SPATIAL STRUCTURING OF TECHNOLOGY BASED PRODUCTION IN TÜRKİYE: THE CASE OF PROFESSIONAL ELECTRONICS INDUSTRY IN ANKARA

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ABSTRACT

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Technology related factors have become important elements within production. In the last two decades, those concepts such as hi-tech production, technology based production have been emphasised. New theories and models related to the spatial structuring of technology based production have been subjected to much debate.

The electronics industry is a special industrial sector concerning the role of technology in production and intensive research as well as further development efforts. Within total electronics, technology relations can be best studied in professional electronics subsector as it is considered as a technology based industry.

Regional pattern of the professional electronics industry in Türkiye reflects a contingent situation. Ankara appears to be an important center for that type of production. The aim of this thesis is to unravel factors for such contingency and, by this way, to achieve characteristics of the spatial structuring of a technology based professional electronics industry in Türkiye.

Various theories and models are offering different explanations for structuring and spatial relations of a technology based production. Each of these factors alone are not sufficient to explain such a contingent situation in Ankara. However, some three common points can be derived from several theories and approaches. These are externalities, linkage structures and transaction relations of firms. We examined this type of contingent situation with a view that these factors offered to us. In order to test these factors through Turkish professional electronics sector, direct interviews were done with 40 professional electronics firms mostly in Ankara and İstanbul. As a result of these efforts, a spatial model have been constructed with regard to the spatial structuring of the technology based professional electronics sector on regional basis.

This model depends on our research which was carried out on the professional electronics sector in Türkiye in order to give an appropriate combination of three factors for Turkish case. Characteristics of Türkiye as a peripheral country is always kept in mind throughout this process.

The scale of technology based production in general and scale of professional electronics in particular is very negligible in Türkiye. On the other hand, this study can give certain hints about spatial structuring of technology based production at regional level in future.

Keywords: Technology, Innovation, Technology Based Production, Professional Electronics, Ankara, İstanbul, Linkage Structures, Transaction Relations, Externalities.

ÖZ

TEKNOLOJİ TABANLI ÜRETİMİN TÜRKİYE'DE MEKANSAL YAPILANMASINA ÖRNEK OLARAK ANKARA'DAKİ PROFESYONEL ELEKTRONİK SANAYİİNİN ARAŞTIRILMASI

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Teknoloji faktörü her zaman için endüstriyel üretimin önemli bir belirleyicisi olmuştur. Son yıllarda yüksek teknoloji, teknoloji tabanlı üretim gibi kavramlar sürekli olarak vurgulanmaya başlanmıştır. Teknoloji tabanlı üretimin mekansal yapılanması hakkında birçok teori ve model geliştirilerek bu konu tartışmaya açılmıştır.

Elektronik sanayii, hem teknoloji ilişkilerinin üretimdeki rolü, hem de yenilik, araştırma-geliştirme faaliyetlerinin yoğunluğu açısından özel bir sektördür. Elektronik sanayiinin alt dallarından olan profesyonel elektronik sektörü yukarıda belirttiğimiz ilişkilerin ve özelliklerin en yoğun yaşandığı bir alan olarak teknoloji tabanlı üretim kavramına uymaktadır.

Profesyonel elektronik sanayiinin Türkiye'deki bölgesel dağılımı arızi bir durum göstermektedir. Bir sanayi şehri olmamasına rağmen Ankara, profesyonel elektronik sanayii açısından en önemli merkez konumundadır. Bu tezin amacı bu arızi durumun araştırılması ile birlikte Türkiye'de teknoloji tabanlı üretimin mekansal yapılanması hakkında bazı ipuçları elde etmektir.

Teknolojik üretimin organizasyonu ve mekansal yapılanması hakkında öne sürülen bir çok teori, model ve yaklaşımdan hiçbirinin söylemi tek başına Türkiye'de profesyonel elektronik sanayiinin organizasyon ve mekansal yapısını açıklamaya yetmemektedir. Tüm bu yaklaşımların ortak noktasını dışsallıklar, ağ ilişkileri ve ticari pazar ilişkileri oluşturmaktadır. Bu faktörlerin bize sunduğu olanaklarla Türkiye'deki bu arızi durumun incelenmesine çalışılmıştır. Bunun için özellikle Ankara ve İstanbul ağırlıklı olmak üzere 40 adet profesyonel elektronik üreticisi ile yüzyüze görüşülmüş ve yukarıda belirttiğimiz faktörlerin Türkiye profesyonel elektronik sanayisinin yapılanmasında oynadıkları roller saptanmaya ve açıklanmaya çalışılmıştır. Bunun sonucunda teknoloji tabanlı üretimin mekansal yapılanmasına ait olarak Türkiye özelinde bir model oluşturulmuştur.

Bu model profesyonel elektronik sanayii üzerinde yapılan araştırmamıza dayanmakta ve üç ana faktörün bileşkesinden oluşmaktadır. Araştırma ve sonuçlarının yorumlanması sırasında gelişmekte olan bir ülke olarak Türkiye'nin özellikleri sürekli olarak göz önünde bulundurulmuştur.

Türkiye'de teknoloji tabanlı üretim yok denecek kadar az olmasına rağmen bu çalışma teknoloji tabanlı üretimin özellikle bölgesel düzeyde yapılanması hakkında geleceğe dair bazı ipuçları verebilir.

Anahtar Kelimeler: Teknoloji, Yenilik, Teknoloji Tabanlı Üretim, Profesyonel Elektronik Sanayii, Ankara, İstanbul, Ağ İlişkileri, Pazar İlişkileri, Dışsallıklar.

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AC/DC: Alternate Current/ Direct Current
ASO: Ankara Sanayi Odası (Ankara Chamber of Industry; ACI)
ATM: Automated Teller Machine
AÜ: Ankara Ünversitesi (Unversity of Ankara)
BSO: Bursa Sanayi Odası (Bursa Chamber of Industry; BCI)
CAD: Computer Aided Design
CAM: Computer Aided Manufacturing
CE: Trademark for Free Trade
CNC: Computer Numeric Controlled
DİE: Devlet İstatistik Enstitüsü (State Institute of Statistics; SIS)
DPT: Devlet Planlama Teşkilatı (State Planning Institution; SPO)
EMO: Elektrik Mühendisleri Odası (Chamber of Electrical Engineers)
ISO: International Standarts Organisation
İMMİB: İstanbul Metal ve Makina İhracatçıları Birliği (Union of Metal and Machinery Exporters of İstanbul)
İSO: İstanbul Sanayi Odası (Industry Chamber of İstanbul)
İTU: İstanbul Technical University (İstanbul Teknik Üniversitesi; İTÜ)
JS: JoinStock (used for companies)
KOSGEB: Küçük ve Orta Ölçekli Sanayileri Geliştirme Birliği (Union for Development of Small and Medium Scale Industries)
KSO: Kayseri Sanayi Odası (Kayseri Chamber of Industry)
LTD: Limited (used for companies)
METU: Middle East Technical University
MMO: Makina Mühendisleri Odası (Chamber of Mechanical Engineers; CME)
NEPA: National Environmental Protection Agency
PC: Personal Computer
PE: Professional Electronics
PLC: Programmable Logic Control
POS: Point of Sale
R§D: Research and Development

R/L: Radio Link
TCDD: Türkiye Cumhuriyeti Devlet Demiryolları (Turkish Republic State Railroads)
TDFT: Technology Development Foundation of Turkey
TESİD: Türkiye Elektronik Sanayicileri Derneği (Association of Turkish Electronics Industrialists; ATEI)
TTGV: Türkiye Teknoloji Geliştirme Vakfı (Technology Development Foundation of Turkey; TDFT)
TÜBİTAK: Türkiye Bilimsel Araştırma Kurumu (National Science and Research Institution of Türkiye)
UCCE: Union of Chamber and Community Exchange
UK: United Kingdom
UME: Ulusal Metal Enstitüsü (National Institute of Metal)
UPS: Uninterrupted Power Supply
USA: United States of America
USSR: Union of Soviet Socialist Republics
WWE: World Wide Express
YTU: Yıldız Technical University

CHAPTER 1

INTRODUCTION

Since the industrial revolution, manufacturing activity has become the most important factor of wealth creation. The position and role of technology and technology related concepts like innovation, R§D have started to be discussed intensively within industrial literature within the last 30 years, whereas debates on technology date back to Schumpeter in the 1930s. Technical innovations and R§D efforts become the most important factors for the production process in a competitive environment. The regions and firms that do not produce new products, through R§D activities and innovation processes are no longer capable of competing in the world markets.

Increasing importance of technology in production and its strategic dimension leads to the evolution of new concepts in production systems. Innovation based production, R§D and high tech production are examples for these new concepts. Concepts of technology based production, innovation, R§D activities become important subjects of industrial researches. New approaches on technological change, new type of production relations, spatial behaviours have come into existence. New theories on technology and space relationships were developed. These started since Schumpeter in the 1930s. Linear innovation theories and recent evolutionary and network approaches are important breakpoints in these discussions. With these theories, there is a tendency to insist on network relations and linkages in spatial structuring of technology based production rather than intra organisational structure and transaction relations of individual firms. With these efforts, spatial studies regarding to industrial innovation gained importance. New concepts such as innovative milieu, regional innovation networks, learning regions, and so on have emerged.

It is not easy and true to adapt consequences of these approaches to all countries. There are totally different macro economic conditions and different innovative basis considering peripheral countries. Especially externalities that stem from rapid conjuncture changes and instable state policies effect structuring of technology based industry very much. As their technological relations and macro economic environments are different, development and spatial structuring of technology based production in peripheral countries require special evaluation.

Technology based industry concept has been used in various parts of this study. The aim is not to include all industries as they have some degree of technology in production processes. In fact, the concept has been used to refer to those consists the main part of the production process and products of that industry are the actual tools of technology. This concept also refers to engineer and innovation based production. These conditions best fit to the electronics, especially professional electronics (PE) sector. Technological concepts like innovation, R§D, technological linkages can be best analysed within this particular industrial sector.

The development of professional electronics (PE) industry in Türkiye is a special case for an example of technology based production. Especially its spatial structuring at the regional level maintain contingencies. In this sense Ankara becomes the most important location for PE industry whereas three fourth of total electronics industry and two fifth of total industry has agglomerated in İstanbul. This is the starting point of this study.

The aim of the study is to clear out and find reasons for this kind of a contingent situation of PE industry in Türkiye. A survey that consists more than half of PE producer firms throughout Türkiye becomes our tool.

There are three important factors within the intersection area of all related theories, approaches and models that try to explain organisational and spatial dynamics of technology based production. These are a-) externalities, b-) linkage structures, c-) transaction relations, in particular market relations. In this respect, our research is organised to understand effects and roles of these

factors on such a contingent spatial structuring of PE industry in Türkiye.

For simplicity, externalities can be divided into three. One is related with macro policies and macro economic environment of the country. Second is related to innovative basis of the country such as education infrastructure, condition of universities and so on. Third is externalities that different localities offer to firms. These cannot be separated as they are related to each other. From firms' point of view, these externalities can be divided into two as they cannot interfere anyway and they can change these conditions at some degree. For example government policies entered into first category whereas, utilising capability of technical infrastructure of the country enter to second group. In this sense, externalities emerging from a developing country perspective appear to be more significant as opposed to an advanced country perspective throughout the study.

Linkage structures can be divided into 3 main groups as supplier and subcontract relations, technology based relations and relations with the state bureaucracy and public institutions. Technology based relations mean inter firm relations, university collaborations, relations with scientific institutions and all types of informational linkages.

The meaning of transaction is so wide but here we use transaction relations as market relations of firms. Location of main markets, customer types, export activities, representations are all subject of transaction relations.

First chapter of the study is divided into two main bodies. In the first part of the chapter, general concepts and theories will be explained on the role of technology in production. Such theories take firm as a unit of innovation. Firm concept and innovative characteristics related to this concept take place in the first chapter. All models and hypotheses related with role of technology in production are analysed within the study. After then, technology based production, innovation and space relations will be examined. In this part, especially new approaches on location such as network approach, milieu

approach as well as linear innovation models will be handled. As these approaches and models do not provide a total explanation for peripheral countries, innovative basis and special conditions of these countries are analysed in second part of this chapter. Moreover, innovative basis of Türkiye is discussed at the end of this part in the quest to understand externalities that emerged from macro economic conditions of Türkiye.

In the second chapter, the structure and the development of electronics sector in Türkiye will be discussed. The spatial structure of electronics industry and PE industry in Türkiye is gathered from this part of the study. Also general development of electronics sector in Türkiye and its evaluation is accomplished within this part. This analysis is complementing the firm research that has been implemented. Especially this part is important to mention importance of historical processes considering electronics sector in shaping the spatial structure of PE industry in Türkiye. A general perspective on importance and condition of electronics industry in Türkiye is developed within this part.

Third chapter of our study consists of results and comments derived from firm research. This firm research were done with 40 PE firms in Ankara, İstanbul, Kayseri and Bursa and conducted between July 1998 and June 1999. Especially core of the subject is the firms in Ankara and İstanbul. We take also some firms from Kayseri and Bursa as these firms are used as control points between Ankara and İstanbul firms. Presence of these firms supports or denies some kind of power relations and some routine relations within firms in Ankara and İstanbul. Participant observation was the aim at the beginning of the study, to stay within firms and observe them for several days were planned. As number of firms that accepted our request had become so much, this method becomes impossible. Direct interviews with founders and top managers of firms were performed in their offices. Also immediate observations were done within the firm, such as working conditions, scale of production, type of work, size of working place, and so on. More than 2500 informational items about structure and different characteristics of firms were gathered within this research. These informations were processed in order to understand structure, historical

process, technological conditions, all type of relations, linkages and spatial characteristics of PE firms in Türkiye.

The interpretation and comments of the field survey have followed four steps. First is to derive a historical outline for PE industry in Türkiye. This is especially for understanding externalities stemmed from conjuncture changes and changing environmental conditions for firms. Second part is to find common findings of interviewed firms. This is more related to firm specific level and trying to understand linkage structures and market conditions or relations of these firms as well as some externalities. These parts are not sufficient to explain organisational and spatial structuring of PE industry in Türkiye so in third part, differences among these firms were derived. Here the major goal is to find out the differences between Ankara and İstanbul. These differences mainly consist not only of firms' general structures but also especially those differences about linkage structures and transaction, in particular market relations of interviewed PE firms. These linkages are mainly informal linkages, subcontracting relations and relations with the state bureaucracy and public institutions. Fourth part is related to locality externalities that give way to such differences between firms.

Aim of the whole study is to understand dynamics behind characteristics and spatial structuring of a technology based industry in a peripheral country like Türkiye. Especially contingent situation of such technology based PE industry in Türkiye make this subject more interesting. The aim is to find out reasons and factors behind this type of contingent situation. Also there are several secondary aims that related to this study. One is to analyse potential of different regions of Türkiye (especially Ankara and İstanbul) for future development of technology based production complexes in Türkiye. Other is to question whether characteristics of PE industry in Ankara are sufficient to give hints about potential innovative milieu character of Ankara in future depending on network and milieu discussions. These are not the main subjects and will be handled in conclusion part.

As a result, we assume that Turkish conditions are very different and require a country specific interpretation of several theories on technology based production-space relations. A proposed spatial model consisting of externalities, linkages and transaction factors for Turkish PE industry as well as the future potential of PE sector in Türkiye will be discussed in the conclusion part.

CHAPTER 2

INNOVATION, TECHNOLOGY BASED PRODUCTION AND SPATIAL RELATIONS OF TECHNOLOGY BASED FIRMS

This chapter is divided into two parts. In the first part, general characteristics of technology based production and innovation, theoretical basis of innovation and space relations will be explained. Various theories and models will be explained in this part to clarify further discussions. These are especially theories and models developed for advanced nations. On the other hand, we need more country specific studies to find out more about conditions that prevail in peripheral countries such as Türkiye.

In the second part, differences between developing countries and developed countries considering innovative basis of them will be examined. Aim of this part is to define a set of criteria for the analysis of technology based production in developing countries. Related to this last issue, innovative basis of Türkiye at macro level will be discussed in order to prepare a base for our firm specific field surveys for PE production in Türkiye.

2.1 Theoretical Basis of Technology Based Production, Innovation and Spatial Structuring of Technology Based Production

In this part of the study, it is aimed to prepare a theoretical basis of the whole study. First, theories on role of technology in production will be examined, than innovation, R§D and firm concepts will be analysed as these are the main concepts in technology based production. Afterwards, discussions and different views on technology based production space relations will be discussed.

Realising technology as a factor of production is a very recent concept. There are various theories, approaches and views conducted on technology in production. Main subject of these are to find out technology's role and position within industrial production, different actors that effect and effected from technology, impact of technological changes and impact of technology and technological change in whole economic systems and causes of technological development. Here we look on these approaches or theories more depend on their explanation on technology's role in production and their effects in spatial restructuring.

Information on various criticisms on technology's role in production is important to understand characteristics of technology based production and its spatial structuring. As we mentioned, there are several approaches on technology related issues. These are neo-classical theory, Schumpeterian, neo Schumpeterian approaches, evolutionary approach and network theories. Schumpeterian and neo Schumpeterian approaches are the first that evaluates firm at the center of technological process. Evolutionary theories try to explain differences between firms as well as it insists on institutional environment of firms. Evolutionary theory is accepted as a behavioural approach (Hall, 1994). This approach also tries to explain all types of linkage structures of firms within a defined institutional environment. These efforts lead to contemporary network approaches that insist on linkage structures.

2.1.1 Theories on Technology and Production Relations

Studies on technological development and innovation space relationships are not very recent concepts. Especially, discussions on technology and production relationships can date back to 1930s.

Technological development means almost nothing to the neo-classical framework. Technology is taken as a residual and external factor for production in neo-classical approach. Neo- classical approach assumes that causes of technological development are not known, and all capitalist restructuring and industrial production are consequences of the capital accumulation (Eser, 1993).

Also it is assumed that technology can be transferred easily between firms and reproduced easily within these firms (Kırım, 1990). As this is not the case, there were some efforts to demonstrate that technology is an internalised factor. Schumpeter's tradition is important in this respect. According to Schumpeterian tradition, vitality of firms depends on their own technological capabilities (Kırım, 1990). Technology is not easily transferred and as a result, firms have to develop their own technologies. Also in Schumpeterian tradition, technological development is taken as primary motive in process of redistribution of resources (Soyak,1996). Schumpeter's tradition insists on innovative power of monopolies and big firms (Scherer, 1991; Weinstein, 1994).

Ignorance of incremental innovations and role of small firms in innovation process lead to new approach called as neo-Schumpeterian approach in 1970s, that classifies different types of technical change. According to this approach there are; incremental innovations, radical innovations, new technological systems and changes in techno economic paradigm (Cassiolato, 1992). Incremental type of technical change will be the focal point in our further discussions. Also this neo-Schumpeterian work is related with technological externalities. Such externalities attitude towards innovation, human capital formation, technological interaction between firms (Cassiolato, 1992).

In 1980s, we were introduced with firm specific evolutionary theories of technical development developed by Winter (1982) and Nelson (1987) that criticises Schumpeterian and Neo-Schumpeterian approaches (Winter, 1982 and Nelson,1987 in Lall 1992; Saren 1992). This theory depends on technological change that depend on firm differences. By this way, evolutionary theory tries to explain technological differences between firms that neoclassic theory did not explain.

According to the evolutionary theory, firms do not behave only on production functions. This claim is based on two arguments. First, theory insists on organisational structure of firms. It takes firms as social systems and behavioural approach is accepted as a method in decision making problem. Technological development is seen as a

result of problem solving mechanism stimulated by external factors. Second, theory insists on learning by doing process. R§D efforts are effected much from ownership patterns. There are technological development differences that depend on R§D differences in a system which individual rights are conserved (Nelson 1981 quoted in Soyak, 1996).

According to this type of model, technological knowledge is not shared equally among firms and not easily imitated. This leads to R§D differences between firms. Also, other institutions apart from firms are important and there are non market linkages between firms and them (Taymaz, 1993). Firms are operating in a selection environment (Nelson,1987 in Saren 1992). Economic, institutional environment and own capabilities of firms are the factors that constitute technological systems. With regarding this theory, not only physical processes but also organisational and operational matters are included in technology definition (Soyak, 1996).

Network concept gain importance in technological context by contribution of several academicians and geographers till the mid 1980s (Tödtling, 1992). Schumpeter also defined networks within firms but according to this new approach, network concept defines relations within firms as well as between firms. Networks are regarded as institutions between markets and hierarchies (Ibid). Context of network can refer to formal corporations such as joint ventures, R§D agreements, research associations, technology exchange agreements, licensing, subcontracting and informal corporations or market relations.

2.1.2 Main Concepts Within Technology Based Production

In this part, our main concern will be the information on basic concepts within technology based production. This is compulsory to know basic concepts within our further discussions. These will be brief information on innovation, R§D and firm. Main concern in the "firm" part will be clear out the question of "How an innovative firm has to be analysed ?".

2.1.2.1 Innovation as Basis For Technology Based Production

Before starting our discussion on innovation concept, it is compulsory to give differences between invention and innovation concepts.

Invention is defined in Hall's study that; "devising of new ways of attaining given ends by both the creation of things previously non existent, using either new or existing knowledge and the creation of things that have existed all the time" (Kennedy and Thirlwail quoted in Hall, 1994). After this explanation Hall insists on the word "creation" with related to invention concept (Hall, 1994). According to this approach, innovation is defined as "commercial applications of inventions for the first time" (Kennedy and Thirlwail quoted in Hall, 1994). This type of understanding lead to linear innovation models that depends on invention-innovation-imitation flow line. In further studies of Kline and Rosenberg in 1986, it was claimed there are various links, chains and feedback effects in invention-innovation interaction (Hall,1994). This view was supported by the presence of incremental innovation concept derived from several studies on developing countries of Latin America. This type of incremental innovation is accepted as puzzle solving or normal technological innovations that constitute the basic source of technological efforts of developing nations.

Apart from the invention-innovation differentiation, our further discussion will be built upon 3 main issues on innovation. These are a-) where innovation takes place, b-measurement of innovation, c-) types of innovation.

Place of Innovation: Innovation is assumed to be driving force of economic development and it takes forms like new commodity, new technology, new source of supply, new organisation and so on (Morgan,1997).

Before Second World War, industrial research and innovation were taking place only in research organisations by scientists. Now, firms and entrepreneurs become main bodies of researches and innovations. For this reason it is not wrong to claim that "Industrial innovation is entrepreneur-led activity" (Sweeney, 1985).

This does not mean that innovation only takes place and ends within firm. On the other hand, according to most scholars, innovation is such a complex and uncertain activity that does not confine within boundaries of firms. Suppliers, customers, competitors, contracted research organisations are all other institutions that take place in innovation process (Rothwell, Dodgson, 1994).

Measurement of Innovation: One fundamental problem in the study of innovation is an absence of satisfactory measures of knowledge and its contribution to technological progress (Zoltan and Audretsch, 1991). There is no universally accepted method of measuring innovative activity (Fischer and Bertuglia, 1995). On the other hand there are three aspects of innovation process exist accepted as a measure of innovation activity. These are; a measure of inputs to innovative process as R§D expenditures and employees, an output such as number of inventions patented and a direct measure of innovation output (Zoltan and Audretsch, 1991). All these measures do not give reliable results as they are biased in such a way that R§D expenditures and employees are the resources allocated for innovation but not give amount of resulting innovation activity. Reliability of patent measures is also questioned that not all patented inventions result in innovation (Zoltan and Audretsch, 1991).

Types of Innovation: One of the important point on innovation and firm relationship is concerning the type of innovation that occurs in the firm. Innovation is not unique (only radical or product innovation) as it was defined in Schumpeterian tradition. Innovation can be divided into two main parts according to its type and structure. We can divide innovation into product and process innovation as well as it can be classified into radical and incremental innovation. Categorisation of innovation as radical or incremental depends on background of those involved in applying a technological advance for commercial purposes (Johne,1985). Radical innovation is the process that introduces something new to the organisation and this requires the development of new routines. On the other hand, incremental innovation is the process of introducing something that can be implemented with only minor adaptations of existing organisational

routines and fits existing norms and values of firms (Tornatsky and Fleischer, 1990). Combining two different distinctions; radical product innovation involves using advances in technology to offer customers a new line of products. Incremental product innovation involves using existing technology to extend an established product line or to improve product performance to a certain degree (Johne,1985).

Incremental innovation goes through learning by doing and it is often a firm specific activity (Rothwell, Dodgson, 1994). Incremental innovation and its combined effects are important factors for productivity growth of technology related industrial branches and overall economic performance of small and medium enterprises (Asheim and Isaksen, 1997; Gregersen and Johnson,1997). By spatial means, incremental process innovation requires the closest possible links between people in production and research, while architectural product innovation needs similarly close links between researchers, market units and customers (Fairtlough, 1994). Also, incremental innovation motivated a need for concentration where skilled labour subcontracting and other transactional arrangements are generally more accessible (Villa and Fischer, 1995).

2.1.2.2 Research and Development Issues Within Innovation and Technological Change

R§D is a concept that get more importance with evolutionary approaches. R§D related values are some of our main tools to explain technological change, although there is little evidence that R§D efforts explain technical change (Walker,1985). R§D is considered as a major component in innovation process but innovation is not considered as a matter of R§D (Fischer and Bertuglia, 1995). Innovation has also production and marketing factors apart from R§D. R§D input and innovation are not deterministic in nature (Ibid).

R§D program is a process or chain of activities ranging from the formulation of new ideas up to marketing throughout of its life span (Teubal, Arnon and Trachtenberg, 1987). Especially there are three types of

R§D. These are like innovation grouping as: a-) Incremental R§D that intensity of development is bigger than research efforts, b-) Radical R§D that includes large amount of research and often large amount of development and c-) Fundamental R§D that there is large research intensity and almost no development (Roussal, Saad and Erickson, 1991). Especially, industrial R§D is related with first two definitions.

In analysis of R§D, descriptive analysis depends on firm size, export intensity, industrial sector, firm linkages with several institutions such as research organisations, universities (Dixon and Seddighi, 1996). R§D intensity of a firm is measured by several ways. Proportion of scientists or engineers to total employment, patent and licensing data, R§D expenditures are examples of these measures (Felsenstein and Shachar, 1988). On the other hand, all these measures have several limitations (Felsenstein and Shachar, 1988; Tornatzky and Fleischer, 1990; Zoltan and Audretsch, 1991).

All firms are not investing R§D at same rates. Different firms in same industries can apply different R§D strategies (Scott,1991). Scott has two explanations for this condition. First, firms have different capabilities and furthermore, R§D environment leads to asymmetrical strategies even firms are identical (Ibid). Also different R§D applications can be applied due to R§D externalities.

R§D has some externalities that effect evolution and strategies of firms. For Taymaz, externalities of R§D can emerge by two ways: First is the knowledge spillover explained by diffusion of knowledge by different mechanism rather than market. This is the form of change of qualified labour between firms or copying of knowledge by other firms. Second externality is described as network spillover that economic advantage of a specific knowledge and product increase by increasing number of users of that knowledge and product (Taymaz, 1993).

Indigenous R§D efforts are not only source of technology acquisition. Also there are different methods of acquiring technology from outside. Licensing, bilateral cooperative technology agreements, buying technology that embedded in

equipment and materials are the most applied methods of technology acquisition (Rubinstein, 1985 quoted in Tornatzky and Fleischer,1990).

2.1.2.3 Firm As a Main Unit of Innovation

Analysing the role of firms in technological process is important to understand characteristics of technology based production. Within firm theory, there are two approaches. One depends totally on transaction cost approach and market mechanisms, while other takes competence and synergy due to share of knowledge as a main point of the theory (Rothwell and Dodgson, 1994). In this respect, evolutionary view and successor views and approaches are more related with second approach.

According to evolutionary theory, "firm" is at the center of innovation process. Different firm characteristics (size, age, status) became the subject of basic academic researches on innovation and firm. Especially, size always becomes a problem within innovation and technology based production discussions.

It is accepted that the application of new technologies is influenced from specific situations of each firm. There are different group of factors operates for different group of firms (Nabseth,1974). Many of these factors are not quantifiable and there are many debates occurring on them. With related to Schumpeterian tradition there are many debates concerning market structure and firm size impacts on innovation. There are plenty of researches exist on these subjects whether small firm or big firm is more innovative, or which market structure leads to successful innovation and so on (Scherer, 1991; Chakrabarti and Halperin, 1991; Fischer and Bertuglia, 1995; Rothwell and Dodgson, 1994; Zoltan and Audretsch, 1991). There are no common and totally accepted views on these subjects according to different researches in various countries. This shows that, innovation-firm size, innovation-market structure relations can be differentiated among different sectors across different locations.

There are several studies to classify various factors about firms. One is Tornatzky and Fleischer's study held in 1990. According to this study, there are three elements of a context of firms that influence the technological and innovative activity. These are defined as organisational context, technological context and environmental context (Tornatzky and Flischer, 1990). We will follow this type of distinction and support it with several academic studies. Also we add linkage context to this distinction.

Organisational Context: It contains descriptive measures about firms such as firm size, age and so on. Managerial structure of firms and the quality of human resources are other issues within organisational context. Added to these factors, informal linkages between employees, decision making and internal communication are all organisational issues within the firm (Tornatzky and Flischer, 1990).

In organisation discussion, most intervening variables are the size and the age of the firm. Within these debates, small and medium sized firms gain some degree of importance as they are considered as main sources of innovation and technological development (Sweeney, 1985). This is opposite to conventional Schumpeterian wisdom that only big firms can able to handle innovation and maintain technological development.

Size is important to define small firms but there are some other characteristics that give its meaning to "small". These are the influence of the founder or founding team and the lack of resources for the firm (Slatter,1992). In Slatter's study, small high tech firms are divided into 5 categories as; a-) dominant sector players aiming for the central position in industry, b-) product group specialists that rely on technological innovation as their principal source of competitive advantage, c-) market specialists that aim to cater for the specialist needs of their markets (All the founders of market specialist companies had a background closely related to markets on which they were focusing), d-) niche players that have the narrowest product market scope of the all small technology based firms and e-) technology

specialists that have strong technical capabilities as they design products for diverse customer groups and markets (Slatter, 1992).

