&D and quality control activities increased. Almost all firms updated their products and/or processes every three to five years to compete locally and internally. Almost all interviewed companies (87%) have R&D departments. And almost all of the firms received ISO 9001, the international quality certificates.

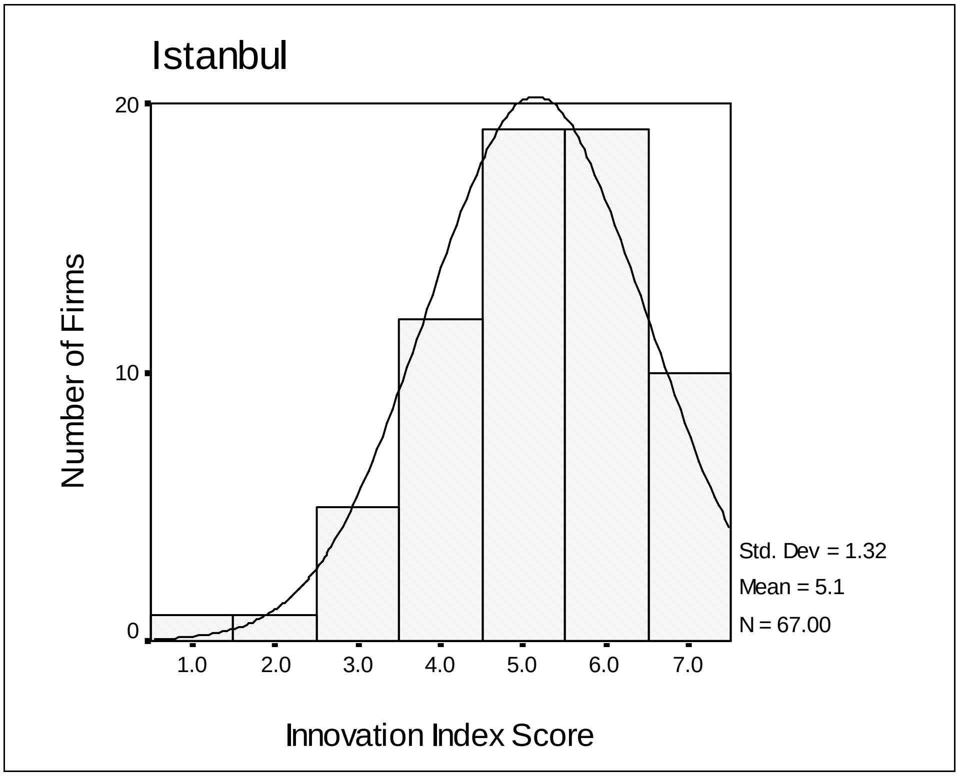
In summary, the capabilities of Istanbul firms were influenced by inside and outside dynamics of the country and region over time. They were able to integrate and reconfigure their internal and external strategies to address rapidly changing environments given the market and macro economic conditions of the region and country. The next section discusses the innovation activities of interviewed firms today.

6.2.2 The Level of innovation activities in Istanbul

How extensively do firms in the Istanbul region engage in innovation? In Istanbul, the innovation index ranges from 1 to 7. The mean innovation index in Istanbul is 5.1 with a standard deviation of 1.32. The majority (75%) of interviewed firms have the score between 4 and 6. Two firms with low innovative capability scores (1 and 2) were a MNC and a joint venture firm. Both firms stated that they did not develop any products or processes in their branch in Istanbul (Figure 6-5).

How innovative are the firms in Istanbul regarding product and process innovation? As Table 6-7 shows, Istanbul firms mostly engaged in product innovation than process innovation. Although 76% of firms mentioned that they introduced process innovation, it is less than product innovation. This difference is statistically significant at 1% level.

Figure 6-5: Innovative Index, Istanbul



Source: Interview data

Table 6-7: Innovations in Istanbul

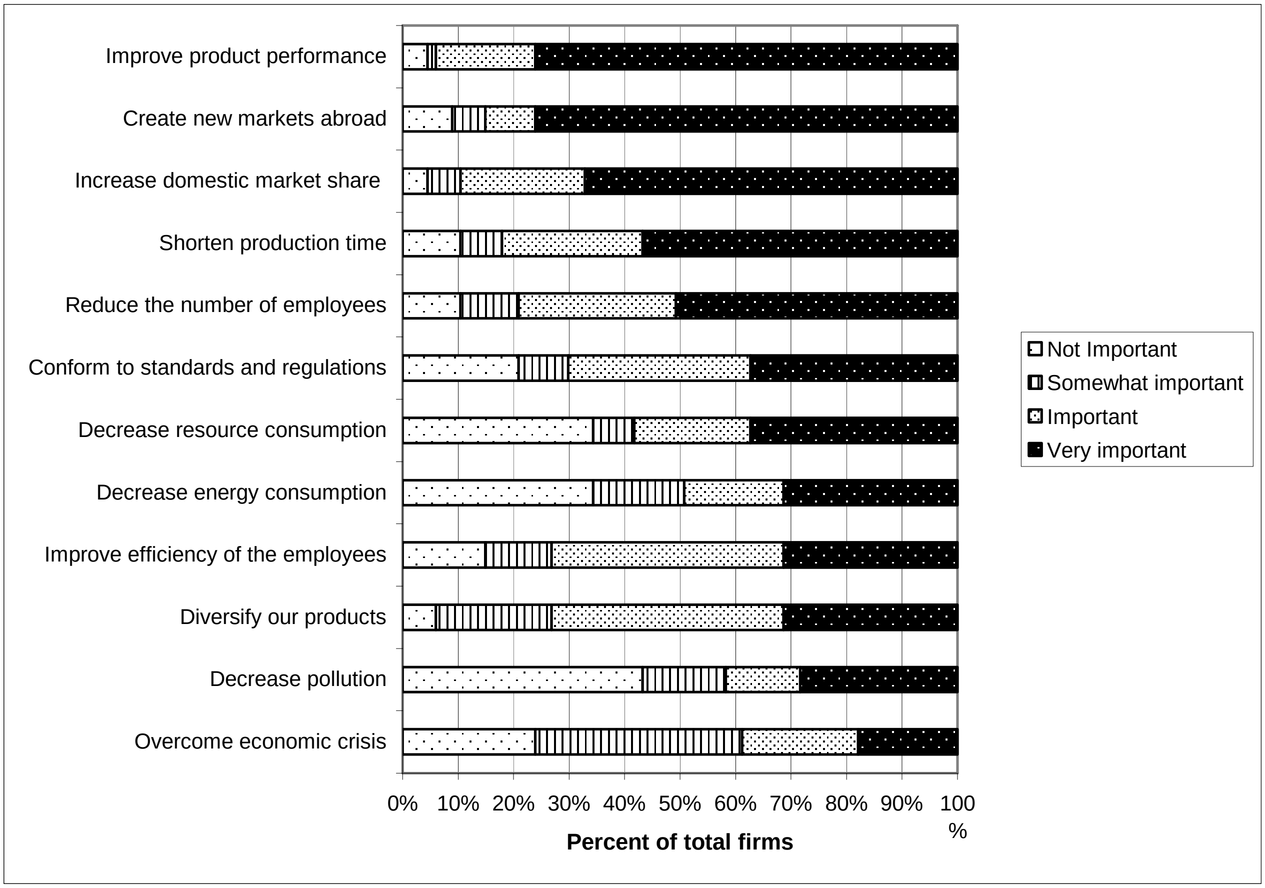
	Total (67)		p-value
	Num	%	
Product Innovation	66	99%	0*
Process Innovation	51	76%	
Product improvement	64	95%	0*
New product	49	73%	
Process improvement	48	71%	0*
New process	24	36%	

*Significant at 1% level
Source: Interview data

As to the novelty of the innovation, incremental innovation in terms of improvement in product and process was higher than products and processes new to the firm or market. Most (95%) firms improved their products. Majority (73%) of the firms claimed that they launched new products that were either new to the firm or the market they serve. The difference between improved and new product innovation is statistically significant at 1% level. Similarly, the process improvement was reported by the majority (71%) of the firms. However, the production process, new to the firm or the market, was reported by only 36% of firms. Again, the difference between improved and new product innovation is statistically significant at 1% level. This is not a surprising finding since it is claimed in the literature that most of innovation activities in developing countries were based on incremental innovation (Kim 1997; Forbes and Weild 2000).

The high innovation activity in products can be explained by the market and product related reasons. As Figure 6-6 shows, the product related reasons were the most important for innovation activities. Most (76%) firms innovated to improve the performance of their product. The market strategies were the second important reason for innovation activities. Most firms (76%) stated that creating new markets abroad and increasing the domestic market share were very important motivations (Figure 6-6). Productivity related reasons such as shorter production time and less number of employees were stressed by the half of the firms. Conforming to standards and regulations as a motivation for innovation was very important for only 37% of the firms. These results are in line with the literature where product innovations are usually associated to the creation of new markets or to the quality enhancement of existing products, whereas process innovations are typically introduced for reducing costs, rationalizing or increasing the flexibility and performance of production processes (Edquist, Hommen, and McKelvey 2001; Simonetti, Archibugi, and Evangelista 1995).

Figure 6-6: Reasons for Innovation Activities, Percent of Total Firms in Istanbul



Source: Interview data

Do SMEs and large firms differ in the type of innovation activities carried? SMEs and large firms differed in the process innovation (Table 6-8). Especially large firms introduced more improvement in product process than SMEs. This result is significant at the 5% level. This supports the claim in the literature where the process-related innovation increases with the size of the firm due to their initial market share (Yin and Zuscovitch 1998). Data also provided evidence to conclude that a difference exists between SMEs and large firms in patent applications.

Table 6-8: Type of Innovation Activities in Istanbul

	SME (48)		**Large (19)**		**p-value**
	N	**%***	**N**	**%****	
Product Innovation	48	100%	18	95%	0.950
New product	36	75%	13	68%	0.591
Product improvement	46	96%	18	95%	0.848
Process Innovation	39	81%	12	63%	0.166
New process	15	31%	9	47%	0.221
Process improvement	31	65%	17	89%	0.017****
Investment in new technologies	47	98%	18	95%	0.498
Patent application	19	40%	12	63%	0.083***
Hired technical staff	47	98%	17	89%	0.275

Source: Calculated from survey data
* % in Total Number of SMEs
** % in Total Number of Large firms
*** 10% significance level
**** 5% significance level

6.2.3 Internal organization of innovation activities

This section focuses the internal organization of innovation process and the technological strategy, i.e. adaptation, applied research or basic research. Of the sixty-seven firms interviewed, 20% of the firms (14) stated that specific customer demands drove innovation decision (either in the form of improvement or a new product). Two of these firms did not have a R&D department. The innovation process was hierarchic in nine of these firms. As the respondents explained:

> Customers come up with a list of new things. It is not a new product but improvement in the existing products. We have P&D (Product development) not R&D. This is partly because our sector is new. Domestic demand is weak and not enough for us to do R&D. We need a strong market to produce a new product. Also, since this is a new sector in Turkey, our suppliers industry is not developed well enough yet. So, we can't take advantage of their experiences since they have limited experience. (Firm IS-61)

> Improvement decisions come from customers. We evaluate whether we can do it or not but 95% of the time we can do it. However, we have to keep our technology, machine and equipment up-to-date. (Firm IS-64)

> We sometimes encounter totally new products due to our customers needs. In order to meet their demands, we continuously renew our production process. (Firm IS-52)

> Depends on the stage of production but once the business analysis regarding the market potential is done, we are open to any feedbacks at the production stage. We develop the *concept map* and test with the R&D and production engineers. Then we take this to outside of our company, mostly academics and customers, to get some feedbacks. (Firm, IS-67)

80% of the interviewed firms (53) stated that the combination of in-house ideas, market trend analysis and technological development together influenced their decision to innovate. Five of these firms don't have an R&D department. Production and R&D are performed together. The innovation process was hierarchical and is led by the general manager, with market trends passed down to development and production.

Table 6-9: Innovation Process in Istanbul, Number of Firms

Innovation Process	R&D Dept	No R&D dept	Total
Customer demands drive innovation	12	2	**14**
In-house and marketing together	48	5	**53**
Total	**60**	**7**	**67**

Source: Interview data

Of the remaining forty-eight firms, all of them have R&D departments. In most cases, firms stated that R&D departments or "project team" (in the case of no R&D departments) interacted closely with their marketing and production department. In most cases, there were no clear departmental boundaries between R&D and production units. As respondents explained:

> We receive feedback from four sources: Global trends, market trends, from our R&D department and customer needs. We have to know the global trends because we compete with foreign companies in big or government related projects. (Firm IS-40)

As to the technological strategy, 37% (25) of firms licensed in the platform technology on which their main product based. This group includes all the foreign and joint-venture companies. In house innovation was initiated at the prototype development. For example, firm IS-54 was established as a subsidiary of a construction company. They specialized in wind power technology and produced wind turbines. The firm licensed in its first product from a company in Denmark which is the pioneer in wind power technology. Full scale production and marketing had been performed in house. In five years, the firm decided to make changes to the first turbine according to domestic conditions and produce a new turbine with new features.

For the remaining 42 firms, in-house innovation started at the applied research and product development phases of the innovation process. For most firms, this involved reverse engineering, or developing products according to customer needs or research areas that needs to be filled or adopting new standards. Only two firms started at the basic research phase of the innovation process.

As to the use of patents in the investigated firms, 46% (31 firms) applied to patent their innovations. 65% of those patented their innovation in Europe and USA. As in the case of Ankara, the software firms stated that they could not patent their software products because Turkish Patent Institute (TPI) does not give patents to the software products in Turkey. The lack of patenting in software industry was also the case in the US until 1994 (Bessen 2004). Some firms also consider the process long and expressed their lack of trust in this instrument.

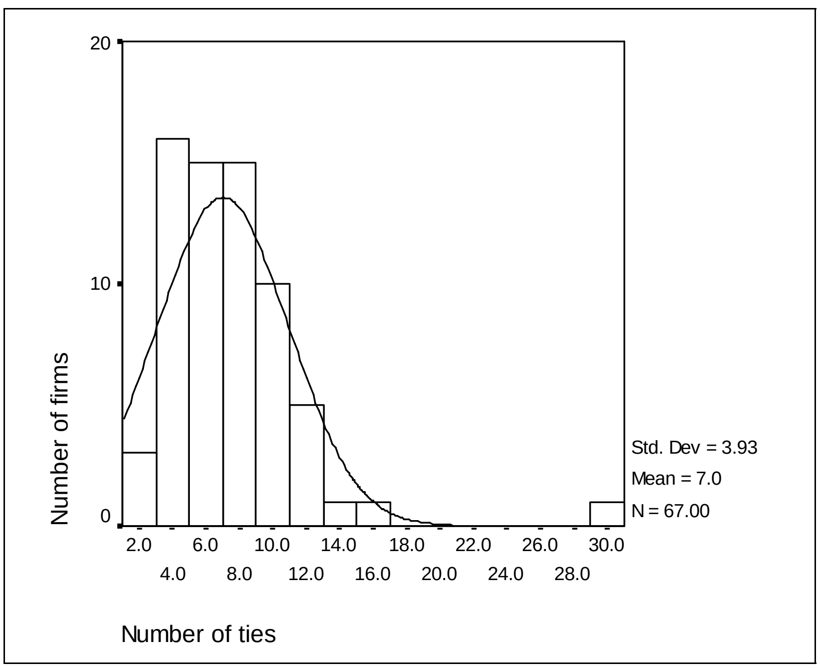
6.3 NETWORKING: EXTERNAL ORGANIZATION OF THE INNOVATION PROCESS IN ISTANBUL

This section investigates the networking behavior of interviewed firms in Istanbul. The first part investigates whether firms in Istanbul interact with other firms and organizations when they develop products or processes. In addition, it examines the geography (local vs. non-local) and size of these innovation ties. The second part compares the characteristics of networks at the local and non-local level in order to analyze whether the region can be considered a nurturing environment for the innovation process.

6.3.1 Innovation ties and their geographic boundaries in Istanbul

To what extent do innovative firms in Istanbul interact with other firms and organizations? All the interviewed firms in Istanbul had ties when innovating (see Figure 6-7). Collectively, sixty-seven firms mentioned a total of 470 significant ties. 69% of the firms had innovation ties between 5 and 15 when developing products or processes. While 28% of the firms stated having less than 5 ties, a few respondents (3%) indicated that their firms have more than 15 ties. The overall mean network size is about 7 in Istanbul. The results show that the interviewed firms in Istanbul had innovation ties. All sixty-seven firms interacted with organizations when developing products or processes. This finding confirms the claim that innovation is an interactive process and created and sustained by inputs derived from interacting with other firms and organizations (Lundvall 1992).

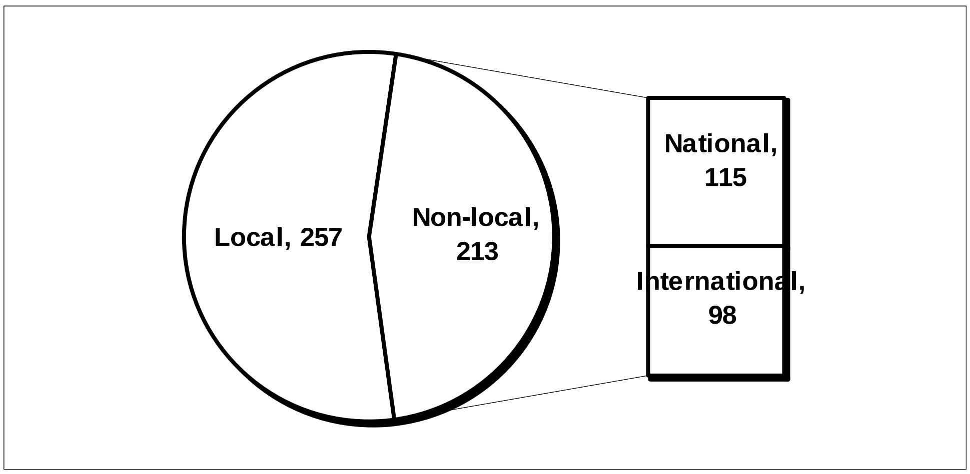
Figure 6-7: Overall Number of Network Ties When Firms Innovate



Source: Interview data

What are the geographic boundaries of these innovation ties? Of 470 total numbers of ties, 257 of them (55%) were local ties in the Istanbul region and 213 (45%) were non-local ties outside of the Istanbul region (Figure 6-8). Of these 213 non-local ties, 54% of them were to another city in Turkey, while 46% were to international organizations and firms. Therefore, according to these results, the networks drew both on local and non-local ties. In Istanbul, we can not argue that innovation were dependent on largely on local network ties. Did all the firms have local and non-local ties?

Figure 6-8: Geography of Innovation Network Ties, Number of Ties by Geography



Source: Interview data

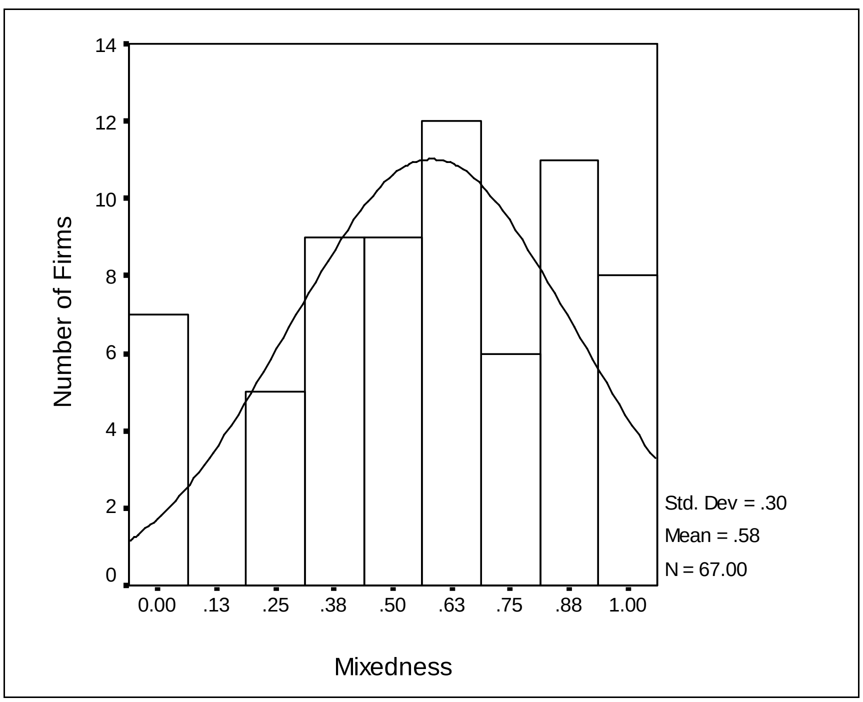
Table 6-10 presents data on the size of firms' networks, i.e. the number of ties of firms and the geographic distribution of network ties. The mean local and non-local network sizes are not statistically different: respondents cited a mean of 4 local ties and 3 for non-local ties (Table 6-10). Most of the firms (90%) in Istanbul stated that they have mixed ties, i.e. both local and non-local ties (Figure 6-9). In order to calculate the degree of local and non-local composition, the mixedness score was used as described in Section 3.3.4. If the mixedness score is different than zero, then the total network of a firm is considered mixed.