Small firms depend on more external opportunities than big firms in unstable market conditions. This makes small firms consult externally about equally for threats and opportunities. On the other hand, big firms depend on internal resources and this is explained by transaction costs. Transaction costs also play important role in selecting market niches for firms. Small and medium sized firms have not been able to engage in much foreign direct investment and have concentrated instead on selecting export market niches from their home base (Villa and Karlsson, 1996). On the other hand, multinationals are advantageous in international markets for high tech goods because of their capability of providing necessary services at geographically diverse locations and transaction cost savings (Kumar and Siddhartan, 1994).

Some ideas stress on personal characteristics of entrepreneurs and managers whether a small or big firm is concerned. This type of view is totally human-behaviour oriented (Tornatsky and Fleischer, 1990). Some of these necessary characters for innovation are like; higher social status, more favourable attitudes toward change, risk, and sciences, greater intelligence, more social participation, more change agent contact, more exposure to interpersonal communication channels, more cosmopolitan backgrounds, more highly integrated links with social system and more information and knowledge about innovations (Tornatzky and Fleischer, 1990).

El-Bar and Felsenstein in 1989 argued that firm organisation can be analysed by inter organisational environment of firm related with linkage studies as well as intra organisational structure related to internal structure of manufacturing unit and technical division of labour within firm (El Bar and Felsenstein, 1989). This view can be more adaptable to network approaches.

Technological Context: It describes both internal and external technologies relevant to a firm. For firms, a major mechanism of learning about technology is obtained

through their internal R§D efforts. Learning concept is important within internal efforts of firms.

Malerba developed typology of learning such as, learning from doing, using, searching, interacting, inter industry spillover, and advances in science and technology (Malerba 1992 quoted in Dodgson 1994). First three is internal, others are external (Dodgson, 1994).

Technological capabilities of firms are accepted as outcome of investments undertaken by the firm in response to external and internal stimuli and on interaction with other various economic agents (Lall, 1992).

There are some studies on various characteristics of innovative firms. Innovative firm has some key features that, it can easily adapt to decentralised learning procedures, its routines are suitable to receive multiple channels of information especially from customers, and there is an intangible asset of work force that feels a sense of belonging to a firm (Morgan, 1997).

Environmental Context: Environmental arena is the one which firm conducts its business, industry and competition relations, access to resources, and dealings with government (Tornatzky and Fleischer, 1990). Two aspects of external environment are key determinants of innovative activity: the competitive characteristic of industry and the presence of a relevant technology support infrastructure.

Factors like infrastructures, production structures, institutional set ups, consumer demand structures and government policies are not independent explanatory factors for innovation performance. They are dependent factors and they evolve in interaction with each other. For example, the development of new industrial sector is strongly affected by how fast a supporting institutional system is built up (Gregersen and Johnson, 1997).

Firm linkages are important within environmental context. These firm relations can be classified as;
- relations may be structured as networks based on personal relationships,

- companies may closely but informally linked with other firms, suppliers, marketers
- companies may highly adaptable and capable of strategic action (Stamer, 1995).

It is noteworthy to give further explanations on linkage structure of firms.

Linkage Context of Firms: Apart from internal characteristics of firms, linkage structures play important role in innovation activities and technological relations of firms. Key reasons for linkage are; access to market and distribution, access to finance, access to technology and access to new markets (Galhardi, 1994). Considering linkages, economic transactions are not only the case, as there are other types of relations and linkages different from anonymous market transactions (Gregersen and Johnson, 1997). Especially there are personal, collaborative and contract types of linkages. Also linkages are divided into formal and informal linkages according to their nature. Especially collaborative type of linkages and informal linkages play important roles in technology based production.

Especially in context of high technology, it is vital for firms to establish new interfirm corporations as response to increasing needs for capital and information. Innovation potential of a firm is regarded as a function of ability of firms in collaborative agreements (El Bar and Felsenstein, 1989).

As mentioned earlier, collaborations have started to gain importance between firms in recent years. Collaboration between firms can take variety of forms. It may be a joint venture, it could be a partnership linking firms on the basis of continuing commitment to shared business or it may be R§D contracts or technology exchange agreements (Rothwell and Dodgson, 1994).

One of the most important aspects of the collaborative process is the nature of relationships between partners. Exchange of technical know-how, open communication, exchange resources, strategic complementarity is often predicated on presence of high trust relationships (Rothwell, Dodgson, 1994). Freeman argues that, personal

relationships of trust and confidence are important for both formal and informal levels (Freeman 92 quoted in Dodgson, 1996). For this reason cultural factors such as language, educational background, regional loyalties, shared ideologies and experiences and even common leisure interests continue to play an important role in networking action (Dodgson, 1996). High trust facilitates are effective on inter firm links both horizontally and vertically because of a-) Sort of knowledge is tacit, uncodified, firm specific and commercially sensitive, b-) Trust facilitates continuing relationships between firms, c-) There are high management costs of such linkages (Dodgson, 1996).

Also there is emerging concentration of new alliances in a small number of technological fields. There are many forms of cooperation, ranging from equity share holding and joint ventures to licensing and more specific areas of functional cooperation (Slatter, 1992). Firms deploy partnering to create market opportunities, access for global markets and to receive true information. Sharing research and production resources reduces costs. Control over a collaboration reduces the risk. Alliances enhance technological sophistication and innovation capabilities by improving access to complementary technological developments and external source know-how. Cooperative arrangements can shorten product cycles by improving response times and flexibility (Gordon, 1991).

According to a study done in 1992, it was found that alliances are important especially for small firms (Slatter, 1992). The typical alliance between a small high tech firm and a partner is defined as one in which the small high tech firms enter into an alliance with a larger company. In this situation, the small firm provides the technology, while the largest partner provides its marketing, manufacturing and financial resources or expertise. This act minimises risks and allows for a wider exploitation of technology (Slatter,1992).

Apart from these discussions, we can divide alliance concept into two as the traditional alliances and strategic alliances. Traditional alliances that took place across national borders are defined often as substitute for foreign direct investment as a method for entry

into particular country's market. On the other hand, strategic alliances are not considered as substitute for direct investment or a method of entry but it aims to give firm the capabilities that do not recognised. In strategic alliances, relationships between partners are defined as more complex. These types of relations can occur between even competitors and these are considered as a new type of relations (Genosko, 1997).

Such linkages are not occurring between firms only. According to Calori's study in 1992, also there are two groups of partners that are;
- Universities, public research institutions and agencies: Collaboration with national institutes is an important source of externalities and a success factor when such institutions are also major clients in the industry. Collaboration with universities and public research institutions is a way to keep close to the scientific forefront and to secure access to highly qualified personnel (Calori, 1992). Linkage with university can occur in various ways as faculty used as consultants, contracted research projects, use of graduate students as researchers.
- Clients and customers: Relations with these institutions improve the competitiveness of new products by incremental innovations. Besides, these vertical alliances between suppliers and clients regulate markets along the vertical chain. Such agreements are needed when the firms are focused at a single level of the vertical chain as happen in many merging industries (Calori, 1992).

Linkage structures have a great impact on innovativeness of industrial production. It was regarded as firms that frequently engaging in R§D interaction with other local firms and related organisations are likely to be more innovative (Preer, 1992 quoted in Leung, 1995). These local linkages are important for firms in order to access technological and market opportunities. In this way, they have better innovation and diffusion possibilities (Leung,1995).

It is argued that interactions or linkages are vital to small firms as they depend much on their environments (Fischer and Bertuglia, 1995). Among interaction between

firms, recent studies suggest that organisational and corporate status of the establishment strongly influences its potential to innovate.

All above discussions give us some hints about technology space relations. On the other hand, searching different theories and views on technology based production- space relations can clarify spatial structuring of technology and innovation based industries.

2.1.3 Spatial Aspects of Technology Based Production and Innovation

Production-technology-space relations become one of the important theme in spatial or geographic studies. It is accepted that, *"Geography can not be read off from technology"* (Walker, 1985). So, in this part we will analyse different views on spatial structuring of technology based production in the line from Schumpeterian approach to contemporary milieu approaches.

Debates on technology's role in production lead to appearance of many models and thoughts on the subject. One of the most famous theory on this subject is the 'industrial life cycle theory'. Especially,classification of industrial development into life cycle stages is based on technological considerations (Hayter, 1990). Industrial life cycle approach can be divided into product life cycle, technological life cycle, technological S curve (innovation diffusion) models and all these models are parts of traditional linear innovation model. Especially, product cycle considerations are related to Schumpeterian sense rather than neo-classical approaches (Storper and Walker,1989).

Product cycle models represent newer regional science models apart from neoclassical location theories that explain location decision as a one of series of decisions about the mix and substitution of factors along a given production function that dates back to mid of 1950s and takes its roots from Isard's and Moses' approaches of industrial location (Storper, 1985). This product cycle vision depends on Schumpeterian approach, labour quality

differentials, economies of scale, joint products, learning curves in production and marketing (Ibid).

These types of linear innovation or product cycle models all stress the hierarchical pattern in space (Tödtling, 1992). These models argue that innovative new products depend on communications and external economies such as infrastructure, environment, venture and long term capital (Simmie, 1998). For these reasons, concentration of R§D and product innovation can be observed in largest agglomerations especially in large metropolitan areas.

In this respect, Tödtling in 1992 discussed locational factors for innovation. Locational factors differ for the generation and adoption of innovations but they generally include the following: a strong knowledge base from which new solutions can be drawn (universities, research facilities), competence and skills of the labour force (technical and management skills and the respective educational institutions), a good communication and transport infrastructure, a high density of relevant information (information rich environment) given through a concentration of relevant firms and institutions. Locational factors for innovation are objectively good in the region that has well developed universities and research facilities, a highly skilled labour force, a good transport and communication infrastructure and well developed producer services (Tödtling, 1992).

Locational environment concept is closely related with technological infrastructure concept. In late 1980s, it was argued that some places grow partly as a result of historical accidents. These accidents will not spark innovation and an economic development if an area lacks technological infrastructure. Locational advantage and innovative capacity appear to depend on existing technological infrastructure of a place (Storper and Scott 1990 quoted in Feldman,1994).

These discussions are all related with agglomeration economies. Walker defined 3 ways of getting from technology to the geographic hierarchy. These are agglomeration economies, technological maturation and innovation diffusion (Walker, 1985). Simmie in his contemporary research, explains 4 alternative explanations

on reasons for agglomeration of technology based firms in several regions (Simmie, 1998). These are;
a-) Related with distance transaction costs between spaces that refers to growth pole theory.
b-) location specific factor cost efficiencies related to i- product life cycle approach, ii- innovation network and milieu theories.
c-) production hierarchy negotiations within spaces related to Fordist type of production and post Fordist flexible specialisation debates.
d-) the need to coordinate hierarchies between production and consumption spaces related to national, international, public, private, military demands to new products and systems.

There are also recent thoughts that explain regional agglomerations as a major factor in explaining the innovative success of firms in various regions. There are 2 ways explained in a study done in 1994 (Cooke and Morgan, 1994).
a-) Localised pattern of development actually facilitates a collective learning process such that information, knowledge and best practices are rapidly diffused throughout the local milieu, raising the creative capacity of both firms and institutions.
b-) Localised production system helps to reduce the elements of dynamic uncertainty: this also facilitates local innovation because it allows for a better understanding of the possible outcomes of the decisions of a firm (Camagni, 1991 quoted in Cooke and Morgan 1994).

Within this new framework, we introduced with a new 'learning' concept. Concept of "learning" bring us to a conclusion that new products rely on cumulative and place specific knowledge. These lead to geographic clustering (Feldman, 1994). Within accumulation of knowledge and exchange of information, 4 characteristics play important role within technology based production. These are; a-) reducing uncertainty by engaging networking with related firms, b-) related industry presence and specialised business services key to innovative success, c-) presence of a university and d-) presence of specialised information sources which tend to locate near client markets (Feldman, 1994).

Especially learning concept is more related with evolutionary approach. Not long ago, a new perspective on industrial location had arisen. This new perspective depends on more evolutionary pattern that it focuses on changing organisation of production and investment priorities (Storper, 1985).

Different from linear innovation models, evolutionary (network theories afterwards) theory gives importance to historically evolved firm strategies. Strong innovation activities are related more with evolutionary model. Structural and behavioural features of firms such as organisational characteristics (status, function, skills), the strategic orientation as well as network links in addition to locational factors are relevant to evolutionary patterns (Tödtling, 1992). Especially evolutionary approach imposes on local embeddedness as an important actor in involved learning process.

In early 1980s; at early times of evolutionary approach on technological change, also debates on high technology production location were started to discussed among geographers and economists.

Castells' studies in 1985 are important in this sense. For Castells, high technology-space relationship depends on two basic processes. These are a-) high technology becomes the development dynamics of regions, b-) new spatial preferences emerge with new technologies. First issue is most related with production while second is about use of these technologies (Castells, 1985). Castells determined that, there are five factors that makes a space attractive for high technology in U.S.A. These are, proximity to universities and research centres, proximity to military research institutes, places that have weak trade unions, places which have intensive joint venture firms and places which have strong communication facilities are preferred (Castells,1985). This is more adaptable to neo Schumpeterian approach that insists on hierarchical patterns.

Ironside and Christy's studies were insisted on important location variables for high tech industry. The results have some differences with regard to Castells' previous

arguments. According to this study some findings on location variables for high technology are;
a-) Universities do not necessarily attract high tech firms, depend on Oakey's studies in Silicon Valley (Oakey,1984 quoted in Christy and Ironside, 1990).
b-) A research park location is not indispensable for high technology development.
c-) While small independent firms are a propulsive innovative force for any high technology development; subsidiaries of large corporations carry out R§D and stimulate high tech linkages.
d-) A strong public expenditure component is effective in all developments either through creation of markets through defence expenditures, research funding, education programmes, aids to improve business climate or capital infrastructure (Christy and Ironside, 1990).

It is argued in the same study that, access to recreational and cultural amenities of metropolitan cities as being necessary to attract scientists, engineers and managers. However others such as Glasmeier suggest this locational factor has been overstated (Glasmeier,1986 quoted in Christy and Ironside, 1990). Depending on a specific research done on 99 high tech firms by U.S. Office of Technology in 1984, Christy and Ironside mentioned that, most significant factors are appeared to be availability of labour skills, accessibility and business climate. Proximity to universities co ranked seventh after entrepreneur peculiarities, closeness to existing operations, labour force issues (Christy and Ironside, 1990).

Begg in 1991 summarises the factors influencing location of high technology activity. These are alike,
a-) Supply side considerations: Residential environments, networking between firms or with research establishments, availability of professional and technical staff or abundant labour for assembly, access to specialist business services, and ownership structure and rates of innovation.
b-) Demand factors: Defence procurement, internal demand from corporate decision centres, export demand, sales to large companies.
c-) Policy influences are: Inward investment incentives, telecommunication and access to air transport links, local

planning stance and attractiveness of locality, location of research establishments (Begg, 1991).

With evolutionary approaches and other studies on high tech production locations; linkage studies gain importance than ever. Not only inter firm linkages but intra firm linkages and linkages with all other institutions become the subject of spatial analysis of technology based production. Linkage and network approaches gained much importance in spatial studies of innovation and technology based production.

One of the category of the theory that explain linkage between firms is referring to emerging spatial systems with changing system of production (Dodgson, 1994). These group of explanations for interfirm technological links sees them as a response to reorganisation and restructuring of industry. Extensive interfirm links are a response to the uncertainty due to loss of control over markets.

Marceau in 1992 provides a distinction for the reworking of the world. This can be evaluated as rethinking of agglomerations with different types of linkages. Basic distinctions of Marceau are; Chains, clusters, and complexes (Marceau, 1992 quoted in Dodgson,1994).
a-) Chains reflect relationship established between core firms and their suppliers and distributors. These vertical production chains draw together all those activities from raw material extraction to product marketing and services. Inter firm links integrate and coordinate their activities through closer subcontracting relationships. Especially chain concept is related with vertical relations, such as Calori in 1992 claims that vertical alliances between suppliers and clients regulate markets along the vertical chain. Such agreements are needed when the firms are focused at a single level of the vertical chain as happen in many merging industries (Calori, 1992).
b-) Clusters refer to Marshallian analysis of group of firms that are geographically proximate. Internal collaboration and competition continue to assist competitiveness. In Rosenfeld's study, main idea behind cluster is that firms find it advantageous to be close to their suppliers, customers, services and competitors. Proximity allows them to transact business more cheaply

and easily, resolve all the problems more quickly and efficiently, and learn earlier and more directly about new and innovative technologies and practices (Rosenfeld, 1997). A cluster is very simply used to represent concentrations of firms that are able to produce synergy because of their geographic proximity and interdependence.
c-) Complexes integrate not only firms but also public sector bodies' industry funded research organisations, regulatory regimes and public procurement policies.

Subcontracting relations are the key in chain concept. Subcontracting is a major factor in start up of new technologically advanced firms. It is described as an outsourcing of manufacturing or service by a firm to another firm. The term subcontracting derives from its usage in projects requiring the signing of contracts between a party commissioning the project and those undertaking it (Sako,1994). Villa and Fischer's study on electronics industry in Austria showed that locating nearby is obviously important for subcontracting as it allows better possibilities to implement innovations and adjustments in production more quickly. Austrian case shows that the concentration of electronics establishments in the capital region is very important for subcontracting and such arrangements have a substantial effect on capabilities of firms to engage in RD.

Hilpert's arguments in 1991 about innovative region concept are noteworthy that it is relating linkage approach with space-innovation and technology based production. In his framework, he claims that a continuing participation in innovation and transformation into an innovative region can not be achieved by the simple location of single research based units. The spatial pattern of techno industrial innovation indicates characteristic differences that require rather the presence of innovative networks. The small technology based firms said above to be incapable of introducing regional indigenous development are important contributors to regional innovative networks. Generally, these firms are founded by non university research staff and scientists who have been engaged in academic research. Because they rarely move into other regions they usually contribute to the innovative capabilities of the regions

where their original institutes and departments are located, supplying large enterprises with high quality services (Hilpert, 1991).

All these studies on technology based production and spatial behaviour show that linkage structures of firms play important role as transaction, in particular market relations in spatial restructuring. Increased flexibility calls for the vertical disintegration, close and tight contractor- subcontractor relationships, continuous information exchange and spatial proximity (Moulaert and Swyngedouw, 1991).

Evolutionary approach and 'linkage' discussions lead to network type of explanations on spatial relations of technology based production. Network explanations did not come after these explanations but they occur within the same time period. Also, network and milieu explanations can be considered as the continuation of evolutionary approach.

Network concept does not directly relate with spatial analysis of innovation and technology based production. Especially, emergence of networks as innovative milieu is directly related with space. The term network denotes the relationship of entrepreneurs and their small businesses with outside world. Although networks are explained in different ways, it is accepted as networks consist of organised systems of relationships and a network is generally defined as a *"specific type of relation linking a defined set of persons' objects or events"* (Nelson, 1988 quoted in Donkels and Lambrecht, 1997).

In the era of flexible specialisation and increasing globalisation of production, many firms in various sectors engage in development of and participation in a variety of networks as an organisational and management response in order to cope with high uncertainty (Lakshmanan, Okumuro, Makato, 1995). Lakshmanan et al., view networks as a basic institutional mechanism that reduces dynamic uncertainty during a period of rapid change (Ibid). Especially networks are vital for small firms. When small firms are considered, some authors

insist on considering entrepreneur related characteristics as well as firm related factors considering networking (Donkels and Lambrecht, 1997).

Networks represent a set of selective and explicit linkages between one production unit and others. These may be in form of technological and marketing relations. Such linkages may be material and nonmaterial in nature and may take several forms as supplier-user relationships, joint ventures, subcontracting, production sharing, licensing agreements, R§D collaboration, contingency contracts and so on.

Maillat et all. defined 3 types of networks as;
a-) A network with a leader firm that has taken the initiative for an innovation project and which controls all the operations (design, industrialisation, marketing)
b-) A network with a hub firm, or hub set of firms, which controls the project, the feasibility study for which is executed in collaboration with all the partners responsible for a module.
c-) A compact network in which the overall design of the project is devised collectively without previously specifying or allocating given tasks (Maillat et al, 1994).

On the other hand factors that help to explain network structure are defined as;
a-) Social ties: Social network relations are maintained with family and acquaintances, so such relations involve an emotional bond of friendship between the parties concerned.
b-) Communication: Communication networks are the collection of those organisations and the individuals with which the small firm has non trading links that provide useful information.
c-)Business considerations: Mitchell 1973 refers to exchange networks as those that contain the individuals, companies and groups with which the small business has commercial transactions (Mitchell 1973 quoted in Donkels and Lambrecht, 1997). The trading partners of the small business constitute i-) the core of the exchange network. ii-) instrumental network, iii-) strategic aspect
d-) Moral aspect: Moral network relations arise from entrepreneurs sense of moral obligation to do everything

possible for their partners (relatives and fellow entrepreneurs) in the network (Donkels and Lambrecht, 1997).

Network arrangements can be distinguished into two as strategic alliances and strategic networks (Genosko, 1997). Strategic alliances represent action sets groups of organisations that enter into alliances or coalitions in order to achieve a certain end. One of the most important characteristic of strategic alliances is direct reciprocal relations between the partners. Strategic alliances are horizontal forms of cooperation in which trade off's are settled not through market transactions but rather by other forms of activity linking. Strategic networks are in turn, vertically or diagonally structured forms of cooperation (Genosko, 1997). The central difference between alliances and networks is that; in the case of strategic networks, market transactions are definitely the order of the day (Jarillo, 1988 quoted in Genosko,1997).

Also, there is another distinction of networks as formal and informal networks. An informal network consists of all possible information channels among individuals. They occur in all the selected network factors. A formal network, on the other hand denotes a possible link between the entrepreneur and an organisation rather than an individual link (Donkels and Lambrecht, 1997).

In networks and other kinds of organised market relations, people develop codes of communication, styles of behaviour, trust, methods of cooperation and so on, to facilitate and support interactive learning. All these are facilitated by proximity between interacting parties. In this context, proximity does not refer to geographical distance but also it refers to economic, organisational and cultural issues (Lundvall,1992 quoted in Gregersen, Johnson, 1997). Here economic refers to how closely located, organisational refers to type of integration, cultural refers to several dimensions of real and imagined interpersonal relationships.

Emergence of networks is explained in various ways:
a-) Transaction costs approach that relies on minimising those transactions costs which consist mainly of all the

information and communication costs. According to this theory, networks contribute especially to minimisation of these costs in cases where highly complex transactions carry a high degree of uncertainty (Genosko, 1997 and Imai, 1989 quoted in Taymaz, 1993). Transaction cost theory alone does not satisfy the theoretical founding of strategic networks (Genosko,1997).

b-) Game Theory Arguments

c-) Neo Fordism

d-) Innovative milieu and approaches of Myrdal, Krugman that indicate innovation, supplier, customer relations. The characteristics of innovative milieu create first intra regional networks between inventors and innovators.

Besides, there are some studies to combine transaction cost approach and milieu approach that points out that it is primarily innovative milieu that reduces transaction costs because in such an environment, information is easier to collect, information circulates more easily and face to face contacts come about more quickly. However Camagni also refers to cost saving potentials that can't be embraced by transaction costs theory alone (Camagni, 1995 quoted in Genosko,1997).

To have positive effects on innovative networking, it is accepted that regional environments must reach a certain level of socio-economic integration. 'Milieu' concept is used to specify that organisational property (Perrin, 1991).

Regional dimension of innovation process is mostly ignored part of the story. At the regional level, this issue is related to industrial milieu in general and to those factors in particular:

a-) Access to information and technological know how such as science and technology oriented universities, research institutions, knowledge centres, national or international repositories of information such as libraries, patent offices and data bank systems, the density and quality of local contact and information networks;

b-) Channels of supply for innovation such as information services, the availability of highly skilled labour force and the availability of finance (Fischer and Bertuglia, 1995). Depend on these discussions, innovative industrial

milieu covers all types of informational relations and technology gathering facilities of firms.

Milieu concept in Maillat and Crevoiser's definition is a complex system made up of economic and technological interdependencies (Maillat and Crevoiser, 1991). According to Tödtling, it refers to a coherent whole in which a territorial production system and technical culture of the performers are linked. The spirit of enterprise, corporate behaviour patterns, organisational practices, ways of using technology and know how are both an integral and constituent part of the milieu (Tödtling, 1992). Maillat and Crevoiser emphasise on sense of belonging, which enhance the local innovative capability through synergetic and collective learning processes (Maillat and Crevoiser, 1991).

The milieu allows an innovation network to be formed and to find a certain coherence at the territorial level. The milieu offers opportunities to collaborate with new partners who have the skills necessary for the innovation project through the established relations. This contribution made by the milieu facilitates the search for partners when setting up innovation network. By this way, the notion of milieu attempts to characterise certain territorial forms of industrial organisation that create technologies, based on a relative stability derived from a set of rules and conventions shared by a community of players and built on a dynamic of non market cooperation and interdependencies of a mainly informal nature (Maillat et al, 1994).

Interfirm networks have the potential to enrich the territorial environments or milieu through the opportunities they provide for information interchange, explicit or tacit know how transmission, and skilled factors mobility through the networks (Camagni, 1991).

In Genosko's definition, innovative milieu is a mixture of strategic alliances and strategic networks, since both vertical-diagonal and horizontal as well as direct and indirect relationships are to be found in them. In spite of importance of proximity and spatial concentration, the milieu approach seems to be geographical but it is rather

cultural. Innovative milieu is based on a common understanding regarding socio economic problems and solutions (Genosko, 1997).

Milieu is considered as one of the important uncertainty-reducing operators. The milieu performs a set of territorial relationships, and generates dynamic collective learning process in strict integration and synergy with the firm, allowing dynamic decision making of local firms (Camagni, 1991). Milieu type local environment performs: a-) a collective information gathering and screening function, b-) a function of signalling in the direction of the market of local firms, c-) a collective learning process mainly through skilled labour mobility, customer supplier interchange, imitation processes etc., d-) a collective process of definition of managerial styles and decision routines through managerial labour mobility, imitative decisions, cooperative decision making through local industrialists associations, e-) an informal process of decision coordination through interpersonal linkages, f-) a function of conversion of external energies to the needs of local firms (Camagni, 1991).

Depending on their studies on Swiss Jura Arc, Maillat, Lecco, Nemeti, Pfistr in 1994 claimed that; without common accepted standards and codes able to transmit information, face to face contact and a common cultural background might become of decisive importance for the information exchange. Both geographic and cultural proximity promote the dissemination and accumulation of the information required by the innovation process. In this sense, the milieu provides a specific technology district with a comparative advantage connected with the historically formed relational capital. From this point of view, "*the milieu acts as an incubator of technological innovation*" (Maillat et al, 1994).

As a result of this framework, there are some ideas claim that technological innovation and relations with space are complex processes that cannot be described and explained by linear models. It is best represented by evolutionary and network models because its appearance in space is strongly shaped by organisation, strategy, markets and network of firms (Dodgson, 1994; Tödtling, 1992, Walker and Storper, 1989).

There are two important examples on how changes in organisational rearrangements, linkages and networks contribute to the change of environmental conditions of technology based firms and spatial behaviours. The case of watch industry in Switzerland (Glasmeier, 1991) and computer systems firms in Silicon Valley (Saxenian, 1991) can be good examples of how firms organise network type of relations in order to react externalities. Also these two examples are important to show how a spatial network reaction to externalities leads to totally different results in two different countries. Though these two countries are developed countries, their industrial histories, production cultures, industrial relations are totally different from each other.

Glasmeier worked on the reaction of a network of watchmaking production in Swiss Jura Arc towards a major technological change coming from outside. One important conclusion of Swiss example shows that the watch industry's collective research efforts are not adequate for catching up new technology. Also organisational structure has to be reorganised. Swiss case showed that elaborate network production systems suffer in the face of unexpected technological change (Glasmeier, 1991).

On the other hand, Saxenian's studies on Silicon Valley represent how network production system contributes to the development of innovation and diffusion activities over U.S. computer firms (Saxenian, 1991). Saxenian in his work found that, by relying on networks of suppliers, Silicon Valley systems firms gain the flexibility to introduce increasingly sophisticated products faster than before. These networks reinforce diffusion of new technologies by facilitating information exchange and joint problem solving between firms and even industries. Also these networks foster the application of new technologies because they encourage new firm entry and product experimentation. As a result, these production networks help account for the sustained technological dynamism of the Silicon Valley economy (Saxenian, 1991).

These two examples show how act of networking and relations among firms can differ according to different external and environmental conditions. Also it is tightly related to conditions of different countries.

2.2 Innovation and Technology Based Production for Developing Countries

Aim of this part is to clear out the meaning of technology and innovation for peripheral countries. All researches and investigations that we explained in last parts depend on realities of advanced industrialised countries. On the other hand as techno industrial innovation aspect is closely related to national industrial histories, national industrial structures, industrial development aspects and cultural aspects of different societies; there are differences between all countries. Especially there are more differences between advanced and developing countries concerning technological relations, innovation and locational aspects.

In this part, first we try to derive out differences between advanced countries and developing countries concerning technology based production and innovation conditions. Depending on these differences, theoretical explanations for developing countries will be searched out. Then basis of technology based production and innovation for developing countries will be the subject. Related to this part, case of Türkiye will be discussed. This will be important for understanding external conditions for Turkish PE firms.

2.2.1 Differences Between Developed and Developing Countries Considering Innovation Concepts

Main difference between several countries comes from meaning of technology in production. Concept of high technology is always used for developed countries whereas it is argued that innovation process in developing countries has little to do with high technology (Hilpert, 1991). Most important issue in developing countries is the specialisation on needs of market niches with combination of high and medium techniques. This achieves dynamism and flexibility for firms to technological changes (Ibid). Beyond this main difference, these countries start to pay particular attention to spreading of R§D to smaller firms from research institutes to generate techno scientific progress.

Developing countries and their firms have some disadvantages to achieve competitive advantage through technology intensive industries. The reasons are listed in one study as; inability to compete through product innovations, shorter product life cycles, firm specific nature of knowledge and significant economies of vertical integration and geographical diversification (Kumar and Siddhartan, 1994).

Kırım's study (1990) on technological differences between countries is important (Kırım, 1990). According to this study, main differences between developed economies and peripheral economies are categorised as;

1- First difference comes from market sizes. Market sizes in developed countries is more large, so application of same technology in different development level of countries give different results.

2- An important difference comes from the presence of scientific infrastructure. As linkages between science system and production are weak, almost there are no basic search activities in developing countries.

3- Third difference comes from the role of governments. In developing countries, governments play important roles for development of innovation. All government incentives and government related taken decisions directly effects technological level of firms in developing countries. On the other hand in developed countries, governments are playing more catalyser roles.

4- Technological changes in developing countries are considered as more incremental in character. Radical innovation is more appropriate for developed nations.

5- As another factor, Kırım insists on that reducing costs is the primary motive for innovation in developed countries. On the other hand, it is one of the factor for technological change efforts. Other factors are quality improvement, product differentiation and so on. Also considered as technological change efforts.

Considering such differences new theoretical discussions on these subjects were emerged. Especially existing neo classical economic theory says almost nothing with technological development process in developing countries (Copley,1990; Kırım,1990; Lall,1992). According to this type of thinking role of developing countries is to import any technology paying with no cost and use it with no

additional effort (Soyak,1996). This type of traditional literature neglects the production of technological activity in developing or less developed countries (Lall,1992). These approaches disregard nature and costs of technological learning, externalities.

Evolutionary approach is more related with technological issues and conditions of advanced countries as this was the case for neo classical approach. On the other hand, evolutionary approach has something to say about developing nations. It reduces technology development based on production function and leads to possibility of technological level differences between firms. As it was mentioned, evolutionary theories are micro level, indigenous and depends on internal differences of firms but it has some doubts on application of this theory on developing countries (Lall, 1992).

Especially, evolutionary approach more explains permanent presence of asymmetry among firms in terms of process technology and quality of output (Dosi 1988 in Lall,1992). On the other hand, Lall argues different innovative capabilities are important to explain this asymmetry (Lall, 1992). According to this approach, innovation has to be defined much broadly to cover all types of search (Soyak,1996). So, technological development concept in evolutionary theory was needed to broaden for application of it in developing countries.

As firm level technological development depends on partly on knowledge accumulation inside and creation of technical knowledge by external factors, innovation concept is automatically expanded. In this respect, innovation is not percepted only as radical process innovation but also it will be accepted as continuous process to adapt for external conditions (Lall, 1992; Soyak, 1996).

This perception of technological innovation prepare a basis for new studies on developing countries done by different authors. These new researches especially held in Latin American countries and lead to Latin American approach that depend mostly on learning by doing models. This new approach is taking relations between economy and technological development within market deficiency context. Most important contribution of this approach is

to take incremental innovation concept into consideration. This approach is different from evolutionary approach that, innovation process is considered as an automatic result of learning by doing.

There are some criticisms on learning by doing process as an automatic result of production process (Soyak,1996). This new approach sees information flows of firms as a result of some costs and efforts. Economic and institutional environment plays important role in generation of technical knowledge (Copley,1990). Lall insists on concept of technological capability related to this new approach. Lall defined firm level technological level depending on two roots. One is the outcome of investments taken by firms and other is interaction with all other economic agents. Also he described national technological capability as common set of elements that show responses of firms to policies, market and institutional framework (Lall,1992). These are important factors in order to understand national differences in technological capabilities.

As a result of all these studies, it is accepted that, a firm level technological capability or in other words innovation capability is existing in developing countries (Copley, 1990; Lall, 1992; Rath, 1990).

Also there are differences between developed and developing countries considering spatial structuring of technology based production. There are almost no studies on spatial structure of technology based industry in developing countries. In spite of this condition, we can point out some generalisations on this subject. First, technopolis concept is not existing in developing countries. Technology based firms locate in biggest metropolitan areas as atomised units or locate within organised industrial sites.

As a result of this part, empirical observations show that process of technological change and innovation differ for firms, sectors and countries. In coming part, we will analyse the factors that prepare a basis for innovation in developing countries. These factors are related with more

macro levels than specific firm level. We will explain firm specific factors when explaining PE firms in Türkiye.

2.2.2 Innovative Basis of Developing Countries

In this part, we will discuss about factors that play role in generation of innovation and technology based production in developing countries. Kırım's criticisms on differences between developed countries and developing countries are also hold true for this part (See previous pages). On the other hand there are some generalisations on some basic characteristics of developing countries concerning innovative basis. First is related with weakness of investment good production. This is one of the main reason for importing technology from abroad. Second it is argued that environmental factors and wrong policies in developing countries create a negative learning and evident dynamism of individual firms and sectors is not carried through across whole economy (Rath, 1990). Third argument is related with lack of venture capital mechanism that it is one of the major factor for technology development in developed nations especially in U.S.A. (Lall, 1992).

Another important characteristic of developing countries is the lack of basic research facilities due to weak technological infrastructure (Dahlman et al. 1987; Lall, 1992; Rath, 1990). This infrastructure is related with educational system, university collaboration and scientific power of countries.

These are some results derived from various concrete researches. On the other hand there are some studies that by which ways we can analyse innovative basis of developing countries. Copley in 1990 defined 5 categories of determinants of the rate of technical change in developing countries. These are;

a-) The nature of production technology related with incremental technical change as a specific character of technological development in developing countries,

b-) Market structure. Copley claimed that small domestic markets of many developing countries may not be sufficient to support competing firms.

c-)Policy environment that covers several government policies. It covers a wide range from trade policies to government support for technological and local scientific infrastructure.
d-) Firm specific factors.
e-) The technological frontier that defines general technological capability at the global level for a given industry.

On the other hand Dahlman, Larsson and Westphal defined 3 factors that determine innovative characteristics of developing countries. These are incentives, related agents and role of government (Dahlman et al, 1987).

Like Dahlman et al., Lall insists on 3 factors that can help to understand technological characteristics and innovative basis of developing countries. These factors consist of a-) various capabilities (physical investment, human capital, technological effort), b-) incentives and c-) institutions (all related institutions including state institutions). Analysing these factors can help us to clarify technological and innovative differences of any country (Lall, 1992).

In 1991, Üçcan from Turkish State Planning Organisation, defined variables to understand innovation potential of Türkiye. These are; socio cultural structure of the country, human resources, entrepreneurship culture and incentives (Üçcan,1991).

With regard to these discussions, innovative basis of Türkiye and macro innovation conditions of Türkiye will be discussed in part 4.2.1 before explaining firm research and firm specific interpretation of technology based PE industry in Türkiye.

Development and structure of PE development in Türkiye is an interesting example to show structure of an example of technology based industry and innovative conditions of small and medium scale firms in such technology based industry. We will analyse several externalities with linkage and transaction relations of firms in order to understand spatial structuring of PE sector in Türkiye as the case of PE production in Türkiye is an important and contingent example of technology based production.

CHAPTER 3

CHARACTERISTICS OF ELECTRONICS INDUSTRY AND DEVELOPMENT OF ELECTRONICS INDUSTRY IN TÜRKİYE

Electronics is one of the special technology based sector that innovative characteristics of an industry can be best studied in this sector. Even, electronics industry has divided into various subbranches according to their technological characteristics. It is also widespread technology based sector when compared with genetics and advanced equipment or aerospace industries. Especially electronics production is existing in every country somehow. Development of electronics industry differs according to national conditions, national industrial histories, different externalities derived from different local conditions and so on. Related to these, development and spatial distribution of PE industry in Türkiye is a contingent situation and deserved to be searched.

In this respect, this chapter is divided into two parts. In first part, general characteristics of electronics and PE industry will be explained whether in second part of the chapter, development of electronics sector and spatial distribution of electronics industry will be given. An important contingent position is derived from this part. It is the condition of PE industry in Türkiye. After giving explanatory and statistical knowledge on this subject in this part, we can analyse reasons and results of this condition by using firm research in next parts.

3.1 General Characteristics of Electronics Industry

In this part, main subject will be the general knowledge on electronics industry and the position of PE industry as a technology based subsector of electronics industry. Characteristics of this subbranch will be explained within comparison with other electronics subsectors.

3.1.1 Importance of Electronics Industry

Electronics is a branch of physical science that deals with the behaviour of electrons and other carriers of electric charge as they flow in vacuum, in gases or in semiconductors. A flow of electric charge is called an electric current, and a closed path that the electric charges can follow is called an electric circuit (Grolier Multimedia Encyclopaedia, 1994).

The growth of electronics technology in the 20th century has been accompanied by the rise of industries that develop and utilise that technology and make it available to consumers. In the early decades of this century a small electronics industry developed based upon vacuum tube technology. It was mostly concerned with communications applications such as radio, radar, and eventually television. In 1947, Bell Telephone Laboratories invented the transistor, and a new generation of smaller, more efficient electronics was born. Electronics firms flourished as the demand for electronics products increased very much. In late 1950s, silicon integrated circuit was invented by Fairchild Semiconductor Company and a third generation of electronics and electronics industries developed based on the miniaturisation of electronic circuitry. Microelectronics started to transform thousands of older industries. By this way, electronics was started to applied in many sectors and automation becomes important issue in manufacturing. In the mid 1980s the achievement of very large scale integration (VLSI) started another revolution in the electronics industry. VLSI, the placement of 100,000 or more transistors on a single silicon chip, vastly expand the power of the computers (Grolier Multimedia Encyclopaedia, 1994). Development of computer technology leads to growing importance of software. It is accepted as fifth revolution in electronics industry because with development of software, electronics industry entered a new phase that industry became able to produce electronic systems as well as physical devices.

The current period is defined as age of electronics as innovations and developments in this sector opened a different era of production and consumption. Advanced information and communication technologies are the main

causes of the structural changes in world that named as an information revolution. The production of these technologies depends on electronics industry. It is obvious that electronics industry will become the most critical sector in global economy at the beginning of 21th century. For example, one tenth of total gross product in the world was produced by only electronics sector in 1992 (7. Year Development Plan). Surely, this value will increase in 2000's. It was estimated that in first quarter of 2000's, about half of the total industrial workplace will belong to only electronics sector (3. İzmir Economy Congress, Electronics Workshop Report,1992).

Electronics industry became so strategic that it has applications in almost all activities. Vitality of electronics brings communication, computer, entertainment sectors work together. Also most of industries have electronics applications. For example, in aeroplane and automation industries; electronics, electronic hardware and software spending are about half of the total cost (Altay, 1996). Such applications and all informatics (included communication) applications need to depend on efficient working of electronics sector. Because of these reasons, a tendency emerged that takes electronics sector as a tool for economic development.

This condition depends on special characteristics of electronics sector such as; a-) electronics is the most rapid growing sector, b-) it is one of the most R§D intensive sector, c-) there is a technological dependency between different parts of electronics industry, d-) there is a wide spectrum of output, e-) there are intense relations between electronic firms concerning R§D, production, selling, marketing and technology issues, f-) global scale is important in production and marketing, g-) there is a rapid diffusion of technology.

One of the important causes for presence and sustain of electronics sector is the technology factor. Electronics industry is noted for the rapid technological change, probably the most rapid of any industry when measured in terms of product life spans (Charles, 1990). Besides, the electronics industry becomes the most flexible and dynamic sector among other manufacturing sectors in recent years. Despite oligopolistic trends in some of its branches,

electronics continues to have a high degree of uncertainty. This can be illustrated by referring to 4 characteristics of electronics industry. These are;
a-) Rapid changes in technologies and markets,
b-) Rapid changes in investment levels at a firm and industry scale,
c-) Rapid change in managerial awareness and organisational structure,
d-) Resultant market structure and segmentation (Charles, 1990).

Technology is not only an ordinary production factor in electronics industry, but becomes the vital factor for performance of firms in this sector. Electronics is the primary sector that has a rapid advance in technological means. Also electronics sector has the most powerful inventive performance according to a thought that claims *"the inventive performance of an industry is determined by nature of its technology"* (Sahal, 1981 quoted in Walker 1985). According to these characteristics, a conclusion can be derived that electronics industry is a technology based industry. This is not totally true in practice as electronics sector is composed of structurally different branches. Rate of technological change, technological sophistication, R§D intensity can vary between various branches of electronics sector. Even, some of electronic subsectors themselves represent technological variations within their subbranches such as it is the case in PE industry.

The review of electronics subsectors will be helpful to understand electronics industry's structure better. Electronics industry can be simply divided into consumer electronics, component industry, telecommunication equipment industry, defence electronics, computer and office equipment electronics, and professional electronics (PE). Although these sectors are highly interrelated and possibly as a technological change in one sector effects another, they have all different characteristics. This is important to understand differences between PE subsector and other subsectors.

3.1.2 Different Branches of Electronics Industry

Electronics sector can be divided into several parts such as;

a-) Consumer Electronics:

This branch can be accepted as basis for development of electronics industry in many countries. Most South Asian countries built their advanced structure of electronics industry on advanced structure of consumer electronics industry in 1980s. This branch of electronics sector depends on mass production technique. Products are generally standardised products. Consumer electronics includes products such as TV sets, radio, video, tape recorders etc (Detailed industrial classification is provided in appendix A).

b-) Telecommunication Industry:

Telecommunications industry is one of the most R§D intensive economic sector in the world that R§D spending in this sector exceeds R§D spending of many industrial sectors. This industry has a big potential of development with parallel to rapid development of telecommunication systems and communication networks all around the world.

This industrial production requires both mass production type and more technology based production. This type of industry includes telecommunication equipment such as telephone devices, telephone exchanges, radio link receivers, facsimile devices and so on (Detailed industrial classification is provided in appendix A).

c-) Component Sector:

This subsector is appreciated as infrastructure of all electronics industry. Production is highly dependent on mass production technique and marketing is dependent on costs.

Required technology differs in all types of components. Some products require higher technology such as semi conductor elements and integrated circuits as ratio of software in production of these components reaches to levels of 30-40 %. These components are named as active components as they are active in operation of a device. Especially these products such as integrated circuits that

are used in computer production have been only designed in few developed countries.

Also there are passive components used for efficient work of electronic devices and systems. These components generally do not take place within electronic devices or systems. These are mostly complementary elements. These passive components are composed of cables, cable elements, antennas, wireless antennas, etc. Production of these types of components does not require much technology and depends on mass production techniques (Detailed industrial classification is provided in appendix A).

d-) Computer and Computer Equipment Sector:
This subsector started to develop after the invention of integrated circuits and introduction of personal computers (PC) in 1984. Regarding computer boom in offices and homes, computer industry became the leader of electronics sector within few years. This sector highly depends on semiconductor industry. As semiconductor industry requires advanced technology, it was become very difficult to enter computer industry competition for developing countries except some of South Asian countries after 1990s.

This subsector includes; personal computers, computer monitors, environmental units such as modem, keyboard, mouse, multimedia intermediate units, scanners, writers and so on. Also this industry includes systems of ATM's (Automated Teller Machines for banks), POS (Point of sale) terminals and optic disc systems (Detailed industrial classification is provided in appendix A).

Besides hardware, software production for operation of computers became important in this period. This branch differs from all other electronic production sectors that it requires only a pencil and paper as a capital input. Software production will be excluded from our electronics industry classification as this type of production as an industry is very recent concept for electronics industry classification.

e-) Military or Defence Electronics:
This type of industry requires one of the highest engineer skills besides other electronic sectors. Especially it requires one fourth of its staff to be engineers. It is

almost impossible to catch up technology without utilising number of engineers and investing huge amounts on R§D. Otherwise, any defence firm becomes only a fitting firm that has producing under dominance of several multinationals. In such a condition, main technology can not be utilised by the home country. In embargo conditions, industry is doomed to collapse.

Especially very high and advanced technology has been using in industry such as micro electronics, opto electronics and so on. Because of all specific reasons and long design periods that lasts for 3-5 years, this sector requires huge amount of government support especially in developing countries. These conditions discourage entrepreneurs. For this reason, there are not specialised firms in defence electronics.

Military electronics includes military applications of electronics such as; military communication and wireless systems, targeting and shooting systems, mine detectors, electronic parts of military vehicles and so on.

f-) Professional Electronics (PE):
PE sector has a big potential towards other electronics subsectors because of its share in other industries. As an example, share of electronics applications in chemistry and automotive sectors was about 10 % at the beginning of 1990s and it has been always increasing (3. İzmir Economy Congress, Electronics Workshop Report, 1992). Several electronic applications have been using in almost all manufacturing sectors. Besides industrial applications of PE, there are various applications of PE parallel to technological developments in electronics. Security systems, building automation systems and medical electronics are some examples. Electronics applications entered into economic, social and cultural lives of people. PE accelerated this situation.

This sector is different from any other electronics subsectors, because of its knowledge and software intensive character. It is the second sector that depends mostly on engineering facilities. *"Sector produces solution more than a tool"* (7. Development Plan). This is because software and service facilities become equally

important with hardware or sometimes become more important than hardware in PE sector.

PE industry has some other special characteristics such as; rapid growth, high employment levels, high value added, high export capability and need for less capital. As mentioned earlier, PE does not require big amount of investments. Human capital is the main source of necessary capital. Only short time incentives such as R§D and software incentives can able to guarantee the presence of this subsector.

Development of PE industry is very important condition for a country to catch up technological level in total electronics sector. After beginning of 1990s, a strategic importance was started to given to this sector in whole world and its value added share in world's total electronics industry was risen up to 30 % (İzmir Economy Congress, Electronics Workshop Report, 1992). Development of PE industry in any developing country is also important in balance of payments. As 1/3 of investment goods are professional electronics elements, local production of industrial electronics will reduce imports with percentage of about 30 % (7. Development Plan, Special Commission Report on Electronics).

PE industry is critical especially for developing countries. There are some specific characteristics of this sector for developing countries as;

a-) Production of firms in this sector depends mostly on demand factor. Production is not continuous and it does not happen in big scales.

b-) Incremental innovations are the basis of technological development of firms in developing countries,

c-) This type of technology with sufficient engineering and design support can exhibit various facilities for small firms in determined market conditions within developing countries.

d-) To access such technology is more possible than to access high qualified technology of developed countries. Also this type of technology is precondition for the production of high technology that requires more R§D, long and complex processes (Ercan, Hokkacı and Oral, 1988).

As a result, this sector is the most dynamic industry among other electronics subsectors in developing countries.

PE production can be classified according to various variables. These classifications depend on qualification of its products, intensity of engineering facilities, system product differentiation, use of technology, market structures and so on.

For the sake of simplicity, PE production can be divided into three groups as;
a-) Intermediate goods indicate especially industrial tools such as control devices, CNC machines,
b-) End products such as power supplies, AC/DC devices, redressers, induction owen etc.
c-) Electronic systems such as automation systems, security systems and so on.

Within this three types of classification, this sector includes production of; power electronics (AC/DC converters, power supplies etc.), CNC machines, measurement control systems, some multimedia devices, testing and measurement devices, process automation systems, security and alarm systems, building automation systems, electronic boards, medical electronic devices and so on (Detailed industrial classification of PE subsectors with industrial identification codes is provided in appendix A).

Throughout the study, a type of classification according to range of products and their technological intensities will be used. This is to give systematic order to the research as this study is related with technology based production. This classification will be the guide and all analysis of PE sector will base on this type of classification. This classification will be as;
a-) Standard electronic equipment as, i-)power electronics devices (UPS- AC/DC converters) and ii-)automotive electronics (taximeter- tacograph and so on).
b-) Industrial electronics as, i-) weighing systems, ii-) control and measurement devices, iii-) automation systems and devices, iv-) testing devices.
c-) Security and alarm systems as, i-)simple alarm systems

such as building and car alarms and ii-) complex security and building automation systems.
d-) Medical electronics
e-) Some other professional devices and systems as, i-) electronic boards such as scoreboards, led boards, sliding announcement panels, ii-) broadcasting equipment, iii-) electronic systems used in automotive sector.

Standard electronic equipment concept within PE subsector, is totally different from standard equipment concept in consumer electronics or telecommunication subsector. For example, there are important differences between an UPS device and a TV set. There is no mass production type for UPS device. For all different levels of electricity, there can be additions on UPS device. This is not condition for TV producers because their products are the result of standardised production methods.

With regard to these explanations, it can be recognised that some electronics sub sectors are more capital intensive than others and they differ in various ways. One important point is the importance of software that makes the operation of a device sometimes becomes more than importance of hardware in advanced telecommunications, military electronics and some subbranches of PE. This situation shows the new side of electronics sector that future of electronics sector will depend on these types of activities.

Just after these explanations, historical development of electronics production structure in Türkiye will help us the level of electronics industry in Türkiye.

3.2 The Electronics Industry in Türkiye

Presence and development of electronics industry in Türkiye is exactly related with socio economic conditions of Türkiye. It has some particular characteristics. The events since 1970s, show importance of externalities on electronics production such as incentives, role of state, changing trade policies and so on. Production structure of electronics industry in Türkiye is still different from

other countries. Within this different structure, presence of PE industry is remaining as an important example of technology based subsector.

In this part, general characteristics of electronics industry in Türkiye will be explained within framework of development of this sector in Türkiye. Though the main focus is the PE sector, giving information on general structure of electronics sector is important to understand spatial distribution of electronics sector and contingent situation of PE as an example of technology based production in Türkiye.

After giving development of electronics industry in Türkiye, an evaluation on development of this sector will be explained. These are given to understand macro external conditions that have effects on electronics industry and its PE subbranch. Within this analysis we will insist on PE subsector as it is appreciated as one of the most technology based subsector and it is the focus of our study. Then occupational and spatial structure of electronics industry and PE subsector will be explained to understand special situation of PE sector in Türkiye towards other sectors of electronics production.

3.2.1 Development of Electronics Sector in Türkiye

History of electronics industry in Türkiye started in early 1970s, although radio fitting was started in 1953 and telephone production was started in late 1960s. It was decided to establish national electronics industry by National Security Council in 1964 but there were no serious action until beginning of 1970s. First Turkish made telemeter device was produced in METU laboratories in 1964 (7. Five Year Development Plan Special Commission Report). This was the first local production activity but cannot be accepted as an industry.

In early 1970s, diffusion of television programming created a demand for TV sets in Türkiye. Increasing demand for TV sets was a motivating force for development of consumer electronics industry in Türkiye. Also this subsector made component production feasible in Türkiye at that period.

After Cyprus war in 1974 and embargoes of developed nations on Türkiye, it became compulsory to establish national military electronics industry. This event played an important role on further development of Turkish electronics industry.

In 1970s, electronic devices were being imported to Türkiye at the first stage. Then some importer firms started fitting activities on these devices and finally they began to produce these devices. Reason for this transformation was to overlap custom barriers. At the mid of fourth plan period (1981-82) it was calculated that about 75 % saving on foreign exchange was maintained from local production of these electronic consumer devices in late 1970s (7. Development Plan Special Commission Report on Electronics).

There were some special characteristics of 1970s. First, market mechanism was not developed in Türkiye. There was a huge state dominance on all communication activities. For example, according to Wireless Law numbered 3222, all transmitter devices were publicly owned and only state institutions were the customers of telecommunication industry. This had a negative impact on producers. Especially entrepreneurship concerning electronics sector was not attractive. At the beginning of 1970s, there were almost no R§D activities existing in electronics production in Türkiye as foreign firms entered into fitting process to exploit cheap labour without serious expenses. Then Turkish importing firms started to imitate this structure (EMO Journal, No:193, 1973).

By 1973, there were total of 43 electronics producers in Türkiye that only 18 % of these firms were dealing with PE. This little share of PE was the sign of the important characteristic of private entrepreneurship that always wants to invest on short term profitable resources (EMO Journal, No:193, 1973). As PE subsector was neglected, it was so hard for Turkish electronics industry to catch up technological line at that period (Ceyhun, 1984).

With incentives given between 1970-78 period, production and investment trend in electronics were accelerated. Also device and component producers showed an excellent example of collaboration until end of 1970s (Renda, 1995).

Establishment of Aselsan in 1976 was very important for Türkiye in order to produce its own technology in electronics sector. This was accepted as one of the important events in Turkish electronics industry history (7. Five Year Plan Electronics Special Commission Report). After this period, between 1976 and 1979 though electronics industry was not developed much, new graduates from electrical and electronic engineering departments (especially from ITU and METU) had a strong mentality towards electronics production. Production was their first aim (3. İzmir Economy Congress, Informatics Workshop Report, 1992). These people tried to establish their own firms with their own capital and know-how but some of them were failed as they were not supported and they had the lack of management capability.

There was a stagnation period of electronics industry between 1979 and 1982 because of economic decisions taken in early 1980. As consumption levels were decreased as a result of economic decisions taken in 1980, this situation leads to a collapse in consumer electronics and component sector. Consumer electronics producers avoid this period with introduction of colour TV's in 1983-1984 period. On the other hand, component producers (especially active component producers) mostly directed themselves to import and trade activities (Oral, Ercan and Hokkacı, 1986).

With transition into parliamentary system in 1983, industrial sectors including electronics industry entered into a new development phase. Great liberalisation efforts had begun within structural adjustment framework. Aim was to develop export base industrialisation. Policies were aimed totally for incitement of all sectors and selectivity was ignored (Şenses, 1993). In this sense also importance of electronics sector was ignored but this sector started to develop rapidly with the help of some other factors. An auxiliary industry for electronics developed within few years. Also access to necessary components in the market became easier than the past. These conditions cause a new motivation for electronics industry. Own designed products were started to produce within firms. Internal market was enlarged. These conditions motivated telecommunication and military electronics sectors. On the other hand, Southeast Asian countries were living golden ages concerning electronics

production. Their products were entered into Turkish market with very low prices. Turkish firms had lack of power to compete with firms of these countries.

Especially huge investments on the telecommunication infrastructure were started in mid 1980s. Introduction of colour TV and video at the same period were other important development motivations for Turkish electronics industry. Some multinationals became shareholder of important telecommunication firms in Türkiye (Alcatel had the share of Teletaş, Northern Telcom had the share of Netaş). By this way, foreign capital became an important element in Turkish electronics industry and technology transfer became possible by this way. Also export possibilities increased in consumer electronics. On the other hand, telecommunications sector was developed totally for local market with forcement of Turkish PTT.

Mid of 1980s was important that such big firms like Aselsan, Netaş, Teletaş, Vestel were started to produce their own technology and had started strong R-D efforts (Saner, 1993). Also, relations with Europe were started to alive and this had a positive impact on foreign trade (Cumhuriyet Eki, Gümrük Birliği, Temmuz,1995). As a result of new liberal trade policies, electronics devices and systems in Turkish market were diversified and this situation forced local firms for increasing the quality of local production. On the other hand, import of components was not easy as import of completed electronic devices. This created a disadvantage for local producers. Apart from this condition, there were some other serious disadvantageous conditions for local production in those years. With the help of the wrong policies, capital was directed to non production fields although aim of the period was to generate export based industrialisation. This situation was a serious obstacle for potential entrepreneurs.

As internal market was saturated for PE producers, it became compulsory to insist on export strategies and facilities in late 1980s. In the beginning of 1990, it was recognised that targeted industrialisation has not been achieved by existing policies depending on the structural adjustment policies. Also some external conditions such as

Gulf war had a negative impact on development of industrial sectors, electronics included. Between 1988 and 1991, Türkiye was not able to protect its own R-D intensive electronic firms. For example Netaş was oppressed with political support maintained by multinationals (Saner, 1993). Whereas, in whole world this type of technology based firms are the most protected firms (EMO Journal, No:379, 1992). Big firms reduced their R-D spending and this condition effected total electronics industry in a negative way.

Increasing importance of informatics, automation facilities and incredible technological developments within electronics made electronics industry as the primary sector in the world. This situation reflected itself on Türkiye after 1992 with increasing efforts within industrial electronics subbranch (3. İzmir Economy Congress, 7. Five Year Development Plan).

Especially increasing importance of R§D leads to implementing R§D specific industrial policies. One of the important result of this situation is the recognition of importance of R§D based electronics industry. In this sense professional electronics sector gained much importance. After 1992-93 period, firms started to produce their own technologies and export activity in PE sector was gained importance. On the other hand, general structure of Turkish electronics industry that depends on consumer electronics as a primary sector did not change in this period.

After beginning of 1990s, a trend depends on external sources in electronics production technology was observed. This situation reflects itself in self source ratio of electronics R§D (This is provided in table 1 in the next page.

Table 1. Self-Sourcing Percentages in Electronics R§D Between 1991-1995.

YEARS	SELF SOURCING	FOREIGN SOURCING
1990	100.0	-
1991	100.0	-
1992	98.0	2.0
1993	97.5	2.5
1994	92.0	8.0
1995	86.0	14.0

Source: SIS, 1990-95 R§D Statistics, 1997.

A new era was started for industrial sectors especially for electronics sector with Custom Union in 1996. Within this process all industrial incentives except R§D incentives were cancelled from application. For this reason, new policies on structural transformation can be applied (Soyak, 1997). This situation stresses increasing importance of technology based electronics subsectors.

According to research of Çubukçu in 1997, within two years after Custom Union, no destructive effects of Custom Union arrangements on electronics industry were observed (Çubukçu, 1997). It is accepted that, Custom Union decreased bureaucracy, it eased foreign trade, it leads to standardisation and it introduced quality as an important element (İlden, 1997). On the other hand high tariffs on components are still continuing whereas, tariffs for electronic devices and systems become almost zero. With Custom Union, foreign firms started to use Turkish market more with more advantages.

Especially after mid 1990s, it is observed that export facilities of electronics sector increased so much (See table 2). Within this period, also efforts on local R§D and local design capabilities were increased in spite of incentive system that nearly 40 % of R§D incentives goes to the tax payment. Consumer electronics and telecommunications subsector entered a new development phase owing to development of audio-visual media activities, technological developments in communication sector and new investment opportunities. It is planned to invest 2400 trillion T.L. (98 prices) for communication infrastructure between 1995 and 1999 (Türk Telekom Raporu,

1996). Despite these opportunities, weakness of active component sector even in 1990s is continuing as a barrier for effective development of electronics industry in Türkiye.

As a result, since 1960s Turkish electronics industry developed with its all subsectors. This development reflects itself on number of firms, number of employment, value added and on export values. Increase of value added and exports of various electronics subsectors according to the different periods are given below (Annual values are provided in appendix B).

Table 2. Annual Average Production and Export Values of Electronics Subsectors in Various Periods * **

*	PROF.ELECTR.	CONSUMER	TELECOM	COMPONENT	MILITARY	TOTAL
1970-1980	1.0 / 0.01	22.7 / 0.1	4.1 / 0.02	1.4 / 0.07	0 / 0	29.1 / 0.2
1981-1989	4.3 / 0.3	78.2 / 5.8	54.9 / 2.2	6.1 / 1.0	NA /0.9	144 / 10.1
1990-1997	19.2 / 2.7	147.2 / 59.1	95.8 / 18.8	15.5 / 9.1	19.4 / 5.1	297.1 / 94.6

*: First values are value of production and second values are export values. All are annual average values in 98 fixed prices- Trillion T.L.