Table 6-10: Distribution of Network Ties in Istanbul, All Firms

Number of Ties	Istanbul Firms			
Local ties (N=257)	**Number of firms**	**% of total number of firms**	**Tie statistics**	**p-value**
0	5	7%	**Mean** = 4 **SD** = 3	0.139
<5	40	60%		
5-9	20	30%		
10-14	2	3%		
Non-local ties (N=213)				
0	2	3%	**Mean** = 3 **SD** = 2	
<5	52	78%		
5-9	11	16%		
10-14	1	1%		
15+	1	1%		

Source: Interview data

Figure 6-9: Geographic Mixedness of Total Networks of Interviewed Firms in Istanbul



Source: Interview data

The network size and the geographic composition of ties differed between SMEs and large firms. The data in Table 6-11 shows that SMEs' local network size was larger than non-local. This is statistically significant at 10%. Moreover, the citation of both local and non-local networks dropped with the size of the firms. However, except for one SME, all SMEs had non-local ties. At the 5% significance level, the data provide evidence to conclude that, in Istanbul, SMEs had less number of ties than the large firms. This is true for the local, and non-local networks. However, most SMEs and large firms (90%) stated that they had mixed ties, i.e. both local and non-local ties. The mean mixedness score does not differ statistically between SMEs and large firms (Table 6-12).

Table 6-11: Distribution of Network Ties in Istanbul, by Firm Size

Number of Ties	**SMEs*** **			**Large**			**t**	**p**
All ties	**Number of firms**	**%**	**Tie statistics**	**Number of firms**	**%**	**Tie statistics**		
0	0	0%	Mean=6 SD=2	0	0%	Mean=9 SD= 6	3.39	0.001*
<5	17	35%		2	10%			
5-9	27	56%		10	53%			
10-14	4	8%		5	27%			
15+	0	0%		2	10%			
Local ties								
0	4	8%	Mean= 3.4 SD=2	1	5%	Mean=5 SD= 3	2.07	0.042**
<5	30	63%		10	53%			
5-9	13	27%		7	37%			
10-14	1	2%		1	5%			
Non-local ties								
0	1	2%	Mean =2.6 SD=2	1	5%	Mean= 5 SD= 4	2.86	0.006*
<5	41	85%		11	58%			
5-9	6	13%		5	26%			
10-14	0	0%		1	5%			
15+	0	0%		1	5%			

Source: Interview data

*1% significance level, ** 5% significance level. ***SMEs' local and non-local network size is different at 10% significance level.

Table 6-12: Comparison of Mixedness Score by Firm Size

	Total	SMEs	Large	t	p**
Number of firms	67	48	19		
Number of firms, Mixedness > 0	60 (90%)	43 (90%)	17 (90%)		
Mean mixedness	0.58	0.59	0.57	-0.26	0.793
Standard deviation	0.30	0.31	0.31		

** At the 5% significance level
Source: Interview data

Why are the reasons for local and non-local network ties? Firms mentioned several reasons which are shown in Table 6-13 and Table 6-14. Three most cited reasons for the ties with local organizations were: 1) satisfaction with the interaction patterns and routines, 2) helpful in the sense that these ties further the goals of the firm, and 3) personal knowledge of ties.

Table 6-13: Reasons for the Ties with Local Organizations in Istanbul

	Number of times mentioned
Satisfaction	37
Helpful	36
Knows personally	36
Responsiveness	22
Best in TR	19
Proximity	19
Familiarity	16
Technological compatibility	13
Goal congruence	13
Group firm	11
Obligation	11
Lack of choice	9
Low prices	6
Problem solving	4
Prestigious	3
Good references	2

Source: Interview data

As to the ties with non-local organizations, three most cited reasons were: 1) higher expertise levels of these ties, 3) the best in their area and 3) goal congruence in the sense that there is an agreement on mutual goals for interaction on their R&D projects.

Table 6-14: Reasons for the Ties with Non-local Organizations in Istanbul

	Number of times mentioned
Expertise	63
Best in its area	28
Goal congruence	27
Lack of choice	18
Satisfaction	16
Group firm	13
Prestigious	11
Responsiveness	9
Technological compatibility	6
Proximity	5
Obligation	5
Problem solving	5
Knows personally	2
Familiarity	2
Good references	1
Satisfaction	1
Utilize the capabilities we lack	1

Source: Interview data

In summary, these results showed that the interviewed firms in Istanbul had ties for their innovation activities. All sixty-seven firms interacted with organizations when developing products or processes. This finding confirms the claim that innovation is an interactive process and created and sustained by inputs derived from interacting with other firms and organizations (Lundvall 1992).

Second, interesting finding is that innovation activities of Istanbul firms did not largely dependent on local ties, but both on local and non-local ties. The reasons for local ties were based on personal knowledge, helping in furthering their innovation goals and satisfaction in working with these local organizations. On the other hand, non-local ties provided best knowledge in their area and expertise needed for their innovation activities. All territorial innovation models mentioned in Chapter 2 emphasized the local networking as an organizational mode in the innovation process(Storper 1997; Porter 1990; Maskell and Malmberg 1999b; Camagni 1991). Therefore, this study extends the local networking hypothesis by adding the existence of non-local networks. In other words, the results from the Istanbul region confirm the study hypothesis that *when firms in developing countries introduce technological innovation of products and/or processes, they engage in mixed networks, i.e. local and non-local (interregional and international) networks*. This was true both for SMEs and large size firms in Istanbul.

Third, both local and non-local network size was smaller for SMEs compared to large firms. Moreover, SMEs had more local networks than non-local networks. The results support the previous research that the existence of local networks is vital for SMEs (Maillat 1990). However, in most cases SMEs took advantage of the availability of non-local sources when local resources proved inadequate. However, large domestic firms were more skilled at building long distance, non-local ties. About 90% of interviewed SMEs and large firms in Istanbul stated that they had both local and non-local ties when developing products or processes. Overall these descriptive figures suggest that innovation ties in Istanbul were widespread. They are not small, and draw on mixed (local and non-local) ties. The next section will look at the characteristics of local and non-local ties.

6.3.2 What are the characteristics of local and non-local networks?

The previous section reflected the existence of the network ties in Istanbul and also showed that innovative firms not only use local ties but also non-local ties when developing products and processes. This section examines the characteristics of local and non-local networks to understand their roles and importance for the innovation process. Five indicators will be used to describe the local and non-local network structures: diversity, multiplexity, durability, formality and the communication frequency.

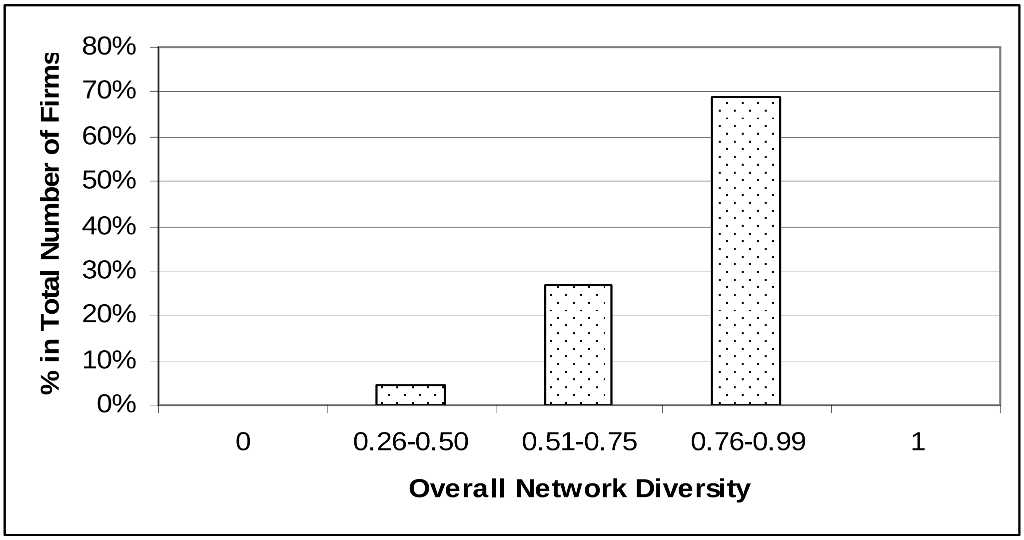
6.3.2.1 Diversity of local and non-local networks

This section examines the network diversity (D) in Istanbul. In other words, how many different types of organizations do exist in local and non-local networks of interviewed firms? The calculation of diversity was explained in detail in Chapter 3, Section 3.3.4.

The distribution of overall network diversity is shown in Figure 6-10. Interviewed firms in Istanbul had diverse set of organizations in their overall network. Majority of the firms (70%) had overall network diversity between 76% and 99%. The distribution of local and non-local network diversity showed similarities (Figure 6-11). Majority (70%) of the interviewed firms mentioned different types of organizations in their local and non-local networks. While 69% of firms had local network diversity between 51% and 99%, 73% of firms had non-local diversity between 51% and 99%. The mean local and non-local diversity is not statistically different at 5% level.[17] Few (20%) of firms stated that they had only one type of organization in their non-local networks.

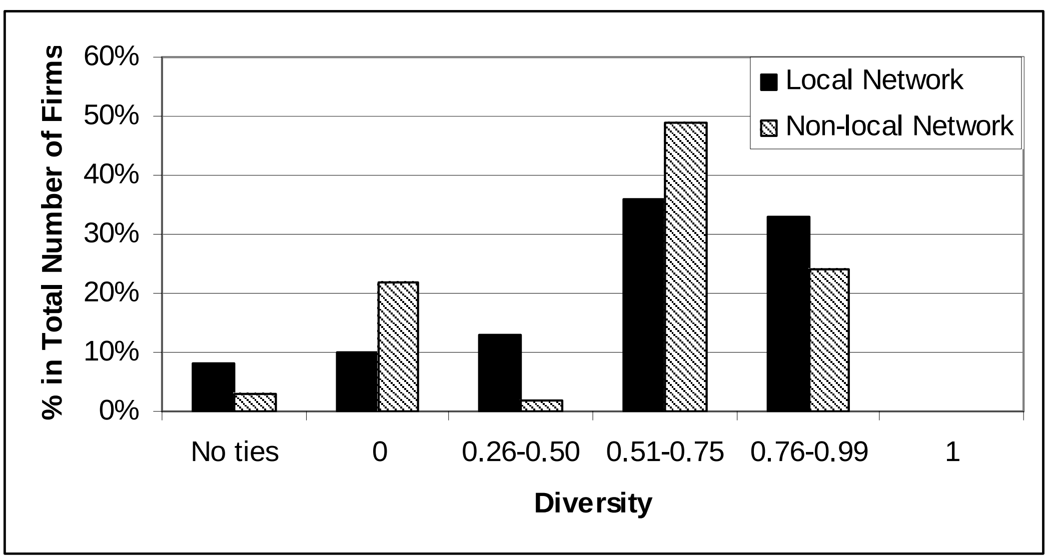
[17] T score=1.259, p = 0.213

Figure 6-10: Overall Network Diversity



Source: Interview data

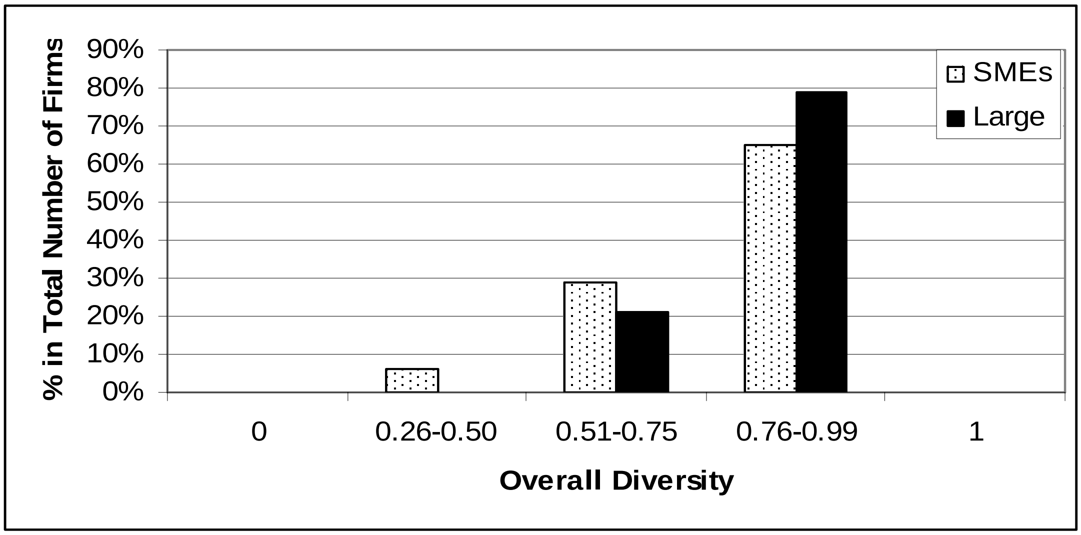
Figure 6-11: Local and Non-Local Network Diversity in Istanbul



Source: Interview data

Does the network diversity differ among subgroups defined by the firm size? Overall network diversity does not differ between SMEs and large firms (Figure 6-12). Most of SMEs (95%) and all large firms had diverse set of organizations in their overall innovation networks.

Figure 6-12: Overall Network Diversity by Firm size in Istanbul



Source: Interview data

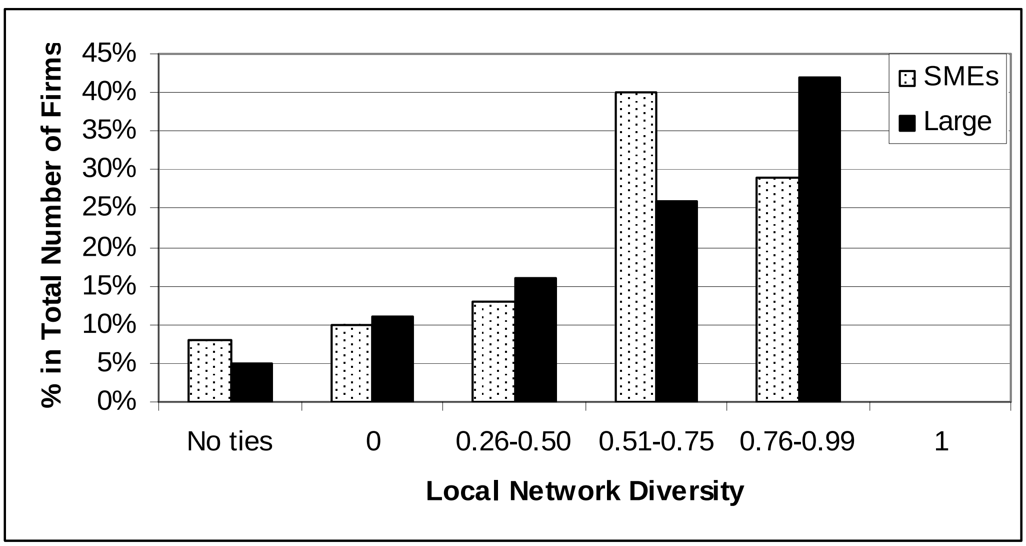
The mean overall network diversity between SMEs and large firms is not statistically different (Table 6-15). This is also the case for local network diversity. The mean local network diversity is not statistically different between SMEs and large firms. As it is depicted in Figure 6-13, majority (70%) of SMEs and large firms had diverse set of organizations in their local networks. However, SMEs and large firms differ in terms of non-local network diversity (Figure 6-14). This result is statistically significant at 5% level. Large firms had more diverse set of organizations in their non-local network diversity than SMEs.

Table 6-15: Mean Network Diversity by Firm Size in Istanbul

	Firm Size	Mean	Std. Deviation	t score	p
Overall Network	All	0.78	0.13		
	SMEs	0.77	0.13	1.188	0.239
	Large	0.81	0.12		
Local Network	All	0.61	0.26		
	SMEs	0.60	0.26	0.362	0.719
	Large	0.63	0.27		
Non-local Network	All	0.54	0.32		
	SMEs	0.49	0.32	2.088	0.041*
	Large	0.67	0.27		

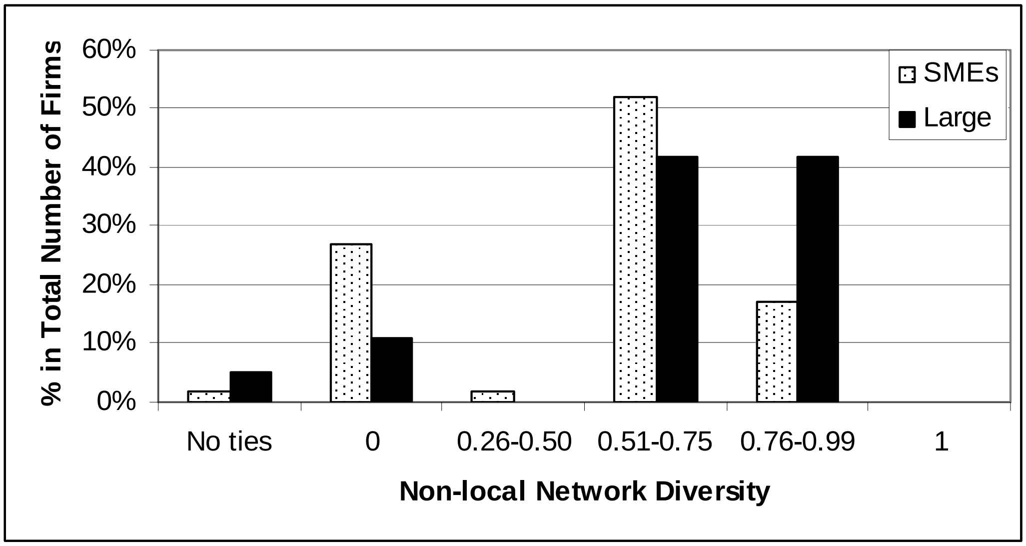
Source: Interview data
5% significance level

Figure 6-13: Local Network Diversity by Firm Size in Istanbul



Source: Interview data

Figure 6-14: Non-local Network Diversity by Firm Size in Istanbul



Source: Interview data

The interview data suggest that the variability in organizational composition of network members is different in local and non-local networks for SMEs. What kind of organizations do innovative firms have in their local and non-local networks? Table 6-16 shows the type of organizations contacted. In the overall network, universities ranked first, suppliers second, and professional association rank third. Ties with government agencies and customers ranked fourth and fifth. As in the case of Ankara, most firms stated that professional associations provided helpful information about their sector, changing standards, and possible project partnerships. As in the case of Ankara, Istanbul firms mentioned TESID and its technological innovation award which helped to advertise firms. Firms also cited KALDER (Turkish Society for Quality) which provided information about total quality management and changing standards. The results obtained are similar to the findings reported by SIS but ranking is different. TUIK nationwide survey revealed that customers, suppliers, and universities were the first three important partners in innovation (TUIK 2004). The difference may be related to the sample of the TUIK study which is not regional but nationwide.

Table 6-16: Types of Organizations by Local and Non-local Networks in Istanbul

Types of Organization	Number of Ties				
	Local	Non-local			Total
		National	European	Global	
Universities	56	15	3	1	75
Suppliers	43	3	14	15	75
Professional Assoc	53	8	6	3	70
Government agencies	27	40			67
Customers	14	15	6	2	37
Providers of funding/financing	1	30	3		34
Consultants	18	1	7	4	30
Research Institutions	11	1	10	3	25
Competitors	8	1	9	3	21
Training institutions	13		1		14
Group firms	13				13
Joint Venture Partner			4		4
Parent firm			3	1	4
Total	257	114	66	32	469

Source: Interview data

Do the local and non-local networks differ in terms of type of organizations contacted? The results are shown in Figure 6-15 and Figure 6-16. Ties with the scientific communities were more confined to the Istanbul region. Universities (76%) and research institutions (48%) were relatively more important at the local level. This is line with the literature where the role of local universities was argued to be important for the innovation process (Audretsch 1998). Interviewed firms mentioned seven reasons for the ties with local universities. These are listed in Table 6-17.