** Table is derived from: SPO,1977, Ercan, Hokkacı and Oral, 1988; CME,1991; SPO,1994; ATEI Almanacs, 1995-96-97.

From the table, significant development of production and export values especially in all subsectors of electronics industry after 1990 can be observed. This shows electronics production in Türkiye entered a new phase after 1990s. This is marked by increasing export ratios. The least ratio belongs to PE subsector. The most important reason is the increasing local demand for PE systems and devices in Türkiye. Another important reason is the "small" character of PE subsector that capital of most of the firms is not adequate for full export activity.

Within development of electronics industry as a whole, also sectoral composition and locational distribution of electronics industry had changed since late 1960s. Share of consumer electronics value added in the total of

electronics industry tend to change. This situation is showed at tables below.

Table 3. Value Added Composition Change in Electronics Industry * **

IN (%)	PROFF. ELECTR.	CONSUMER	TELECOM.	COMPONENT	MILITARY	TOTAL
1970-1980	3.4	77.8	14.0	4.6	0.2	100
1981-1990	3.1	55.6	35.1	4.1	1.9	100
1991-1997	6.3	49.1	32.8	5.0	6.4	100

* values are percentages of value added

** Table is derived from: SPO,1977; Ercan, Hokkacı and Oral, 1988; CME,1991; DPT,1994; ATEI Almanacs,1995-96-97.

This composition change in Turkish electronics industry also shows itself in number of firms.

Table 4. Percentage of Firms Belongs to Different Subsectors in Various Years *

IN (%)	PROFF.ELECTR.	CONSUMER	TELECOM.	COMPONENT	COMPUTER	MILITARY
1973 (43 firms)	18.6	44.2	25.6	11.6	0	0
1984 (275 firms)	13.5	35.2	13.1	38.1	0.01	0.01
1998 (494 firms)	14.9	18.2	13.2	45.1	5.3	3.3

* Table is derived from: Skoumal,1973; SPO, 1977; Türkiye Sanayi Rehberi,1984; UCCE Lists, 1998.

It is impressive that though number of component firms is greater than other subsectors, their contribution to value added of electronics sector is very low. This is because there are plenty of passive component firms in Türkiye that produce antennas, cables and so on. These firms are non technology based firms. Also this situation is important to indicate that classification of electronics sector according to contemporary technological level has to be redefined.

It is noticeable that, there was significant increase in technology based electronics production such as PE and military electronics within recent years.

Besides sectoral distribution change, also locational distribution of electronics industry was changed till 1970s. This situation is provided in table 5.

Table 5. Composition of Electronics Firms by Years

(IN %)	1973	1984	1998
İSTANBUL	77	66	60
ANKARA	9	13	17
İZMİR	14	12	11
OTHERS	0	9	12
TOTAL	100	100	100

* Table is derived from: Skoumal,1973; SPO, 1977; Türkiye Sanayi Rehberi,1984; UCCE List, 1998.

Increasing importance of Ankara and other regions for electronics production can be easily observed from the table. Locational structure of electronics industry began to change in mid 1980s. This situation is still in progress.

3.2.2 An Evaluation on Development of Turkish Electronics Industry

Electronics industry in Türkiye can be considered as a late comer. In spite of this condition, development of electronics industry in Türkiye can be evaluated considering these developments:

a-) After 1970s universities become push factors for electronic industry as qualified graduates started to work in this area.

b-) With parallel to increasing wealth, demand for consumer electronics increased. This leads to production increase in consumer electronics between 1975-80 and establishment of many electronic firms after 1980 like Vestel, Simko etc.

c-) Huge investments in telecommunication infrastructure made the telecommunication equipment production available in Türkiye.

d-) With development of building technology, also electronic systems were started to applied within buildings. Especially after 1985, establishment of big

hotels and airports were push factors for developing of building automation and security systems.

e-) In the past, industrial systems were established as package and electronic systems were import to Türkiye within these systems. When Türkiye had started to establish its own industrial systems, a demand emerged for electronic systems and locally produced technology was started to use in these industrial systems. As an important point, Turkish professional electronic firms learned the production ability.

f-) Electronic using in health sector was developed. Than, few local technology based firms emerged in this sector.

g-) Military electronics industry was developed with local efforts and this situation played an important role on development of other electronic sectors.

Considering these developments, electronic industry became an important sector that has the future potential for Türkiye. Despite the development level and composition change of electronics industry within time (see tables 3 and 4), there is still a structural difference between Turkish electronics industry and electronics industry in developed and some of the developing countries. Even Turkish electronics industry composition in 1997 is different from structures of other countries in 1990. This is provided in table 6.

Table 6. Structure of Electronics Industry in Various Countries-1990 (Rates indicate Value Added in production)

	INDUSTRIAL + TELCOM	CONSUMER	COMPONENTS
TÜRKİYE (*)	47.1 %	47.0 %	5.9 %
INDIA	44.7 %	36.2 %	19.1 %
BRAZIL	59.6 %	22.1 %	18.3 %
SINGAPORE	47.8 %	16.5 %	35.6 %
S. KOREA	21.5 %	35.0 %	43.4 %
GERMANY	69.4 %	9.0 %	21.6 %
U.S.A.	76.3 %	2.7 %	20.9 %

Source: MMO, 1991 Sanayi Kongresi (* 1997 values)

Consumer electronics based structure even in 1996 is accepted as a sign of undeveloped structure of electronics

industry in Türkiye. It is obvious that this structure will due to change in future.

Value added of component subsector is very low when compared with other countries. Weakness of components subsector creates a negative condition on development of total electronics sector. Especially the production of PE devices highly depends on imported components. Turkish producers never entered to semiconductor industry. By 1998, it was planned to produce semiconductors and sensors within TESTAŞ production area with support of METU (Yücel, 1997).

There are various potentials for Turkish electronics industry. First, Turkish electronics industry gained much importance since end of 1960s. Also Türkiye has the potential of young and dynamic human capital when compared to its neighbours and European countries. Most successful high school graduates want to continue their education in electronic engineering departments since beginning of 1980s. Top 1 % of students who have get right to continue university education prefers electric and electronics engineering departments (1992 İzmir Economy Congress, Electronics Group Discussions). This is considered as a great human potential for Turkish electronics industry.

Despite these potentials, also there are some shortcomings that can be a barrier to development of Turkish electronics industry. Reasons for weakness of electronics can be found in structural weakness of Turkish socio economic and policy systems.

As a result of deficiencies within economic system, and related to low level of research capability, also R§D efforts in electronics are also very low in degree (1). Only 2.6 % of yearly total electronics production value goes to R§D expenditures in electronics industry. This so low when compared to advanced countries that about 10 % of their production value goes to R§D activities in electronics sector (Renda, 1995).

Another important weakness of the sector came from wrong policies on customs and incentives through 1980s and 1990s. Imported devices are not subject to custom payments whereas it is very expensive to import components. This

creates a disadvantageous position for local producers (İzmir Economy Congress Discussions, 1992). Most of incentives depend only on tax reducement, credits with low interest rates and so on (Taymaz, 1993). Besides, there are various shortcomings in incentive system for firms in present. R§D expenditures of firms have to be taxed as firms do not able to decrease these expenditures from tax payments.

Electronics sector does not get necessary support for its development. Supports of "Technology Development Foundation of Turkey" are important for technology base producers. Till the establishment of this foundation, it supported and is still supporting 111 projects of various firms or institutions. Only 20 of these supported projects (18 %) belong to electronics sector. About two third of these projects are belonging to biggest electronic firms in Türkiye (Information based on TDFT Lists).

3.2.3 Some General Characteristics of Turkish Electronics Industry

Information on general characteristics of Turkish electronics industry is useful to understand conditions for PE industry. These characteristics of Turkish electronics industry include; inventive capacity, firm size, foreign capital share, public ownership and condition of supplier and auxiliary firms.

Inventive Capacity: Patents are the most important indicators of inventiveness. Patents may be taken by individual people as well as firms and institutions. Depending on data taken from Turkish Patent Institute; there were 164 patent applications done between January 1993 and March 1999. Only 46 (28%) of these applications are related with electronics industry. Electronics producer firms applied with only 21 projects that is about 45 % of total electronics applications and 13 % of total patent applications. Biggest firms such as BEKO and NETAŞ have about 1/3 of these applications. This condition shows that inventive capacity of Turkish small and medium electronics industry is not developed to catch up level of developed countries.

Firm Size: Turkish electronics firms can be accepted as small considering number of total employees. About 85 % of total electronics firms employ between 1-99 employees. Firm profile is provided in figure 1.

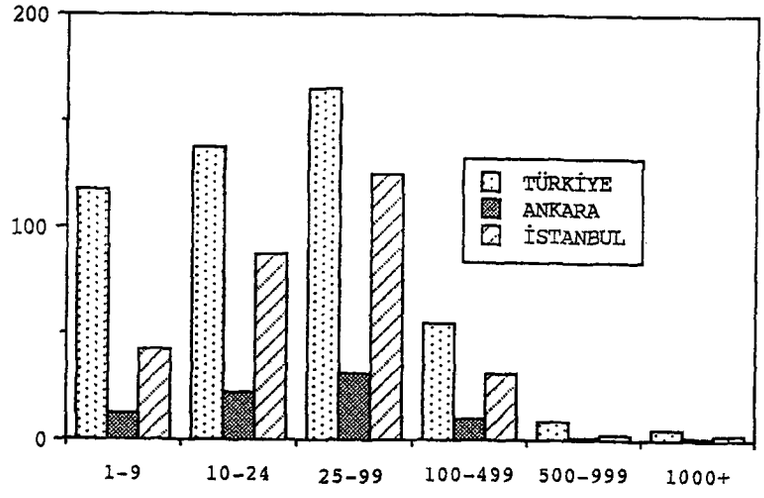

Figure 1. Labour Profile of Turkish Electronics Firms

Despite these values, about 30 % of total employees are working in the largest 8 firms (The list of these firms is provided in appendix C). It is an important point that 37.5 % of total engineers in electronics industry are employed in these 8 big firms. This can be interpreted as big firms are more technological intensive or have a more potential to be technological intensive than other firms. This situation also shows that engineering activities are important in these firms. These firms are active mostly in telecommunications subsector and consumer electronics. Five of them locate in İstanbul, one in Ankara, one in Manisa and one in Tekirdağ. There are no PE firms out of these 8 firms. In other words PE is not the major activity in these firms. On the other hand, firms like Aselsan and Simko are dealing with branches of professional electronics such as security systems, uninterrupted power supplies in spite of their main activity is something else (See appendix C).

Foreign Capital: Foreign capital share is almost low in Turkish electronics industry. There are about 22 firms that have some rate of foreign capital. Locations and subsectors of these firms are provided in table 7.

Table 7. Distribution of Foreign Shared Firms According to Their Activities and Locations

SUBSECTOR/PROVINCE	ANKARA	İSTANBUL	İZMİR	OTHERS	TOTAL
PROFF. ELECTRONICS	-	-	-	1	1
CONSUMER	-	4	1	-	5
TELECOMMUNICATIONS	1	4	-	-	5
COMPONENT	-	6	1	2	9
COMPUTER FITTING	-	-	-	1	1
MILITARY ELECTRONICS	1	-	-	-	1
TOTAL	2	14	2	4	22

Foreign capital is existing in electronics subsectors that are not much technological intensive. About 63 % of firms that has foreign capital are the component and consumer electronics producers. Only one professional electronic firm "ITEMAŞ" with the share of 10 % of foreign capital takes place in Bursa. Concerning locational structure, it can be recognised that, İstanbul has the greatest share concerning foreign capital in electronics sector. Except Ankara, İstanbul and İzmir, other 4 firms take place in Bursa, Manisa and Bilecik.

As an important point, though number of foreign shared firms is about 4.5 % of all electronics producers, number of employees in these firms constitutes about 30 % of total employment in Turkish electronics sector. This shows that nearly all of the larger firms have a foreign share in their structure. These firms mostly locate in İstanbul. About 41 % of electronics employment in İstanbul are working in firms that has foreign capital share. This condition shows that İstanbul has the biggest potential for integrating globalisation trend considering electronics production in Türkiye.

Public Ownership: There is also a noticeable public ownership pattern in electronics sector in Türkiye even within end of 1990s (2). Ankara has the most of these publicly owned firms (3).

Condition of Supplier Firms: There are about 436 supplier firms of electronics industry in Türkiye.(Data obtained from Turkish Electronics Association) 88 % of them locate in İstanbul, 6 % of them locate in Ankara, 2 % of them locate in İzmir and 4 % of them locate in other provinces.

Professional electronics producer firms use only about 120-160 (27 %- 37 %) of these provider firms.

Considering these discussions, importance of PE as a technology based subsector and importance of Ankara as a major location for this type of production can be recognised. If spatial distribution of electronics firms is provided, than contingent situation of PE industry in Türkiye can be well understood.

3.2.4 Occupational and Locational Structure of Turkish Electronics Firms at Present.

By the end of 1998, according to UCCE (TOBB), ATEI (TESID), ACI (ASO), ICI (İSO) date, Automation Fair Catalogues there were total of 494 firms and about 41809 of employed person in different branches of Turkish electronics industry (4) (Full list of all firms and general information of these firms are provided in appendix D). Data is controlled with comparing these various data sources and full list of firms were tried to achieved from these sources.

According to the analysis, a distribution of electronics producer firms according to subsectors has been made:
- 40.5 % of total firms are active in components,
- 13.5 % of total firms are active in PE,
- 19.5 % of total firms are active in consumer electronics,
- 7 % of total firms are active in telecommunications,
- 5.5 % of total firms are active in computer and computer equipment sector (nearly all are dealing with fitting activities)
- 2 % of total firms are active in military electronics
- 11.5 % of total firms are dealing with mixed activities (Detailed list of firms and information is provided in appendix D).

From the firm analysis throughout Türkiye, regional and structural differentiation of Turkish Electronics Industry can be easily read from two tables below. Tables are designed according to major activity of firms.

Table 8. Distribution of Electronics Producer Firms and Employment in Different Regions Through Different Subsectors by 1998 (in %)

IN %	PROF.ELEC	CONSUMER	TELECOM.	COMPONENT	COMPUTER	MILITARY	TOTAL
NO.OF FIRMS							
TÜRKİYE (494)	14.92	18.16	13.26	45.10	5.30	3.26	100
ANKARA (85)	41.17	3.52	14.11	28.23	3.52	9.45	100
İSTANBUL (296)	9.80	20.63	13.51	48.64	5.40	2.02	100
İZMİR (54)	12.98	20.37	16.66	44.44	3.70	1.85	100
OTHERS (59)	10.17	23.74	6.78	49.15	8.47	1.69	100
NO.OF EMPLOYMENT							
TÜRKİYE (41809)	9.53	21.57	18.92	37.61	3.67	8.70	100
ANKARA (7601)	26.81	0.59	15.81	13.93	0.52	42.34	100
İSTANBUL (23848)	6.33	27.21	25.39	37.92	1.67	1.48	100
İZMİR (2590)	7.95	31.69	23.66	31.19	3.78	1.73	100
OTHERS (7770)	2.97	21.40	0.55	61.94	12.87	0.27	100

Table 9. Distribution of Electronics Producer Firms and Employment in Various Subsectors Through Different Regions by 1998 (in %)

	ANKARA	İSTANBUL	İZMİR	OTHERS	TOTAL
NO. OF FIRMS					
PROFF. ELEC. (77)	45.45	37.66	9.09	7.80	100
CONSUMER (89)	3.37	68.53	12.36	15.74	100
TELECOM. (65)	18.46	61.53	13.84	6.17	100
COMPONENT (221)	10.85	65.15	10.90	13.10	100
COMPUTER (26)	11.53	61.53	7.69	19.25	100
MILITARY (16)	50.00	37.50	6.25	6.25	100
TOTAL (494)	17.20	59.91	10.93	11.96	100
NO. OF EMPLOYMENT					
PROFF. ELEC. (3984)	51.15	37.91	5.15	5.79	100
CONSUMER (9011)	0.47	71.95	9.11	18.47	100
TELECOM. (7913)	15.19	76.52	7.74	0.55	100
COMPONENT (15725)	6.73	57.51	5.13	30.63	100
COMPUTER (1538)	2.60	26.00	6.24	65.00	100
MILITARY (3638)	88.48	9.73	1.23	0.56	100
TOTAL (41809)	18.18	57.04	6.19	18.59	100

Some important and interesting results can be concluded from tables 8 and 9. First, number of firms in component subsector (especially passive component firms) constitutes about half of the Turkish total electronics industry. Component subsector is the most developing and important subsector in whole world and presence of a developed component subsector is a sign of an advanced electronics industry. Though values indicate such a structure, this is not a true condition in Türkiye, as most of component producers are active in passive or semi passive components such as cable-radio-TV-telecommunication device parts and so on. This production is not considered as technology based production. Component producers in Türkiye work as auxiliary firms of other subsectors. Technology based semi conductor industry is not existing in Türkiye. Also table shows that, military electronics and computer subsectors are not much developed as other subsectors. PE industry is not much developed but has the biggest potential for growth as this will be explained in later parts.

Within all this structural situation, it is clear that İstanbul has the leadership concerning total electronics sector in Türkiye (5). It can be concluded that, İstanbul is the centre of consumer electronics, telecommunications, components and even computer fitting subsectors within electronics industry. Spatial distribution of electronics firms in Türkiye, is a sign of dominance of biggest metropolitan areas (İstanbul, Ankara and İzmir) in electronics production. On the other hand, İzmir is not developed as much as İstanbul or Ankara (6).

If other regions are taken into consideration, it is observed that electronics production takes place in industrially developed provinces such as Tekirdağ, İzmit, Bursa, Manisa, Denizli, Adana, Kayseri and so on (Observed from appendix D). Concerning employment numbers, most important sectors in these regions are computer fitting (owe to Vestel), component subsector and consumer electronics. There are almost no telecommunications industry and military electronics in these provinces.

If military electronics and PE sectors are accepted as technology based subsectors, it can be observed that Ankara is more advanced than other regions concerning

these subsectors. Concerning number of firms, major subsector in Ankara is PE subsector. Though, 1/10 of Ankara firms are military electronics firms, nearly half of electronics work force in Ankara is employed in military electronics subsector. Of course the most important factor of this situation is the presence of giant military electronics firm "Aselsan" in Ankara. If general structure is examined, it can be observed that nearly half of PE and military electronics firms in Türkiye locate in Ankara. This situation is true for employment numbers. Almost there are no firms active in consumer electronics and computer fitting subsectors in Ankara. All these show that industrial structure of electronics production in Ankara is different from İstanbul, İzmir and other regions in Türkiye.

In previous parts it is assumed that military electronics and PE subsectors are the most technology based sectors within whole electronics production. There is no direct measure to check this assumption. On the other hand engineer percentage is one of the tools in order to check technological intensity of a firm or an industry. For this reason, engineer percentages of different subsectors and locations will be helpful to understand technological intensity of different subsectors and locations.

Table 10. Engineer Percentages of Subsectors According to Different Locations by 1998 (in %)

ENGINEER/EMPL	PROF.ELEC.	CONSUMER	TELECOM.	COMPONENT	COMPUTER	MILITARY	TOTAL
TÜRKİYE	15.36	7.42	20.51	6.79	7.05	27.68	12.28
ANKARA	16.14	16.27	23.46	13.03	20.00	27.36	21.64
İSTANBUL	15.09	6.23	21.07	5.78	14.75	31.63	10.91
İZMİR	12.50	15.22	9.62	9.03	10.20	17.77	11.77
OTHERS	10.82	7.99	13.95	6.93	7.70	30.00	7.47

There are some impressive results derived from the table above. If subsectors are considered, it is observed that telecommunications subsector has the biggest engineer percentage in Türkiye. Especially this is because of biggest firms active in telecommunication sector.

Engineer percentages in PE, telecommunication and military electronics subsectors are over the Turkish electronics average. Concerning PE industry, there are not many differences between ratios of Ankara, İstanbul and İzmir.

If locations are considered, Ankara's position is found to be interesting related to engineer percentages. In all subsectors except military electronics (it is the most important electronics subsector of Ankara) Ankara has the biggest engineer percentage. These values are not under 10-12 % as this intercept is accepted as a virtual border of technological intensiveness (Johne,1985). Among other locations, only Ankara's value is over Turkish average. İstanbul has the lowest engineer percentage after Ankara and İzmir concerning total electronics sector. This situation can be related to intensive component subsector in İstanbul and mass production style of electronics industry in İstanbul that will be observed in evaluation of professional electronics structure in next parts.

An important result is derived from all these discussions. It is the contingent situation of PE sector in Türkiye. Apart from other sectors, it shows various special characteristics. Especially spatial distribution of this sector does not resemble any other electronics subsector.

3.2.5 Evaluation of Professional Electronics Subsector at Firm Level in Present.

Importance of PE subsector and its characteristics were provided in last parts. Before analysing firm research study, it will be useful to give some special characteristics of PE subsector in Türkiye related to its technology and R§D level at the end of 1990s. The subbranch differentiation made in part 3.1.2 will be used throughout the study.

Especially PE is the most R§D intensive electronic subsector that it has the biggest R§D expenditure per production value ratio in Türkiye. R§D spending and its share shows the R§D intensive characteristic of PE subsector (7).

At the firm level, it is observed that there are total of 77 PE producer firms in Türkiye by the end of 1998. Also there are 16 infant firms locate in KOSGEB Technology Development Centres (8) (General knowledge on these firms is provided in appendix E). Unregistered firms that do not take place in any of these sources do not matter for our study.

Distribution of these firms according to their locations and subsectors is provided in table 11 (Table is organised according to main activities of firms).

Table 11. Distribution of Turkish Professional Electronics Firms According to Location and Subbranches by 1998

SUBSECTOR/ LOCATION	ANKARA	İSTANBUL	İZMİR	KAYSERİ	BURSA	BOLU	TOTAL
STANDARD EQUIPMENT	6	14	2	-	-	-	22
INDUSTRIAL ELECTR.	9	8	1	-	2	-	20
SECURITY-ALARM SYSTEMS	9	6	2	3	-	-	20
MEDICAL ELECTRONICS	5	-	-	-	-	1	6
OTHER PROFF. DEVICES	6	1	2	-	-	-	9
TOTAL	35	29	7	3	2	1	77

There are about 3984 employees including 612 engineers in this sector by the end of 1998. Distribution of number of firms, number of employees and engineers is provided in table 12.

Table 12. Locational Distribution of Professional Electronics Employment by 1998(in %)

	NO. OF FIRMS	NO. OF EMPLOYMENT	NO. OF ENGINEERS
ANKARA	45.5	51.2	53.9
İSTANBUL	37.6	37.9	37.3
İZMİR	9.0	5.1	4.9
KAYSERİ	3.9	1.7	1.3
BURSA	2.6	2.3	2.0
BOLU	1.4	1.8	0.9
TOTAL	100.0	100.0	100.0

Ankara has the greatest number of firms and employees in PE sector. If this condition is compared with composition of total electronics production, this situation shows the importance of professional sector in Ankara and importance of Ankara's position towards technology based PE production in Türkiye. Also it can be observed that Ankara has about half of the engineers employed in total PE subsector.

If location quotient values of total electronics and professional electronics in different regions is examined, importance of PE subsector for Ankara can be identified. These values indicate special position of PE subsector for Ankara (9) (Calculation table is provided in Appendix F).

As total electronics sector can be divided according to different technological intensities, also PE subsector can be divided into its various subbranches according to their technological levels. Starting from this point, if subbranches of PE included in location problem then we confront with an interesting result (See table 11). Considering number of firms; İstanbul is specialised in standard electronics equipment production such as UPS, taximeters etc, that nearly half of PE firms in İstanbul are dealing with this sub-branch. On the other hand, firms in Ankara are directed to R§D intensive automation and security systems production. Structure of İzmir resembles structure of Ankara. Also it is impressive that there is almost no medical electronics producer in İstanbul. On the other hand, about 80 % of medical electronics firms in Türkiye take place in Ankara. Ankara is also a preferable location for firms that belong to other branches of PE such as electronic and digital boards.

Turkish PE firms are especially small and medium size firms (10). Labour profile of PE firms in different locations is provided in figure 2 in the next page.

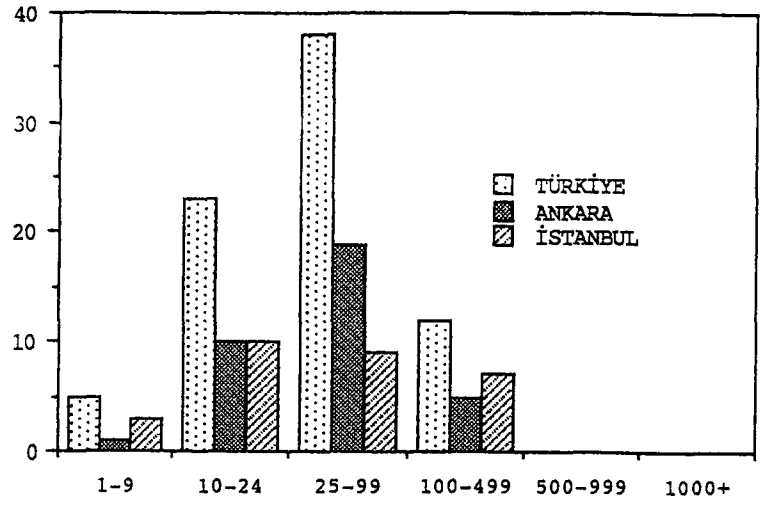

Figure 2. Labour Profile of Professional Electronics Firms in Different Locations

Depending on previous parts (see 3.1.2), it is assumed that; medical electronics, some branches of industrial electronics (especially including automation systems), complex security systems and some other branches that contain electronic boards are the most technological and engineering intensive subbranches of PE subsector. Also these subbranches give importance to solutions and depend mostly on custom designs and production. It is obvious that, Ankara has the dominance concerning some of the subbranches of PE industry in Türkiye. On the other hand some subbranches of PE depend on more mass production type and a unique design can be sufficient for marketing of that type of production. Especially, subbranches of standard equipment and simple alarm systems enter into this category. This type of production mostly locate in İstanbul rather than Ankara. If İzmir is considered, we confront with a mixed production type within overall of 7 firms. Also, a mixed production type in other locations is observed as a whole.

Among 77 firms, there are also about 16 infant firms who started their business lives in different Technology Development Centres of KOSGEB in various universities. Eight firms locate in METU KOSGEB (Ankara) and other eight firms take place in Boğaziçi, İTU, Yıldız KOSGEB's

in İstanbul. Distribution of these firms is provided in table 13.

Table 13. Distribution of New Professional Electronics Firms According to Their Locations and Subbranches by 1999

	INDUSTRIAL ELECTR.	MEDICAL ELECTR.	OTHER SYSTEMS	TOTAL
ANKARA (METU)	3	3	2	8
İSTANBUL	4	2	2	8
TOTAL	7	5	4	16

Number of firms are equal in Ankara and İstanbul. It is an impressive point that number of firms in METU KOSGEB is equal to number of firms in 3 KOSGEB's of İstanbul.

If these firms are included to PE subsector, there are about 93 firms that 17 % of PE firms locate in Technology Development Centres of KOSGEB in various universities. These new firms also effect the average age of total firms in PE sector.

Nearly half of the PE firms in Türkiye were established between 1981-1990. 76 % of total firms were established between 1981 and 1997. If 16 firms in various Technology Development Centres are added to the analysis, this value rises up to 81 %. Establishment periods of PE firms are provided in table 14.

Table 14. Distribution of Professional Electronics Firms According to Establishment Dates (in %)

	ESTABL. PERIODS OF 77FIRMS (in %)				WHEN INFANTS ADDED (in %)-93FIRMS		
	ANKARA	İSTANBUL	TÜRKİYE		ANKARA	İSTANBUL	TÜRKİYE
1950-1960	6	0	3		4	0	2
1960-1970	0	7	3		0	5	2
1971-1980	20	17	18		16	14	15
1981-1990	46	45	49		37	35	40
1991-	28	31	27		43	46	41
TOTAL	100	100	100		100	100	100

Table 14. shows us that PE industry is a recent concept for Türkiye, and there is no much difference between Ankara and İstanbul firms considering their establishment dates.

Death ratio of PE firms is another important subject in such analysis. We have previous firm data on 1973 and 1984 (Skoumal,1973; DPT, 1977; Ankara Sanayi Rehberi, 1984) (41 firms were established between 1973-84 and 49 firms were established -infant firms that locate in KOSGEB's are not included- between 1984-1998). Death ratio and ratio of firms that changed their activity since 1973 is provided in the table below (List of closed firms and list of firms that become trader since 1973 are provided in appendix G).

Table 15. Death and Change of Activity Ratio of Professional Electronics Firms Since 1973. *

DEATH RATIO	TÜRKİYE	ANKARA	İSTANBUL
1973-1984	19 %	21 %	20 %
1984-1998	14 %	9 %	11 %
1973-98	17 %	14 %	15 %
ACTIVITY CHANGE RATIO			
1973-1984	7 %	11 %	0 %
1984-1998	6 %	9 %	6 %
1973-98	7 %	10 %	3 %

* Table is derived from; (Skoumal,1973, DPT, 1977, Ankara Sanayi Rehberi, 1984, UCCE Firm List, 1998)

Concerning death ratio, there is significant difference between various periods. Clearly, leaving import substitution policy in early 1980s caused withdrawal of various professional electronics firms in Türkiye. This condition is clearly seen in Ankara and İstanbul. On the other hand, there is no significant differences between Ankara and İstanbul concerning death ratio whereas, there is a significant difference between Ankara and İstanbul values concerning activity change. Ankara firms tend to transform into trader firms opposite to firms in İstanbul. On the other hand, this tendency in İstanbul increased after 1984.

All these values and evaluations are the consequences of special spatial characteristics of PE subsector in these two regions. An explanation on this subject is provided in the fifth chapter.

Among producer firms, there are about 134 firms that only deal with trade of professional electronics by 1997. These firms include both Turkish trade firms and trade firms of foreign electronic producers. List of these firms according to subsectors is provided in appendix H and distribution of these firms is provided in table 16.

Table 16. Distribution of Trading Firms in Professional Electronics According to Subbranches and Locations in 1997

	INDUSTRIAL EL.	SECURITY SYS.	MEDICAL	OTHER	TOTAL	%
ANKARA	15	9	6	2	32	23.88
İSTANBUL	49	30	11	5	95	70.89
İZMİR	1	-	2	-	3	2.23
OTHERS	4	-	-	-	4	3.00
TOTAL	69	39	19	7	134	100.00
%	51.49	29.10	14.18	5.22	100.00	

PE trader firms tend to locate in İstanbul unlike PE producers. This shows the importance of İstanbul as a trade centre for the professional electronics. Two important subjects worthwhile for research can be derived from this situation. First, İstanbul is more trade based region than Ankara concerning PE, as well as number of producer firms and employment belong to technology based subbranches of PE are lower than Ankara. Ankara has several advantages of a locality that attracts technology based production. Second important subject is the success or sustainance of İstanbul producers among numerous traders in PE subsector. Technological levels of foreign firms are relatively high in this competition. On the other hand, Turkish firms have some other competitive advantages (Detailed information on competitive characteristics is provided in chapter 4).

Within this structure, PE firms have different characteristics and different histories. These firms are

reacting Turkish socio economic conditions and their innovativeness based on existing technology infrastructure of Türkiye. They can be considered as technology based and innovative firms. This innovation concept is more adapted to incremental innovation concept and their technological capacities are very limited. Also there are serious problems towards them considering linkage capabilities. Presence of these firms and their technological capabilities are themselves a contingent situation in such macro economic environment of Türkiye. Related macro conditions also effect these firms. In next chapter, focus will be on individual firm level as well as macro innovative conditions of Türkiye in order to understand dynamics and factors behind their spatial structuring and understand contingent situation of PE industry in Türkiye, Ankara.

CHAPTER 4

THE STRUCTURE OF TURKISH PROFESSIONAL ELECTRONICS SECTOR AND CONTINGENT DEVELOPMENT OF PROFESSIONAL ELECTRONICS INDUSTRY IN ANKARA

In last parts, spatial distribution of PE was examined. PE industry shows a contingent situation that Ankara becomes an important place for this industry. This situation depends on structuring of electronics industry in Türkiye. Three main factors played role in this situation. These are the externalities, linkage structures and transaction, in particular market relations These factors effect structuring of any technology based industry at different levels in different economies. Our aim is to derive out effects of these factors on regional spatial structuring of PE industry in Türkiye. Our research is based on face to face interviews with firms in Ankara and İstanbul. Some Bursa and Kayseri firms are also taken into consideration to understand especially transactional power relations between these regions.

This chapter is divided into two parts. In first part, organisation of firm research and general characteristics of interviewed firms are explained. Whether in second part, comments and interpretations on firm research are provided. Also, innovative basis of Türkiye will be explained within this part. There are three key factors within the research. These are externalities, linkage structures and transaction relations. Aim is to analyse these characteristics on Turkish PE firms to understand contingent situation of PE industry in Türkiye.

To achieve this aim, we followed two main bodies of discussion. In first part, macro economic conditions and innovative basis of Türkiye will be explained. This is especially to understand macro economic conditions and innovative basis for development of PE sector in Türkiye. In the second main body of discussion, we followed four

steps to understand the structure and contingent situation of PE industry in Türkiye. First, historical process of these firms is explained to understand effects of externalities. Especially these externalities are concerning macro economic conjuncture changes and policy related issues. Also this historical narration gives us some hints about linkage and transaction relations of these firms, but giving only the historical outline is not sufficient to understand these relations. So in second part, we insist on common points among these firms found from firm research. These are utilised to understand special characteristics of PE industry in Türkiye as well as to understand linkage and transaction characteristics of this industry. Still this is not sufficient to clear out contingent situation of Ankara concerning PE industry. Then in third part, we started to discuss different characteristics of firms in different regions especially in İstanbul and Ankara. This will help to compare different characteristics of firms in different regions. Finally we insist on local external conditions that lead to these types of differences among firms. In this part especially another part of externalities; locality externalities for Ankara and İstanbul are searched out.

4.1 Organisation and Structure of the Firm Research

Our study is based on direct interviews done with 34 PE firms in Ankara, İstanbul, and Bursa. Indirect contact with telephone and facsimile were established by four firms (One firm from İstanbul, three firms from Kayseri). Also, direct interviews were done with two infant firms which located in METU KOSGEB. All data gathered from these two firms are taken into analysis with other firms as to compare their conditions with other firms.

Besides firms, direct interviews were done with several people who know conditions of industry. These people are from Turkish Electronics Industry Association, Chamber of Electrical Engineering, several KOSGEB's in İstanbul, METU and a trader firm located in Ankara (List and addresses of all these people are at appendix I).

Within interviews, also personal observations about firms and their workplaces were listed. Interview method was

more useful than questionnaire method because it is more flexible and we keep the chance of ask anything in mind. This becomes more useful to get right and useful information. Interviews were in structured pattern in earlier periods of research that all questions were prepared before but after some experience, interviews began more unstructured pattern that it allowed to get deep information about firms (List of questions used within interviews is at appendix J). It has to be added that, latest interviews were not pure unstructured ones. It was given importance to take right and valid information from the right person that knows about firm well. This goal was achieved anyhow as 30 of interviewed persons were founders or shareholders of firms. Others were top managers of various departments in firms (Full list of these people and their open addresses are provided in the appendix I). The profiles of people whom we interviewed with are alike.

Table 17. Profiles of Interviewed People in Professional Electronics Firms

	ANKARA	İSTANBUL	KAYSERİ	BURSA	TOTAL
FOUNDER OF THE FIRM	11	8	2	1	22
SHAREHOLDER OF THE FIRM	8	-	-	-	8
GENERAL MANAGER	-	2	-	-	2
R$D MANAGER	2	-	-	-	2
PRODUCTION MANAGER	-	2	1	-	3
PUBLIC REL. MANAGER	-	1	-	-	1

As a result, we have information and data on total of 38 PE firms (infants excluded) out of 77 firms in Türkiye. This value is 49 % of all Turkish PE firms. Twenty-one of these firms locate in Ankara, that means 60 % of PE firms in Ankara. Thirteen firms locate in İstanbul that means 45 % of PE firms in İstanbul. Three firms locate in Kayseri (whole firms in Kayseri) and one firm locates in Bursa (One out of two firms in Bursa). Unfortunately we had chance to contact with only one İzmir firm, but we could not able to get healthy information from this firm. So this firm is not included to the research.

If employment measures instead of number of firms are taken as the basis then it is observed that interviewed

Ankara firms have about 42 % of total PE employment in Ankara and interviewed İstanbul firms have about 55 % of total PE employment in İstanbul. Interviewed Kayseri and Bursa firms have 48 % of PE employment in remaining parts of the country apart from Ankara, İstanbul and İzmir. Employment ratio of interviewed Ankara firms is so low when it is compared with number of firms. This situation is arising because of presence of the publicly owned Sugar Factory Electromechanical Part. If this firm is ignored then this value rises from 42 % to 53 % (See appendix E).

All above values indicate that over half of the total PE firms has been selected as the sample of this field survey. These firms are not randomly selected. Interviews and contacts were done with firms whom accepted the offer. Distribution of these firms according to their major field of activity is provided in the table 18.

Table 18. Distribution of Interviewed Firms According to Major Activity and Location.

*	ANKARA	İSTANBUL	KAYSERİ	BURSA
STANDARD EQUIPMENT	2 (6)	3 (14)	-/-	-/-
INDUSTRIAL ELECTR.	6 (9)	6 (8)	-/-	1 (2)
SECURITY-ALARM SYSTEMS	6 (8)	3 (6)	3 (3)	-/-
MEDICAL ELECTRONICS	4 (6)	-/-	-/-	-/-
OTHER PROFF. DEVICES	3 (6)	1 (1)	-/-	-/-
TOTAL	21 (35)	13 (29)	3 (3)	1 (2)

* Values in parenthesis indicate total number of PE firms

Size and age are important variables to define firms. These variables give some hints about structure of these firms and their institutional levels (11).

If interviewed firms are classified according to size and age then, we get such a result as viewed in table 19 in the next page.

Table 19. Classification of Interviewed Firms According to Age and Size

SIZE	ANKARA	İSTANBUL	KAYSERİ	BURSA	TOTAL
1-9	3(2 in KOSGEB)	1	-	-	4
10-49	14	6	3	1	24
50-199	6	6	-	-	12
200<	-	-	-	-	-
AGE	ANKARA	İSTANBUL	KAYSERİ	BURSA	TOTAL
0-3	(2 in KOSGEB)	-	-	-	2
4-5	-	-	-	-	-
6-10	4	6	2	-	12
11-15	10	3	1	1	15
15 <	7	4	-	-	11

Generally, interviewed firms are small and medium size firms. Firm size in Ankara is smaller than İstanbul. About two third of the interviewed Ankara firms are small size firms and about half of the interviewed İstanbul firms are medium size firms. On the other hand, average firm age in Ankara is higher than İstanbul. About 50 % of interviewed Ankara firms are in prematurity period whereas 50 % of İstanbul firms are in standstill period.

General characteristics of individual interviewed firms are at table 20 in the next page. Arrangement of firms in this part was done according to their field of activity. This arrangement will be used throughout the study (at appendices between L and S). More detailed and short information on these firms is provided in the appendix K.

Structure of interview within the firm research is organised to understand; general characteristics, technological aspects, linkage structures and transaction relations of firms and externalities that has effect on performance and spatial structuring of these firms (12).

4.2 Evaluation of the Firm Research

This part is divided into two main bodies consisting of four parts within this part of the text. One is the explanation of innovative basis of Türkiye to understand these types of externalities effecting PE such as macro technological and innovative conditions of the country.

Table 20. General Characteristics of Interviewed Firms

ANKARA	FIELD OF ACTIVITY	DATE OF ESTABL.	AGE OF FIRM	NO OF EMPLOYEES	ENGINEER RATIO	STATUS	SISTER FIRMS	SISTER FIRM LOCATION
ELSİS	1	1971	28	27	0.15	AŞ	-	-
OES	1	1987	12	30	0.17	LTD	-	-
ELİMKO	2	1976	23	127	0.17	LTD	-	-
GATE	2	1989	10	55	0.35	AŞ	GATEMAK(MACHINERY)	KOSGEB
MEKO	2	1984	15	25	0.32	AŞ	MEKMAK (MACHINERY)	OVEÇLER
MOSTEK	2	1988	11	15	0.20	LTD	-	-
NEL	2	1985	14	41	0.24	AŞ	GROUP FIRMS/NUVE	KIZILAY
SİSTEK	2	1984	15	25	0.12	LTD	-	-
ETA	3-2	1984	15	17	0.47	AŞ	GROUP FIRMS	ISTANBUL
TETA	3	1981	18	105	0.39	AŞ	GROUP FIRMS	SAME PLACE
ENERSİS	1/3/7	1982	17	84	0.30	AŞ	GROUP FIRMS	SAME PLACE/ENGLAND
ELSİM	3	1982	17	14	0.14	LTD	-	-
UTES	3	1984	15	24	0.08	LTD	-	-
YESTAŞ	3	1956	43	25	0.16	LTD	-	-
PETAŞ	4-6	1977	22	71	0.17	AŞ	-	-
KARDIOSIS	4	1988	11	26	0.31	AŞ	TEPA (MARKETING)	BALGAT
NÜVE	4	1976	23	51	0.08	AŞ	GROUP FIRMS/NEL	ESENBOGA/SAME PLACE
PCK	4	1993	6	38	0.11	LTD	-	-
EPROM	5	1984	15	22	0.18	LTD	-	-
ON	5	1991	8	9	0.33	LTD	-	-
ORTANA	5	1992	7	15	0.26	LTD	TASK (CARD TEST SYS)	SAME PLACE
EGİS	*2*	*1996*	*3*	*1*	*1.00*	*LTD*	-	-
MEDİSPO	*4*	*1996*	*3*	*4*	*0.50*	*LTD*	*KARUZEL(MARK.-PRODUCER*	*KOSGEB*
İSTANBUL								
EGES	1	1974	25	105	0.11	AŞ	-	-
ROTA	1	1993	6	25	0.12	LTD	-	-
EKA	1/2/7	1977	22	93	0.27	AŞ	GROUP FIRMS	SAME PLACE
BAYKON	2	1991	8	32	0.22	AŞ	-	-
BKS	2	1992	7	8	0.25	LTD	-	-
ESİT	2	1987	12	125	0.12	LTD	-	-
ELİAR	2	1984	15	26	0.42	AŞ	-	-
POLARİS	2	1993	6	18	0.22	LTD	TAYF (TERMO ELEMENTS)	SAME PLACE
SİSEL	2	1989	10	41	0.15	AŞ	ENDA (MARKETING)	FREE ZONE
CEDETAŞ	3-7	1958/1984	15	128	0.23	AŞ	GROUP FIRMS	SAME PLACE
EEC	3-7	1982	18	111	0.29	AŞ	GROUP FIRMS	SAME PLACE
EDS	3	1990	9	47	0.25	LTD	-	-
ERA	5	1968	31	67	0.09	AŞ	-	-
KAYSERİ								
AAZ	3	1988	11	30	0.13	LTD	-	
ENDSİS	3	1990	9	15	0.13	LTD	-	
HES	3	1990	9	21	0.10	AŞ	GROUP FIRMS	
BURSA								
EMKO	2	1986	13	45	0.20	AŞ	-	

ACTIVITIES 1:ST.EQUIPMENT 2:INDUSTRIAL ELECTR. 3:ALARM+SECURITY SYS. 4: MEDICAL ELECTR. 5: OTHER PROF. ELECTR. DEVICES

Second part is more related with the sector and firm specific issues. This part is divided into three parts as the historical outline of PE, common findings and differences among PE firms in Türkiye.

4.2.1 Innovative Conditions of Türkiye at the Macro Level

In this part, Turkish conditions for technology based production will be analysed. Common findings for developing countries are also hold true for Türkiye. On the other hand, several studies on developing countries (Copley, 1990; Dahlman et al, 1987; Rath, 1990; Lall, 1992) show that even developing countries have different national histories of technology and its application to industrial applications. They have even different innovation conditions. It is very difficult to generalise conditions of every developing country within several criteria. Also Türkiye has its own specific conditions that have effects on technology based production and innovation concepts especially related with electronics and PE sectors.

In this part, innovation conditions of Türkiye will be insisted on. This evaluation will be more at macro level. Especially external factors for firms will be summarised through explaining some basic socio economic conditions of Türkiye. However, it is not possible to evaluate Turkish socio economic system and its reflections on technology based production and innovation with its all dimensions in this study.

In this respect, we can talk about positive and negative conditions for innovation based industries in Türkiye. In this part, our discussions will be more based on macro conditions of Türkiye that can have effect on electronics production. These types of conditions include position of entrepreneurship culture, technological infrastructure, firm- university collaboration, condition of technological incentives and role of state bureaucracy and institutions for technology based production.

First as it is discussed within several researches and papers, Türkiye has a big human potential (Boratav, 1991;

Eser, 1993; Kaya, 1997; Üçcan, 1991; 3.İzmir Economy Congress Discussions, 1992). On the other hand, there are lack of physical and moral support, finance arrangements and politics to take big potential of human capital to productive actions. Creativeness is existing in Turkish society but this cannot be converted to innovativeness in existing Turkish economic conditions. In other words, this big human potential is not efficiently used as a result of structural weakness of Turkish economic and policy systems. Considering general economic conditions of Türkiye, it is impossible to discuss reasons for the backwardness of Turkish economy and its effects on innovation in this study.

Besides the human power, second big advantage of Türkiye comes from its geographic location. Concerning relations with European countries, Türkiye's geographic position is important. For example Türkiye is more advantageous than South Asian countries in case of trade with European and Independent States Union countries. With the help of this advantage, Türkiye started to produce its own technology and learned how to react towards international markets. Geographic proximity to new countries in Independent States Union opened new export possibilities for Turkish firms and this is playing an important role for these firms in developing their production and technology.

However, there are some factors that is generated from backwardness of the economy. Most important macro barriers for technology production in Türkiye are the high inflation rate and the undeveloped production culture. These factors prevent possible investments on technology based production and innovation.

Underdeveloped entrepreneurship culture of Türkiye is strictly related with the macro economic conditions. This underdeveloped structure also shows itself in lack of entrepreneurship for technology based production. Production lost its importance in Turkish economy since early 1980s according to wrong policies. Moreover, Turkish entrepreneurs do not like to take risks (Müftüoğlu, 1998).

Added to these factors, also Turkish scientific and technological infrastructure is not so strong. First,

inadequacy of innovativeness reflects themselves in R§D activities. Turkish yearly R§D spending between 1990-1995 is nearly about 0.5 % of total GDP (S.I.S., 1997). This value is about 2 % in advanced countries as well as their GDP's are much bigger than Türkiye's GDP. Only about 22.7% (annual average value) of total GDP expenditure was derived from productive sectors between 1990 and 1995 (S.I.S., 1997) This value reaches to levels of 60-70 % in advanced countries (Kaya, 1997). R§D is a matter of public institutions and universities in Türkiye, however productive sectors are the main actors in R§D activities in advanced nations (Ibid). Industry in Türkiye is specialised especially on sectors that work at lower technological levels like food, clothing, metal industries. About 95 % firms are small scale firms that they have limited possibilities to make research and/or development facilities. Only 2 % of Turkish firms have continuous research and development facilities (National Science and Technology Report, 1996). By this way it is discussed that technological production is limited within Turkish economy (Kaya, 1997).

Another structural deficiency causing backwardness of technological infrastructure of the country is emerging from the lack of effective university-industry collaboration. University- industry relationship is so important for high technology firms because of two reasons; first, it is a mechanism to reduce research costs. Moreover, it is a method to identify potential productive employees. It was only after 1993 period that studies had begun about university-industry collaboration in Türkiye. On the other hand, full contact between academicians and entrepreneurs is not being maintained as it is the case in advanced nations.

Weak university-industry relations are not total fault of firms. Also this condition is not raised as a result of lack of knowledge in universities. This is a problem of organisation and right policies. For example, universities take 40 % of the income of the project from small and medium scale industries for the expenses. Besides, lack of necessary equipment and machinery are some other factors for weakness of the university-industry collaboration (National Science and Technology Report, 1996). If KOSGEB's are taken into consideration, university's role

in technology development centre of KOSGEB is only the maintenance of university land for KOSGEB. KOSGEB organises these complexes. Firms located in these centres cannot utilise university laboratories unless founder of the firm is an academician in the university. Also academicians can not help these firms much. In their spare times, only they deal with projects that they find interesting (Interviews with firms who grew in METU KOSGEB and two infant firms in METU KOSGEB). This situation shows ignorance and time problems of university staff.

Besides these problems, state bureaucracy brings limitations to universities. Especially limited budget conditions of universities make efficient industry collaborations impossible. On the other hand, private universities have no possibilities to make such collaborations as they are very new and trade oriented institutions.

Another important subject is the insufficient condition of incentives for technology based production in Türkiye. As there is no efficient macro technology policy in Türkiye, incentives concerning technology based production and other industrial production depend only on tax reducement, credits with low interest rates etc that give way to any irregularities (Taymaz, 1993). With Custom Union process started in 1996, it was decided to remove all incentives apart from R§D incentives in industrial sector (Soyak, 1996). After this procedure, Soyak insists on inconsistency of R§D policies in Türkiye. For Soyak, structural transformation is not aimed and R§D incentive system is not depending on any strategic technology policy. Also he adds that this incentive system is prepared under dominance of international finance institutions (Soyak, 1996). These views show insufficient condition of incentive system for technology based production.

Added to these shortcomings, some necessary institutions for technology based production are not exist in Türkiye. Risk capital as the most used capital source of electronics industry as in U.S.A. was not exist in Türkiye until 1995's. Institutional arrangements on this subject were have done even in 1996 by Capital Market Council. The results of this joint venture mechanism will not be

achieved until 5 to 10 years as this is very recent concept for Türkiye. High inflation rate is the most important barrier for joint venture mechanism in Turkish electronics industry.

Despite limited support opportunities, some activities and policies in recent years such as establishment of Patent Institution in 1993, Patent Law accepted in 1995, competition law accepted in the same year are important to prepare a ground for technology production in Türkiye. Industrial property gained importance with these efforts, but these types of policies indirectly effect technology based production. There is still a lack of overall technological and technology based industrial policy for Turkish industry. New policies are needed according to new evolutions such as Custom Union. Only giving incentives become not sufficient in the environment of techno industrial innovation. Roles of state institutions are changing. To start up techno scientific development and to prepare a ground for firms to enter foreign markets becomes more important than giving only incentives in technology based industries such as electronics sector (Hilpert, 1991).

These are the macro conditions as preparing basis for innovation. Also there are some specific conditions of Turkish firms among innovation concept. Innovation power of Turkish firms is not enough to compete in international markets. Weakness of Turkish firms becomes apparent in foreign markets.

It is argued that, small and medium firms are flexible and ready to adapt every type of new conditions (Müftüoğlu, 1998). On the other hand it is a reality that many small and medium scale firms in Türkiye cannot able to use this type of advantage (Ibid). Production is starting with imitation but this imitation cannot be converted to innovativeness. This condition is related with lack of information flow, lack of R§D activities and wrong strategies within growing period (Müftüoğlu, 1998). As a result; in spite of huge potential of human capital of Türkiye, this potential cannot be taken into innovative structure.

Information on innovative basis of Türkiye is important to understand externalities that comes from macro economic environment and macro innovative conditions of the country. From this point, structure of PE industry and firm specific characteristics of such a technology based sector can be started to explain.

4.2.2 Development of Professional Electronics Sector in Türkiye

It is important to know historical process of interviewed PE firms to understand their establishment stories. This part is especially drawn from interviews with firms and supported with various sources. Within this part, Especially these periods will be analysed through three elements. These are a-) externalities; especially macro conditions for development of PE sector, b-) linkage structures of firms, c-) transaction relations, in particular market relations of these firms. Considering these factors, also we insist on Ankara and İstanbul differentiation within historical process.

As it was explained in part 3.2, historical development of total electronics and PE subsector cannot be separated from Turkish economic and industrial history. For this reason, evaluation of PE industry within different periods has to be done according to related conjuncture of Turkish economic and industrial and foreign relations.

It will be right to divide three periods for establishment for PE firms. These are, period before 1970, period between 1970-80, period between 1980-90 and period from 1990 up to now. The period till 1990 can be divided into two considering establishment of PE firms. One is between 1990-1995 and other is the period after 1995. Especially entrance to Custom Union after 1995 is playing important role in this distinction. Also after 1995, with efficient work of various Technology Development Centres, firms had started to establish within these centres of KOSGEB in Ankara and İstanbul. The establishment period of interviewed firms is provided in the table 21.

Table 21. Establishment Periods of Interviewed Firms

	BEFORE 1970	1970-80	1981-1990	1991-
ANKARA	YESTAŞ	ELİMKO	ELSİM, ENERSİS	ON
		ELSİS	EPROM, ETA	ORTANA
		NÜVE	GATE, UTES	PCK
		PETAŞ	KARDİOSİS	EGİS
			MEKO, NEL, OES	MEDİSPO
			SİSTEK, TETA	
İSTANBUL	ERA(in Ankara)	EGES	CEDETAŞ GR.	BAYKON
		EKA	EDS, EEC	BKS
			ESİT, SİSEL	POLARİS
			ELİAR	ROTA
BURSA	-	-	EMKO	-
KAYSERİ	-	-	AAZ, HES	-
			ENDSİS	

There were few production facilities concerning PE industry in Türkiye even in mid 1970s. There were some existing firms in Türkiye, but these were not technology based firms and they were specialised mostly in fitting activities. There were no local efforts on design process in this subsector though it is one of the most important characteristics of PE industry. Not only production, but also use of electronics systems and devices were very strange for Turkish society. Even by 1978, it was reported that using professional electronic devices were causing important problems in Türkiye (4. Development Plan Special Commission Report on Electronics Industry).

1970s were the period that publicly owned TESTAŞ and ASELSAN was established in Ankara. Establishment of these firms in Ankara owes this situation to being capital city of Ankara. These have strategic reasons. This condition plays important role on development of PE subsector in Ankara.

There were representatives of foreign producers in Ankara at that period. As public institutions were the major customers, Ankara was important market location for these firms. Also the presence of METU and the acquaintancy provided with foreign language factor in its education system played important role in location choice of these firms. Also wage levels were relatively low in Ankara. On

the other hand, those young people were able to follow technological developments from the international sources easily. Establishment of several producer firms in Ankara was based on this type of physiological reasons. It was compulsory to establish face to face contacts with customers especially with the state bureaucracy. After sales services and technical back up were started to provided by firms to all customers. This was very important condition for customers. Relations of trust emerged between customers and PE industrialists in Ankara. These firms in Ankara were active mostly in medical electronics and industrial control devices. Also some firms were established in İstanbul. İstanbul firms were active in power electronics with a different customer type. Private sector and end users were the major customer type of İstanbul firms.

Start of PE industry in Türkiye as a fitting sector prevented firm development and firms in this sector started working as an auxiliary industry and some were closed within time. Copying dominated instead of technological knowledge in this sector in 1970s.

This weakness has several reasons. First, there was lack of component industry added to restricted importing facilities and it was very hard to find qualified component. There were travelling salesmen called as "man with bags" who gathered components provided by European electronics scraps, bring them to Türkiye and sell it to Turkish small electronics producers. Also there were no auxiliary producers, hence firms had to produce all types of mechanics, boxes by themselves. The equipment of this type of auxiliary production brought additional expenses and capital expenditures for PE firms. Especially financially strong firms established this type of production and started to electronics production as vertically integrated firms. All firms had not a chance to produce required components and mechanics.

Young people were production oriented but policies and overall economic, technological backwardness of the country prevented technology based production efforts. In this initial phases PE industry were weak. On the other hand there were some positive conditions for PE production in 1970s. Young graduates from METU and İTU had production

oriented attitudes. As electronics depends much on brain ware or human capital, Türkiye had always this kind of advantage in production. Also education system gave design and research incentives. Hence graduates in late 1970s and early 1980s became entrepreneurs. Also it is argued that, information accumulation in METU was well beyond the technological level of Türkiye. So, graduates wanted to implement this information with production. These factors related to presence of METU were important reasons for electronics and evolution of PE industry in Ankara. Also, face to face relations are easy and dense in Ankara. These types of social linkages are important at starting period of firms. With the help of leader firms in Ankara, knowledge diffused rapidly, people use these experiences and it leads to establishment of many other firms in 1970s. There is a trust relation in Ankara. This condition is not holds true for İstanbul.

Besides human capital, also there are some other positive conditions that prepare the ground for the development of PE production. Concerning market, as the state institutions were the main customers, former firms had the chance of guaranteeing their production. Also import substitution industrial policy prepared an advantageous condition for PE producers.

In spite of negative conditions, especially firms established between 1970 and early 1980s were engineering intensive firms that can easily adapt current technologies and products. These firms were small in scale and established by personal efforts of new graduates. Also there were some construction firms that invest in electronics. Of course financial power of these types of firms was sufficient but these firms lack of technical power (Oral, Ercan, Hokkacı, 1986). Some of these firms established in 1970s, are still strong in PE market in Türkiye (See appendix E). As we explained before, all PE firms established before mid of 1980s suffered from lack of components and lack of auxiliary industry such as mechanics, box, printed circuits and so on. Most of these firms had limited capitals and their production depended on the local demand (Oral, Ercan, Hokkacı, 1986).

Ankara firms started with businesses with the public institutions in 1970s, up to mid 1980s (13). Orders by the

government was the major reason for survival of first PE firms in Ankara. Many firms started do business with public institutions. Also there were some external conditions that played further role on development of PE industry in Ankara. For example security systems for banks were first introduced in Ankara. These played important role in development of PE sector in Ankara. Model firms of state in electronics sector were established in Ankara. For Ankara, the location reflects a concern for the proximity to customers. With the help of various experiences and strong educational basis, Ankara firms learned how to produce own technology and compete in free markets. At the same time, few İstanbul firms (EGES, EKA) enjoyed their favourable positions in the internal market thanks to import substitution.

Few exceptions set aside though most PE firms had vertically disintegrated production structures. Few of existing PE firms were started as vertically integrated firms as there were no auxiliary production for PE in Türkiye in 1970s. For example, some Ankara firms (ELSİS-NÜVE) established between 1970-80 began to produce electronics as a part of big construction firms or big companies. ELİAR established in 1984 in İstanbul is a similar example. It was part of CEDETAŞ in İstanbul. Important point is that, these big companies were not directed to electronics production at the beginning. These firms acquired autonomous position in time. As it is the case in other "niches" in the electronics sector those firms had workshop type plants. This is one characteristic of PE sector.

PE industry developed within structural adjustment programs and industrialisation efforts after 1980s. There were favourable conditions for development of electronics industry. Lifting of import barriers, presence of İTU and METU as sources of qualified personnel, increasing information technology facilities are all examples for these conditions. Within new adopted economic policies and changing technological patterns, PE industry began to develop its own design capability.

However, graduates after 1980s, were not as innovation oriented as their predecessors because of some economic policies that discourage their production willing through

the 1980s (Aviral, 1991). In spite of this condition, several firms had to produce their own technologies. On the other hand, there were no enough attention to this sector as this sector was not easily adapt assembly line production (Ceyhun, 1984) and it required some degree of R§D efforts. For these reasons, production capacity of this sector was limited and also production was domestic market oriented.

Despite insufficient supporting policies, this condition continued up to 1990s and many firms were established and began to produce by their own know-how at the first stage.

Importation of components was hard in 1970s. When import of components becomes free in 1980s with liberalisation of foreign trade, İstanbul acquired an advantageous position for PE production as it is more integrated to foreign markets. Many foreign component firms established offices in İstanbul and it becomes easy to find all type of electronic components with the help of face to face relations.

In later years, also it becomes easy to find necessary components in Ankara. Especially the presence of ASELSAN and TESTAŞ played important roles in supplying formerly scarce components for production in late 1970s. However, it was still hard for Ankara firms to find advanced and specialised components, necessary for technology based production. Some components were ordered from catalogues. However when delivered components were inappropriate, this cause loss of time and money for Ankara firms.