Table 6-17: Main Reasons for the Ties with Local Universities in Istanbul

	Number of times mentioned
Knows personally	17
Satisfaction	12
Familiarity	9
Proximity	9
Responsiveness	6
Prestigious	2
Technological compatibility	1

Source: Interview data

Figure 6-15: Type of Organizations in Local Networks in Istanbul

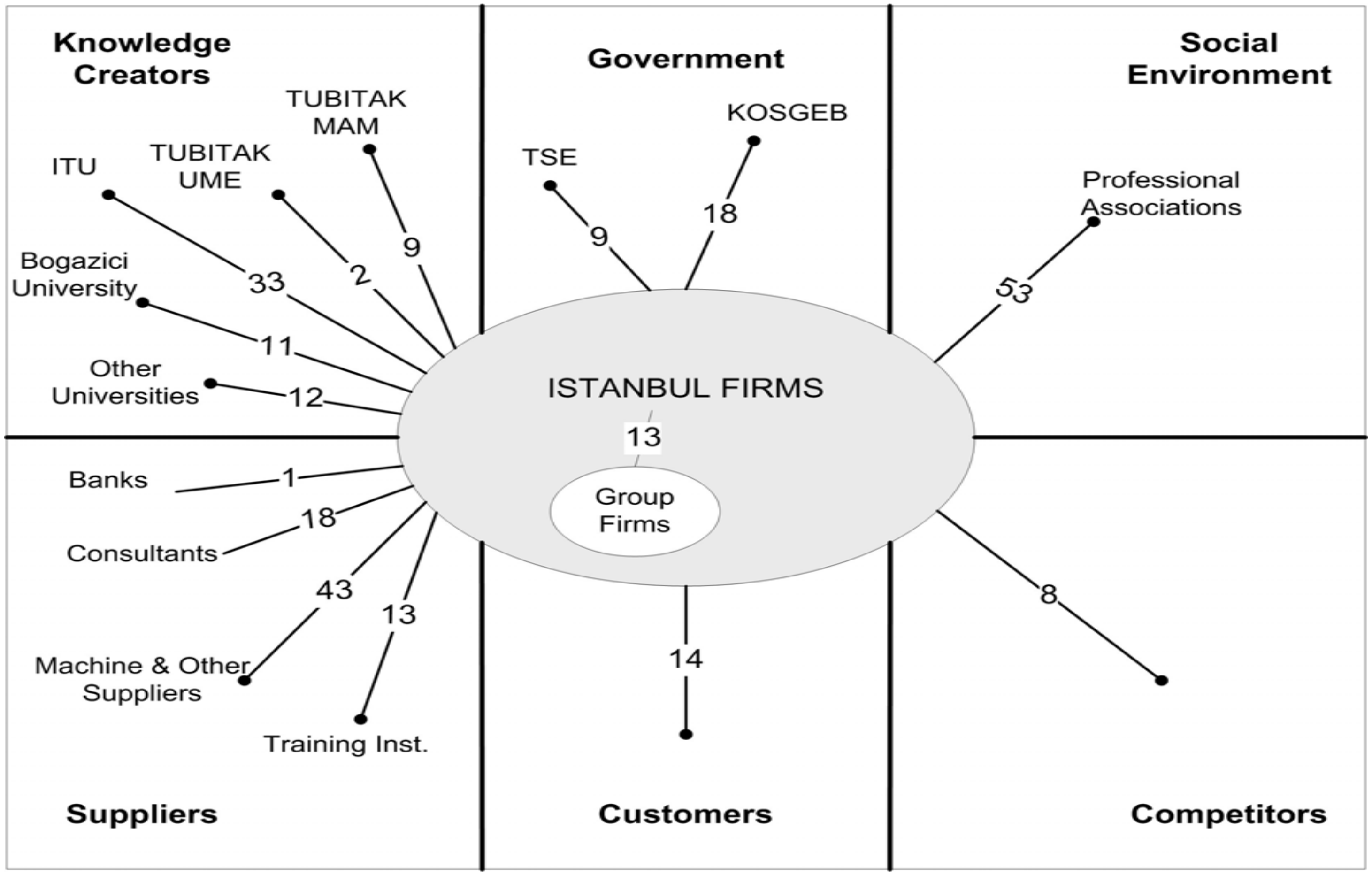
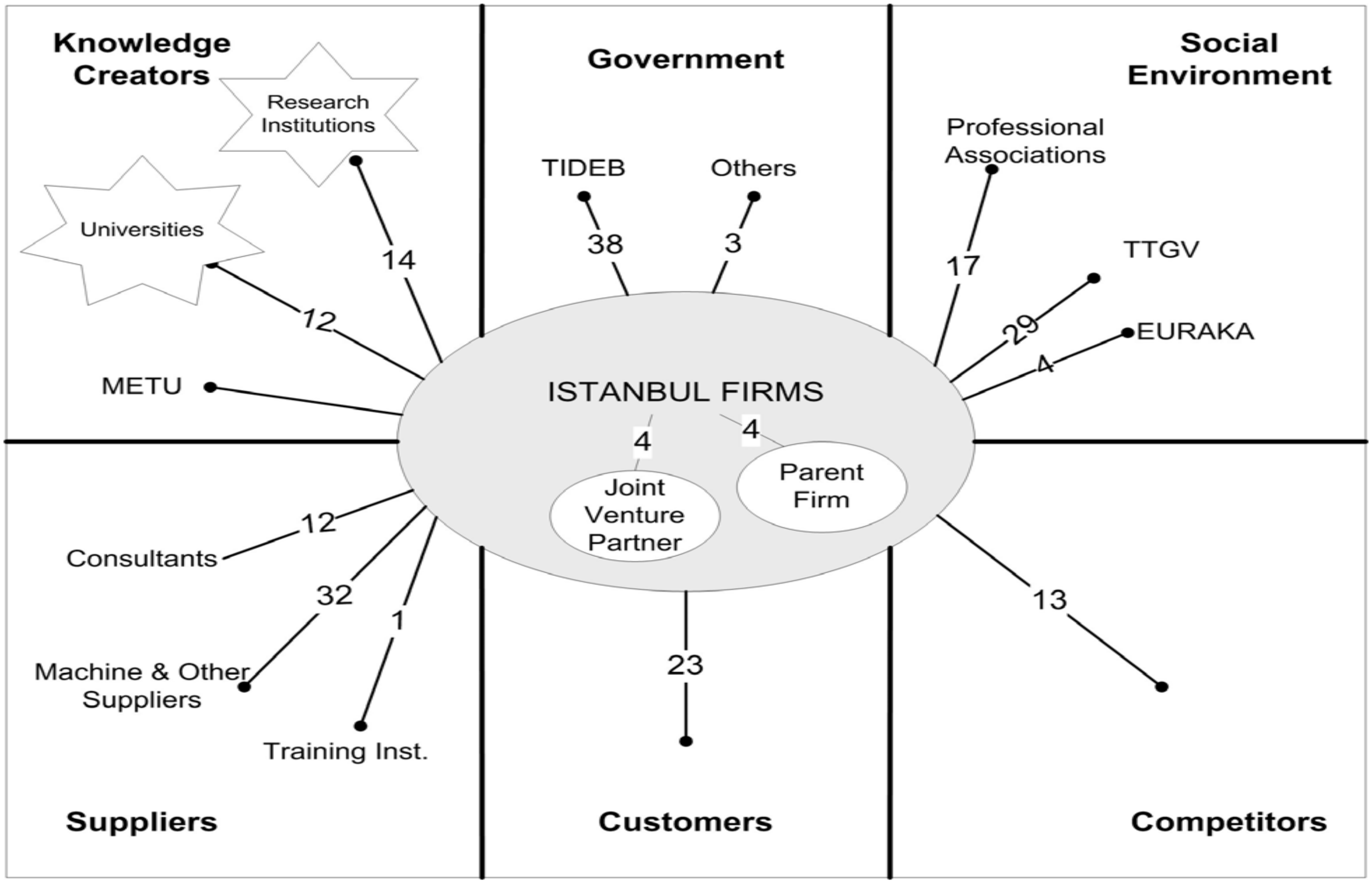


Figure 6-16: Type of Organizations in Non-Local Networks in Istanbul



Several informants mentioned that they were graduates of these local universities. Therefore, they personally knew the faculty. Second, the firms mentioned that they were satisfied with their interaction patterns and routines. As one of the respondents reported:

> Faculty is expert in this area and their technical infrastructure satisfies our testing needs. IS-41

Third most mentioned reason was familiarity with local universities. As one of respondents mentioned:

> Faculty there now knows our firm since we have been working for a long time now. We are acquainted with each other's routines and interaction style. IS-61

The fourth reason mentioned was proximity. Several firms mentioned that they specifically chose a local university because they wanted to take advantage of face-to-face interaction when they tried to solve any problems during the innovation process. Responsiveness was another reason for working with local universities. Respondents stated that *the faculty had the knowledge and expertise and was able to react quickly to address concerns of their firm*.

In addition, ties with national universities (mostly universities in Ankara) and European research institutions (42%) were cited by some interviewed firms. Two most cited reasons for the ties with non-local universities were responsiveness and being best in their research area. Firms mentioned some of the local universities were not practical and slow to their problems so they had contacted non-local universities since they knew that these universities were able to react quickly to address their needs.

Table 6-18: Main Reasons for the Ties with Non-Local Universities, Istanbul Firms

	Number of times mentioned
Responsiveness	8
Best in its area	5
Knows personally	2
Familiarity	2
Satisfaction	1
Technological compatibility	1

Source: Interview data

Ties with local and non-local suppliers are both important for interviewed firms in Istanbul: 57% of ties were with local suppliers, while 43% with non-local suppliers. The main reason cited for ties with local suppliers were satisfaction with their interaction patterns and routines with them (Table 6-19):

> So far we had great experience with them. They are quick and accurate. Our relationship provided high quality results. IS-63, R&D Engineer

Table 6-19: Main Reasons for the Ties with Local Suppliers, Istanbul Firms

	Number of times mentioned
Satisfaction	26
Technological compatibility	9
Responsiveness	4
Familiarity	2
Prestigious	1

Source: Interview data

In addition, ties with non-local suppliers (43%) were cited by interviewed firms. One of the most mentioned reasons for these ties were to interact with the "best" suppliers in their own area and satisfaction in their interaction patterns with non-local suppliers (Table 6-20).

Table 6-20: Main Reasons for the Ties with Non-Local Suppliers, Istanbul Firms

	Number of times mentioned
Best	10
Satisfaction	10
Technological compatibility	4
Responsiveness	3
Goal congruence	2
Group firm	1
Not available in local area	1
Problem solving	1

Source: Interview data

The data lead us to two conclusions. First, ties involved a variety of actors: universities, suppliers, government agencies and professional associations. The results contained some evidence of horizontal co-operation rather than joint-venture project with firms. Second, interviewed firms had ties with different institutions at various locations. Although local ties were important especially in the case of universities, non-local ties were used at the same time. These findings stress the importance of both local and non-local ties in the process of innovation.

6.3.2.2 Multiplexity of networks

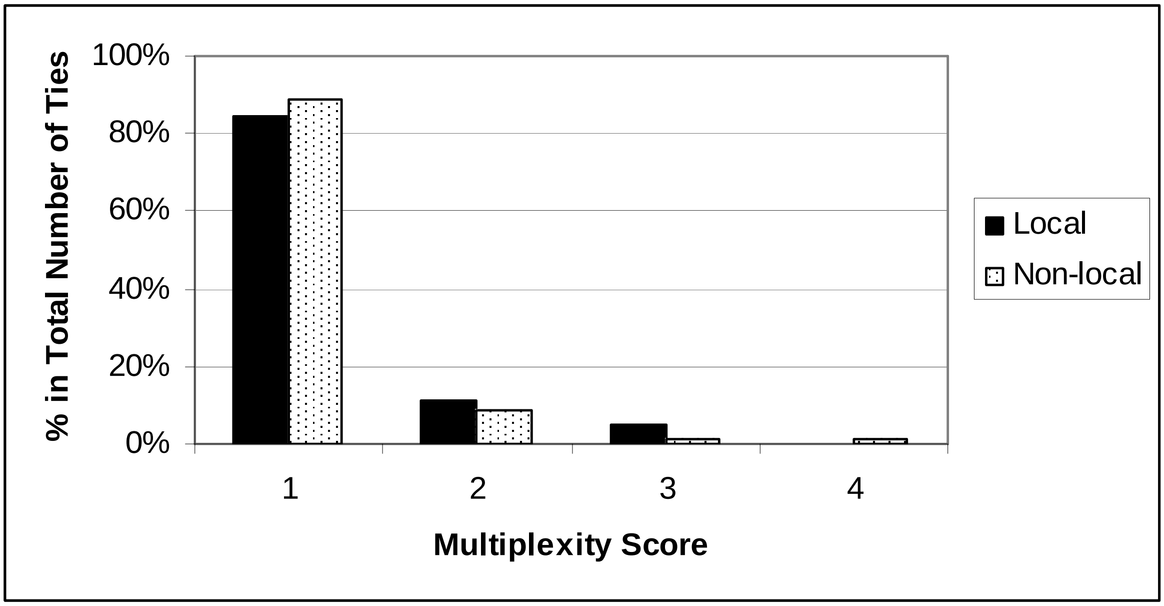
This section examines the network multiplexity in the Istanbul region. Network multiplexity is defined as the degree to which ties are multidimensional (Ibarra 1995).[18]

In the Istanbul region, multiplexity ranged from 1 (only one type of resource) to 4 (four types of resources). Most of the local (84%) and non-local ties (89%) ties provided one resource type (Figure 6-17). A few local and non-local ties provided more than one type of resource. Only 11% of local and 9% of non-local ties provided two types of resources. Types of institutions included mostly local universities (ITU), suppliers, government agencies (KOSGEB),

[18] For detail description of multiplexity, please see chapter 3.

and joint venture firms. These results show that multiplexity did not differ between local and non-local networks.

Figure 6-17: Local and Non-local Network Multiplexity



Source: Interview data

What were the different types of resources? Overall, firms had ties for different type of resources. Overall, the non-material and support resource ties were prominent in Istanbul. Of 571 resource ties, 53% of them were non-material and 26% were support resources (Table 6-21). All three types of resources (non-material, material, and support resources) were important for SMEs. Almost half of the SMEs' resource ties included non-material resources. SMEs cited support (26%) and material resources (28%) equally. However, large firms used more of non-material and support resource ties. Majority (64%) of all ties were non-material. This is followed by support resources (24%).

Table 6-21: Type of Resources by Firm Type in Istanbul

Type of Resources	Number of Resource Ties		
	SMEs Ties	Large Firms Ties	Total Ties
Non-material resources	160 (46%)	145 (64%)	305 (53%)
Exchange of technical knowledge	81	65	146
Being in the loop	20	36	56
Formal R&D collaboration	25	15	40
Consulting	19	11	30
Know-how	15	18	33
Support resources	91 (26%)	55 (24%)	146 (26%)
Personnel help	13	13	26
Technical lab needs	26	29	55
Training	52	13	65
Material resources	95 (28%)	25 (11%)	120 (21%)
Borrowed equipment	17	6	23
Funding/Financing	78	19	97
Total	**346**	**225**	**571**

Source: Interview data

In terms of non-material resource ties, exchange of technical information was the highest in both SMEs and large size firms. Formal R&D collaboration ranked second among SMEs. These kind of ties were higher in SMEs' networks than large size firms. Both SMEs and large size firms were involved with organizations which provided information about their sector, technological development and available projects. These ties were mostly with professional associations. All firms stated that these memberships keep them in the loop.

In terms of support resources, training is the most used support resources among SMEs. Most of the training ties were with suppliers, institutions including universities and research institutions, and other firms including consultants and private training institutions. Use of technical lab ranked second in SMEs and first in large size networks.

What is the geographic distribution of resources? Table 6-22 suggests that local, interregional, and international resources were all used when firms developed products or processes.

Table 6-22: Type of Resources by Location

Type of Resources	Number of Ties				
	Local	Non-local			Total
		National	European	Global	
Non-material resources	161	48	58	38	305
Exchange of technical knowledge	76	32	21	17	146
Being in the loop	43	6	4	3	56
Formal R&D collaboration	22	6	10	2	40
Consulting	16	4	6	4	30
Know-how	4		17	12	33
Support resources	112	7	24	3	146
Personnel help	23	3			26
Technical lab needs	37	3	15		55
Training	52	1	9	3	65
Material resources	31	82	5	2	120
Borrowed equipment	17	3	2	1	23
Funding/Financing	14	79	3	1	97
Total	304	137	87	43	571

Source: Interview data

The use of non-local resources is noticeable in all resource types except material resources. Majority (74%) of all material resource ties were non-local especially national. Almost half (47%) of all non-material were non-local. A few (23%) number of support ties were non-local. Following observations surface from the data. First, the European ties stand out among non-local ties. This is especially true for non-material and support resources ties among other non-local locations.

In summary, interviewed firms used local, interregional and international resources simultaneously. Firms tapped into non-local networks to access resources for possible projects and technological development in their sector. These findings support the claim that firms depended differentially on different knowledge types (Amin 1999; Nonaka 1995).

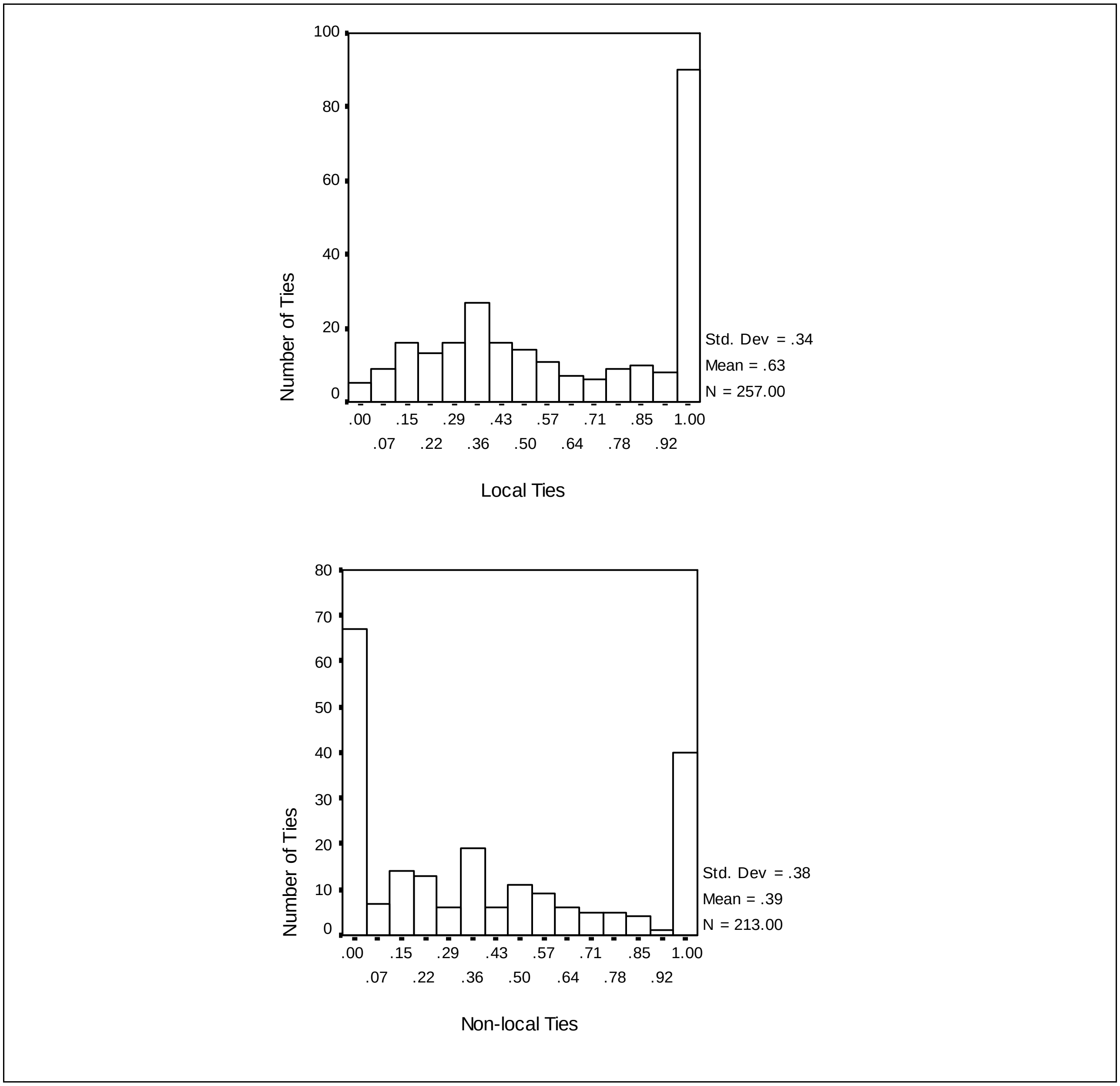
6.3.2.3 Stability of local and non-local networks

This section compares the durability of local and non-local networks of Istanbul firms. Stability is measured by the duration of a network tie, i.e. how long the firm (ego) and network member (alter) have known each other. This is explained in detail in chapter 3. It was argued that the higher the duration score is more stable the network (Andersen 2001; Wasserman and Faust 1994; Wellman 1982).

Figure 6-18 shows the distribution of duration score of each local and non-local tie. The distribution of duration score (DR) of local and non-local ties illustrate differences. Almost 60% of local and 36% of non-local ties happened over half of firms' existence. However, 2% of local ties and 32% of non-local ties were one time relationships. One time local ties mostly included relations with competitors and suppliers. One time non-local ties mostly included relations with government agencies. The mean duration of local and non-local networks do differ statistically.[19] While the firms had ties with local institutions during 63% of their existence, the mean duration of their ties with non-local institutions is 39% of their lifetime.

[19] T score is 7.295 and p value is 0.000. Significant at 5% level.

Figure 6-18: Distribution of Duration Score (DR) by Local and Non-Local Ties



Source: Interview data

Overall the network duration differed between SMEs and large firms (Table 6-23). The mean overall duration of SMEs' network was higher than large firms. This was also valid for local SMEs' networks. SMEs had a relationship with the local institutions during 70% of their existence. These results are statistically significant at 5% level. In terms of non-local networks, SMEs and large firms did not differ statistically.

Table 6-23: Duration by Firm Size

	Size	N	Mean	Std. Deviation	t score	p value
Overall Network Duration	Total	67	0.53	0.22		
	Large	19	0.44	0.22	-2.30	0.02*
	SMEs	48	0.57	0.21		
Local Network Duration	Total	62	0.65	0.25		
	Large	18	0.50	0.24	-3.20	0.00*
	SMEs	44	0.71	0.24		
Non-Local Network Duration	Total	65	0.37	0.28		
	Large	17	0.34	0.20	-0.42	0.68
	SMEs	48	0.38	0.30		

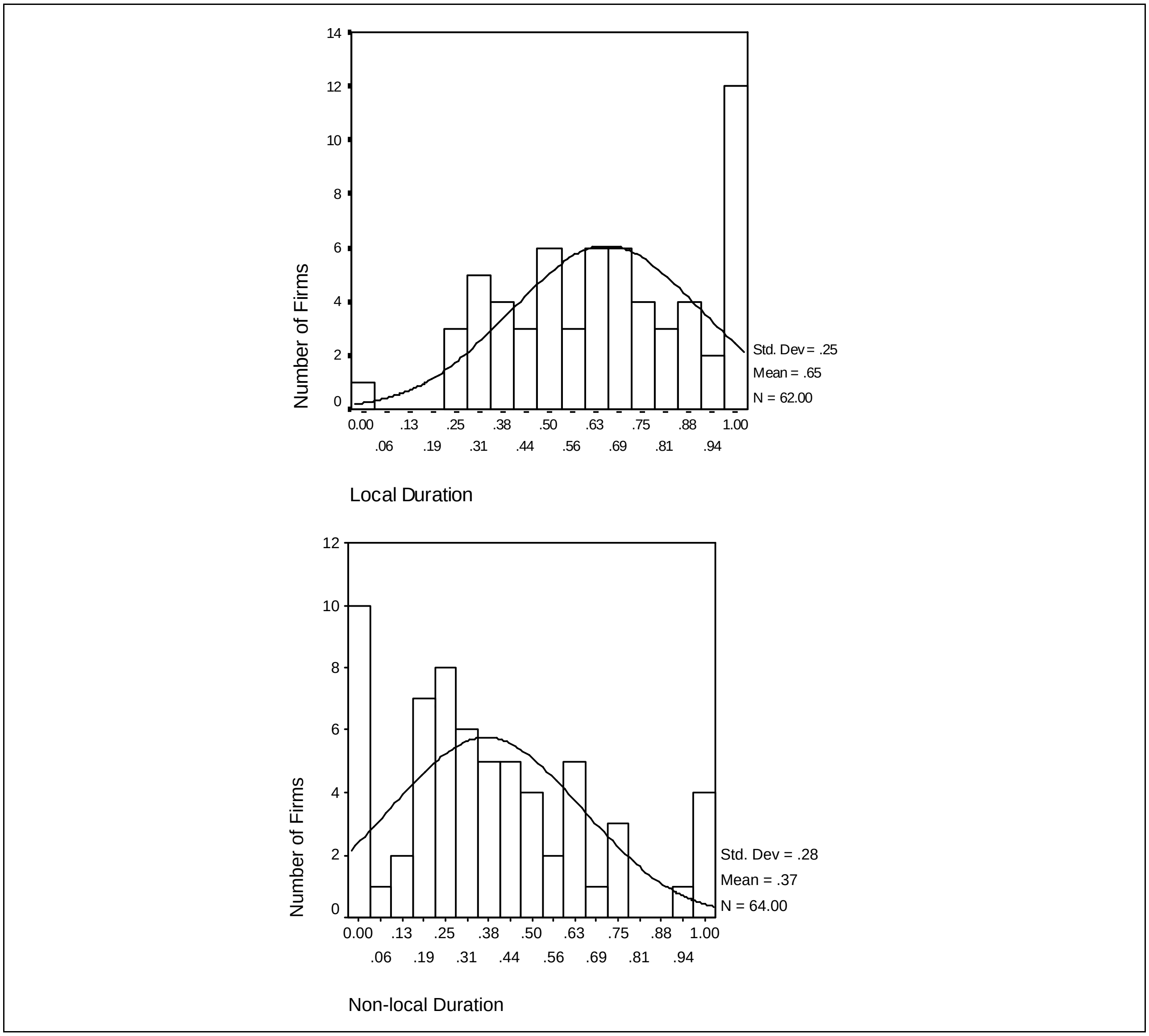
*5% significance level
Source: Interview data

Figure 6-19 shows the distribution of mean network duration of firms in Istanbul. Majority (70%) of firms had ties with the local institutions during 50% - 75% of their existence. On the contrary, the mean duration of non-local network was skewed. A few (25%) of interviewed firms had ties with non-local institutions during 50% - 100% of their lifetime.

In summary, the mean duration of local and non-local networks differed statistically.[20] Local networks were more stable than non-local networks. While the interviewed firms had ties with local institutions during 63% of their lifetime, the mean duration of their ties with non-local institutions was 39% of their lifetime.

[20] T score is 7.295 and p value is 0.000. Significant at 5% level.

Figure 6-19: Mean Duration by Local and Non-local Networks of Firms



Source: Interview data

6.3.2.4 Formality of local and non-local networks

This section compares the formality of local and non-local networks. In the literature, network ties were distinguished as either formal or informal network ties. Istanbul firms had all types of combinations of formal and informal market mechanisms. A few (18%) ties were cited as informal. Most (82%) of ties were formal. Within the local and non-local networks, the distribution of informal and formal ties differed. Table 6-24 and Table 6-25 shows that local networks contained more informal networks than non-local networks. This finding is inline with the literature.

Table 6-24: Formal and Informal Ties by Geography

	Formal		Informal		Total
	Num	%	Num	%	
Local	199	77%*	58	23%*	257
Non-Local	201	94%**	12	6%**	213

* % of all local ties
** % of all Non-local ties
Source: Interview data

Table 6-25: Components of Informal and Formal Ties, Local Networks

Local Network Ties		Informal		Formal		Total
		Freq	%	Freq	%	
Written Contracts	No	43	74%	83	42%	126
	Yes	15	26%	116	58%	131
	Total	58	100	199	100	257

Source: Interview data

As Uzzi (1996) demonstrated that informal or personal network ties had a variety of social attributes within their dyadic relationships. This was also the case in Istanbul. While 76% the non-local networks had some kind of contracts such as non-disclosure agreements, local networks showed variety of attributes. Within local networks, firms had non-disclosure agreements even within their informal networks. These contracts were required when they collaborated on R&D projects. Within formal ties, there were cases which did not need contracts.

These were the cases when firms bought services such as training from other firms; or used lab testing services from government; or borrowed machines from other firms and organizations.

6.3.2.5 Communication frequency and media

This section presents how frequently and via which media the firms communicated with other firms and organizations. It also presents whether communication frequency and media differed between local and non-local networks.

Table 6-26: Communication Frequency in Istanbul

	Local ties		Non-local ties		Total ties	
	Num	**Freq**	**Num**	**Freq**	**Num**	**Freq**
Very frequent	37	14%	21	10%	58	12%
Frequent	35	14%	34	16%	69	15%
Infrequent	22	9%	9	4%	31	7%
Need based	163	63%	149	70%	312	66%
Total	**257**	**100%**	**213**	**100%**	**470**	**100%**

Source: Interview data

Local and non-local ties showed similarities in terms of communication frequency. A few numbers of local (14%) and non-local (10%) ties were maintained frequently by the interviewed firms. Frequent local ties were mostly with customers, suppliers, and universities. Non-local ties included competitors, suppliers and joint venture firms. Table 6-26 shows that majority (65%) of the local and non-local ties were need-based. Several firms reported that their communication frequency was based on their problem solving needs:

> Our communication with them all depends on our needs. We contact them to solve our problems during product development. We do not always communicate with them. IS-13 (General Manager of Quality Engineering)

Data showed that a few (21%) local ties were based on face to face contacts (Table 6-27). This number decreased in non-local ties. Only 8% of non-local ties were based on face to face communication. In both local and non-local networks, the impact of communication technology – the internet and phone network- on networks were obvious. Computer and telephone support to social interaction merely extends the relations beyond the locality to a greater extent.

Table 6-27: Communication Frequency and Media in Istanbul

	Face to face	Combination of face to face, communication technology	Communication technology only
Local ties total	**54 (21%)**	**155 (60%)**	**48 (19%)**
Very frequent	5	24	8
Frequent	10	23	2
Infrequent	3	13	6
Need based, once	36	95	32
Non-local ties total	**18(8%)**	**150 (70%)**	**45 (22%)**
Very frequent		8	13
Frequent	2	26	6
Infrequent	1	5	3
Need based, once	15	111	23

Source: Interview data

6.4 CONCLUSION

This chapter analyzed the innovation activities and the networking behavior of manufacturing firms in the Istanbul region. The rationale behind focusing on this region was to understand the networking behavior in an innovative and a core industrialized region.

Istanbul is one of the most dynamic and industrious regions in Turkey. It has the highest share (33%) of manufacturing establishments in 2004. Almost half of the manufacturing export originated from Istanbul in 2004. Engineering industry (ISIC 38) has been mostly concentrated in Istanbul. Diverse industry base and a wide variety of institutions favoring innovation and technology transfer characterize this region. Istanbul had the largest of share of patent application among cities and has the highest number (41%) of firms applied for R&D grant to TUBITAK.

Istanbul has always been an attractive location for entrepreneurs. The interviewed firms also cited regional synergies as the reason for locating in Istanbul. Domestic capital played an important role in the formation of interviewed innovative firms. SMEs made up most of the innovative firms.

This analysis of Istanbul region provided interesting insights into innovation activities and networking behavior in a core region. We should stress that the case of the Istanbul study illustrated that the region was organized and promoted at the local level, but firms' innovation processes were more integrated into wider systems of innovation, such as national and international. Thus, Istanbul appeared to lie somewhere between a grassroots regional innovation system and a regionalized national innovation system and (Asheim 1996). The other results discussed in detail below.

As to the type of innovation, product innovation was more important than process innovation. The most important reasons for innovating were market creation and product related strategies. This supports the argument in the literature where product innovations are related to the creation of new markets, whereas process innovations are typically introduced for reducing costs (Edquist, Hommen, and McKelvey 2001; Simonetti, Archibugi, and Evangelista 1995).

The nature of innovation was mostly incremental in Istanbul, that supports the findings of other research in developing countries (Kim 1997; Forbes and Weild 2000). A large part of innovation activities seems to be based on improvement of existing production processes. The new process innovation was lower than process improvement in Istanbul. SMEs and large firms differed in terms of process improvement. SMEs introduced less process innovation compared to large firms. This finding supports the claim that a large firm invests more in process innovation than a small firm because of market share (Yin and Zuscovitch, 1998).

The findings provided interesting insights into the networking behavior and the characteristics of the networks. Local ties were obviously important for the firms, especially when it came to interaction with universities and suppliers. Although local ties were striking, firms interacted with non-local firms and organizations. This was due to two main reasons. First, non-local ties had the required knowledge and expertise and they were able to react quickly to address concerns of interviewed firms. Second, firms interacted with the non-local ties because of their reputation. These results from revealed the existence of non-local ties both for most SMEs and all large size firms. Therefore, this study extends the local networking hypothesis by adding the existence of non-local networks. In other words, the results from Istanbul confirm the study hypothesis that *when firms in developing countries introduce technological innovation of products and/or processes, they engage in mixed networks, i.e. local and non-local (interregional and international) networks*. The reasons for non-local networks were the need to access capabilities not available locally.

Both local and non-local networks were important for the Istanbul firms. Firms took advantage of similarly diverse local and non-local networks. Most local and non-local ties provided one type of resources, i.e. uniplex. While local networks were important in providing non-material and support resources, non-material resources were prominent in non-local ties. The firms had longer relationship with their local ties. This was mostly because Istanbul is an established industrial region compare to Ankara. Local networks were not only made up of informal mechanisms. While all the non-local networks had some kind of contracts such as non-disclosure agreements, local networks showed both informal and formal contacts. Local and non-local ties showed similarities in terms of communication frequency and media. A few numbers of local and non-local ties were maintained frequently by the interviewed firms. In both local and non-local networks, the impact of communication technology was obvious. Computer and telephone support to social interaction merely extends the relations beyond the locality to a greater extent. In summary, local networks in Istanbul were similar in size to non-local,

In this chapter, no attempt was made to comp are the findings with those of Ankara. The interregional comparison makes the core of the following chapter. Surprisingly, the next chapter illuminates the fact that both regions share more similarities than differences concerning firms' innovation and networking behavior.

CHAPTER 7. AN INTERREGIONAL COMPARISON

One of the objectives of this study is to compare the innovation activities and networking behavior of firms located in two innovative but different regions, i.e. newly industrializing vs. established (core) regions. It was chosen to study innovation networks in a comparative perspective in order to increase the chances of obtaining a better understanding of the role of region in innovation process in developing countries. The previous chapters discussed the innovation activities and networking behavior of firms in Ankara and Istanbul regions. This chapter draws upon these results to compare firms' innovation activities and networking behavior within each region.

7.1 REGIONAL PROFILES: INTERREGIONAL COMPARISON OF INNOVATIVE FIRM CHARACTERISTICS

The regional milieus or contexts of two regions showed similarities and differences. First, interviewed firms in both regions mentioned highly urbanization effects such as the existence of skilled labor, regional transportation systems, and general and specialized business knowledge for locating in these regions. However, Ankara firms mentioned the existence of government agencies as opposed to regional synergies which was mentioned by the Istanbul firms. This is not surprising considering that government was an important customer for Ankara firms which will be discussed in detail later.

Second, SMEs composed 70% of the interviewed innovative firms in both regions (see Table 7-1). Actually, SMEs dominated the manufacturing industries in both regions. All SMEs were established by domestic capital. In both regions, policy instruments, such as Technoparks and TEKMERs, played a role in supporting some of the SMEs' innovation activities. Studies in many countries showed that SMEs relative share of new employment has increased since the 1980s (Herrigel 1993; Piore and Sabel 1984; Scott 1988). Much of the literature on flexible specialization documented the importance of SMEs. In the innovation process, SMEs also received attention in the studies of both developing and developed countries because of their ability to innovate through networks. It was further argued that SMEs and their localized cooperation and interactive learning enhance innovative capacity of the region due to the increased transfer of knowledge, skills and ideas (Schmitz 1990; Audretsch 1998).

Table 7-1: Interregional Comparison of Firm Size

	ANKARA		ISTANBUL	
Firm Size	**N**	**% of total**	**N**	**% of total**
SMEs	15	68%	48	72%
Large (100+ employee)	7	32%	19	28%
Total	**22**	**100**	**67**	**100**

N = number of interviewed firms
Source: Interview data

However, we can not dismiss the existence of large firms in both regions. Almost 30% of interviewed firms were large firms in both regions. Most of these large firms were established by domestic capital. Domestic large firms had different functions in these two regions. In Ankara, most of the SMEs mentioned large firms in defense industry as their innovation partners. Large, state-anchored firms have played an important and dominant role in the development of electronics industry in Ankara (Dede 1999; Tekeli 1994). Similarly, Scott (1992) acknowledged that large firms in defense industry in California existed alongside SMEs and played an important part in sustaining growth and development of the regions (Scott 1992).

In Istanbul, on the other hand, some domestic large firms played an incubator role. Some start-up companies began under the roof of domestic holdings in Istanbul (Table 7-2). In this context, these large firms provided the needed infrastructure and some resources for these innovative firms. In both cities, some large joint-stock companies founded the SMEs as the R&D arm of the company.

Third, in both regions, domestic capital, not international capital, played an important role in the establishment of the innovative firms and in the industrial development of regions (Table 7-2). Domestic firms made up the majority (around 90%) of the interviewed innovative firms. These data suggest that domestic firms in both regions were active innovators. The sample of this study included very few MNCs and joint-venture firms. MNCs had no or very limited innovation activities, mostly adaptation to the local context. They only interacted with the parent company and had no local or very small network size. One observation was that production and innovation activities went together. If MNCs had very limited production capabilities, their innovation activities were very limited too. Consequently, the local industry in developing countries can not be seen as passive, involving only the adoption and routine operation of externally supplied technologies which was the view of 1950s and 1960s. This set of findings is consistent with other cases in the literature where firms in some developing countries recently have attained the status of creators of new technologies instead of assimilators of technologies created elsewhere (Mani and Romijn 2004).

Table 7-2: Regional Comparison of Ownership Type

	Ankara		Istanbul	
	Number	%*	Number	%
Domestic	**20**	**90%**	**59**	**88%**
Domestic Private	9	41%	35	52%
Domestic Family	4	18%	13	19%
Domestic Subsidiary	5	23%	11	16%
State	2	9%	0	0%
Joint venture	**2**	**9%**	**4**	**6%**
Foreign	**0**	**0%**	**4**	**6%**
Total	**22**	**100%**	**67**	**100**

* Percentage of total interviewed firms in the region.
Source: Interview data

Fourth, the business structures of the two regions were also to some extent reflected in the market orientation of the interviewed firms (Table 7-3). In Ankara, local market played an important role since the government was the biggest customer. For Istanbul firms, however, local market was insignificant. Most (87%) of the Istanbul firms operated in a national market. Similarly, 67% of the firms operated in an international market, essentially in Europe, Middle East, and Central Asia. The interesting finding was that half of the Ankara firms also had some international (50%) market orientation. For Istanbul firms, creating new markets abroad was the most important reason for innovation, while for Ankara firms, it was the second. It is generally claimed in the literature that there is a strong link between exposure to foreign markets and innovation (Basilo 2001). For example, evidence from both Chile and Mexico suggested that plants that export some of their outputs were more likely to introduce product innovations and improve the production process and invest in new technologies (Alvarez and Robertson 2004). The survival of the firms was mostly based on export capabilities.