In both locations, lack of auxiliary industries prevented the development of PE in early years. However with the establishment of auxiliary producers, PE industry in İstanbul entered into a new development phase in 1980s. Ankara firms were depended on these auxiliary producers until beginning of 1990s. After this period, technology based mechanics firms (that use latest techniques such as laser cutting) were established in Ankara as a crucial development for technological advancement for PE industry in Ankara. Ankara firms acquired a competitive position with İstanbul firms as number technology based auxiliary producers in Ankara increased.

In 1980s, state policies played important roles in demand and market conditions of firms. For example in 1983, a law stimulating the establishment of compulsory security systems. This led to the establishment of several electronic alarm systems firms in Türkiye.

Besides these types of external conditions, starting from early 1980s, huge investments on communication and transportation facilities were done throughout Türkiye. This led to the enlargement of market especially for firms in İstanbul. On the other hand, İstanbul and Marmara market was enlarged for Ankara firms. Nearly the half of the PE firms in Türkiye were established in the 1980-90 period (See appendix E).

After mid 1980s with the gradual lifting of import barriers, Turkish market becomes very attractive for foreign electronics firm as demand for electronics was very high. This is also true for PE subsector. Many foreign firms entered into Turkish market and established offices especially in İstanbul. Though these firms have more opportunities when compared with Turkish firms, time showed that competition of these firms with Turkish firms is so difficult. This stemmed from two reasons. One is related to labour costs, and other is related to tight customer relations of Turkish firms. These conditions hold true for all Turkish PE firms. Regarding these factors, Ankara firms had competitive advantages with foreign firms since few foreign firms had branch offices in inner cities of inner Anatolia.

End of 1980s was the period that some PE firms were established in other regions such as Kayseri and Bursa serving regional markets at the initial stages of production. In time some acquired market niches in other regions. In Kayseri and Bursa, main market for components was İstanbul. It is still the case at the present. They had no difficulties in finding necessary components. On the other hand, lack of auxiliary industry in these regions forced them to depend on İstanbul firms.

In late 1980s, as internal market becomes saturated, some electronics firms started to take foreign representations. This also holds true for Ankara firms as their market opportunities were limited than İstanbul firms. Also there

emerged some other negative external conditions concerning this sector. After the Gulf War in beginning of 1991, all government expenses except security were severely restricted. This had negative impact especially on Ankara firms. On the other hand, this condition played important role on only further development of alarm systems firms. Alarm systems firms were established in Ankara and developed through the state policies, hence state policies affected firms in Ankara much more than their counterparts in İstanbul.

Despite these negative conditions in 1990s, sector followed its development trend of 1980s. Production was not at higher levels but technology was highly advanced in this subsector. The volume of sales in domestic industrial electronics market was about 500 million dollars by 1993 (Ekonomist Yıllığı, 1994). Internal market opportunities were become saturated so export facilities were started after 1993. Also, local technologies were started to develop rapidly.

There were no PE firms established between 1994-1996 especially as a result of economic crisis. After this period from 1996 and onwards, new PE firms started their industrial lives in Technology Development Center's of KOSGEB. By this way, a new style of formation and a new era was opened for PE sector in mid 1990s.

PE firms established after mid 1990s display important characteristics. These are established under KOSGEB's control. Subsequent to successes in their technological projects they leave these centres. Unlike the oldest firms, new firms have a tendency to get entrepreneurial credits as it is the case for firms in METU KOSGEB.

Professional electronics as it is the case in other industries entered a new phase with the Customs Union in 1996. Import of devices became very easy. New international standards were started to applied. Exports became harder. It will be even harder, when CE (indicates free circulation certificate) trademark will become compulsory by 2002.

However there are advantages emerged for PE producers. Customs Union led to a general reduction of price levels.

As it is the case in other industries, Customs Union facilitated the import of components. New business services such as worldwide cargo services were established and delivery of components in time became possible. On the other hand, there are some other shortcomings that specialised export firms are not exist for this sector. Furthermore, the existing incentive system is not appropriate such an engineer intensive production in an environment of free trade.

Historical process of PE industry in Türkiye shows us that, external conditions; especially macro policies and state relations play important roles in the development and spatial structuring of this industry. PE industry entered to a development phase in some periods. On the other hand, industry usually faced with many problems as related to rapidly changing and instable economic conjuncture of Türkiye. These findings are relevant but not sufficient factors to account for the contingent development situation of PE industry in Ankara. So we have to search out common findings on firms and different aspects of these firms that we have searched out.

4.2.3 Common Findings Derived From the Firm Research Study

Historical arguments was account for several aspects of the development of PE industry in Türkiye. Especially, historical argument explains externalities to understand development of PE industry in Türkiye and contingent situation of PE sector in Ankara. On the other hand we have to know further information related to linkage structure and transaction relations of PE firms in order to understand organisational and spatial structuring of PE industry and contingent condition of PE in Ankara.

In order to get this information, first step is to explain contemporary common findings on interviewed firms. These common findings relate to a-) structural characteristics such as basic organisational, technological and innovative characteristics of firms, b-) network / linkage structures and c-) transaction relations of firms. These findings especially show us the common points regarding PE firms in different regions.

4.2.3.1 Common Findings on Structural Characteristics

There are some common findings on structural characteristics related to administrative function, financial position, marketing opportunities and personnel relations. All of these are interrelated, so these structural findings are not independent observations.

Ownership and Intra Organisational Pattern:
Interviewed firms display similarities concerning their organisation. Similarity between all interviewed firms comes from their establishment styles. About 90 % of firms were started as personal firms. This situation is more visible in İstanbul in early times of the establishment. As we mentioned in historical development of PE sector, low and individual capital is the basis for establishment of a PE production.

Within time, some firms both in Ankara and İstanbul grew and they became group of firms (14). These types of firms are seen as more institutionalised than others. They have separate production, selling, advertisement, formal R§D departments. Specialised people were appointed for these departments. On the other hand, decision making system is done by the capital owners. For this reason, organisational structure of these firms is not fully institutionalised.

PE firms are rapidly growing after their establishment because especially after mid 1980's, demand for PE systems and products were increased very much. This condition makes rapid growth of these firms easy. There are some criteria of a rapid growth of a firm. If a firm is active in more technology based subsector it gains a flexibility to enter different areas of electronics as parallel to technological developments in electronics. There are thousands of electronics applications considering every type of activity. These types of firms have a chance for rapid growth. In spite of these conditions, if they enter into crisis considering production, firms that take representations of foreign firms can able to survive thanks to commercial profits. On the other hand, though these firms have a potential for growth, they can not go beyond personal or family firm level because of some macro economic conditions and personal, physiological reasons.

Administrative Structure:
In most of the interviewed firms in Ankara, İstanbul and other places, it is observed that the director is the founder or owner of the firm (15). On the other hand critical decision making mechanism in these firms still belongs to firm owners. In relatively smaller firms, there were no professional managers. Even in Ankara, İstanbul and other places, administration function of firms is depending on ownership pattern. Owner of firm directs firm at his/her own risk.

It is observed that informal relations are dense within this type of firms in all locations. More flexibility is observed in these firms. These intrafirm informal relations are not negligible even in bigger firms of İstanbul. Short and medium scale strategies are taken in all interviewed firms located in Ankara, İstanbul and other regions.

Finance Structure:
There is another common point of interviewed PE firms considering finance function. All interviewed firms were self financed firms established by individual capital except some firms in Ankara (16). Also none of interviewed firms are joint venture except ETA firm in Ankara (17). None of these firms get credit from banks or government incentives in their infant period. This condition did not change in time. Locational differences are not observed concerning origin of the starting capital. On the other hand, quantities of capital in Ankara firms were smaller than İstanbul firms at starting periods. This shows strong economic power of founders of İstanbul firms when compared with entrepreneurs in Ankara.

Marketing Opportunities:
All interviewed firms have deficiencies about marketing opportunities. There are no separate marketing departments in firms except relatively bigger firms (18). Even in these firms, marketing departments work only as selling departments. On the other hand, there are strong and well organised after sales services in all firms of Ankara, İstanbul and other places. This is the major factor for their success especially in Turkish markets.

Personnel Characteristics and Relations:
In all interviewed firms, human factor is the major factor for production. Informal intra firm personnel relations exist in all firms. This condition is more visible in Ankara firms and also this holds true for relatively small firms in İstanbul.

In all regions, as firm size is getting smaller, owner of firm begins to deal with all type of works. All firms have a flexible production style. Workers and mostly technicians have some rights on production processes. This situation is more definite in firms of technology based subbranches (security systems, electronic systems, medical electronics) in Ankara, İstanbul and Bursa.

Most of the firms were established by electronics engineers especially from METU and ITU (19). Also more than half of the engineers that work in these firms were METU and İTU originated (20). Founder and engineer compositions of interviewed firms support the importance of METU and İTU for development of PE sector in Türkiye.

It is impressive that there were very few Bilkent and Boğaziçi graduates working in PE sector although these universities have very qualified faculties of electronics. The reason for that condition may be that these graduates prefer to work in biggest firms or go to abroad. Almost there are very few entrepreneurs graduated from these universities. It is open to debate that education formation in these electronics faculties is not oriented for entrepreneurial skill.

There are some firms that founder of them are not electronics engineers. Number of these firms in Ankara is more than number of firms in İstanbul (21). Most of these firms were established as hobby and common point is that, they are less technology based firms.

One common point considering personnel characteristics is related with labour mobility. Labour mobility especially engineer mobility is high in this sector. As a last point considering personnel characteristics, there are very few working women and foreign employees in firms (22).

Summarised information on personnel characteristics and relations is provided in the the appendix L.

Technological Considerations:
Especially technological considerations are related with some quantitative measures on technological capability, own design capability, R§D efforts, license conditions, inventive activities.

There is no difference between firms in different regions considering engineer percentages as this is one of the few quantitative measurements of technological level of firms (23). This value exceeds the average of Turkish electronics industry as this value is 12.3 % (24). This ratio varies according to firms that specialised in different subbranches of PE industry (25). For engineer percentages of all firms see table 10).

Own design capability is an important indicator of technological capability of PE firms (26). On the other hand, qualification of design capabilities differ according to different subbranches. About 60 % of Ankara and İstanbul firms have formal R§D departments. Less technology based firms have almost minimum R§D efforts (27).

None of interviewed firms work under license condition except one in İstanbul. Also none of firms have know how transfer from abroad except three interviewed firms (28). On the other hand, their design and production systems are not depending totally on know how transfer as it is very limited process. Firms mostly depend on their own knowledge in production. All other firms use their own know-how in production. This does not mean that all these firms have invention activity, but they get their know how from various sources rather than other firms. As there is no invention activity in these firms, none of interviewed firms have patents. One medical firm in Ankara (PCK firm) applied for a patent. Almost all firms have trademarks.

Firms active in technology based subbranches have extensive use of software in their devices and systems. This kind of software is self produced in all firms (29). This shows the brain ware characteristics of PE.

Various technological characteristics of interviewed firms are provided in the appendix M.

4.2.3.2 Common Findings on Linkage Relations

These types of relations consist common points on supplier and subcontracting relations and technology based linkages. Technology based linkages include university and research centre collaborations, inter firm linkages and informal linkages with customers.

Supplier and Subcontracting Relations:
Most of the firms subcontract auxiliary works to other firms. Subcontracting works include mechanics, box production, preparation of printed circuits, trafo, laser cutting works and so on. Especially these types of works are given to firms that are located in same region in Ankara and İstanbul (30).

All of these subcontracting facilities consist of specialisation type of subcontracting. This is very important for PE firms that their products require various materials that they cannot be able to produce. Especially structure of PE industry and these firms is not appropriate to be vertical integrated. Their capital and organisational structure are not sufficient for that type of production. Also characteristics of auxiliary industry are not suitable to be at the same work place as it leads to more noisy and dirty work. This type of work conditions does not adjust with engineer based production. On the other hand, some interviewed firms had some parts of auxiliary work as mechanics or boxes in industrial site different from their firm locations. These firms are more in Ankara (31).

Finding components is not a problem as it was the case in 1980s. There is no serious difficulty to find components for all firms. If necessary, they order it from internet and get them from international cargo services. All these discussions show two things. One is that, inputs for this kind of industry are so small and second is the importance of advanced level of business services related to submitting of these inputs. Especially domestic cargo services and international cargo services (DHL- WWE) play

important role in submitting of these inputs. Also, some PE firms in Ankara have branch offices in foreign countries in order to find necessary components easily (32).

It is impressive that most of the firms prefer to import components directly. This structure shows their high technological levels. None of Ankara or İstanbul firms depend on each other considering inputs and auxiliary industry. On the other hand, dependency of Kayseri firms to İstanbul is an important point. Kayseri firms get components and subcontracted auxiliary works to İstanbul firms though Ankara is located near to Kayseri. This indicates advanced levels of auxiliary producers and component providers in İstanbul.

Supplier and subcontracting relations of interviewed firms can be observed from appendix N.

Technology Based Linkages:
This includes university relations, inter firm linkages and informal informational relations.

Generally, relations of these firms with universities or research institutes are very weak (33) (our analysis is for the past as well as for today). As it was mentioned in part 2.2.3, this weak relations are not fault of firms but depends on other external macro reasons. As another point, coordination between firms and research institutes is much worse than university relations (34).

On the other hand, informal information relations with universities are at high degree. Especially this is true for METU originated Ankara firms. Founders of these firms have strong informal relations with their teachers and friends in university. This condition is partially true for İTU graduates in İstanbul.

We observe almost no relations between firms considering inter firm relations. These types of relations can exist in various ways. Partnership in product development, common or subcontracted R§D, formal or informal information relations, engineer exchanges are some examples for these kinds of relationships.

Within interviewed firms, inter firm collaboration is not much developed as it is the case in firm-university, firm-research institution collaborations. Almost there are no technological collaboration between these firms. Only there are commercial and weak informational links between them. On the other hand, there are some relations of these firms with other electronics firms (35). Especially there are no relations between firms active in the same market. Also there are no relations between firms considering partnership at R§D or doing common R§D (36). In spite of lack of collaboration between firms, informal relations between these firms and informal relations with other institutions are highly developed.

It is noteworthy that, most of the PE firms in Ankara have some type of relation with Turkish biggest electronics firm; "ASELSAN". These relationships are different kind of relations. ASELSAN is competitor for some of them, some founders of firms worked in Aselsan before and ASELSAN is a customer of some firms and so on. Important point is that relations with ASELSAN are not at R§D level, because ASELSAN is an isolated firm in this sense. Few İstanbul firms have relations with the ASELSAN firm (37). The presence of ASELSAN is one of the important factors for development of professional electronic sector in Ankara.

Besides collaborations between firms and informational type of relations, we do not observe any interfirm labour relations. There is no labour or engineer exchange between firms. Also there are no any common education programmes between these firms. Common education programs are more applied within group firms and with sister firms.

Dense informational relations are established between these firms and customers. Informational relations with customers are occurring parallel with after sales services. This is more important in custom design products. Most of the firms in Ankara and İstanbul have informational relations with customers (38). Informational relations with customers are dense because every firm gives importance to after sales services and this service is strategic in their business lives as they produce mostly custom products, systems. For managers, these types of information linkages with customers play important role on their production strategies.

Summarised information on inter-firm linkages, university linkages, customer relations is provided in appendix O.

4.2.3.3 Common Findings on Transaction Relations

There are some common points especially related with customer types and competitive conditions of firms.

Production structures of all firms are different from each other. Firms differ very much according to their subbranches. Some firms produce material products, some other are specialised in systems (especially designing control boards of mechanical systems). Most of the firms produce investment goods. Even uninterrupted power supplies can be considered as an investment good, that it conserves machinery from voltage disorder. Also firms in some branches produce end products such as simple alarm systems firms.

Major customer type surely changes according to different activities of firms. On the other hand we have some generalisations. Industrial firms, public institutions, hospitals, contractors are the main types of customers of specific products (39). There are no differences between locations considering customer type. Customer differences depends on sectoral distribution.

Firm interviews show that more technology based PE firms are relax in competition. In other words, competition level between Turkish PE producers are decreasing when technological intensity of that production increases. Technology based producers are competing with traders. On the other hand, their capital is not sufficient to cope with international competition. More less technology based firms suffer from imitation market within Türkiye.

Some firms are the only producers of some electronics devices and systems but this condition does not lead to a monopolistic condition as import of this type of devices and systems is free in Türkiye. In this respect, Turkish firms are not competitors among each other concerning some sub branches of PE sector (40).

It is impressive that competition degree is very low between firms located in same region. Various firms in Ankara and İstanbul are direct competitors. This situation shows that Ankara firms get skill of marketing at some degree with their high technological levels.

As an interesting point, even firms that produce same products are not competitors. This condition shows the technological diversity within same subbranch of PE. Technological development leads to compatibility within products, after than diversification occurs. Competition may not harm these firms as soon as they renew their technologies under such a condition. Also, there are many areas in PE sector that nobody deals with. This condition is the consequence of increasing number of electronic applications with parallel to technological developments in electronics sector.

More competition between interviewed firms is visible within less technology based firms. These firms are active in standard equipment, alarm systems and some branches of industrial electronics (41).

Endless demand for some products and systems of PE sector play important role in competitive conditions. This type of demand holds true for electronic boards, power electronics, medical electronics and building automation systems. These types of markets have a big growth potential. For this reason, firms in these areas have potentials at least to stay in market for long years. Also interviewed firms organise their production so flexible that they can easily enter to production facilities in some other professional subsector.

Common findings are not sufficient to explain contingent situation of PE industry in Ankara. So we have to analyse differences between regions (especially Ankara and İstanbul) to understand special condition of PE industry in Ankara. In this respect, also Kayseri and Bursa firms are taken into analysis to understand market relations well.

Summarised transaction and market relations of interviewed firms is provided in the appendix P.

4.2.4 Different Aspects of Professional Electronics Firms in Different Regions

There are significant differences between firms in different regions. These differences can be categorised in general structures including technological aspects, different linkages and transaction, in particular market relations. Linkages can be divided into subcontracting and supplier relations, technology based linkages and relations with state bureaucracy and public institutions. Differences within technology based linkages are observed within mostly informal information linkages. Besides, there are important differences concerning future aims of firms in different regions.

Especially this part is more related with differences between Ankara and İstanbul. Number of Kayseri and Bursa firms are not sufficient to take them into this kind of comparison. Most significant differences between firms in Ankara and İstanbul reflect itself in market and transaction relations of firms. Also innovation procedures, information gathering, informal relations, experience of staff, relations with public institutions are other important factors that reveal some significant differences between firms in Ankara and İstanbul. Firms also differ much considering intra metropolitan locational factor.

4.2.4.1 Differences In General Structure of Professional Electronics Firms

There are significant differences on production structures of firms and personnel relations relating general structure of firms in different regions.

In the part 4.2.3.1, similarities of firms concerning origin of capital were explained. Despite similarities depending on origin of capital, there were differences concerning starting activities of firms in different locations. This difference is obvious in Ankara and İstanbul. Some firms started as a trader, some started as a producer of another electronics subsector (42). Firms in Ankara were more production oriented at beginning. They do not make a full market research before they enter into

production of PE. On the other hand, entrepreneurs in İstanbul consider every possibility of commerce and search for commercial links before they establish a firm. They do not start as a producer from first time.

There are continuing structural differences between firms in Ankara and İstanbul (43). Development trends become different for Ankara and İstanbul firms after their establishment. This resembles itself mostly in taking representations (44).

One of the distinctive characteristic comes from different activities of firms. Some firms are specialised in devices whereas other firms are specialised in systems (also they have production). That system intensive firms are considered as more technology based firms. Difference on this subject comes from the characteristics of subbranches which firms belong to. Security system firms that work mostly on custom design systems are good examples for this condition. On the other hand simple alarm systems firms produce standard products. Within industrial electronics, firms that produce control devices have not to be much technology intensive, on the other hand, firms that produce automation systems are more engineering based firms.

Especially system oriented firms are working on custom design production (45). This differentiation reflects itself in different locations. İstanbul firms are more specialised in subbranches more appropriate for mass and standardised production type. UPS, taximeter, tacograph and some control device producers are examples. Some firms also specialised in electric sector in İstanbul. On the other hand, Ankara firms are more specialised in technology based subsectors as industrial electronics and security systems.

Personnel Relations:
One of the important difference between regions is the differences in wage levels. Wage levels are high as this is one of the peculiarity of whole electronics industry. On the other hand, wage levels are higher in İstanbul than Ankara and other provinces. Wage level of engineers and technicians in İstanbul are about 1.5-2 times more than in Ankara.

Another difference comes from the experience of engineers working in these firms. Firm owners and engineers in İstanbul firms seem to be more experienced (46). As engineer mobility is high in this sector and this condition is more noticeable in İstanbul firms to find a qualified engineer is not an easy process for PE firms in İstanbul. Giant electronics firms in İstanbul (47) play important role on this condition. One of the disadvantageous position of İstanbul comes from lack of educated personnel or engineers. It is an interesting point that although wage levels are high in İstanbul, engineers from METU do not prefer to work in İstanbul concerning PE sector.

Engineers in İstanbul firms are mostly graduated from universities in İstanbul and engineers in Ankara firms are mostly graduated from universities in Ankara. We explained about dominance of METU in Ankara and İTU in İstanbul in last part (also see end notes 19 and 20). Besides, there are differences concerning education background of technicians working in these firms (48).

Summarised information on personnel characteristics and relations is provided in the appendix L.

Technological Aspects:
There are some procedural differences between firms in Ankara and İstanbul concerning innovation. Half of İstanbul firms are using their own designs in their production. Other half of the firms can also use their own design capability as well as they use adaptation techniques for local conditions. Only a simple examination of an electronic device is sufficient to imitate that device if necessary components are ready. On the other hand, about 75 % of firms use their own designs in Ankara. Adaptation is used by firms which produces standard products in alarm systems and industrial electronics. It has to be kept in mind that all parts of devices and systems are not own inventions of firms who have self design process whether in all places including Ankara and İstanbul.

Interviewed firms have different channels of getting information. Trade fairs and Internet are some channels of getting technological information for firms. There are

differences especially in attending trade fairs. Firms in İstanbul tend to attend these fairs more than firms in other regions (49). On the other hand, there are no differences between Ankara and İstanbul firms in utilisation of Internet. Ankara firms are at advantageous position as nodes of important internet links are in Ankara. This maintains more potential for Ankara users. Internet possibilities of firms in Kayseri and Bursa are less than Ankara and İstanbul. Firms that belong to lower technology basis do not utilise Internet much. Relatively biggest firms have web pages in Internet (50).

As another way of getting technological information, about half of İstanbul firms sent its personnel to various technological or trade meetings as this is the case for largest firms in Ankara. There are no such activities in smaller firms in Ankara. Also İstanbul firms have more relations with abroad and some sent its personnel to abroad. Only ETA firm in Ankara does this type of activity. There is no such an activity in Bursa or Kayseri.

ISO certificates are important signs of technological level of firms (51). Percentage of firms that have this certificate in İstanbul is higher than other regions (52). Relatively larger firms have this certificate in all regions. Especially it is an interesting result that, though own design process is dominant in Ankara firms; more İstanbul firms have ISO 9001 certificate. This was because of Ankara firms are not much successful to utilise their own design capability from design period to marketing period although they have higher design capability than İstanbul firms. Another reason is that Ankara firms are not preparing necessary documents or too busy for this kind of application. These are related with low institutional level of relatively smaller firms in Ankara.

It is wrong to claim that Ankara firms are more technological intensive than İstanbul firms. This condition depends on different sub branches of PE. Technology awards may give some hints about this condition but, only one İstanbul firm and one Ankara firm get this kind of award from Turkish Technology Development Foundation (53). Also, projects of two İstanbul firms were

supported by Technology Development Foundation of Turkey. Two supported projects of one firm in İstanbul are still continuing (54).

On the other hand, Ankara firms mostly use their own know how than İstanbul firms in production. In spite of this condition, İstanbul firms tend to be more institutionalised about technology such as most of them have ISO certificates and so on. Degree of source of know how differs according to structure of production in Kayseri and Bursa.

Various technological characteristics of interviewed firms are provided in the appendix M.

4.2.4.2 Differences Concerning Linkage Structures of Professional Electronics Firms.

As it was explained, there are differences between firms in different regions considering supplier and subcontracting relations, informal information linkages and relations with state bureaucracy and public institutions.

Supplying and Subcontracting Relations:
A significant difference shows itself in subcontracting activities. İstanbul firms are doing more subcontracted work for others (55). On the other hand, these kinds of works are very limited and not continuous for all PE firms who do subcontract work.

All of the PE firms need components for their production and these components have strategic importance for their production. There are different styles of obtaining components for firms in different regions (56).

Supplier and subcontracting relations of interviewed firms can be observed from appendix N.

Informal Informational Linkages:
Firm research showed that there are wide informal relations between firms. These types of informal relations are informational type in general and they are about different aspects of electronics business. Informal information relations are more widespread in Ankara than

İstanbul (57). Managers of Ankara firms give much importance on these kinds of relationships, and they argued that these relations are one of the important characteristic of electronics industry in Ankara. To establish face to face contact is very important issue for managers in Ankara. Also there are dense informal informational relations between these firms and subcontracted firms and their sister firms. Informal relations are not developed in Bursa and Kayseri as İstanbul or Ankara. This does not mean that these firms are isolated. They have informal relations especially with firms and traders in İstanbul.

Relations with State Bureaucracy and Public Institutions: One of the most significant difference between firms show itself in relations with state bureaucracy and public institutions. This can be analysed within two points. One is incentives and other is customer type relations.

Within state relations, 'incentive' concept is important and worth to analyse. It is an impressive point that, more technology based firms do not take any incentives. There is a recognisable difference between Ankara and İstanbul firms considering taking incentives. İstanbul firms tend to take more incentives than Ankara firms (58). This is significant that although Ankara firms are very near to state institutions, İstanbul firms are more active and desirable to get incentives or credits. Especially infant firms that locate in several KOSGEB's tend to take entrepreneurship credits.

On the other hand, state and public institutions are the important customers of Ankara firms at significant rates. This is not the case in İstanbul or other regions (59). State and public institutions are customer of scoreboards, security-alarm systems, medical devices and some industrial control devices. Especially military is an important customer for some Ankara and İstanbul firms (60).

Relations of interviewed firms with state institutions, some other institutions and their incentive conditions are provided in the appendix R.

4.2.4.3 Differences Concerning Transaction Relations of Professional Electronics Firms

There are significant differences considering transaction relations. There is a basic difference considering market positions of firms. Related to general market characteristics and market positions of interviewed firms, Slatter's (1992) distinction for categorisation of these firms can be used. This distinction combines market and technological opportunities of firms. It is provided in the table 22.

Table 22. Categorisation of Interviewed Firms According to Their Market and Technology Powers.

	ANKARA	İSTANBUL	KAYSERİ	BURSA	ANK.%	İST.%
DOMINANT SECTOR PLAYERS	ELİMKO	EGES, EKA	-	-	14	23
	PETAŞ, TETA	ESİT				
PRODUCT GR. SPECIALISTS	ENERSİS	BAYKON	-	-	43	23
	ETA, GATE	ELİAR				
	KARDİOSİS	POLARIS				
	MOSTEK, ON					
	ORTANA, PCK					
	SİSTEK					
MARKET SPECIALISTS	MEKO	CEDETAŞ	-	EMKO	14	38
	NEL	EDS, EEC				
	NÜVE	ERA, SİSEL				
NICHE PLAYERS	ELSİM, ELSİS	BKS	AAZ	-	29	16
	EPROM, OES	ROTA	ENDSİS			
	UTES, YESTAŞ		HES			
TECHNOLOGY SPECIALIST	-	-	-	-		

The table above shows that, firms in Ankara more rely on their innovative characteristics and their technology based production as their principal source of competitive advantage than İstanbul. Niche players in Ankara are more than niche players than İstanbul. Market specialists and dominant sector players constitute about 60 % of firms in İstanbul. This value is 28 % in Ankara. These situations indicate that firms in İstanbul are more market oriented and product development is seen at secondary importance. On the other hand, firms in Ankara give more importance on development of their devices and systems for the

sustainance in several markets. Firms especially in Kayseri, are more niche players that have the narrowest product scope.

As another important distinction, there are significant differences on market concentration of firms. Rate of İstanbul market varies between 50-80 % for İstanbul firms. Also other provinces in Marmara region are the second big market for these firms. On the other hand, Concentration of Ankara market varies between 5-60 % for Ankara firms. Market structure for Ankara firms is more dispersed in pattern. Firms in Ankara have more domination on inner, South Eastern and Eastern Anatolia market than firms in İstanbul (61). Firms in Kayseri and Bursa have more local markets (62).

There are several reasons for this type of market structure. Local market is sufficient for İstanbul firms. This is not the case for Ankara as industry and commercial market in Ankara are not developed as much as İstanbul. Ankara firms serve for huge İstanbul market at some degree. Also locational demand for special branches of electronics plays important role in the market differentiation. In special sectors such as medical electronics, Ankara market is best for medical device producers. On the other hand, İstanbul is the best market for industrial electronics producers.

Few firms have direct export. More İstanbul firms are exporting at higher rates than other firms in Ankara or other regions (63). Exports of other firms are negligible or done in indirect way. Indirect means their systems are exported within machinery. Most of these exports are done to old USSR republics (Exporting activities of firms is provided in the appendix P).

In export activity, the qualification of exported goods becomes important. Special products have more chance to be exported. For example, a medical electronics firm in Ankara that produces kidney stone crusher machine and another medical electronics firm that produces ECG devices are exporting about 75 % and 35 % of their total production respectively.

Taking representation becomes vital factor for continuation of these firms especially after 1980s. Ankara firms tend to take more representations than İstanbul firms (64). This is especially as a result of weakness of market opportunities of Ankara. It is observed that, Ankara firms take representations after they start production. On the other hand most of İstanbul firms start production after they take some representations. Representation institution is not developed in other regions other than Ankara or İstanbul (65). It is an impressive point that, firms that do not take any representation are more technology based firms.

Summarised transaction, market relations of interviewed firms are provided in the appendix P.

4.2.4.4 Differences Concerning Intra Metropolitan Locations of Professional Electronics Firms

Most significant differences between Ankara and İstanbul firms reflect on intra metropolitan locational factors. In this respect analysing intra metropolitan locational differences between Ankara and İstanbul firms is important to understand structure of firms in these regions.