Table 7-3: Regional Comparison of Market Distribution

	Ankara		Istanbul	
	Num	**%***	**Num**	**%**
Only Local	8	36%	5	7%
Only Central Anatolia or Marmara Region	0	0%	4	6%
All of Turkey	14	64%	58	87%
International	11	50%	45	67%

* Percentage of total interviewed firms in the region.
Source: Interview data

The next section compares the innovation activities of interviewed firms between Ankara and Istanbul regions. These firm characteristics and regional profiles should help to inform firms' innovation activities and their networking behavior.

7.2 REGIONAL COMPARISON OF INNOVATION ACTIVITIES

As it was explained in detail in Chapter 5 and 6, the results showed that firms in two regions in Turkey had important innovation capacity. Specifically, almost all the firms in both regions engaged in product and/or process innovation. Firms in both regions showed the conscious efforts for quick adaptation to changing market conditions to protect their competitive advantages.

Is there a regional difference regarding the level of innovation activities? Table 7-4 shows the innovation activities in both regions. Regarding the scope of innovation, product innovation (regardless of new or improved) was more prevalent and was more important for interviewed firms in both regions than process innovation. Virtually, almost all firms in both regions engaged in product innovation (except one in Istanbul). On the other hand, around 80% of all firms in both regions engaged in process innovation (regardless of new or improved).

Although product innovation was more common than process innovation, not surprisingly Istanbul and Ankara firms reported above-national average levels of product and process innovation. The TUIK's national survey found that while 26.3% of responding innovative firms developed product innovation (regardless of new or improved), 36.4% of responding innovative firms developed process innovation (TUIK 2004). The higher ratio in product and process innovation implied the dynamic nature of firms in these two regions. In other words, it showed the conscious efforts for quick adaptation to changing market conditions to protect their competitive advantages. Why is there high involvement in product innovation in both regions? It was argued in the literature that product innovations are usually associated to the creation of new markets or to the quality enhancement of existing products, whereas process innovations are typically introduced for reducing costs, rationalizing or increasing the flexibility and performance of production processes (Edquist, Hommen, and McKelvey 2001; Simonetti, Archibugi, and Evangelista 1995). This was also reflected in the motivations of interviewed firms pursuing innovation in both regions. As depicted in Figure 7-1, creating new markets were cited as the most important reasons for innovation. This finding supports the literature.

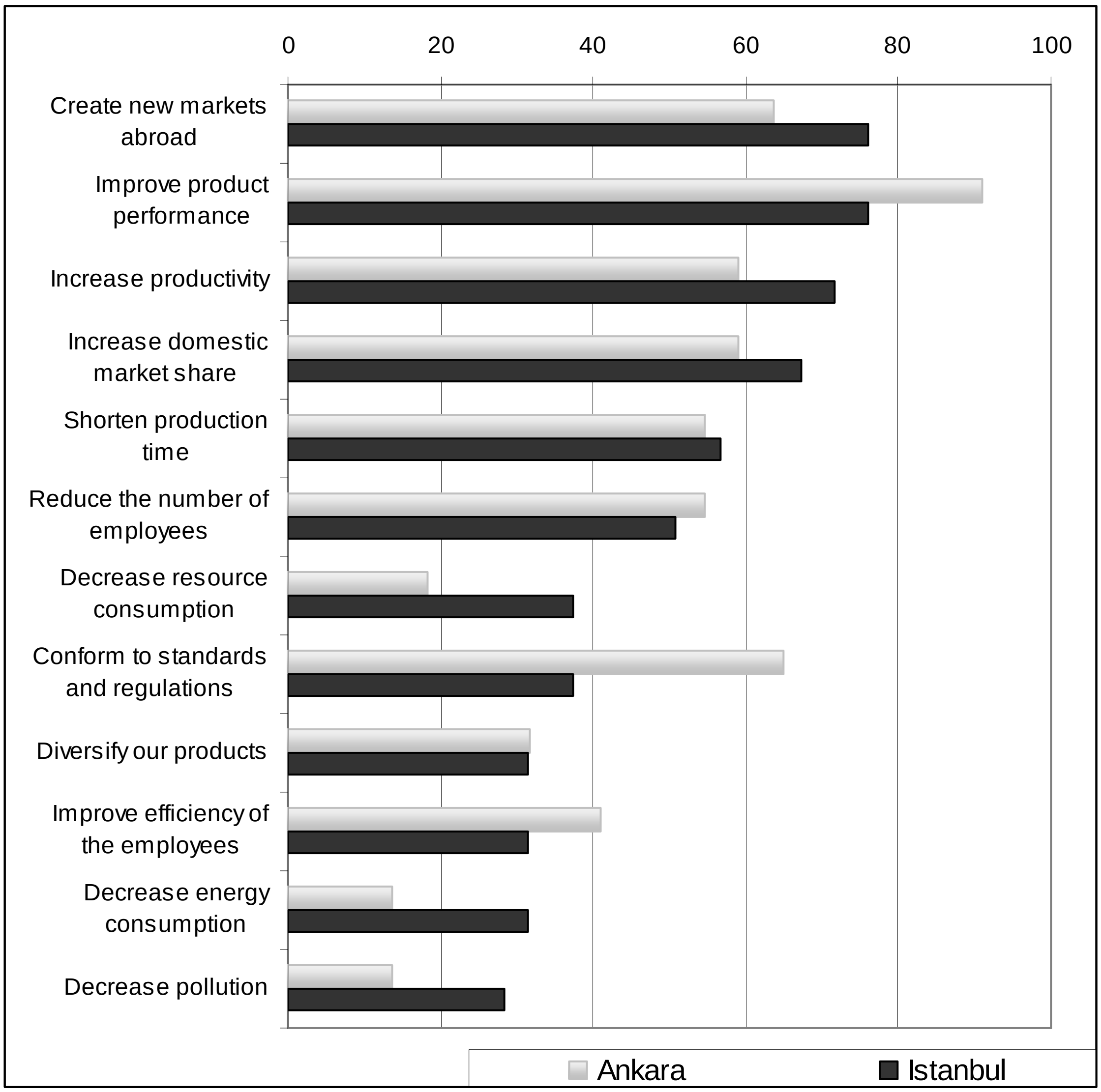
Table 7-4: Regional Comparison of the Type of Innovation Activities

	Ankara		Istanbul		p-value
	Total (22)		Total (67)		
	N	%*	N	%*	
Product Innovation	22	100%	66	99%	0.570
New product	15	68%	49	73%	0.658
Product improvement	21	96%	64	95%	0.990
Process Innovation	19	86%	51	76%	0.314
New process	**4**	**18%**	**24**	**36%**	**0.093****
Process improvement	19	86%	48	71%	0.121

Investment in new technologies	20	91%	65	97%	0.235
Patent application	7	32%	31	46%	0.231
Hired skilled staff	20	91%	64	96%	0.421

* % of total interviewed firms in the region
**At the 10% significance level
Source: Calculated from interview data

Figure 7-1: Reasons for Innovation



Source: Interview data

When process and product innovation is broken into new and improvement, improvement in product and process were dominant types of innovation activities in both regions. Majority of the firms in Istanbul (73%) and in Ankara (68%) introduced new products. This is also true for process improvement. We don't see any statistical regional differences between new product, product and process improvement.

However, we see important difference in new process innovation between Ankara and Istanbul (Table 7-4). In the Istanbul region, 36% percentage of firms introduced new process innovation, while it was only 18% in Ankara. This result was statistical significant at the 10% level. The difference between Ankara and Istanbul can be explained by two factors. First is related to the product life cycle. Research shows that the emphasis change from product to process innovation when products were standardized and prices become the new critical factor of success (Abernathy and Utterback 1982). Cost competition may be more important for firms in Istanbul than Ankara. Majority of the firms in Ankara were oriented to local market due to their emphasis on government. However, in Istanbul most of the firms did not focus on local but national or international market (Table 7-3).

The second argument which needs to be further explored is related to the spatial pattern of process innovation. There is no convergence in the literature but it is suggested that new processes are first implemented in core regions (Fritsch 2000). Istanbul, being a core and a dynamic region, invested more in new process innovation then Ankara.

Looking at the type of firm that created this difference in innovation process, data showed that there were no differences among large firms in Ankara and Istanbul (Table 7-5). However, SMEs in Istanbul introduced more new process innovation than the SMEs in Ankara. This result is statistically significant at 5% level (Table 7-6). This also can be explained by the reasons mentioned below. SMEs in Istanbul expose to national and international markets where cost competition becomes an important factor. Therefore, SMEs in Istanbul invested more on new process innovation than Ankara to get a competitive advantage in their markets.

Table 7-5: Innovation Activities of Large Firms in Ankara and Istanbul

	Ankara	**Istanbul**	
	% of total (15)	**% of total (48)**	**p-value**
New products	71%	68%	0.89
New process	43%	47%	0.85
Improved products	100%	95%	0.70
Improved process	100%	89%	0.39
Investment in new technologies	100%	95%	0.55
Patent application	43%	63%	0.37
Hired skilled people	100%	89%	0.39

Source: Interview data

Table 7-6: Innovation Activities of SMEs in Ankara and Istanbul

	Ankara	**Istanbul**	
	% of total (15)	**% of total (48)**	**p-value**
New products	67%	75%	0.53
New process	**7%**	**31%**	**0.01***
Improved products	93%	96%	0.70
Improved process	80%	65%	0.27
Investment in new technologies	87%	98%	0.08
Patent application	27%	40%	0.37
Hired skilled people	87%	98%	0.25

* At the 5% significance level
Source: Interview data

7.3 INNOVATION NETWORKS: EXTERNAL ORGANIZATION OF INNOVATION PROCESS

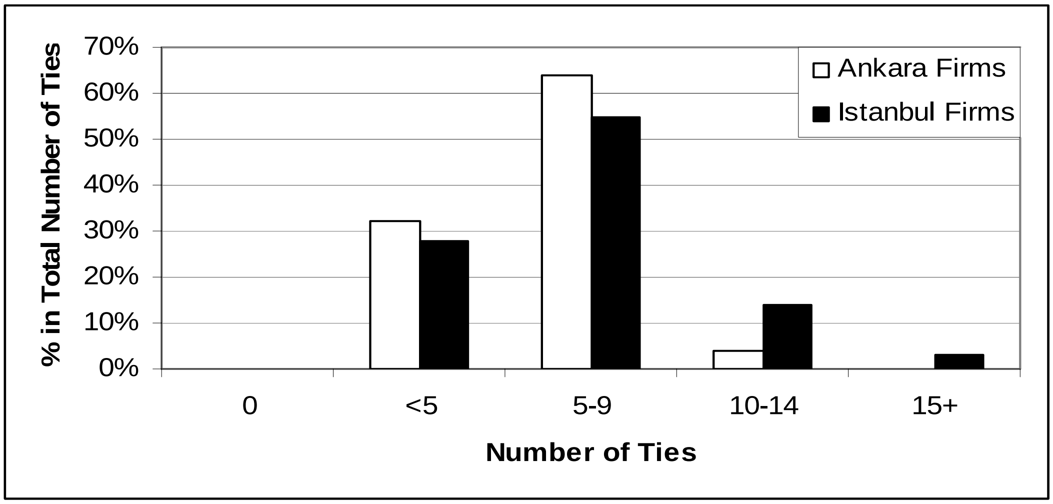
Do the two regions differ in networking patterns and characteristics? This section investigates this question and compares the networking behavior of firms in Ankara and Istanbul. The first section compares geographic composition and size of the network ties. The second section investigates the differences in network characteristics.

7.3.1 Interregional comparison of geographic network composition

Overall all the firms interviewed in Istanbul and Ankara interacted with other firms and organizations when developing products and processes. The overall distribution of network ties (Figure 7-2) and mean network size (Table 7-7) did not differ between Ankara and Istanbul. Analysis of the data supports the hypothesis that, in both regions, firms' innovation activity is not solely based on in-house capabilities. The results obtained clearly demonstrated the importance of external networks in the innovation process of manufacturing firms in two regions. This supports the conclusion of (Lundvall 1992; Håkansson 1987) who found that firms innovated within networks.

Do regions differ regarding the geography of innovation networks? Why? The analysis of geography of innovation networks in two regions reported here led to a number of interesting findings. First, the importance of spatial proximity was linked to the question of whether or not firms make use of the local ties so that the region can be regarded as an innovative seedbed. Data suggests that local networks were important for both regions. The mean local network size did not differ statistically between Ankara and Istanbul (Table 7-7). These results corresponded to the results of a number of other analyses in which they argued that local networks were important in the innovation process (Storper 1997; Porter 1990; Maskell and Malmberg 1999b; Camagni 1991).

Figure 7-2: Distribution of Overall Network Ties in Istanbul and Ankara



Source: Interview data

In Ankara, however, the local network size was larger than its non-local. This can be explained by the existence of large-state firms and government to which SMEs and large firms had most ties to. In Ankara, most of the SMEs mentioned large firms in defense industry as their partners and cited the existence of government for location decision.

In Istanbul, both local and non-local network sizes were similar. We could not find any statistical difference between two types of networks. This is not surprising considering that being a global city, Istanbul had large non-local networks. At the same, by the most industrialized and dynamic region, it had large local networks, too. Both types of networks are important in Istanbul.

Second, most of the firms in Ankara (82%) and Istanbul (89%) had both local and non-local networks ties, i.e. mixed ties, when developing products and processes. In other words, their mixedness score was different than zero. This was true both for a new industrialized region like Ankara and a core industrialized region such as Istanbul. Usually, firms needed to enter into non-local networks in order to screen markets, and gained access to expertise and complementary resources (Amin and Cohendet 1999; Doloreux 2004; Fromhold-Eisebith 1999; Hudson 1999; Malecki and Oinas 1999). The findings of this study support the hypothesis that firms did not only have local but also non-local ties (interregional and international). In other words, interviewed firms in both regions had mixed ties when innovating.

In contrast to this general picture, the *degree of mixedness* differed between these two regions (Table 7-7). Istanbul had a higher mixedness score than Ankara. In other words, Istanbul firms did not rely on one type of ties but they used both local and non-local ties at the same time. Istanbul firms cited more non-local ties compared to Ankara. This result was statistically significant at 5% significant level (Table 7-7). In Ankara, however, it was mostly one type of networks tie, especially local. This result was statistically significant at 5% significant level. Again, this can be explained by the differences in the regional profiles and business structure. Istanbul region is a dynamic, global city that contains dynamic relation with interregional and international networks due to their international and national market orientation. However, the firms in Ankara the relation to government business, especially in the defense sector might be a strong reason for a local ties dominated business structure. This reinforces the same finding for local and non-local networks. The firms in the Ankara region are largely tied to the government sector. This confirms the study hypothesis that innovative firms in both type of regions engaged in mixed networks. However, regional characteristics determine the degree of mixedness.

Table 7-7: Mean Network Sizes in Ankara and Istanbul

	Region	Mean	S. Deviation	p
Total Network Size	Ankara	7	3	0.643
	Istanbul	7	4	
Local Network Size	Ankara	5	2	0.7
	Istanbul	4	3	
Non-local Network Size	Ankara	2	1	**0.009****
	Istanbul	3	3	
Mean Mixedness	Ankara	0.42	0.28	**0.037***
	Istanbul	0.58	0.30	

* 5% significance level
**1% significance level

Did networking behavior change between SMEs vs. large firms between regions? The analysis of networking behavior of SMEs and large firms in two regions reported here led to a number of interesting findings. First, the overall network size dropped with the size of the firm both in Ankara and Istanbul (Table 7-8). Large firms interacted with more number of firms and organizations in both regions. This is true both for local and non-local network size. The citation of non-local ties fell in SMEs. SMEs had a smaller interaction space. Therefore, external ties with especially local organizations have a higher relevance for SMEs. Therefore, the results from Ankara region support the argument that SMEs *have fewer non-local network ties than large firms.* These results corroborate those of prior research which indicated that large domestic firms were skilled at building long distance, non-local ties. Large firms do have advantages in non-local networks since it is much harder for an SME to update its technical knowledge than for a large firm which is also to send people to conferences and seminars all over the world (Rothwell and Zegveld, 1982).

Table 7-8: Mean Network Size by Firm Size in Ankara and Istanbul

		Large Firms				**SMEs**			
Number of Ties	**Region**	**Mean**	**Std. Deviation**	**t**	**p**	**Mean**	**Std. Deviation**	**t**	**p**
Total	Ankara	9	1	0.003	0.997	5	2	1.13	0.263
	Istanbul	9	6			6	2		
Local	Ankara	6	2	1.248	0.224	4	2	1.29	0.2
	Istanbul	5	3			3	2		
Non-local	Ankara	3	1	-1.03	0.315	1	1	3.74	**0***
	Istanbul	5	4			3	2		
Mixedness	Ankara	0.62	0.21	0.418	0.679	0.33	0.27	4.17	**0***
	Istanbul	0.56	0.30			0.59	0.30		

* Significant at 1% level.
Source: Interviewed data

Second, the networking behavior of large firms showed similarities between Ankara and Istanbul. They had a similar local, non-local and mixedness score. However, regions differed in terms of SMEs networking behavior. While SMEs in both regions had similar local networking pattern, their non-local networks differed between Ankara and Istanbul. SMEs in Istanbul had more non-local ties compared to SMEs in Ankara. These results were significant at 1% level. This results show that SMEs in Istanbul region used more of local and non-local resources while SMEs in Ankara relied more on local networks. This difference can be again explained by the dominant business structure and regional profiles. Ankara was dominated by several large defense firms and government institutions due to being a national capital. Most SMEs had relations with these local firms and institutions rather than non-local ones. The existence of government related business was the reason for locating in the Ankara region.

However, Istanbul is a core industrial city in TR, as well as a global city where high levels of linkages with local and non-local organizations and firms. The national and international ties become important. Consequently, SMEs in Istanbul also operate in the national and international context and had a larger non-local network size.

In summary, the findings here are compatible with the argument that clusters are enriched by a mix of local and non-local network ties and learning opportunities (Diez 2002; Doloreux 2004; Gertler 2003; Amin and Cohendet 1999; Malecki and Oinas 1999). Both study regions had mixed network ties when it came to product and/or process innovation. However, this study found that regions matter because differences in economic, business, social and institutional infrastructure influence the type and intensity of local networks (Storper 1997; Amin 1999; Visser and Boschma 2004), and its mixture with non-local relations. Similarly, the regional milieus of Ankara and Istanbul influenced the intensity of local networks and non-local networks. The regions differed in the degree of mixedness of local and non-local networks. Istanbul as a global city had more ties to international and national organizations while Ankara had mostly local ties due to specialization in defense industry and government as the main customer. Therefore, the optimal mix might differ according to region's context.

7.3.2 Characteristics of local and non-local networks in Istanbul and Ankara

The prior section showed that firms in both regions used not only local but also non-local ties when developing products and processes. However, the mixedness differed by the type of the region. This section compares the characteristics of these local and non-local network ties between regions. Five characteristics were used to compare the local and non-local network structures in Ankara and Istanbul: diversity, multiplexity, stability, formality, and the communication frequency and media.

The distribution of local network diversity showed similarities between Ankara and Istanbul. In both regions, interviewed firms had diverse set of organizations in their local networks. Majority of the firms had local network diversity more than 0.50. At the 5% significance level, the local network diversity did not statistically differ between Ankara and Istanbul (Table 7-9). However, the non-local diversity differed between regions. The non-local diversity was higher in Istanbul than Ankara. This result was statistically different at 1% significance level (Table 7-9). This was especially true for SMEs' non-local networks. SMEs in Istanbul had more diverse set of organizations in their local networks than SMEs in Ankara. This result was statistically different at 1% significance level (Table 7-10). This can be explained by the differences in the regional profile which suggests different local and non-local network characteristics.

Table 7-9: Mean Network Diversity in Ankara and Istanbul

	Region	N	Mean	Std. Deviation	p
Overall Network	Ankara	22	0.79	0.13	0.864
	Istanbul	67	0.78	0.13	
Local Network	Ankara	22	0.69	0.21	0.196
	Istanbul	62	0.61	0.26	
Non-local Network	Ankara	18	0.29	0.35	**0.006***
	Istanbul	65	0.54	0.32	

*Significant at 1% level
Source: Interview data

Table 7-10: Mean Network Diversity by SMEs in Ankara and Istanbul

	Region	N	Mean	Std. Deviation	T score	p
Overall Network	Ankara	15	0.74	0.13	-0.663	0.514
	Istanbul	48	0.77	0.13		
Local Network	Ankara	15	0.65	0.23	0.597	0.553
	Istanbul	44	0.60	0.26		
Non-local Network	Ankara	11	0.11	0.26	-3.582	**0.001***
	Istanbul	47	0.49	0.32		

* Significant at 5% level
Source: Interview data

Table 7-11: Mean Network Diversity by Large Firms in Ankara and Istanbul

	Region	N	Mean	Std. Deviation	T score	p
Overall Network	Ankara	7	0.88	0.07	1.3740	0.1820
	Istanbul	19	0.81	0.12		
Local Network	Ankara	7	0.78	0.11	1.4390	0.1640
	Istanbul	18	0.63	0.27		
Non-local Network	Ankara	7	0.58	0.28	-0.7520	0.4900
	Istanbul	18	0.67	0.27		

Source: Interview data

As to the type of institutions, Ankara and Istanbul showed similarities and differences. First, in both regions, ties with the scientific communities were more confined to the locality. Universities and research institutions were relatively more important at the local level. Interviews revealed that most of the employees were graduates of local universities. Therefore, as graduates, they kept their relationship with these local universities. The result that local universities were innovation partners is not surprising. It corresponds to the results of other studies (Breshci and Lissoni 2000; Audretsch 1998).

Second, ties with non-local suppliers were particularly high in Ankara. However, in Istanbul ties with local suppliers were particularly high. This may be because of different development levels of regions. Considering that Ankara does not have a well-developed supplier base compared to other industrial cities of Istanbul, Izmir, this is not a surprising finding. This local context was also mentioned by several interviewed firms. In addition, non-local suppliers, especially international ones, were also important for Ankara firms. This could be related to the sector. Defense related firms had international ties. This difference between Ankara and Istanbul is rather interesting. In the literature, local supplier ties were specifically emphasized. It was argued that a flow of incremental innovations is generated through localized interaction with suppliers where embodied technologies were imported into the firm through the exchanges, as knowledge spillovers (Audretsch 1998). Although suppliers are obviously an important innovation partner, this study revealed that depending on the local context, firms engaged in local or non-local networks to overcome any difficulties.

In both regions, most (80%) of the local and non-local network ties were found to be uniplex. In other words, network members provided one type of resource. Comparison of local and non-local networks showed that the uses of local resources in non-material and support resources were prominent in both regions (Table 7-12). In other words, non-material and tacit knowledge was mostly shared through local networks. However, firms in both regions utilized all types of resources not only non-material resources ones. Therefore, several resources were needed to be innovative for firms in both regions. To some extent, non-local networks also complemented the needed resources. Tacit and codified knowledge are not alternatives but complements for competitive advantages of firms (Amin and Cohendet 1999, 2005; Gertler 2003; Howells 2002; Lawson and Lorenz 1999).

Table 7-12: Type of Resources by Type of Networks in Istanbul and Ankara

Type of Resources	Number of Ties					
	Ankara			Istanbul		
	Local	Non-local	Total	Local	Non-local	Total
Non-material resources	63 (68%)*	29 (32%)	92	161 (53%)	144 (47%)	305
Exchange of technical knowledge	14	5	19	76	70	146
Being in the loop	16	2	18	43	13	56
Formal R&D collaboration	19	11	30	22	18	40
Consulting	13	3	16	16	14	30
Know-how	1	8	9	4	29	33
Support resources	56 (74%)	21(28%)	76	112 (78%)	34 (22%)	146
Personnel help	16	0	16	23	3	26
Technical lab needs	25	4	29	37	18	55
Training	15	16	31	52	13	65
Material resources	30 (100%)	0	30	31 (26%)	89 (74%)	120
Borrowed equipment	4	0	4	17	6	23
Funding/Financing	26	0	26	14	83	97
Total	149	49	198	304	267	571

* % in total number of the resource type in the region.
Source: Interview data

Local network duration scores did not differ between two regions. Firms in both regions had ties with local institutions during an average of 50% of their existence. This was the case for both large firms and SMEs (Table 7-13, Table 7-14 and Table 7-15). However, the Ankara region differed from Istanbul in non-local duration. Both SMEs and large firms in Ankara had a higher non-local duration score. This is statistically significant at 5% and 1%. This is rather an interesting finding. It can be argued that Istanbul firms were capable of searching, finding and changing non-local networks ties when needed. This may represent the dynamic non-local relations in Istanbul. This condition does not lock the region into one technology trajectory. However, Ankara's situation can be explained the sectoral difference. The nature of defense sector may be the reason. Defense firms probably keep their non-local ties and had longer duration.

Table 7-13: Comparison of Duration, All Firms

	Region	N	Mean	Std. Deviation	t score	p value
Overall Duration	Ankara	22	0.58	0.20	1.035	0.303
	Istanbul	67	0.53	0.22		
Local Duration	Ankara	22	0.58	0.17	-1.311	0.194
	Istanbul	62	0.65	0.25		
Non-local Duration	Ankara	18	0.65	0.37	3.523	0.001*
	Istanbul	64	0.37	0.28		

*Significant at 5%
Source: Interview data

Table 7-14: Comparison of Duration, Large Firms

	Region	N	Mean	Std. Deviation	t score	p value
Overall Duration	Ankara	7	0.61	0.217	1.818	0.082
	Istanbul	19	0.44	0.216		
Local Duration	Ankara	7	0.57	0.150	0.675	0.506
	Istanbul	18	0.50	0.236		
Non-local Duration	Ankara	7	0.73	0.397	3.221	0.004*
	Istanbul	17	0.34	0.203		

*Significant at 5%
Source: Interview data

In both regions, local networks contained more of informal, frequent, and face-to-face ties than non-local networks (Table 7-16 and Table 7-17). This finding is inline with the literature. Territorial innovation models identified local networks as *strong* networks in the innovation process, since they are informal and personal relationships depending on trust. Moreover, it was argued that tacit knowledge was best transferred via face to face and frequent interaction which can be managed within local proximity (Audretsch 1998). However, this study also reveled that local networks contained both informal and formal type of ties. As a matter of fact, while informal ties made up 21% of all local ties, the majority (75%) of all local ties were formal. In addition, most of the 'need based' ties were maintained through face-to-face contacts. However, the impact of communication technology on networks was obvious in both local and non-local networks. This was valid for both regions. Therefore, we could argue that both local and non-local have qualities that were advantageous for different purposes (Uzzi 1996 ; Hite and Hesterly 2001; Rowley et al. 2000).

Table 7-15: Comparison of Duration, SMEs

	Region	N	Mean	Std. Deviation	t score	p value
Overall Duration	Ankara	15	0.57	0.193	0.070	0.944
	Istanbul	48	0.57	0.206		
Local Duration	Ankara	15	0.58	0.184	-1.994	0.051
	Istanbul	44	0.71	0.237		
Non-local Duration	Ankara	11	0.60	0.366	2.089	0.041*
	Istanbul	47	0.38	0.300		

*Significant at 5%
Source: Interview data

Table 7-16: Formality of Network Ties in Ankara and Istanbul

	Ankara				Istanbul			
	Formal		Informal		Formal		Informal	
	Number	%	Number	%	Number	%	Number	%
Local	86	79%*	23	21%*	199	77%*	58	23%*
Non-Local	36	92%**	0	0%**	201	94%**	12	6%**

Source: Interview data

Table 7-17: Communication Frequency and Media in Ankara and Istanbul

	Ankara			**Istanbul**		
	Face to face	**Combination of face to face, communication technology**	**Communication technology**	**Face to face**	**Combination of face to face, communication technology**	**Communication technology**
Local ties total	**55 (50%)***	**39 (35%)**	**15 (13%)**	**54 (21%)**	**155 (60%)**	**48 (19%)**
Very frequent	17	10	1	5	24	8
Frequent	1	2		10	23	2
Infrequent	3			3	13	6
Need based, once	34	27	14	36	95	32
Non-local ties total	**16 (44%) ****	**16 (44%)**	**4 (11%)**	**18 (8%)**	**150 (70%)**	**45 (22%)**
Very frequent		3			8	13
Frequent		1		2	26	6
Infrequent		4		1	5	3
Need based	16	8	4	15	111	23

Source: Interview data

7.4 CONCLUSION

This chapter compared the case study regions in terms of innovation activities and the networking behavior of manufacturing firms. The interregional comparison revealed similarities and differences. However, this study found that regions matter because differences in economic, business, social and institutional infrastructure might influence innovation type and the type and intensity of local networks (Storper 1997; Amin 1999; Visser and Boschma 2004), and its mixture with non-local relations. Ankara and Istanbul with different regional milieus influenced the type, intensity and characteristics of local and its mixture with non-local networks.

Did Ankara and Istanbul differ in innovation activities? First, both regions showed the conscious efforts of firms for quick adaptation to changing market conditions to protect their competitive advantages. Second, there was an emphasis on product innovation among the interviewed firms in both regions. The most important reasons for innovating were product related strategies and market creation. This supports the claim in the literature where product innovations are argued to be associated to the creation of new markets or to the quality enhancement of existing products, whereas process innovations are typically introduced for reducing costs, rationalizing or increasing the flexibility and performance of production processes (Edquist, Hommen, and McKelvey 2001; Simonetti, Archibugi, and Evangelista 1995).

Second, while the majority of the interviewed firms introduced new products, improvements in product and process development were dominant types of innovation activities in both regions. This is not surprising considering that incremental innovation is the dominant innovation type in developing countries. However, the number of Istanbul firms seemed to introduce more number of new process development. The difference between Ankara and Istanbul can be explained by the spatial pattern of process innovation and regional context. It is suggested in the literature that new processes are first implemented in core regions (Fritsch 2000). However, there is no convergence in the literature on this issue. As to the regional context, some firms in Ankara were oriented to local markets due to their emphasis on government. However, in Istanbul most of the firms did not focus on local but national or international market (Table 7-3). Therefore, cost competition may be more important for firms in Istanbul than Ankara. Research shows that the emphasis will change from product to process innovation when products were standardized and prices become the new critical factor of success (Abernathy and Utterback 1982).

Did Ankara and Istanbul differ in networking behavior? Innovative firms in both regions engaged in mixed networks, i.e. local and non-local. However the degree of mixedness differed between regions. Istanbul had a higher mixedness than Ankara since firms in Istanbul had more non-local networking capability. The regional structure played an important role in this result. Istanbul as a global city had more ties to international and national organizations while Ankara had mostly local ties due to specialization in defense industry and government as the main customer. Therefore, the mix differed according to region's context.

Did the characteristics of local and non-local networks differ between Ankara and Istanbul? Local networks were important for the innovation process in both regions. In both regions, local networks were strong ties. They were large in size; included diverse set of organizations; contained the most number of non-material or tacit knowledge ties; contained more informal, frequent and face-to-face interactions. These findings are in line with the literature where local networks are characterized as strong ties for innovation. However, the findings also revealed the existence of non-local ties in both regions. Although in some aspects, the non-local ties were 'weak' ties, they played an important role in the innovation process. They provide access to novel information and problem solving capabilities. But again the characteristics of non-local networks differed according to regional context. In Ankara, non-local network were smaller in size, less diverse but longer in duration than Istanbul. Therefore, we could argue that both local and non-local ties have qualities that were advantageous for different purposes and for different regions. A key issue is to understand these regional differences in understanding the determination of network benefits.

CHAPTER 8. DISCUSSION AND CONCLUSIONS

In the final chapter of this study, the main findings of this research are discussed. The first section summarizes the main points of the study by revisiting the objectives and research questions presented in the first chapter of this dissertation. It also summarizes the research methodology that was carried out to answer the questions. Second section presents the conclusions and its theoretical contributions of this study by summarizing the answers to each of the research questions. This is followed by the section summarizing the policy implications made by this research. Last section of the chapter discusses the limitations of the research and finally, presents some suggestions for future research on this theme.

8.1 SUMMARY OF THE RESEARCH

This dissertation focused on how firms in developing countries innovate and the role of territory in innovation. The point of departure of this research has been the need for a better understanding of innovation activities and the role of region in the innovation process in a developing country context. Specifically, the objectives of this dissertation were: 1) to analyze the networking behavior of innovative firms and the geography of these networks; 2) to examine the characteristics of local and non-local networks; and 3) to understand similarities and differences between regions for policy implications.

The literature concerning the relationship between innovation and space seemed to have some limitations. First, most of the literature on the geography of innovation has analyzed the patterns of behavior of innovative firms in the context of the advanced economies. Yet, 'innovative' firms in developing economies may have different networking patterns when firms introduce technological innovation of product and/or process kind. Second, in developed countries there was a large volume of empirical data and studies available that described the innovation activities of firms, as well as the results which confirmed the links between innovation and networking. This is not so in developing countries, where the characteristics and scope of innovation processes and networking behaviors were still largely unknown.

Third, notion of networking in the innovation process has not been discussed very thoroughly in the territorial innovation models. These models have put an emphasis on proximate or local ties in facilitating knowledge exchange among firms and local organizations, which in turn facilitates innovation (Camagni 1991; Storper 1997; Audretsch 1998). In addition, a more empirical problem in the literature was that the majority of regional studies had a tendency to focus on finding data at the local level, and consequently neglecting the importance of other spatial networks. However, firms might have engaged in other forms of non-local networking extending beyond their immediate locality (Amin 1999; Markusen 1999; Oinas 1999). Lastly, the characteristics of these networks have not been investigated systematically. However, their characteristics were important to understand the role of these different networks in innovation process in different regions.

It was concluded that the existing literature related to innovation and networking was limited in describing and providing understanding for the innovative firms in developing countries and their networking behavior. Thus this research had theoretical importance in the sense that contributions could be made to the gaps in the literature with regard to understanding the role of different spatial networks in the innovation process. To this end, this study had three main research questions: 1) To what extent do innovative firms in developing countries interact with other firms and organizations in order to introduce innovations of the product and process kind? What is the geography of these networks? 2) To what extent are local ties important relative to non-local ties for innovative firms? What are the characteristics of local and non-local ties? 4) Does the networking behavior of innovative firms differ between regions?

In order to answer these questions, networking behavior of innovative firms in two regions was studied in two regions, Ankara and Istanbul in Turkey. These two regions are highly urbanized, considered innovative and contained good universities. However, the regions are at different stages of industrial development. Istanbul is the core, established industrial metropolitan region of Turkey and it has a well developed and dynamic manufacturing capacity. On the other hand, the capital, Ankara is important mostly in terms of administrative functions. Recently, however, it has become identified and studied as a new high-tech industrial agglomeration emerged in 1990s (Dede 1999; Tekeli 1994). The selection of cases and firms as well as the qualitative research methods, data gathering and analysis were discussed in Chapter 3. The detailed profiles of these regions were discussed in Chapter 4.

In the following section, I summarize the main conclusions and discuss the most important theoretical contributions that this study has made to the literature. The conclusions are discussed by answering each of the three questions at a time.

8.2 CONCLUSIONS AND THEORETICAL IMPLICATIONS

This section is centered on the implications of the findings for the literature. This study makes a number of contributions to research on innovation activities in developing countries, spatial innovation networks, and the role of region.

Innovation and developing countries: Are firms in developing countries innovative? This study findings showed that firms in two regions had important innovative capability. This capability included mostly incremental innovation and to large extent ability to create new products and to some extent processes innovation. Product innovation was more frequent than process innovation. This might be explained by the need to open up new markets; to increase domestic market share; and to increase the performance of the product. The results suggested that domestic firms in both regions showed the *conscious* effort for quick adaptation to changing market conditions to protect their competitive advantages. 'Learning' was not an automatic process but a conscious, systematic, and frequent effort made by the firms (Bell and Pavitt 1992; Cooper 1991; Mytelka and Ernst 1998; Westphal, Rhee, and Pursell 1984). Consequently, the local industry in developing countries can not be seen as passive, involving only the adoption and routine operation of externally supplied technologies which was the view of 1950s and 1960s. In this study, most of the innovative firms were domestically owned and operated. This set of findings is consistent with other cases in the literature where firms in some developing countries recently have attained the status of creators of new technologies instead of assimilators of technologies created elsewhere (Mani and Romijn 2004). Some of these examples included India, China, Korea, Taiwan, and Singapore. Mani and Romijin (2004) argued that this status has been achieved through a process of learning and incremental innovation.

Interactive innovation process in developing countries: Do innovative firms in developing countries interact with other firms and organizations? The results of this study confirmed the claim in the literature that innovation does not happen in isolation. Although the types and the level of interaction differed from firm to firm and region to region, firms in both regions interacted with other firms and organizations during their innovation activities. The reason for this interaction was to access resources for their innovation activities as they did not have all the resources internally. This finding corroborates the view that innovation is not a linear, but rather is an interactive process (Asheim 1996; Dosi and Nelson 1994; Håkansson 1987; Inkpen 1996). As stressed by the interactive model of innovation in the literature, in this study innovation was sustained by inputs derived from *interacting* with suppliers, universities, government agencies, or feedback from customers (Lundvall 1992). However, this study emphasized that innovation networks should be defined broadly and it should include several resources but not one of type resource which will be discussed in detail in the following themes.

Territorial Innovation Models and local spatial networks in developing countries: Do firms innovate in local networks? To what extent are local ties important relative to non-local ties for innovative firms? All territorial innovation models highlighted the local dimensions of networks. It is argued that proximate or local ties play an important role in facilitating knowledge exchange among firms and local organizations, which in turn facilitates innovation (Camagni 1991; Storper 1997; Audretsch 1998). However, this dissertation found that innovation and its geographical manifestation was a more complex phenomenon for developing countries. Perhaps the most striking pattern of findings in this research was that the study regions in this study converged into similar behavior as far as the role of geography was concerned. While local networks were important in the innovation activities of the interviewed firms, these firms also had non-local ties, i.e. national and international ties. Again, the degree of mixedness differed from region to region which will be discussed later. These networks were not substitutes but complements. Non-local networks were used to access capabilities that were not present locally. The region could not contain all the resources, especially in the case of developing countries. Firms had to stay tuned with what happened in the market, what happened among other producers, customers, and suppliers.

Although, this study produced results which corroborated the importance of local networks, this study extends the local networking hypothesis by adding the existence of non-local networks to territorial innovation models. Firms in both regions had relationships with other firms and organizations outside the region. This confirmed the suspicion of several authors who argued that the importance of proximate relationships may be overstated by failing to take account of the forms of networking in which firms engage, extending beyond their immediate locality (Alderman 1999; Amin 1999; Oinas 1999; Hendry 2000; Markusen 1999; Malecki 1999; Harrison 1994; Simmie 1998; Simmie, 1999; Amin 1992; Amin 1999; Ernst 1999; Staber 1996; Amin 2005). This finding is especially true for peripheral regions and regions in developing countries. These areas needed to blend diverse international and domestic sources of knowledge (Ernst 2002). The key to success is to facilitate the simultaneous mobilization of multiple and diverse sources of knowledge-the global production networks of buyers and suppliers of both foreign and domestic origins, as well as the diverse carriers of national innovation systems (Ernst, 2002). It is true that interactions have spatial nature. But they also have organizational nature. Non-local networks might represent organizational proximity (Oinas 1999).

<u>Local and non-local networks characteristics:</u> To what extent are local ties important relative to non-local ties for innovative firms? What are the characteristics of local and non-local

ties? Territorial innovation models identified local networks as *strong* networks in the innovation process, as they were larger in size (Storper 1997); they facilitated production and diffusion of tacit knowledge which was emphasized as an important component of the knowledge used in innovation; they were built on longer, informal, and personal relationships depending on trust. Moreover, it was argued that tacit knowledge was best transferred via face to face and frequent interaction which can be managed within local proximity (Audretsch 1998). Within the local networks, customers and suppliers were specifically emphasized. It was argued that while a flow of incremental innovations is generated through localized interaction with customers (Von Hippel 1988), embodied technologies were imported into the firm through the exchanges with suppliers, as knowledge spillovers (Audretsch 1998).

To some extent, this study also found that local networks constituted the strong ties in the innovation process in both regions. They were larger in size than non-local networks, contained more informal ties and allowed more frequent relations. In addition, non-material and tacit knowledge was mostly shared through local networks. However, to some extent, non-local networks also provided all three types of resources. As some other research also showed that the simple tacit vs. codified dichotomy and its local and global implication is problematic (Bathelt, Malmberg, and Maskell 2004).