Most of the İstanbul firms tend to locate within industrial sites however firms in Ankara are located within city centre (66). There is no significant difference between ownership pattern of workplaces (67). There is a tendency among PE firms that they do all production within the same building. This condition is more visible in İstanbul (68). Mechanics parts of some Ankara firms locate in industrial sites as this type of work is accepted as dirty and noisy work.

Ankara firms tend to have more offices in other cities. This condition is not recognisable in other regions like Ankara (69). These findings support our argument that trade facilities in Ankara are not sufficient for professional electronic firms.

Concerning PE, work started in a small workshop at the beginning of the production. This situation holds true for all PE firms. If these firms were started as traders, they

began fitting activities in the back room of their offices. By time when production intensity gets larger, these firms tend to move bigger spaces. Movement ratio in İstanbul firms is higher than Ankara and other regions (70). As most of the İstanbul firms did not start as producer, movement rate becomes high in İstanbul. There are other factors related with land values and so on. Firms in İstanbul are accustomed to standard production and they tend to locate in the industrial sites at the periphery of the city center. Also there are some thoughts on future movements of firms (71).

Factors for selecting locations differ much according to İstanbul and Ankara firms (72). There are different structured reasons between Ankara and İstanbul. It can be recognised that, proximity to centre and environmental factors play important role in locational choice of firms in Ankara. One reason for locating near center is the increased possibilities of face to face contact. Also a trend was started in 1990s that some firms move to residential areas around the city center such as Balgat and Dikmen. These are far from center but access to city center is very easy from these locations. This shows the importance of quite and non problematic places for technology based firms. Proximity to suppliers or auxiliary industry is not much important in Ankara as this situation is same for firms in İstanbul. Proximity to the center is important for İstanbul firms, but not at the same degree as Ankara. This situation arises because of traffic, parking and other standards problems of central areas of İstanbul. Also land values are very high in these areas. It is interesting that land value means almost nothing to Ankara firms.

Intra metropolitan locational aspects of interviewed firms can be observed in appendix S, also intra metropolitan location of firms in Ankara is provided in the appendix T and İstanbul is provided in the appendix U.

4.2.4.5 Differences Concerning Future Aims of Professional Electronics Firms

Despite their pasts, also there are structural differences between future aims of these firms. Firms in İstanbul want

to grow as they can. They want to convert their production process to more mass and standardised production type when they start to grow. This is true for all size of firms in İstanbul. Also it is true for Bursa firm. This is not the case for Ankara firms but this kind of desire holds true for firms that have relatively bigger capitals than others in Ankara. Aims are differentiated according to firm size in Ankara. Relatively biggest firms want to expand system works with imported materials rather than production. Relatively small firms want to become more institutionalised and have more standardised pattern of production. To increase export is an aim for all firms. Four firms in Ankara have a decision to be active in different branches of PE (73). These are the fields that nobody is active. Electronic education materials, simulators, traffic sector are some examples for these new fields.

Related to these discussions, it is an interesting finding that various firms in Ankara tend to stop their production step by step. Some become active in system and contracting works. Also, this condition holds true for some İstanbul firms (74).

If the future of these firms are considered then different scenarios holds true for different subsectors. More technology based firms have more flexibility to enter some other areas of PE sector if they entered into crisis.

Some interviewed firms see their future very bright. Other see their future not bright as others. Global relations and policies are some reasons for this case. Especially export oriented firms have to adjust themselves to changing economic relations and political considerations. For example all firms have to prepare necessary documents and works to take CE trademark in future. This is not easy as capital of these firms is not capable of this kind of transformation in short run.

Lack of standards and ignorance of governments to this sector are other reasons for looking desperate to future. Also there are some other shortcomings for firms in different locations. These problems are mostly location specific problems discussed in coming parts.

Former activities of firms, their present condition and their future aims are provided in the appendix V.

4.2.4.6 An Evaluation on Differences Between Firms in Ankara and İstanbul

For structural differences of firms in Ankara and İstanbul, to summarise the research on interviewed firms is useful. Different factors considering Ankara and İstanbul firms are provided in table 23 in the next page. Values in the table show the ratios of firms that have such activity, ratios of firms that have a special relation, ratios of firms that belong to any kind of group and so on. First group reflects factors that firms in Ankara and İstanbul resemble each other. Second group of factors are seriously different for firms in Ankara and İstanbul. Firms in Ankara and İstanbul differ totally from each other considering factors that is provided in the third group.

Table 23. Differentiation Ratios of Ankara and İstanbul Firms According to Various Factors

FACTORS	ANKARA	İSTANBUL
DOING SUBCONTRACT R§D (past and present)	0.24	0.23
R§D PARTNERSHIP	0.1	0.08
UNIVERSITY RELATIONS (past and present)	0.29	0.31
ENGINEER RATIO	0.23	0.2
OWNER OF BUILDING	0.8	0.85
INFORMATION EXCHANGE WITH CUSTOMERS	0.86	0.8
ACTIVITY CHANGE IN FUTURE	0.29	0.23
RELATIONS WITH ANY OTHER FIRM	0.29	0.23
PRESENCE OF FORMAL R§D	0.62	0.54
HAVE MECHANICS WORKSHOP	0.23	0.31
OWN DESIGN CAPABILITY	0.86	0.77
USE SOFTWARE IN PRODUCTION	0.86	0.77
TOTAL IMPORT OF COMPONENTS	0.24	0.15
KNOW-HOW TRANSFER	0.05	0.15
HAVING ANOTHER ACTIVITY	0.19	0.08
EXPORTING FIRMS	0.33	0.46
TO BE A JOIN STOCK COMPANY (A.Ş.)	0.48	0.62
USING OWN DESIGN	0.71	0.54
RELATIONS WITH RESEARCH. INSTITUTIONS.	0.28	0.46
ISO INSCRIPTION (Applications included)	0.19	0.38
FUTURE MOVEMENT	0.43	0.23
TAKE SUBCONTRACT WORK (past and present)	0.24	0.46
MOVED TWICE AND MORE	0.19	0.46
START AS A PRODUCER OF PROF. ELECTR.	0.67	0.38
ACTIVITIES IN SAME BUILDING	0.48	0.77
INFORMAL RELATIONS	0.76	0.46
TESID MEMBERSHIP	0.24	0.54
TAKING REPRESENTATION	0.71	0.38
HAVING AUXILIARY PRODUCTION	0.05	0.38
HAVE ANOTHER OFFICE	0.67	0.31
ENGINEER EXPERIENCE	0.15	0.52
GETTING INCENTIVE	0.24	0.62
ATTENDANCE TO TRADE FAIRS	0.48	0.92
RELATIONS WITH ASELSAN	0.67	0.15
SELLING TO PUBLIC INSTITUTIONS	0.71	0.15
FOUNDER EXPERIENCE IN ELECTRONICS	0.43	1
LOCATE IN CITY CENTER	0.8	0.15
SELLING TO LOCAL MARKET	0.19	1

It is effective that firms in Ankara and İstanbul resemble each other considering various technological factors and various linkage structures. Most of the firms have their own R§D, own design capability both in Ankara and İstanbul. Very few firms have linkages with universities, and interfirm linkages in both locations. Ownership of the firm building is another common character.

Their differences began to arise considering using own design, know-how transfer, relations with research institutions, ISO inscription and so on. These are also technology related factors. There is no much difference between Ankara and İstanbul firms considering export activities. Also their future aims related with further movements resemble each other. Ankara and İstanbul firms seriously differ from each other concerning commercial relations, market locations and informal relations. If these factors are classified then we get such a result shown in the table 24.

Table 24. Characteristics of Interviewed Firms in Different Regions

	ANKARA	İSTANBUL	BURSA / KAYSERİ
PRODUCTION PECULIARITIES			
PRODUCT CHARACTER.	MORE CUSTOM DESIGN	MORE STANDARDISED	MORE STANDARDISED
PROCESS	MASS AND FLEXIBLE	MORE MASS IN TYPE	MORE MASS IN TYPE
PRODUCT QUALIFICATION	MORE INVESTMENT PR.	MORE END PRODUCTS	MORE END PRODUCTS
OTHER PRODN. ACTIVITY	NOT EXISTING	EXISTING	NOT EXISTING
STRUCTURE OF FIRMS			
AGE	OLDER FIRMS	YOUNGER FIRMS	MORE YOUNGER
SIZE	RELATIVELY SMALLER	RELATIVELY BIGGER	RELATIVELY SMALLER
RESISTANCE TO CRISIS	AVERAGE	STRONG	WEAKEST
STARTING CAPITAL	LOW	HIGH	LOW
TECHNOLOGY			
PRODUCTION KNOW-HOW	OWN R§D	MIXED WITH OWN R§D	OWN R§D
DESIGN CAPABILITY	OWN	OWN	OWN
INSTITUTIONAL LEVEL	LOW	HIGH	HIGH IN BURSA
NETWORK RELATIONS			
SUBCONTRACT RELATIONS	DENSE	DENSE	DENSE
FIRM COLLABORATION	WEAK	WEAK	WEAK
UNIVERSITY COLLAB.	WEAK	WEAK	WEAK
INFORMAL RELATIONS	STRONGEST	STRONG	AVERAGE
CUSTOMER RELATIONS	DENSE	DENSE	DENSE
GOVERNMENT RELATIONS	AVERAGE	WEAK	WEAKEST
TRANSACTION RELATIONS			
MARKET INTENSITY	DISPERSED	OWN REGION	DISPERSED
PUBLIC BUYING	AVERAGE	NOT MUCH	NOT MUCH
EXPORT ACTIVITY	NOT MUCH	AVERAGE	ALMOST NONE
MARKET OPPORTUNITIES	NOT DEVELOPED	DEVELOPED	NOT DEVELOPED
LOCATIONAL CHARACT.			
LOC. PATTERN IN CITY	DISPERSED	DISPERSED	DISPERSED
LOCATION	MOSTLY WITHIN CITY	INDUSTRIAL SITE	MIXED
LOCATIONAL MOVEMENT	HIGHLY OCCURRING	HIGHLY OCCURRING	NOT MUCH

It can be observed that different localities show different characteristics considering different factors.

This is especially due to location specific externalities. This subject will be the explained in coming part.

4.2.5 Locational Differences For Professional Electronics Production

There are some location specific factors that leads to some kind of differences that is shown in table 24. We can observe these location specific factors within different group of discussions. These groups are related to technology infrastructure, transaction relations, input relations, educational structure, labour relations, relations with various public and civil institutions. Technology infrastructure is highly related with educational structure of the location, so these two factors will be combined within technology infrastructure concept.

Technology Infrastructure:
It is related with educational structure, as well as it is related with presence of research institutions, presence of information technology facilities for information gathering, condition of R§D supports and R§D policies.

Within unitary political system, there are no different government policies for different regions in Türkiye. Only there are some policies to support development in some underdeveloped regions. There is no difference among R§D policies in Ankara, İstanbul or other regions that have been examined. Inadequate policies for development of electronics industry is the major problem. Ignorance of governments have been true for all electronics firms in all regions.

There are no differences between Ankara and İstanbul considering the presence of information technologies critical for information gathering and transaction facilities. Information technologies are metropolitan originated issues. Ankara and İstanbul are the most developed centres of Türkiye concerning information technologies (Dede, 1994). Firms in Ankara and İstanbul can able to marketing, buying components, doing advertisement through Internet or other communication

networks. Developed structure of information technologies is important for firms who have tight relations with customers and have a custom design type of production. Information technology opportunities are not developed in Bursa and Kayseri as Ankara or İstanbul. With further development of communication infrastructure, this gap will be narrowed.

The last and most important issue in technology infrastructure is the presence of brain ware or skilled human power. This is related with presence of universities and skilled personnel graduated from these universities. There are different departments related with electronics. These are total of 9 departments of electric and electronics engineering, electronics engineering, electronics and communication engineering in İstanbul and Ankara (75).

Electronics sector is said to be an industry created by METU in Türkiye. Despite this kind of claim, METU has important role in development of electronics sector in Ankara. METU has the first modern electronics faculty. Its education level in electronics was beyond the commercial market level. It has the advantage to give advanced education level.

Despite changes in macro political and education system, dominance of METU in PE industry in Türkiye did not change within time. It is claimed that METU graduates define technology for PE industry in Türkiye. İTU in İstanbul has such peculiarities concerning electronics industry in İstanbul. METU in Ankara and İTU in İstanbul are considered as the main sources of the brain force of PE industry in Türkiye.

Besides these factors, there are important differences concerning philosophies of industrial production in different regions. Philosophy of production İstanbul insists on immediate production in great masses and its financial income. On the other hand, philosophy of production in Ankara insists on production of technology and advancement of technology for reliable market relations. Effects of Ankara firms in creating technology for PE sector can not be denied.

Transaction Relations:
The characteristics explained for Ankara and İstanbul in this part are mostly related with PE sector and its business dynamics. Concerning transaction relations, most important difference between Ankara and İstanbul is coming from power of commercial market. İstanbul has about 35 % of total circulated money in Türkiye by the end of 1990s (Sönmez, 1998). It is a reality that, business potential in İstanbul is advanced than Ankara and other regions. As business potential is more developed in İstanbul, market opportunities in İstanbul are more developed than Ankara.

Consumer market is advanced in İstanbul concerning electronics industry, because industrial and commercial activities are agglomerated in İstanbul. About 40 % of all manufacturing firms in Türkiye locate in İstanbul by 1996 (DİE, 1998). As an another example, about 52 % of computer firms locate in İstanbul by 1993 (Dede, 1994). There are buying or selling departments of various manufacturing or trading firms in İstanbul from all over Türkiye. For example purchasing department of a manufacturing firm in Gaziantep or Şanlıurfa takes place in İstanbul.

Integration to world markets from İstanbul is easier than other places. Global relations are easier in İstanbul. It becomes the city of fairs. This is another sign of integration with world markets. Industrial fairs also increase commercial potential of İstanbul. When customers come to these fairs from any part of Türkiye, İstanbul firms that attend these fairs become advantageous than other firms.

Relations are more professional, and export is more easy than other regions in İstanbul. Bureaus of many foreign firms are located in İstanbul so it is easy to contact with these firms and establish global relations in İstanbul. Especially export to European countries is more easy from this city. On the other hand it is noteworthy that, it become more easy for Ankara firms to contact and do job with Turkish Republics in old USSR. Direct airline connection from Ankara to these countries plays important role in this case.

There are huge commercial relations in İstanbul. It is evaluated that, İstanbul firms do not give much importance

on R§D issues as they have not much time for this activity. Especially in İstanbul, there are so much commercial efforts and bureaucratic procedures in PE production that R§D issues are given importance at second hand.

Despite some of their advantages over foreign firms within Türkiye, PE firms in İstanbul have not enough capital and capacity to invest huge amounts in R§D to compete in foreign markets. On the other hand, they are successful in maintaining necessary technological level in their products. One disadvantage for İstanbul firms is the presence of imitation market specially for less technology based professional electronics (Especially considering end products).

Ankara is in disadvantageous position than İstanbul considering business and commercial opportunities. Trade relations in Ankara are not developed as İstanbul. Firm managers claim that there is almost no commercial market for electronics in Ankara when compared with İstanbul. Number of manufacturing firms in Ankara is about one seventh of firms in İstanbul by 1996 (DİE, 1999). This value can help us to compare market potentials of Ankara and İstanbul for industrial electronics. On the other hand, considering some products, Ankara market has more potential than İstanbul. This is especially true for medical electronics. Biggest health institutions are located in Ankara as the major customers for this subsector.

On the other hand, Ankara has more dominance over Anatolia market though almost all producers in Anatolia have bureaus in İstanbul. Relations of Ankara firms with Anatolia market are more dense. Proximity to Anatolia markets gives a commercial advantage to PE firms in Ankara. This leads to a geographic advantage for Ankara. As another important factor, Ankara firms guarantee the confidence of their local customers with their advanced technological levels and with their dense informal relations.

Despite the less capacity of commercial market in Ankara, public purchasing plays important role in development of professional electronic firms in Ankara. Government and

public institutions were the major customers of Ankara firms in late 1970s and beginning of 1980s. Still professional electronics firms in Ankara are selling important quantities of their production to public.

Labour Relations:
PE firms are engineer and technician based firms. Ratio of these skilled personnel to total employment can rise up to 4/5 in some firms.

Ankara is acting as a human capital source. Graduates from METU or other faculties of Ankara did not want to leave Ankara (most of students who leave Ankara are going to abroad). It is easy to find engineers for R§D in Ankara. Engineer supply in Ankara is more than engineer supply in İstanbul. Labour costs are same in Ankara and İstanbul, but engineer costs in Ankara are nearly 2/3 of engineer costs in İstanbul. Also qualification of engineers in Ankara is said to be more advanced than any other regions.

It is an important point that, though qualification of engineers in Ankara is more advanced, engineer wage levels in Ankara are lower than engineer wage levels in İstanbul. This is related with big electronics production potential of İstanbul. Engineer demand in İstanbul exceeds engineer supply. Interviewed managers claimed that, to find skilled engineers for PE firms was not hard 5 years ago as it is today. The presence of various biggest electronics firms and various electronic trade firms are some obstacles among İstanbul firms to find qualified engineers. Even banks in İstanbul are employing electronics engineers with high wages. These PE firms do not compete in engineer wage levels of the big companies and foreign branch firms or banks. High rates of skilled labour movement between firms is a character for the PE industry in İstanbul. This condition is not totally holds true for Ankara as there is only state owned ASELSAN firm who can attract new graduated engineers.

Technicians graduated from inner Anatolia cities are important human capital source for Ankara firms as most of them work in Ankara after their education.

Related to institutional relations and environmental facilities of Ankara, engineers graduated from faculties

in Ankara do not prefer to work in İstanbul in spite of wage levels are higher in İstanbul.

Institutional Relations:
These types of relations cover inter firm relations, relations with state bureaucracy and informal relations. There is no difference between Ankara and İstanbul considering interaction between firms. It is at minimum level in both locations. Relations are only subcontracting relations with auxiliary producers and commercial relations.

Ankara is important for its dense informal relations. Most of managers and engineers in Ankara firms know each other. There is no strict social network between firms but there are very intensive informal information relations between these firms. This is not the case in İstanbul. They know firms by name but do not know each other. It is noteworthy that, only interviewed persons who take place in high technology based small firms know each other (76). As opposite to their openness in commercial areas, İstanbul firms are closed to outside considering all type of informal relations.

Targets of firms are important for this kind of difference. Basic concern of İstanbul firms is to survive in commercial markets. This has to be first aim of a firm for its survival. On the other hand, founders of Ankara firms enjoy their works at starting periods. After they confront with some difficulties in business life, they become conscious about commercial matters rather than technological matters.

After sales services are strong in both regions. On the other hand, Ankara is advantageous considering customer relations. In most of İstanbul firms, basic consideration is to sell products, but in Ankara there are strict relations with customers beyond after sales services. As an analogy, they marry with their customers.

Relations with state institutions are more visible and dense in Ankara. These relations are mostly at customer level. Face to face relations with state institutions are dense in Ankara. This does not mean that there any advantage for Ankara

firms to be close to state institutions in Ankara. Relations with state bureaucracy have the big overhead costs. There is no help from state bureaucracy to this sector.

It was claimed that Ankara firms have more possibilities to contact face to face relations with state institutions. Also it is possible for firms in Ankara to work with contractors as these people have strict relations with public institutions.

Environmental Factors:
Searching of appropriate locational conditions for technology based electronics production becomes one of the important issue in academic searches that deal with space technology based production relations. In this respect location specific factors offered by different locations become a part of our study. There are some locational factors that Ankara and İstanbul have the potential for development of PE subsector.

Considering professional electronics, all the graduates from faculties tend to stay and work in the the same city. Depending on views of founders, first reason to locate in Ankara or İstanbul is their affinity with that city. This condition is more visible in İstanbul that almost all managers claim that they are very happy to stay in İstanbul despite some environmental and security problems. On the other hand, interviewed people in Ankara only suffer from lack of trade potential for Ankara when compared with İstanbul.

Some managers were claimed that there were some environmental factors played role in their location selection for their production. The presence of the high quality electronics faculty is one of these factors. Another factor is related with living standards in the city. Especially, design facilities in PE work needs place to be more calm and quite. For most firms in Ankara, living standards in Ankara is better than anywhere in Türkiye. In managers' opinion, Ankara is more secure than İstanbul for living. Moreover condition of traffic is an important variable for firms in Ankara. Land values and rental values are cheaper in Ankara then İstanbul at a ratio of 1/2. On the other hand İstanbul had some other

advantages that airport network with foreign countries is more developed. İstanbul has more diversified hotel opportunities for customers that come from other provinces or from abroad.

Living standards are important for person who is working in PE sector. If firm is more technology based, these conditions become more important as this is the case for Ankara firms. All these informations are provided in the table 25.

Table 25. Locational Advantages of Ankara and İstanbul for Professional Electronics Production

	ANKARA	İSTANBUL
ADVANTAGES	EXISTENCE OF METU	DEVELOPED COMMERCIAL MARKET
	ABUNDANCE OF SKILLED MANPOWER	SATISFACTORY LOCAL DEMAND
	STRONG PUBLIC RELATIONS	EXISTENCE OF FAIRS
	STRONG INFORMAL RELATIONS	HIGH EXPORTING FACILITIES
	MORE TECHNOLOGY ORIENTED PEOPLE	ACCESS TO ALL TYPE OF COMPONENTS
	MORE RELATIONS WITH TURKISH STATE	MORE INTEGRATED WITH EUROPA
	DOMINANCE ON ANATOLIA MARKETS	HUGE MONEY FLOW
	ENVIRONMENTAL FACTORS	ADVANCED AIRPORT AND HOTEL FACIL.
		BIG BUSINESS POTENTIAL
DISADVANTAGES	WEAK COMMERCIAL MARKET	EXPENSIVE ENGINEER COSTS
	WEAK MONEY FLOW FROM MARKETS	ENGINEER SCARCITY
	LOCAL MARKET IS NOT SUFFICIENT	EXISTENCE OF IMITATION MARKET
		STANDARD ENVIRONMENTAL PROBLEMS

These findings are important to indicate that location specific factors have strategic importance for technology based production.

From this part of the study, it is concluded that PE industry has some particular characteristics. This is related to externalities as well as it is related to linkage structures and transaction relations. Especially general characteristics of PE firms in different regions resemble each other. On the other hand, externalities as well as linkages and market conditions shapes the performance, development and spatial structuring firms in PE industry.

CHAPTER 5

CONCLUSION

Within the overall structural restructuring of economic relations, industrial production maintains its significance for the vitality of economics. Furthermore, production and utilisation of information related issues have gained unprecedented importance. The combined effects of two phenomena gave way to innovation based industries. Development of such industries and the interrelations among technology, production and space concepts have become even more complex than before. It is a task for planners and geographers to unravel the dynamics of these relations.

Electronics industry is the most strategic industry in the information age among other innovation based industries such as aerospace or genetics industries. Electronics industry is on the way to be the most important and largest industrial sector in the world (Todd,1990; Altay,1996; TESİD Almanacs). Due to its characteristics, innovation and space relations can be best studied in electronics sector. According to new criteria and new relations in technology based subsectors; the firms in electronics industry have their own specific locational characteristics adaptable to evolutionary and network theories which are different from neoclassical industrial location theories.

Electronics industry can be divided into various subbranches according to technological intensity, R§D intensity and innovation process. Within this classification, PE shows the new type of production that is more information intensive and technology based. Even professional electronics can be divided into various subbranches according to their information intensive character.

PE is the sector that reflects the basic characteristics of technology based production because of some reasons as, a-) It is the most engineer intensive sector in total electronics. b-) Vitality of sector depends on innovativeness. c-) There is important technical diversification within products, d-) It requires design and R§D facilities. In addition, there is another important characteristic of PE that products of this sector are used in technological progress of other industrial sectors.

The structure of PE sector can be best adapted to flexible production structure that arises with post Fordist debates. It requires high skill levels. Ordinary labourers in the sector are the technicians graduated from two year faculties of electronics departments. These people are named as intelligent terminals as they have decision right on production.

Production process in this sector can be divided in many parts. This sector may require a vertical integrated structure, but especially firm structure does not fit to a vertical integration structure as technological, industrial and economic opportunities are not make such condition feasible. This is true for firms that are small scale, has limited capital and innovation oriented.

In spite of increasing importance of electronics in world industrial system, electronics production has no importance and it is not a basic sector within Turkish industry. It started to develop after mid 1970s, as this is the case for many developing countries. Production of electronics in Türkiye never reached to level of advanced countries.

Value added of total electronics production is about annually 1.5-2 % of total industrial value added within last 5 years (1993-1998) in Türkiye, also export value is about 2 % of total export value within last 5 years (1993-1998). However these values can rise up to 15-20 % of total industrial production in advanced countries (Todd, 1990). This structure holds true for employment values. Electronics employment is only about 4 % of total employment in industrial manufacturing by 1998 in Türkiye.

Moreover, nearly half of this electronics employment belongs to passive component sector like production of cables, antennas and so on, that is not technology based.

These findings are also valid for PE as it is one of the subsector of electronics. Its value added and GDP shares in total industry are less than 0.3 %. Despite these values, it is the most important technology based sector that has big potential for development. Also, it is a critical sector for the development of technological level of industry in Türkiye. There are no monopolies in the world concerning this sector as products of this sector are very diversified and complex. This condition gives advantage to those countries that want to develop local electronics production. As another implication, also local production of PE is critical for Türkiye to improve its all industrial sector without high investment costs. On the other hand as Türkiye is a peripheral country, evaluation of technology based production such as PE have to be done within realities of this structure. Organisational and spatial structuring of such an industry in less developed or developing countries cannot be placed within a strict model or theory valid for central or advanced countries.

Spatial distribution of PE firms at the regional level is attractive and starting point of our study on spatial structure of technology based production in Türkiye. Regional distribution of PE is totally different from spatial distribution of electronics and other industrial sectors in Türkiye. Though 65 % of total electronics production is agglomerated in İstanbul, Ankara becomes important location for PE sector. Ankara is also known as a nonindustrial based location that value added from industry in Ankara amounts to only 3.5 % of total industrial value added of Türkiye in 1996 (DİE, 1999). In spite of this case, nearly half of PE firms and more than half of PE employment as well as nearly all the military electronics employment are located in Ankara. As these are the technology based subsectors, Ankara becomes an important location for technology based electronics production in Türkiye. This contingent situation has two dimensions. One is the sector itself and other is the location. For this reason, PE firms in Ankara and İstanbul have become our variables in the study. Bursa and Kayseri

locations are also held in order to check some market relations of firms in Ankara and İstanbul.

In our research based on partial participant observations on 40 PE firms in Türkiye, the intention is to understand and evaluate the development of PE industry in the context of the contingencies regarding regional spatial structuring of this industry in Türkiye.

There are several theories, models and approaches related to technology based production such as the Schumpeterian approach, neo-Schumpeterian approach, linear innovation models, evolutionary and network theories, Latin American Approach and so on. All these attempt to explain the dynamics behind technology based production and spatial structuring of these types of industries. Many important problems and issues are discussed within these theories, models and approaches. All these theories, models and approaches give importance to intra organisational structure of firms, externalities, linkage characteristics and transaction i.e. market relations of firms.

In our analysis within the concept of general characteristics of surveyed firms, an important step has been to determine technological and innovative levels of these firms. Measuring the technological capacity of a firm with tangible elements is very difficult as we have only R§D measures in hand. Reliable values to determine technological level of surveyed firms can not be given. On the other hand it can be claimed that, incremental innovation is the common and basic characteristics of PE firms of Türkiye. This is usual as these firms are small and medium scale firms and had scarce resources. It is a sign that technology in industry can not be evaluated by inventiveness and even radical innovativeness. Incremental innovation constitutes technological base of PE firms.

Three variables, i.e. externalities, linkage structures and transaction relations become our tools to understand spatial structuring of PE industry in Türkiye. Innovative basis of Türkiye at macro level and history of electronics and PE industry gives us information on effects of externalities related with macro economic environment and conjunctural changes. Under these conditions, the presence of technology based electronics production is a contingent

situation itself. Within such external conditions, firms in PE sector have to be appreciated even for their survival.

In order to understand linkage characteristics and transaction relations of firms, two methods were utilised. One is to derive common points of firms and other is to derive differences between these firms. These helped to understand how linkage and transaction relations influence general and spatial structuring of PE sector in Türkiye. The study on differences among firms in Ankara and İstanbul have been given particular emphasis. Moreover there are some location specific factors that effect these similarities or differences of PE firms. Commercial opportunities, presence of universities, condition of communication infrastructure are all these types of factors. There are also some differences that come from historical background of firms in different locations. These are evaluated as location specific externalities.

Certain common characteristics for PE firms can be outlined as; a-) small scale in character, b-) having limited capital, c-) being engineer intensive, d-) presence of strong after sales services, e-) importance and intensity of supplier relations, f-) weak university linkages, g-) weak inter firm linkages, h-) own design capability. In addition to these characteristics, almost all firms have established as personal firms although firms in İstanbul are oriented to more standardised products. All firms had a change within its organisation or production within the last three years. These firms tend to grow to the point that one person can still manage the activities of the firm. In other words, the limit of these firms does not go beyond one's control.

A high level of flexibility has been observed in all firms. With increasing technological possibilities and increasing number of auxiliary producers, this situation calls for vertical disintegration. Intense subcontracting relations and dense information gathering facilities are common for all firms. On the other hand, different characteristics for firms especially in Ankara and İstanbul are; product differentiation, intensity of informal linkages, relations with public institutions,

market opportunities, intensity of using own designs, intra metropolitan locational styles and so on.

Especially one of the basic distinction comes from market structures and commercial relations. Market structure effects technological outcome of firms in this sector. Intensity of industries in Marmara region and their immediate demands leads İstanbul firms to produce more standardised products and systems. On the other hand, Ankara has specialised on customised products as its market is diversified and there is not much demand pressure on it.

Some important results can be concluded from our analysis that externalities played important roles in the establishment of PE industry in Ankara. Following this, their innovative characteristics, their informal linkages and their market relations that depends on trust relations play important role for their sustainance despite their commercial weaknesses among İstanbul firms. This study also shows that any factor alone is not effective on the development and spatial structuring of PE industry in Türkiye. Rather it is the combination of certain factors that give way to development of this particular industrial sector.