The important finding of this dissertation was that firms did not only employ non-material resources but material and support resources from their local networks. Several resources were needed to be innovative for firms in both regions. This also supported the argument in the literature that tacit and codified knowledge are not alternatives but complements for competitive advantages at different stages of a firm's life cycle (Amin and Cohendet 1999, 2005; Gertler 2003; Howells 2002; Lawson and Lorenz 1999).

Another finding of this dissertation regarding the local networks were that they contained diverse set of organizations not only customers or suppliers, but universities, financial, research institutions and professional associations (Kaufmann and Todtling 2000; Perrin 1991).

Although non-local networks can be considered as weak ties, non-local ties were beneficial as they provided access to novel information, expertise and problem solving capabilities (Granovetter, 1973, 1982; Burt, 1992). This builds on the theory of strength of weak ties of Granovetter. Therefore, we could argue that both local and non-local networks have qualities that were advantageous for different purposes. This study extended the theory of strong local networks by introducing the mix of local (strong) and non-local (weak) ties since each of them contributing in a particular way to the innovation process in developing countries. Of course, the issue here is that the determination of network benefits is the search for the optimal mix (Uzzi 1997; Rowley et al. 2000) of local (strong) and non-local (weak) ties for a specific region. This is discussed in the next theme.

Regional milieus, innovation, networking, and regional development: Does the networking behavior of innovative firms differ between regions? How does this inform regional development policies? It was found in this study that regions matter because differences in economic, business, social and institutional infrastructure influence the type and intensity of local networks (Storper 1997; Amin 1999; Visser and Boschma 2004), and its mixture with non-local relations. Ankara and Istanbul differed in the degree of mixedness and characteristics of local and non-local networks. Istanbul as a global city had more ties to international and national organizations while Ankara had mostly local ties due to specialization in defense industry and government as the main customer.

Empirical studies have identified a variety of types of regions. To reiterate the work presented in Chapter 2, Markusen (1996), for example, has identified four types of regions. These are:

> 1) Marshallian industrial districts where the business structure is dominated by small, locally-owned firms, there is substantial intra-district trade among buyers and sellers, long-term contracts and commitments between local buyers and suppliers, and low degrees of cooperation or linkage with firms external to the district.
>
> 2) Hub-and-spoke districts where the business structure is dominated by one or several large, vertically integrated firms surrounded by suppliers, core firms are embedded non-locally, with substantial links to suppliers and competitors outside the district, substantial intra-district trade among dominant firms and suppliers, long-term contracts and commitments between dominant firms and suppliers, high degrees of cooperation, linkages with external firms both locally and externally, low degrees of cooperation among large competitor firms to share risk, stabilize market, and share innovation, and a high degree of public involvement in providing infrastructure.
>
> 3) Satellite industrial platforms where there is minimal intra-district trade among buyers and suppliers, the absence of long-term commitments to local suppliers, high degrees of cooperation, linkages with external firms, especially with the parent company, and low degrees of cooperation among competitor firms to share risk, stabilize market share, and share innovation.
>
> 4) State anchored industrial districts where the business structure is dominated by one or several large, government institutions such as military bases, state or national capitals, large public universities, surrounded by suppliers and customers, substantial intra-district trade among dominant institutions and suppliers but not among others, high degrees of cooperation, linkages with external firms for externally headquartered supplier organizations, low degrees of cooperation among local private-sector firms to share risk, stabilize market share, and share innovation, and a high degree of public involvement in providing infrastructure. (Markusen 1996)

Ankara showed similarities to state-anchored innovative region characterization where business structure was dominated by one or several large, government institutions such as military and national capital, large universities, surrounded by suppliers and customers, substantial intra-district trade among dominant institutions and suppliers. There is also high degree of public involvement in providing infrastructure. However, different than Markusen's typology was high level local linkages for innovation activities and some degree of non-local linkages with other firms and organizations.

With Istanbul, this study perhaps showed a fifth type of region. Istanbul can be characterized by multiple clusters of innovative sectors, high levels of linkages with local and non-local organizations and firms, the importance of national and international markets, and the involvement of both public and private investment in infrastructure. Istanbul differs from the Marshallian district in the sense that Istanbul had the high degrees of linkage with firms and organizations external to the district. It also differs from the hub-and-spoke because the business structure was not dominated by one or several large firms.

The next section discusses the policy implication of the findings so far.

8.3 POLICY IMPLICATIONS

The growing interaction between innovation and economic development in today's world presents new challenges in public policy. This study only covers a portion of the complex interrelationships between innovation and the regional economies in developing countries.

This study showed that to large extent innovations in regions in developing countries are incremental. Policies related to incremental innovations should not be disregarded as it was shown in this study and other empirical research that it made up most of the innovation activities in developing countries. These incremental innovations add value and create learning. However, firm level innovation policies should also encourage innovations which are new to the firms and market they serve. Therefore, firms do not follow existing technological trajectories, a pattern which may create problems of 'lock-in' in the long run (Kaufmann and Todtling 2000). This could be done by strengthening of industry-university relationships and human capital training.

This study also showed that using external resources is important for innovation activities, thus stressing the importance of including network variables in the innovation policy design. Policies could be to set up incentives by supporting networks and not individual firms (Maskell, 1999). At this time, the main innovation policy in Turkey is to provide R&D grants or tax credits to individual firms rather than networks. Government policies are usually designed to support production of knowledge, such as through incentives for R&D activities rather than the utilization of knowledge (Santos 2000). However, policy tools should encourage diffusion and utilization of knowledge by the regional actors. This could be done by supporting networks rather than individual firms. These networks should involve quite a large variety of actors: firms, suppliers, universities, professional organizations, universities, public institutions, banking system, research labs, training institutions, and various private services. In inter-firm networks relationships between large and small firms as well as those between small and small firms are important for innovation (Park, 1996; Young *et al.*, 1994). However, it is important to keep in mind that context matters. Each region has its own local culture and its set of institutions. Policy must take into account the fact that regions do not have similar resources and economic trajectories so their response to policy interventions might be different.

The networks should also include different spatial scales. The results of this study reveal that there is a both local and non-local component to innovation process. Given its mix of international, inter-regional and local networks, innovative firms in Ankara and Istanbul are an illustration of the need to view clusters in broad network terms if we are to understand their strengths and possible weaknesses. The models of local networking have already emerged in policy agendas of developing countries (Altenburg and Meyer-Stamer 1999; Cooper 1991; The World Bank 1992), such as Technopark development. In addition, local universities provide various positive externalities to industry locally. Regional universities are certainly the most important source for human capital. SMEs can involve with universities through internships and academic theses which can help to overcome barriers and open up and channel the international knowledge. Local informal linkages were emphasized by the literature; however, public policy can help forming formal ties which may in the long run produce informal relationship that builds on trust. Formation of social networks among various actors should be promoted through diverse workshops, seminars, conferences, and informal meetings. It should be noted that informal networks among work forces are an important source of the exchange and transfer of tacit knowledge. These models should be enriched by adding non-local (i.e. inter-regional and international) linkages. Public and private associations can act as intermediaries by organizing international trade fairs, exchange programs, joint qualification schemes, and participation in international funding programs. Collaborative inter-regional technology networks should be promoted.

Regional innovation policy has to consider that different paths of successful innovative development exist as it was shown in Ankara and Istanbul regions. It is important to ask the right questions and design the right tools for each region. These questions need an accurate understanding of the regional context to be answered. Since interregional variety is persistent phenomenon, policy makers have to define their objectives and policy measures based on an analysis of region specific context.

8.4 LIMITATIONS OF THE STUDY AND THE AVENUES FOR FUTURE RESEARCH

It is important to critically evaluate the results of the study. The present study has certain imitations that need to be taken into account when considering the study and its contributions. However, some of these limitations can be seen as fruitful avenues for future research under the same theme.

This study has focused on important phenomena, innovation and networking in a developing economy. In this study, this extensive and complex phenomenon has been studied from a rather narrow empirical perspective. The number of interviewed firms was somewhat small in relation to the potential universe of relevant firms, especially in Ankara because the business structure was more closed to innovation surveys. Also another innovation survey by TUIK was going on at the same time. Because of the small number of interviewed firms, sectoral differences could not be investigated. To study sectoral differences, for example, is clearly one of the future research challenges in this topic. This would enable us to understand the innovation activities and networking behavior of innovative firms further. Similarly, the sample in two regions contained a small number of joint venture and MNCs. The limited observations in this study provided very preliminary hypotheses. The observation about the innovation activities and networking behavior were very interesting. The preliminary findings suggested that production capability and innovative capability went together. If MNCs had very limited production capabilities, their innovation activities were very limited. Consequently, they only interact with the parent company and had very small network size. This did not contribute much to the regional development. The comparison of domestic vs. foreign or joint venture firms could reveal interesting insights in this topic. Another interesting finding that needs to be further studied is the role of universities and technoparks in building innovative capability in regions in developing economies. To study the level of university R&D activities and industry R&D in regions would be another interesting study. As to the technoparks, several firms mentioned the importance of being close to the university, but at the same time they mentioned that being far from suppliers is a problem. This needs to be studied further.

Another limitation of this study is the network perspective adopted. This research studied the partial networks of firms, not the whole networks in the region. The whole network relations reveal potential valuable insights. Studying whole networks reveal imitation and innovation behavior among directly tied actors. It also provides a broader regional network structure.

Within these limitations, the study produced a valuable and analytically useful set of empirical data which allows us to raise important questions about the implications of these findings for the literature on territorial innovation models.

APPENDIX A: THE LIST OF ALL FIRMS CONTACTED

Num	Name of the Organization	Region
1	ELİAR ELEKTRONİK SAN. A.Ş.	Istanbul
2	SADIK OTOMOTİV SAN. VE TİC. A.Ş.	Istanbul
3	TRİO ÇÖZÜM EVİ BİLİŞİM HİZMETLERİ A.Ş.	Istanbul
4	GORDİON BİLGİ HİZMET LTD. ŞTİ.	Istanbul
5	İNFOTRON ELEKTRONİK VE BİLGİSAYAR SİST. ÜRETİM VE TİC. A.Ş.	Istanbul
6	ULTİMA BİLGİSAYAR VE İLETİŞİM TEKNOLOJİSİ A.Ş.	Istanbul
7	BEKO ELEKTRONİK SANAYİİ A.Ş	Istanbul
8	KANCA EL ALETLERİ DÖVME ÇELİK VE MAKİNA SANAYİ A.Ş	Istanbul
9	ÖZKOÇ HİDROLİK MAKİNE SAN. VE TİC. A.Ş.	Istanbul
10	ALKAN MAKİNA SAN. TESİSLERİ VE TİC. A.Ş.	Istanbul
11	ARGE OTOMOTİV ARAÇ VE GEREÇLERİ SAN. VE TİC. A.Ş.	Istanbul
12	DORUK OTOMASYON VE YAZILIM SAN. TİC. A.Ş.	Istanbul
13	İNTER SERVİS MAK. MÜM. SAN. VE TİC. A.Ş.	Istanbul
14	ENPAY A.Ş.	Istanbul
15	İNTEGRAL BİLGİSAYAR HİZMETLERİ A.Ş.	Istanbul
16	VİSTEK BİLGİSAYAR VE DANIŞMANLIK HİZM. LTD.	Istanbul
17	BİLDEN BİLGİSAYAR A.ŞÜKRÜ KORMAN	Istanbul
18	IAS BİLGİ İŞLEM DANIŞMANLIK A.Ş.	Istanbul
19	ONTROL TEKNİK MALZEME SANAYİ VE TİCARET A.Ş.	Istanbul
20	MİKROSAY ELEKTRONİK SANAYİ VE TİC. A.Ş.	Istanbul
21	IMS YAZILIM DANIŞMANLIK VE DIŞ TİC. LTD. ŞTİ.	Istanbul
22	LAFER TEKSTİL MAKİNA SAN. TİC. A.Ş.	Istanbul
23	PANEL SİSTEM POLİÜRETANLI PANEL SİSTEMLERİ SAN. VE TİC. A.Ş.	Istanbul
24	TETİSAN END. KLİMA TESİSLERİ İMALAT SAN. VE TİC. LTD. ŞTİ.	Istanbul
25	KOMSAN KOMPRESÖR SANAYİİ VE TİC. A.Ş.	Istanbul
26	EAE ELEKTRİK ASANSÖR SAN. VE TİC. A.Ş.	Istanbul
27	EAE ELEKTRİK AYDINLATMA ENDÜSTRİ SAN. TİC. A.Ş.	Istanbul
28	EAE ELEKTRONİK ALETLER ENDÜSTRİSİ A.Ş.	Istanbul
29	FRENTEKNİK OTOMOTİV SAN. VE TİC. LTD. ŞTİ.	Istanbul

30	HİDROKET HİDROLİK MAKİNA SAN. VE TİC. A.Ş.	Istanbul
31	HİPAK HİDROLİK MAKİNA SAN. A.Ş.	Istanbul
32	LOGO YAZILIM SANAYİ VE TİCARET LTD. ŞTİ.	Istanbul
33	FORD-OTOSAN OTOMOBİL SAN. A.Ş.	Istanbul
34	HALICI ELEKTRONİK VE TELEKOMÜNİKASYON SAN. VE TİC. LTD. ŞTİ.	Istanbul
35	İNTER MÜHENDİSLİK DANIŞMANLIK VE TİC. A.Ş.	Istanbul
36	SEM LAB. CİH. PAZ. SAN. TİC. LTD.	Istanbul
37	ULTRASONİK ENDÜSTRİYEL YIKAMA MAK.SAN.LTD.ŞTİ.	Istanbul
38	ABC CEDETAŞ OTOMASYON VE KONTROL LİMİTED ŞİRKETİ	Istanbul
39	FRENTEK BALATACILIK VE OTOMOTİV SAN. VE TİC. A.Ş.	Istanbul
40	SİMKO TİC. VE SAN. A.Ş.	Istanbul
41	ALTINAY ROBOTİK VE OTOMASYON SAN. TİC. A.Ş.	Istanbul
42	MOR YAZILIM HİZM. VE BİLGİSAYAR SİS. LTD. ŞTİ.	Istanbul
43	SAYOT SAYAÇ OTOMASYON SİSTEMLERİ SAN. VE TİC. A.Ş.	Istanbul
44	ÜNİVERSAL TEKNOLOJİK ÜRÜNLER SAN. TİC. LTD. ŞTİ.	Istanbul
45	OTOKAR OTOBÜS KARASÖRLERİ SAN. A.Ş.	Istanbul
46	YAPSAR MAKİNA KALIP SAN. VE TİC. LTD. ŞTİ.	Istanbul
47	EBİ ECZACIBAŞI BİLGİ İLETİM SAN. VE TİC. A.Ş.	Istanbul
48	ÖZYAK ISITMA SOĞUTMA SAN. VE TİC. A.Ş.	Istanbul
49	GÜVEN BİLGİSAYAR SAN. VE TİC. LTD. ŞTİ.	Istanbul
50	AKA YAZILIM BİLGİSAYAR TEKNOLOJİLERİ SAN. VE TİC. A.Ş.	Istanbul
51	OTONOM US VE BİLGİ TEK. BİLGİSAYAR YAZ. DAN. SAN. TİC. A.Ş.	Istanbul
52	SİBERNETİK BİLGİ TEK. BİLGİSAYAR YAZ. SAN. TİC. LTD. ŞTİ.	Istanbul
53	VERİKON ELEKTRONİK KONTROL VE VERİ İŞLEM SİST. SAN. VE TİC. LTD. ŞTİ.	Istanbul
54	İSTANBUL BİLGİ İLETİŞİM SİST. SAN. VE TİC. A.Ş. (IBS A.Ş.)	Istanbul
55	MİNERVA YAZILIM A.Ş.	Istanbul
56	PROFİLO TELRA ELEKTRONİK SAN. VE TİC. A.Ş.	Istanbul
57	VERİPARK BİLİŞİM YAZILIM VE DAN. HİZMETLERİ A.Ş.	Istanbul
58	OPAŞ OTOMOTİV PLATİNLERİ SAN. VE TİC. A.Ş.	Istanbul

59	TESAN TEKSTİL MAKİNALARI SAN. VE TİC. LTD. ŞTİ.	Istanbul
60	NETA ELEKTRONİK CİHAZLAR İMALAT VE TİCARET A.Ş.	Istanbul
61	SANOR BİLİŞİM TEKNOLOJİLERİ LTD. ŞTİ.	Istanbul
62	ERTAŞ ISI VE MAKİNA SANAYİ VE TİCARET A.Ş.	Istanbul
63	TEKNOMATİK MÜHENDİSLİK SAN. VE TİC. LTD. ŞTİ.	Istanbul
64	BİLKO BİLGİSAYAR OTOMASYON VE KONTROL A.Ş.	Istanbul
65	SES 3000 CNC TAKIM TEZGAH. VE CAD/CAM BİLGİSAYAR SİS. LTD. ŞTİ.	Istanbul
66	UZEL MAKİNA SAN. A.Ş.	Istanbul
67	İNFORM ELEKTRONİK SAN. VE TİC. A.Ş.	Istanbul
68	OERLIKON KAYNAK ELEKTRODLARI VE SANAYİ A.Ş.	Istanbul
69	İMPER ELEKTRİK SAN. VE TİC. A.Ş.	Istanbul
70	AYBİM BİLGİSAYAR TİCARET LİMİTED ŞİRKETİ	Istanbul
71	İMAT BİLGİSAYAR SAN. VE TİC. A.Ş.	Istanbul
72	VERİSOFT BİLGİ İŞLEM TİC. VE SAN. LTD. ŞTİ.	Istanbul
73	EST, ENERJİ SİSTEM TEKNOLOJİLERİ SAN. İÇ VE DIŞ TİC. LTD.	Istanbul
74	PROTEKİLA ELEKTRONİK YAZILIM VE OTOM. SİS. SAN. VE TİC. LTD. ŞTİ.	Istanbul
75	KMS KUBA MAKİNA SANAYİİ VE TİCARET LTD ŞTİ.	Istanbul
76	MERCEDES-BENZ TÜRK A.Ş.	Istanbul
77	TÜRK ELEKTRİK ENDÜSTRİSİ A.Ş.	Istanbul
78	ARÇELİK A.Ş.	Istanbul
79	ARTESİS TEKNOLOJİ SİSTEMLERİ A.Ş.	Istanbul
80	BURGMANN ENDÜSTRİYEL SIZDIRMAZLIK SAN. VE TİC. LTD. ŞTİ.	Istanbul
81	ONUK TAŞIT SAN. LTD. ŞTİ.	Istanbul
82	ADAM ELEKTRONİK LTD. ŞTİ.	Istanbul
83	EKA ELEKTRONİK KONTROL ALETLERİ SAN. VE TİC. A.Ş.	Istanbul
84	ENKO ENDÜSTRİYEL KONTROL MÜH. SAN.TİC.LTD.ŞTİ.	Istanbul
85	KOMSA ELEKTRONİK ENDÜSTRİ TİC. A.Ş.	Istanbul
86	NETAŞ	Istanbul
87	TOYA MAKİNA SAN. VE TİC. A.Ş.	Istanbul
88	BİLKOM BİLİŞİM HİZMETLERİ A.Ş.	Istanbul
89	GVZ SES TANIMA TEKNOLOJİLERİ, YAZILIM HİZMETLERİ A.Ş.	Istanbul
90	LİNK BİLGİSAYAR SİSTEMLERİ YAZILIMI VE DONANIMI SAN. VE TİC. A.Ş.	Istanbul

91	ALARKO CARRIER SAN. VE TİC. A.Ş.(ALPOM MÜESSESESİ)	Istanbul
92	ALCATEL TELETAŞ TELEKOMÜNİKASYON ENDÜSTRİ TİC. A.Ş.	Istanbul
93	ARLA MÜHENDİSLİK SAN. VE TİC. LTD. ŞTİ.	Istanbul
94	HİDROTAM MAKİNA LTD. ŞTİ.	Istanbul
95	KOMBASSAN KANUNİ MOTORLU ARAÇLAR İMALAT VE SAN. Tİ	Istanbul
96	ISI SANAYİ A.Ş.	Istanbul
97	TELENİTY İLETİŞİM SİSTEMLERİ SAN. VE TİC. A.Ş.	Istanbul
98	ARIKAZAN MAKİNA SAN. VE TİC. A.Ş.	Ankara
99	ASELSAN A.Ş.	Ankara
100	ASMEK ASFALT SAN. A.Ş.	Ankara
101	ATİKUS ELEKTRONİK İNŞAAT SAN. VE TİC. LTD. ŞTİ.	Ankara
102	BARMEK ELEKTRONİK SAN. VE TİC. A.Ş.	Ankara
103	BAŞARI ELEKTRONİK SAN. VE TİC. A.Ş.	Ankara
104	BİLGİ COĞRAFİ BİLGİ DÖNÜŞÜM VE YÖNETİM SİS. TİC. LTD. ŞTİ.	Ankara
105	BİLGİ GRUBU YAZILIM ARAŞTIRMA EĞİTİM DAN. LTD. ŞTİ.	Ankara
106	BİLİŞİM SAN. VE TİC. LTD. ŞTİ.	Ankara
107	E.E.S. ELEKTRİK-ELEKTRONİK SİSTEMLER A.Ş.	Ankara
108	EMEK ELEKTRİK END. A.Ş.	Ankara
109	ENERSİS, ENERJİ SİSTEMLERİ SANAYİ VE TİC.A.Ş.	Ankara
110	ETA ELEKTRONİK TASARIM SAN. VE TİC. A.Ş	Ankara
111	FNSS SAVUNMA SİSTEMLERİ A.Ş.	Ankara
112	GATE ELEKTRONİK SAN. VE TİC. A.Ş.	Ankara
113	GEMTA GENEL ELEKTRONİK SAN. VE TİC. A.Ş.	Ankara
114	HALICI YAZILIM SANAYİ A.Ş.	Ankara
115	HAVELSAN A.Ş.	Ankara
116	HAVELSAN EHSİM A.Ş.	Ankara
117	HEMA DİŞLİ SAN.TİC.A.Ş.	Ankara
118	HEMOSOFT BİLİŞİM VE EĞİTİM HİZMETLERİ LTD. ŞTİ.	Ankara
119	HİDROMEK HİDROLİK VE MEKANİK MAK.İM. SAN. VE TİC.LTD.ŞTİ.	Ankara
120	KARDİOSİS LTD. ŞTİ.	Ankara
121	KAREL ELEKTRONİK SAN. TİC. A.Ş.	Ankara
122	MDA MÜH. DAN. ARAŞTIRMA BİLGİSAYAR TEK. SAN. YAPI VE TİC. A.Ş.	Ankara
123	METEKSAN SİSTEM VE BİLGİSAYAR TEKNOLOJİLERİ A.Ş.	Ankara

124	MİLSOFT YAZILIM TEKNOLOJİLERİ A.Ş.	Ankara
125	MKEK ELROKSAN ELMADAĞ ROKET SAN. VE TİC. A.Ş.	Ankara
126	MKEK ELSA ELEKTRİK SAYAÇLARI SANAYİ VE TİCARET A.Ş	Ankara
127	MKEK GENEL MÜDÜRLÜĞÜ	Ankara
128	MOSTEK MODERN OTOMASYON SİST. VE TEK. SAN. VE TİC. LDT. ŞTİ.	Ankara
129	MÜSAN MAKİNA ÜRETİM SANAYİ VE TİCARET A.Ş.	Ankara
130	NORM ELEKTRONİK SAN. VE DIŞ TİC. A.Ş.	Ankara
131	NURİŞ ELEKTRİK VE KAYNAK MAKİNALARI SAN. VE TİC. A.Ş.	Ankara
132	NÜVE SANAYİ MALZEMERİ İMALAT VE TİC. A.Ş.	Ankara
133	ODESA ORTADOĞU ELEKTROMEKANİK SAN. VE TİC. LTD. ŞTİ.	Ankara
134	ORTADOĞU RULMAN SAN. VE TİC. A.Ş.	Ankara
135	ROKETSAN A.Ş.	Ankara
136	SELEN ELEKTRİK SANAYİ VE TİC.A.Ş.	Ankara
137	SİSPA TEKNOLOJİ, SİSTEM SANAYİ TİCARET A.Ş.	Ankara
138	SİSTAŞ SAYISAL İLETİŞİM SAN. VE TİC. A.Ş.	Ankara
139	SONSAN SONDAJ SAN. LİMİTED ŞTİ.	Ankara
140	STM SAVUNMA TEKNOLOJİLERİ MÜH. VE TİC. A.Ş	Ankara
141	TEGA MAKİNA SANAYİ VE TİCARET A.Ş.	Ankara
142	TEPA TIBBİ ELEKTRONİK ÜRÜNLER PAZARLAMA A.Ş.	Ankara
143	TNS ENFORMASYON TEKNOLOJİLERİ LTD.ŞTİ.	Ankara
144	TUSAŞ HAVACILIK VE UZAY SANAYİİ A.Ş. (TAİ)	Ankara
145	TÜRK TRAKTÖR VE ZİRAAT MAKİNALARI A.Ş.	Ankara

APPENDIX B: SEMI-STRUCTURED INTERVIEW GUIDE

Innovative Capability and Networks

About This Survey:
This is a research project designed and carried out by a Turkish PhD student, Yesim Sungu, at the University of Pittsburgh. It examines how firms in Turkey are responding to today's increasingly competitive business environment. The objective of this study is to assess the role of various economic and social institutions in facilitating innovative behavior of firms. Your participation in the survey is voluntary. Refusal to participate in this study will involve no penalty of loss of benefits, and you may withdraw at any time without penalty and loss of benefits. However we believe that the results of the study will be useful in desiging, developing and improving technology policies which is directly relevant to your company. There is no risk associated with answering this questionnaire since the survey does not ask questions related to specifics of products or process development projects.

Confidentiality:
You are assured complete confidentiality in this survey. Only Ms. Sungu will have access to the answers and your completed survey will be handled exclusively by her. Your completed survey will be assigned a code number and individual responses will not be identifiable in reports.Only aggregate data will be used for analysis and interpretation. Once answers entered into the computer, the paper copies will be destroyed.

Instructions:
The questions in this survey consist of multiple choices, a limited number of short fill-in-the-blank type and some open ended questions. Please make every effort to answer all questions as precisely and candidly as possible, since the validity of the study's results depends on complete and accurate responses. This survey is intended for the President, CEO or the owner of your company who is most knowledgeable about all aspects of your business. Executive Summary of the results will be mailed to participants who request. If you have any questions or concerns, please contact Yesim Sungu at 543-806 4018 or e-mail yesst1@pitt.edu.

Thank you for your time and attention.

If you want a copy of the executive summary of this report, please fill out the following information.

Name of the firm:
Name of the respondent:
Title of the respondent:
Address of the firm:
Fax No:
E-mail:

Date: _____________ Questionnaire Code: __________

I. FIRM HISTORY - *First, I would like to ask you a few questions about the history of your company.*

1A. When was the firm established? _____________(Year)
1.B. Where was the firm established? _____________ (City) _________________ (District)
2. Who established the firm?

	Name	Position now	Education level	3. Were the founders trained in the city where the firm was established? 1.Yes 2. No. City?
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

4. At establishment, Was your firm:
    1. a family company? 1. [ ] Yes 2. [ ] No
    2. a spin-off of another company? 1. [ ] Yes → Whichone____________City ___________
    2. [ ] No
    3. a new business at that time.? 1. [ ] Yes 2. [ ] No
    4. a subsidiary of another company? 1. [ ] Yes → Which one_____________ City_____________
    2. [ ] No
    5. Other? ____ (Please specify)

5. How would you classify your firm at present? (Check only one)
    1. [ ] Private, family 2. [ ] Private
    3. [ ] Private, multinational 4. [ ] Public
    5. [ ] Other (Please specify) ____

6A. If your firm is a family business, which generation works for the company? ________________

6B. What are their level of education and their responsibilities?

Education level	Responsibilities

7. Has your firm ever been relocated? 1. [ ] Yes
    2. [ ] No → skip to question 11A
    8. How many times? ________________
    9. Did your company move: 1. [ ] to another city ?
    2. [ ] within the same city?

10. When and from where did you come here? __________ (City/district) __________ (month/year)

11A. What are the advantages of your location here?

11B. What are the disadvantages of your location here?

12. What were the turning points in the business life of your firm? How did they affect your firm? (Changes in products, firm status, administrative structure, etc.. Please state the approximate dates.)

II. INNOVATION ACTIVITY - *Now, I would like to ask you a few questions about changes in your firm's operations and products..*

13. In which sectors does your firm mainly operate?
____

14. What are the main products/services of your company?
(i) ________________________________
(ii) ________________________________
(iii) ________________________________

15. How long has your firm been in this business? ________

16A. In your sector, who are the **domestic** leading firms? How would you evaluate your firm's position with respect to them?

16B. In your sector, who are the **foreign** leading firms? How would you evaluate your firm's position with respect to them?

17. Over the **last five years,** has your firm **redesigned** or **significantly improved** any of its products?

1.[ ] Yes
2.[ ] No → skip to question 18

17A. Please specify the improved or redesigned products.

1. ______________________________
2. ______________________________
3. ______________________________

18. Over the **last five years,** has your firm introduced **new products** technologically different in use and character?

1. [ ] Yes
2. [ ] No → skip to question 19

18A. Please specify the new products.

1. ______________________________
2. ______________________________
3. ______________________________

19. Over the **last five years,** has your firm significantly **improved** its **production processes**?

1. [ ] Yes 2. [ ] No → skip to question 20

19A. Please specify the improved production process/es.

1. ______________________________
2. ______________________________
3. ______________________________

20. Over the **last five years,** has your firm developed **new production processes**?

1. [ ] Yes
2. [ ] No → skip to question 21

20A. Please specify new production processes.

1. ______________________________
2. ______________________________
3. ______________________________

21. Over the **last five years,** has your firm invested in new technologies (machine, equipment, software, etc)?

1. [ ] Yes
2. [ ] No → skip to question 24

21A. Please specify the new technologies.

1. ______________________________
2. ______________________________
3. ______________________________

	1st Organization	2nd Organization	3rd Organization
22.1. Name of the organization from which you acquired the new technologies ? (Initials can be given)			
22.2. How would you classify this organization? **(Give the 1st Card)**			
22.3. Where is this organization located ?(City / country name.)			

23. Has any organization(s) assisted your firm in selecting or transferring these new technologies?
1. [ ] Yes
2. [ ] No ⟶ skip to question 24

23A. Please specify their names and locations.

Names	**Location**

24. Has your firm borrowed any tools/equipment from any organization/firm when developing products or processes? 1. [ ] Yes
2. [ ] No ⟶ skip to question 25

If yes, please answer the following questions.

	1st Organization	2nd Organization	3rd Organization
24.1. Name of the organization ? (Initials can be given)			
24.2. How would you classify this organization? **(Give the 1st Card)**			
24.3. Where is this organization located ?(City / country name.)			
24.4. Kind of tools/equipments?			
24.5. What is the nature your relationship with this organization (partnership, product dev. partnership, etc.)?			
24.6. How would you describe your relationship with this organization? (Hierarchical, competitive, etc.)			
24.7. What are the reasons for choosing this organization (trust, quality, location, etc..)?			

25. When developing products or processes, has your firm received **FUNDING** or **FINANCING** ?
1. [ ] Yes
2. [ ] No → Skip to question 26

If yes, please answer the following questions.

	1st Source	2nd Source	3rd Source
25.1. Name of the organization? (Initials can be given)			
25.2. How would you classify this organization? **(Give the 1st Card)**			
25.3. Where is this organization located ?(City / country name.)			
25.4. Kind of funding?			
25.5. How did you find out about this organization?			
25.6. What are the reasons for choosing this organization (trust, quality, location, etc..)?			

25.7. How difficult was it to obtain financing?
1. [ ] Very difficult   2.[ ] Somewhat difficult   3. [ ] Not difficult

26. What other means of finance did you use to develop products or processes?
____
____

27. Does your firm have an R&D department?   1. [ ] Yes
2. [ ] No → Skip to question 29

28. When is the R&D department established? ________________________

29. How are the decisions made regarding the product or process development?

30. Reasons for developing new products and processes are listed in the following table. Please rate the importance of each reason for your firm. Please put √ in the selected box. (2nd Card)

	Not important 1	Somewhat Important 2	Important 3	Very Important 4
A. To get a competitive advantage				
D. To increase domestic market share				
E. To create new markets abroad				
F. To improve product performance				
G. To diversify our products				
H. To increase productivity				
I. To improve efficiency of the employees				
J. To shorten production time				
K. To reduce the number of employees				
L. To decrease resource consumption				
M. To decrease energy consumption				
N. To decrease pollution				
O. To conform to standards and regulations				
P. Other (Please specify) ____________				

31. Over the last **five years**, has your firm hired technically skilled people?

1. [ ] Yes
2. [ ] No

31A. Where do you mainly recruit your technical staff?

1. [ ] Local universities, technical schools
2. [ ] Nationally
3. [ ] Internationally
4. [ ] Other (please specify) ___________________________________

32. Has any organization assisted you in recruiting your technical staff?

1. [ ] Yes ⟶ Which ones and their location? ____
2. [ ] No

33. Where do your technical staff have training?

1.[ ] Hands on in this firm
2.[ ] Hands on in their former firm
3 [ ] In training institutions financed by your firm
4.[ ] In training institutions financed by their former firm
5.[ ] Other (Please specify) ____

34. What are the reasons for providing training to your employees? (new technology, new responsibilities, etc..)

____

____

35. If your employees receive training outside your company, please answer the following questions.

	1st Organization	2nd Organization	3rd Organization
35.1. Name of the organization? (Initials can be given)			
35.2. Where is this organization located ?(City / country name.)			
35.3. Kind of training?			
35.4. How did you find out about this organization?			
35.5. How long have you been working with this organization?			
35.6. What are the reasons for choosing this organization (trust, quality, location, etc..)?			

36. Do you have difficulty in finding technically skilled people?

1. [ ] Yes
2. [ ] No → Skip to question 38

37. What are the reasons for these difficulties?

38. Does your firm have any patent application? 1. [ ] Yes
2. [ ] No → Skip to question 39

38A. In which countries? ____

39. Is your firm a member of any professional or non-profit organization?

1. [ ] Yes
2. [ ] No → Skip to section III.

40. Which organizations? What is the level of involvement of your firm? (Please write the name of the organization in the "Name" column. Please state the level of involvement by putting √ in the related box.)

Name	Member 1	In Executive Committee 2	Other (Please specify) 3

41. Has any of the above organizations offered any service or assistance to your firm when developing products or processes?

1. [ ] Yes
2. [ ] No → Skip to Part III

42. If yes, Which ones and what kind of service or assistance did they offer ?

Name	Kind of assistance or service

III. EXTERNAL SOURCES - *Next, I would like to ask you a few questions about your firm's relations with other organizations when your firm develop new products, processes.*

43. When developing products or processes, has your firm acquired any **KNOW-HOW** or **LICENSE**?

1. [ ] Yes
2. [ ] No → Skip to question 44

If yes; please answer the following questions.

	1st Organization	2nd Organization	3rd Organization
43.1. Name of the organization ? (Initials can be given)			
43.2. How would you classify this organization? **(Give the 1st Card)**			
43.3. Where is this organization located ?(City / country name.)			

44. When developing processes or products, where has your firm obtained INFORMATION in case of insufficient internal information ? Please answer the following questions for the three most important formal and informal sources.

	1st Source	2nd Source	3rd Source
44.1. Name of the source ? (Initials can be given)			
44.2. How would you classify this source? **(Give the 1st Card)**			
44.3. Where is this organization located ?(City / country name.)			
44.4. Kind of information?			
44.5. How did you find out about this source?			
44.6. What is the nature of relationship with this source (partnership, product dev. partnership, etc.)?			
44.7. How would you describe your relationship with this source? (Hierarchical, competitive, etc			
44.8. How long have you been working with this source?			
44.9. What are the reasons for choosing this source (trust, quality, location, etc..)?			
44.10.Do you have a written agreement with this source?			
44.11. How often does your firm contact with the source?			
44.12. What is the main mean of communication with this source?			
44.13. How has your relationship changed in time?			
44.14. If changed, why?			
44.15. Do you have long term plans with this organization ?			

45. When developing products or processes, has your firm used any **CONSULTANCY** or/and **EXPERTISE** from other firms/organizations? 1. [ ] Yes
2. [ ] No → Skip to question 46

If yes, please answer the following questions.

	1st Source	2nd Source	3rd Source
45.1. Name of the source ? (Initials can be given)			
45.2. How would you classify this source? **(Give the 1st Card)**			
45.3. Where is this source located ? (City / country name.)			
45.4. Kind of consultancy or expertise?			
45.5. How did you find out about this source?			
45.6. What is the nature of your relationship with this source (partnership, product dev. partnership, etc.)?			
45.7. How would you describe your relationship with this source? (Hierarchical, competitive, etc.)			
45.8. How long have you been working with this source?			
45.9. What are the reasons for choosing this source (trust, quality, location, etc..)?			
45.10. Do you have a written agreement with this source?			
45.11. How often does your firm contact with this source?			
45.12. What is the main mean of communication with this source?			

46. When developing products or processes, has your firm received any **TECHNICAL SERVICE** or used **RESEARCH LABORATORIES** outside your firm?
1. [ ] Yes
2. [ ] No → Skip to question 47

	1st Organization	2nd Organization	3rd Organization
46.1. Name of the organization ? (Initials can be given)			
46.2. How would you classify this organization? **(Give the 1st Card)**			
46.3. Where is this organization located ? (City / country name.)			
46.4. Reasons for using			

technical service or lab?			
46.5. How did you find out about this organization?			
46.6. What is the nature of your relationship with this organization (partnership, product dev. partnership, etc.)?			
46.7. What are the reasons for choosing this organization (trust, quality, location, etc..)?			

47. Are there any other organizations that have not been mentioned so far but which have been important to your firm in products and processes development?

1. [ ] Yes
2. [ ] No → Skip to Part IV.

If yes, please answer the following questions.

	1st Organization	2nd Organization	3rd Organization
47.1. Name of the organization ? (Initials can be given)			
47.2. How would you classify this organization? **(Give the 1st Card)**			
47.3. Where is this organization located ? (City / country name.)			
47.4. How did you find out about this organization?			
47.5. What is the nature of your relationship with this organization ? (Partnership, product development, etc.)			
47.6. How would you describe your relationship with this organization? (Hierarchical, competitive, etc.)			
47.7. How long have you been working with this organization?			
47.8. What are the reasons for choosing this organization (trust, quality, location, etc..)?			
47.9. Do you make long term plans with this organization ?			

IV. GENERAL INFORMATION

48. Is your firm a subsidiary of a group of companies?

1. [ ] Yes
2. [ ] No → Skip to question 50

49. Please state the name and the country of the group which has the highest share in ownership.
Group name ___________________________
Country _______________________________

50. Please indicate the capital distribution of your firm.
Domestic Capital ______%
Foreign Capital ______%

51. Is your firm traded on a stock exchange? 1. [ ] Yes
2. [ ] No → Skip to question 53

52. What percentage is traded on the stock exchange? %_____

53. Did your firm export between 1997-2001? 1. [ ] Yes
2. [ ] No → Skip to question 55

54. What is the percentage of export in total sales for the last five years?
1997 ____________
1998 ____________
1999 ____________
2000 ____________
2001 ____________

55. What is the total TL amount in sales over the last five years?
1997 ____________
1998 ____________
1999 ____________
2000 ____________
2001 ____________

56. To whom do you distribute your products? (Please choose all apply)
1. [ ] directly to the consumer
2. [ ] directly to the wholesaler
3. [ ] directly to the retailer
4. [ ] through a consortium with other manufacturers
5. [ ] other (specify)

57. Where are your products sold? (Please choose all apply)
1. [ ] Local -only Istanbul (or Ankara region)
2. [ ] Marmara Region (or Central Anatolia Region)
3. [ ] National (Please specify the cities) ____
4. [ ] Exported (Please specify the countries) ____

58. Where is the location of your firm's: (Name of the city)
a. Headquarter? _________________________
b. Marketing & Sales Office? _________________________
c. Research & Development? _________________________
d. Production? _________________________

59. How many employees does your firm have? _________________________

60. How many employees work in these departments?

a. Production	Total________	Full time________	Part-time_______
b. Technical/engineer.	Total________	Full time________	Part-time_______
c. Management	Total________	Full time________	Part-time_______
d. Marketing and sales	Total________	Full time________	Part-time _______

61. Does your firm have any quality certificates?
1. [ ] Yes Which ones? ____
2. [ ] No

62. What are your general comments that you would like to make in regard to the product or process development in Turkey?

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS SURVEY.

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