Historical process can give us hints about how externalities played role on the establishment of firms in Ankara. Establishment of early firms in Ankara depends on public purchasing. Ankara, as being the capital city of Türkiye hosts the central government whereby public expenditure constituted a significant factor. Also import substitution policies of 1970s and lack of commercial market related to this factor played positive role in development of this sector as early firms do not suffer from competition very much. Except for general public expenditures, there was no special effort of state bureaucracy to develop this industry in Ankara. In this sense, only establishment of Aselsan in Ankara played an important role on future establishments of PE firms in Ankara till early 1980s. The establishment of state owned military electronics industry in Ankara leads to an important external effect for the development of PE industry in the city. As another important factor, those firms in Ankara had the accessibility advantage compared

to those firms in İstanbul. Underdeveloped transportation and communication systems were advantages for Ankara firms to be more active in Anatolia markets. It was easier for Ankara firms to access Anatolia markets than İstanbul firms in 1970's and early 1980's.

It is impressive that until the 1980s and 1990s, Ankara maintained her leadership in PE even though all desirable conditions for its development were changed. Increasing transportation and communication facilities, changing economic policies, increasing globalisation opportunities, changing economic relations were all favourable conditions for İstanbul firms throughout the period of late 1980s and 1990s. However, it is observed that within time Ankara firms gained some degree of technological ability. This condition played important role on the continuous development of this sector in Ankara beyond keeping its traditional position. We can understand this from the condition that, half of established PE firms after 1995 had been located in Ankara. This has to be stemming from some other factors apart from transaction relations for success and survival of firms.

Ankara has innovative capacity whereas it has several commercial weaknesses. Because of this deficiency, even though Ankara firms have markets, they are small and their growth potential has not developed. Depending on innovation potential of the PE sector and educational infrastructure and as well as presence of military electronics in Ankara, it is debatable that Ankara as capital city of Türkiye is on the way of becoming a technology center in terms of technology based electronics industry. This vision is mostly related with emerged technology based electronics production culture of Ankara. This situation is more related with informal linkage and trust relations emerging in Ankara rather than transaction relations or policy externalities. Ankara has the capacity to be an innovative milieu. Because, collective learning takes place with strong informal linkages and customer-supplier relations. Moreover some mechanisms such as the presence of largest medical centres play important role for the development of medical electronics market. On the other hand, collectivity has not developed among firms in Ankara.

The firm survey has shown the importance of linkage structures of firms in addition to their transaction relations. These linkages mostly depend on informal information relations. Face to face contact and a common cultural background becomes quite important in establishing these relations. Managers of Ankara firms are of the same age group, as most of them are between 35-45 years of age. Their educational backgrounds that they are all graduates of METU, seem to play an important role in their personal relations. This point indicates another important aspect of technological infrastructure of a particular location. This refers mostly to educational infrastructure. Graduates from universities play important role on the establishment of firms in PE sector. On the other hand, the presence of universities is not an attractive factor for firms, because there is no desired support from universities and university industry collaboration does not exist as it is the case in most of the developed countries. Only the presence of graduates and their personal informal information relations with universities have appeared to be important factors for the development of PE sector.

These findings indicate that externalities that have originated from locational conditions are important in shaping innovation process. Furthermore they also show that organisational characteristics of firms are not the sole factors that influence the spatial structuring of PE sector. Important factors in spatial structuring are external factors such as government policies, relations with public institutions, educational infrastructure and informal linkages between firms. These are all the signs of common production culture.

When the linkage structure of PE firms were analysed, it is observed that the structure of Turkish PE firms and relations between these firms do not totally applicable to theoretical discussions concerning linkages, formal information exchanges, networking issues as these are the basic concepts and issues in recent theories of technology space relations. As it was mentioned before, a strong informal linkage structure and very limited learning process exist within sample firms.

This research shows us how combination of three factors that are externalities, linkage structures and transaction relations effect spatial structures, intra organisational structures and technological considerations of PE firms.

Using PE example in Türkiye, we can derive a spatial structuring of a technology based industry model that combines three factors. Depending on all information up to now, there are two groups of factors that have effects on technology based PE industry. First group includes those factors that an individual firm can intervene and have a role on them. This is also divided into two main factors as a-) transaction relations that consist market relations of firms and b-) network relations that consists all type of linkages with every actor except market and sales linkages. Second group includes externalities and factors that any firm has no possibility to intervene. Also this group can be divided into two as a-) macro economic conditions and global events such as state policies, global crisis, disasters and so on, b-) location specific factors that offer some kind of possibilities to firms. Historical processes play important role on the presence of these externalities.

All these factors are tightly related to each other and cannot be easily separated. With the integration of these factors, we can derive a spatial model for technology based production shown at figure. 3 in the next page. Here linkage, transaction and externalities concepts are utilised.

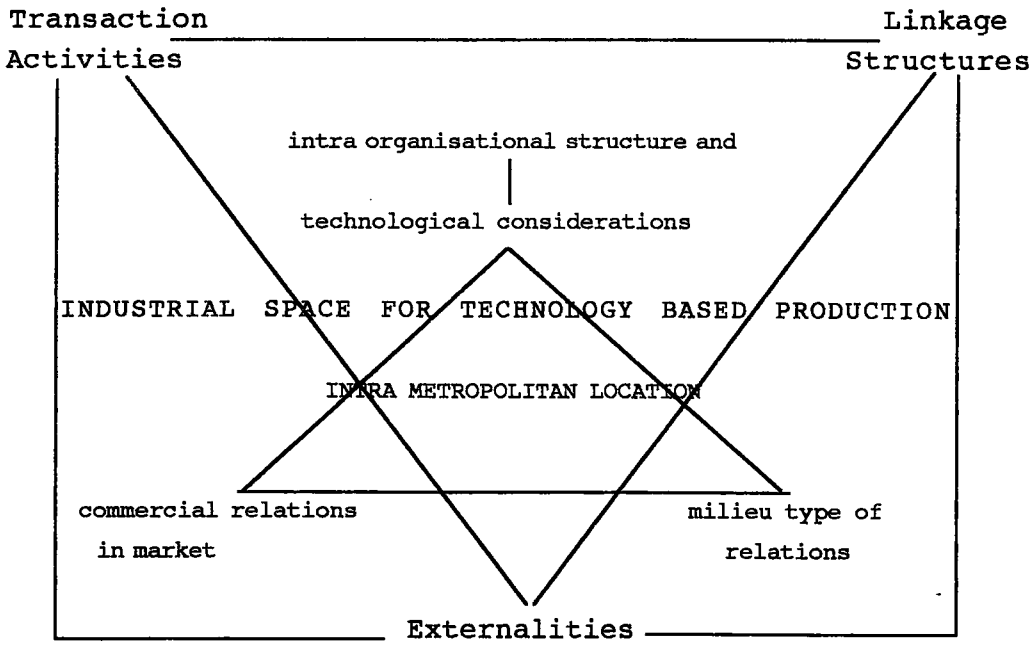

Figure 3. A Spatial Model For Technology Based Production

There are some interactions between these factors such as,
Transaction- Linkage Interactions:
Effects are mutual. Linkage actions such as linkages between firms and alliances can effect market conditions as well as specific market conditions shapes the linkages between firms. For example, there are strong informal relations between managers of Ankara firms considering evaluation of market conditions and supplier relations. Also, customer relations and some kind of transaction activities can be included into linkage relations. Donkels and Lambrecht in 1997 explained business considerations within a network structure (Donkels and Lambrecht, 1997). In the era of globalisation, especially new PE firms that locate in several KOSGEB's try to conduct new transaction linkages with foreign firms in technology and several collaboration subjects.

Linkage- Externalities Interactions:
Some locational specific factors ease linkage facilities. Union of firms in any place courage entrepreneurs. Also linkages and its opportunities themselves create externalities for firms. For example, METU plays important role in educational infrastructure of Ankara.

Unlike İstanbul, managers that graduated from METU have strong relationships (especially these are informal and informational relations) with each other. In early years of PE industry in Ankara, strong linkages between PE firms and strong linkages with customers played important role in development of this industry in Ankara. These factors still play important role in success of firms in Ankara though firms in İstanbul have more opportunities concerning market conditions. Linkage and externalities factors are important to define a milieu concept (see part 2.1.3).

Externalities- Transaction Interactions:
Competitive characteristics of a production or firm is considered as one of the determinant of external environment (Tornatzky and Fleischer, 1990). Moreover, location specific factors effect transaction activities as some places may not be commercial oriented or have possibilities of more integration with world markets as these are the cases for Ankara and İstanbul. Also government policies can play role in market conditions of any firm. Especially role of government in determining market size is important as this was the case for PE sector in 1970s. Development of professional electronics in İstanbul in 1970s was due to large size of the local market though there were several disadvantages of İstanbul when compared with Ankara. In those years, Ankara firms have more opportunities to access Anatolia market. This is another factor for development of PE in Ankara. These two concepts; externalities and transaction relations are the basic determinants of market relations.

These 3 factors (linkage issues, transaction relations, externalities) have effects on intra organisational pattern of firms and this intra organisational pattern is important in shaping the technological level of any firm. Especially these three factors are determining elements of technological capabilities of PE firms. Technological capability depends on power of linkage capabilities of firms, position of these linkages and firms in market.

In the model, rectangle area between all these factors considers spatial structure of technology based production

and all related issues with these 3 factors are the main determinants of spatial arrangement of PE firms in Türkiye.

Technological considerations, market linkages and milieu factors derived from interaction of three factors are the most important determinants of intra metropolitan locational pattern of technology based firms which can be observed from model. Presence of many engineers, existing linkages with other firms and customers, and informal information relations require proximity to each other and center.

This model has a peculiarity that network linkages and milieu concepts differs from theoretical considerations of developed nations. In Turkish conditions, linkage relations especially do not refer to formal interfirm linkages but informal linkages between them and linkages with customers, supplier firms and other institutions.

Even this model is hold true for all firms, it can be applied to different locations. Left triangle is most appropriate to firms in İstanbul, on the other hand Ankara firms can be adapt to the right triangle of the model. In other words, left part is more effective in İstanbul, on the other hand, right part of the model is more valid for Ankara. Especially transaction relations with external conditions that support these transaction relations have more role on spatial structuring of firms in İstanbul whereas some linkage relations and linkages with externalities depend on military and governmental effects are more effective on spatial structuring of PE firms in Ankara.

Clearly, PE subsector as an example for technology based production is a specific sector and has several characteristics that shape the spatial structuring of itself. Not only market relations are sufficient to explain this structuring as well as linkage and linkage approaches are not capable of explaining spatial structuring of this sector in Türkiye. Externalities that cover all types of external impacts within historical process and location specific factors mixed with transaction and linkage opportunities can be considered as

being capable of understanding spatial structuring of technology based production in Türkiye.

All of these findings are special for PE sector in Türkiye, however they can be generalised to a some extent.

Findings and claims of several theories, models and approaches cannot be totally applicable for the situation of PE sector in Türkiye. Türkiye has its special characteristics and analysis of a technology based production have to be provided according to these characteristics. A mix of these universal findings and claims can tell something about structuring of this type of technology based industry in Türkiye. This condition depends on special economic and social conditions of a developing country Türkiye.

The number of firms in PE sector is very few, and sectors' share is quite negligible in Turkish industrial production. However this sector has a big potential for development. Technology based structure of this particular sector provides a strategic significance for the further development of technological level of industry in Türkiye. The development of this sector with right industrial policies and right organisational structures will lead to new researches to clarify spatial structuring of technology based production.

ENDNOTES

(1) Between 1993 and 1995, at an average, 20 % of total GDP in productive sectors were belonging to electronics industry (S.I.S.,1997). This means that about 4 % of total R$D spending in Türkiye belongs to electronics sector. This value is about annually 7.36 trillion T.L. (98 prices)

(2) There are total of 5 firms that are owned by public. Number of work force in these firms constitutes about 8.5 % of total electronics employment in Türkiye. Two firms deal with telecommunication subsector, two firms deal with professional electronics and one firm deals with military electronics.

(3) 80 % of publicly owned firms (4 firms) take place in Ankara. Also, about 92 % of total work force in publicly owned firms are employed in Ankara.

(4) Data is taken from Union of Chambers and Community Exchange-1998, Ministry of Industry-1995, Electronics Industry Association-1998, List of Chamber of Industry in Ankara-1997, List of Chamber of Industry in İstanbul-1997, Automation Fair Catalogues-1995,97,98.

(5) İstanbul has over 70 % of total employment in consumer electronics and telecommunication sectors throughout Türkiye. On the other hand about half of İstanbul firms and 38 % of İstanbul's electronics employment are dealing with component subsector. Though, 60 % of computer fitting firms take place in İstanbul, about 65 % of total employment in this sector take place in other regions. This is a result of small firm size in İstanbul. On the other hand there are big firms in other regions such as Vestel monitor factory in Denizli.

(6) İzmir has only 7% of the employment in total electronics sector. İzmir's internal structure resembles İstanbul as it can be observed from table.7 On the other hand, concerning number of employment, consumer electronics is the major electronics subsector in İzmir.

(7) Annually there was about 5.3 trillion T.L (1998 prices) spent on R$D in electronics sector between 1993-95.(Derived from DIE statistics of R$D). About 12.6 % of this yearly spending belongs to professional electronics subsector, 13.4 % belongs to software partnerships and 74 % belongs to consumer electronics, telecommunication and component subsectors. These values show that about annually 667 billion T.L. was spent for R$D activities in professional electronics subsector. This is about 5.3 % of yearly production of professional electronics between 1993 and 1995. If we

assume that 1/3 of software R$D spending belongs to professional electronics subsector (it is shared between military, professional electronics and telecommunication), this value rise to 7.4 % annually. On the other hand percentage of R$D/total production is about 2.34 % concerning consumer electronics, telecommunication and component sectors altogether. If we add 2/3 share of software R$D spending into the calculation, than share of R$D spending of these total 3 sectors will rise only to 2.62 % of annual production between 1993-1995.

(8) Data is taken from Union of Chambers and Community Exchange-1998, List of Ministry of Industry-1995, List of Electronics Industry Association-1998, List of Ankara Chamber of Industry-1997, List of İstanbul Chamber of Industry-1997, Automation Fair Catalogues- 1995, 97, 98.

(9) LQ values of total electronics sector for different locations are as, Ankara: 4.11, İstanbul: 1.95, İzmir: 0.61, Other Places: 0.33. On the other hand, LQ values of professional electronics subsector for different locations are such as; Ankara: 11.58, İstanbul: 1.30, İzmir: 0.62, Other Places: 0.09 (Values derived from firm data and DİE,1998).

(10) Twenty-eight firms (36 % of total firms) have between 0-24 employees. Thirty-six firms (47 % of total firms) have between 25-99 employees.

(11) Though firm size is not sufficient to qualify structure of a firm, it is an important measure to understand contemporary position of firms towards the market. There are many arguments on classification of firms according to their sizes. Even though the problem of scale is not only the quantitative one, we have to accept a certain criterion. The employees appear to be a proper measure for determining firm scale. We accept, firms that have 1-9 people are in very small size, firms that have 10-49 people are in small size, firms that have 50-199 people are in medium size and firms which have greater than 200 people are in large size. (Values are from Müftüoğlu, 1998) Age is another important concept in the institutional evaluation of these firms. It is accepted by firm owners that 0-3 ages are the pre- nominee period to become a producer, 4-5 ages are the nominee period to become a producer, 6-10 ages are standstill period that being a nominee position is still continuing, but standards are appearing. 11-15 ages are the period that firm get out from nominee position. Over 15 years is the period of maturity.

(12) The aim of the research was to understand different peculiarities of technology based professional electronics firms in Türkiye. An interview in this research contains 5 general parts. These are;
I-) At the first stage, general characteristics of firms were concerned. These characteristics include:
A-) Some basic structural characteristics as;
* date of establishment,
* number of employment and engineers,
* status of firms,
* primary activity of firms.

B-)Characteristics of basic entrepreneurial functions as;
* administration,
* financing,
* marketing,
* production peculiarities.

C-) Within this general information, historical backgrounds of firms were also asked. Most important factors in their historical process were important turning points they confront with. These can be an invention of a new
product or process, new methods in marketing, new financial opportunities, firm marriages and so on. It will be analysed whether these factors vary according to location of firms or not. From this point, effect of locations on historical processes of firms and impact of several turning points on location of firms will be handled out.

D-) Fourth part includes work force, employment relations within the firm.

E-) Fifth part of general information is related to defining technological level of firms. Important points are;
* dependency level of technological development process,
* existence of local design capability,
* existence of formal or informal R§D,
* existence of software in products and way of using,
* external information gathering facilities such as
  i-) participation to industrial fairs,
  ii-) utilisation of internet etc.
  iii-) literature following
* peculiarities of innovation process within the firm.

Apart from this information, also technological awards, taken patents of firms were researched if exist.

II-) In the second part of research, network relations of firms were searched out. These relations were composed of such relations like;

A-) Investment-production relationship: These relations include vertical and horizontal production relationships.
* Inter-firm relations such as
  i-) Supplier relationships,
  ii-) Subcontract relations,
* Intra-firm relations (especially personal relation-ships) which identifies the role of firm within a production line.

B-)Technology based linkages are surveyed. These include,
* linkages and partnerships with universities,
* linkages and partnerships with research institutions,
* linkages and partnerships with other firms such as
  i-) subcontracted R§D
  ii-) common R§D,
  iii-) formal information relations
  iv-) informal information linkages
  v-) partnership in production
  vi-) labour exchange
  vii-) common education programmes
* informational relations with customers,

C-) Relations with public and public institutions were examined included,
* incentives,
* export relations with public,
* most related public institutions,

* relations with civil organisations are searched out.

III-) In the third part of the research, transaction relations of firms were are analysed. These include;

A-) Market relations included in this part. Within it there are

* product service category,
* locational market concentration,
* primary customer type,
* export activities were all asked to firms.

B-) Trade relations

* existence and condition of after sales services,
* existing representations
* marketing structure such as direct sale, sales with vendors etc.

IV-) Fourth part in research is organised to understand locational preferences of these firms directly. Mostly, Open end questions were asked in such this part within 2 main group as;

A-) Regional aspects

* personal and institutional reasons for location in that province,
* advantages and disadvantages of the region at the time of establishment,
* advantages and disadvantages of the region at later stages of the firm,
* impact of universities in that regions
* existence of bureaus and vendors in other regions
* impact of firms in same province/region

B-) Inner City Aspects

* personal and institutional reasons for location in that locality,
* advantages and disadvantages of that locality in the city at the time of establishment,
* advantages and disadvantages of that locality in the city at later stages of the firm,
* displacement activities within city,
* existence of bureaus and other parts of firms in same city.

V-) In the next part entirely open ended questions were asked in order to get information on

- their shortcomings,
- their future aims,
- views on existing conditions and future of the sector.

(13) These firms are ERA, ELSİS, NÜVE, PETAŞ, ELİMKO, ELSİM.

(14) EEC, EKA in İstanbul, ENERSİS, TETA in Ankara are examples for firms who established group of firms. GATE firm in Ankara is on the way to establish a group.

(15) This is true for relatively bigger firms in Ankara such as TETA, ENERSİS, ELİMKO. On the other hand, we face with more institutionalised structure especially in big firms of İstanbul. This type of firms such as CEDETAŞ, EEC, ESİT, have professional managers.

(16) Very few of them (ELSİS-NEL-NÜVE) in Ankara were established as group firms of construction firms that have big financial opportunities at the beginning. Within few years, they left their companies and began production with their own finance.

(17) Only one firm in Ankara; ETA is a member of international group of firms (TARGET).

(18) Relatively big firms in Ankara and İstanbul such as TETA, ENERSİS, NEL, NÜVE (Ankara), CEDETAŞ, EKA, ESİT, EEC (İstanbul) have marketing departments. Marketing opportunities are the weakest in Kayseri firms except HES group.

(19) About 60 % of firms in İstanbul were established by İTU graduates. About 75 % of firms in Ankara were established by METU graduates or METU teachers. Also founder of Bursa firm was graduated from METU. One firm in Kayseri was established by a graduate from Erciyes and other was established by a Boğaziçi graduate.

(20) Engineers that work in the İstanbul firms are graduated from İTU (40 %), Yıldız (30 %), Boğaziçi (15 %), Uludağ(5 %), METU (4 %), Others (6 %) respectively. Engineers that work in the Ankara firms were graduated from METU (65 %), Hacettepe (20 %), Gazi (5 %), ITU (5 %), Others including Bilkent (5 %). Engineers in Kayseri was graduated mostly (80 %) from Erciyes University and engineers in Bursa firm are from Uludağ and ITU.

(21) Founder of one firm (EKA) in İstanbul was not an electronic engineer. Also founders of 4 firms in Ankara were not engineers. These Ankara firms are ELSİM, YESTAŞ, UTES and EPROM.

(22) The founder of one infant firm in Ankara (MEDİSPO) and shareholder of one firm in İstanbul (POLARİS) are women. Besides, number of women engineers or technicians is negligible within interviewed firms. Women in these firms do secretary and other types of service works. Only EKA firm in İstanbul employs foreign engineers. Apart from this firm, there were no foreign engineers employed in any interviewed professional electronic firm. Firms that have bureaus in foreign countries (ENERSİS- TETA) employ foreign engineers in these bureaus.

(23) There are very few quantitative values about measurement of technological level of professional electronics firms. Some of these criteria are engineer percentage, ratio of their technology based marketed goods to all goods, R$D expenditures etc.

(24) This value varies between 20 and 23 in Ankara and İstanbul and lower in Bursa and Kayseri (15 %).

(25) In ERA firm that produces less technology based automotive electronics, this percentage is about 9 %. In relatively big firms, this ratio gets bigger such as in TETA-ENERSİS-NEL (Ankara), EEC-EKA (İstanbul) firms. Also this is higher in software based firms such as in MEKO-ETA-TETA-GATE(Ankara) and ELİAR (İstanbul)

(26) About 86 % of firms -18 firms- in Ankara and 77 % of firms -10 firms- in İstanbul, one firm in Kayseri and only one interviewed firm in Bursa has 100 % of own design capability.

(27) Less technology based firms (YESTAŞ, UTES, ELSİM in Ankara, ERA, EDS in İstanbul, AAZ, ENDSİS in Kayseri) have almost minimum R$D activities.

(28) Only CEDETAŞ is working under license. Also, only 15 % of firms (EKA, CEDETAŞ) in İstanbul have know- how transfer from abroad and only one firm has this kind of know-how transfer in Ankara (NÜVE).

(29) About 77 % of firms -10 firms- İstanbul and 86 % of firms -18 firms- in Ankara use different rate of software in the production. Also, EMKO in Bursa and ENDSİS in Kayseri need software in their production. Necessary software for production is self produced in all these provinces. (Software in some firms may mean machinery language that guarantees proper work of that device)

(30) For İstanbul firms, all these works are given to firms which take place in same province. This ratio is about 90 % in Ankara firms. Remaining work is subcontracted to İstanbul and Denizli firms. Bursa firm has its auxiliary works in Bursa and Kayseri firms subcontract various works to firms in İstanbul.

(31) For example ELİAR in İstanbul, PETAŞ, PCK, MEKO firms in Ankara are these types of firms. PETAŞ firm is an interesting example that this firm was started as vertically integrated firm. After some time, its machinery became idle and this firm started to produce integrated circuits for other firms. Also ELSİS was such a vertical integrated firm but in time they left behind this condition.

(32) These firms are ENERSİS and TETA firms in Ankara.

(33) Eight firms (62 %) in İstanbul have no relation with universities, one firm (8 %) grew in İTU KOSGEB, two firms (15 %) tried collaboration with universities but it was failed. Only two firms, ERA and EKA (15 %) have healthy relations with universities at KOSGEB level. This situation is not much different in Ankara. Twelve firms (57 %) have no relation with universities. Three firms (14 %) grew in METU KOSGEB, three firms (14 %) tried collaboration with universities but it was failed. One firm (5 %) had a collaboration in the past. Only two firms in Ankara, GATE and ELİMKO (10%) work on common projects with universities.

(34) Seven firms (54 %) in İstanbul, fifteen firms (72 %)in Ankara have almost no type of relationship with research institutes. Mostly information exchange exists between firms and research institutes instead of direct collaboration. Also some personnel in these firms are still working as part time engineers in TÜBİTAK. One firm (ESİT) in İstanbul and two firms (ETA-GATE) in Ankara have a collaboration type of relationships with TÜBİTAK. Also one Bursa firm had this type of relationship. Two firms in Ankara (SİSTEK-MOSTEK) had this type of relation in past. Kayseri firms had no relation with research institutions.

(35) For example, ELİAR and POLARİS in İstanbul have some contacts with software firms, EKA in İstanbul has strategic relationship with TÜMEL in İzmir. Six firms in Ankara (MEKO-ELSİS-ETA-PCK-ON-ORTANA) have relations with some other electronics, software, research firms.

(36) ON and ELSİS firms (10 %) in Ankara have R$D partnerships with other firms. Only one firm (EKA) in İstanbul had such a relation

in past. There is no kind of firm collaboration concerning firms in Kayseri and Bursa. Two firms (EEC-EKA) in İstanbul had done a subcontract R$D in past. One firm (ELİAR) is doing subcontract R$D now. Three firms (KARDIOSIS-ELSİS-MOSTEK) had done subcontract R$D in the past. 2 firms (ETA-TETA) are doing subcontract R$D now. There are no such relations exist in Kayseri and Bursa firms. Common R$D is seen between the firms who has strategic relationships. There is only one example of collaboration on product development is observed in Ankara between ON-SİNTEK firms on enumerating electronic boards on traffic lights.

(37) EDS firm in İstanbul had done some subcontracted work for Aselsan and EKA as another İstanbul firm, has informational linkages with Aselsan.

(38) About 80 % of İstanbul firms and 86 % of Ankara firms have continuous information exchanges with customers. Other firms in Ankara and İstanbul have informational relations with customers at sometimes. These relations are standard for Kayseri firms and so tight for Bursa firm.

(39) We can define customer types according to subbranches as;
Standard equipment: end users, transportation firms,
computer firms, industrial firms.
Security-alarm systems: hotels, banks, contractors,
jewel shops, public institutions,
end users, other shops, computer firms.
Industrial electronics: industrial firms, military,
public institutions
Medical electronics: hospitals, health institutions
Other type of electronics: public institutions,
universities, military, schools,
end users, firms.

(40) This condition is more visible in Ankara. MOSTEK (performance test device), KARDİOSİS (ECG device), GATE (default finding system), PCK (kidney stone crusher), EPROM (video link systems) firms are examples from Ankara that have no local competitors.

(41) Within interviewed firms, direct competition occurs between EMKO(Bursa), ELİMKO (Ankara), SİSEL (İstanbul) in control systems, between ELİAR (İstanbul) and SİSTEK (Ankara) in automation systems, between ON (Ankara) and ORTANA (Ankara) in electronic boards, between EKA (İstanbul), OES (Ankara) and EGES (İstanbul) in uninterrupted power supplies, between TETA (Ankara), EEC (İstanbul) and ENSER (CEDETAŞ-İstanbul) in security systems, between ELSİM (Ankara) and ENDSİS (Kayseri)in alarm systems.

(42) EEC, ERA firms are some examples from İstanbul. In Ankara, we observe this condition in firms like NÜVE, ELSİS, ELİMKO, ELSİM, UTES, YESTAŞ. Percentage of firms that started with professional electronics production is 65 % in Ankara. This value is 38 % in İstanbul. About 20% of Ankara firms were started as trader or engineering firm. This value is about 38 % in İstanbul. Remaining firms (15 % of Ankara firms and 24 % of İstanbul firms) were started

as a producer of different branch of electronics. Two firms in Kayseri were started as a trader and one Bursa firm started as a producer. These values give us important difference between Ankara and İstanbul firms.

(43) About 40 % of İstanbul firms are active in different sectors rather than professional electronics. These firms are active mostly in electric sector. CEDETAŞ, EEC, ERA, EKA, POLARİS are the examples. Two firms in Ankara (10 % of Ankara firms- PETAŞ, ENERSİS) are active in other sectors like components and electric sector.

(44) Five firms (38 %) in İstanbul had take representative of one or more foreign firms. On the other hand, nearly half of the firms (11) in Ankara had take this kind of representatives after their establishment. Also one Kayseri firm (1/3) had taken representatives after its establishment.

(45) ENERSİS- ETA- TETA- MEKO- MOSTEK in Ankara (24 % of total firms in Ankara), CEDETAŞ- BAYKON- POLARİS- ELİAR in İstanbul (31 % of total firms in İstanbul) are this type of firms.

(46) All founders in İstanbul had an experience in electronics sector. On the other hand, only 40 % of founders of Ankara firms had an experience in electronics sector before they established their firms. In Ankara, about 50 % of the engineers had no experience. This ratio is also true for Kayseri and Bursa. On the other hand, about 75-80 % of engineers in İstanbul had an experience.

(47) SİMKO-VESTEL- NETAŞ- TELETAŞ- BEKO are some giants firms of İstanbul.

(48) Almost all technicians in İstanbul firms were graduated from schools in İstanbul. Also there were few technicians (10-15 %) that came from Thrace, Bursa, Kocaeli. Nearly 60 % of technicians in Ankara firms are graduated from Ankara and 40% of them are graduated from schools that take place in inner Anatolia provinces. (Çankırı-Kırıkkale) Technicians work in Kayseri and Bursa firms were graduated from schools in these two provinces.

(49) Nearly all İstanbul firms attend trade fairs. This ratio is 1/2 for Ankara firms. Kayseri firms never participate to trade fairs. Bursa firm is usually attending these kinds of activities.

(50) These firms are EKA and ESİT in İstanbul and PETAŞ, ELİMKO, KARDİOSİS in Ankara.

(51) ISO 9001 certificate is given to firms who has self design process, had a capability to develop the design, produce device or system which is designed by own efforts and recommend it to market. ISO 9002 certificate are given to firms who do not involve design process but whom involve in production process (KOSGEB Yayın No: 1994.12, 1993).

(52) Number of firms that have ISO certificate in İstanbul (EEC-EDS-EKA-ESİT) are more than firms that have ISO certificate in Ankara (PETAŞ- KARDIOSIS- ELİMKO). Also EMKO in Bursa has ISO 9001

certificate. Also one firm in İstanbul (SİSEL) and one firms in Ankara (NEL) was applied for this ISO 9001 certificate. 1 firm in Ankara (GATE) has ISO 9002 certificate.

(53) EKA in İstanbul, PETAŞ in Ankara had taken this award.

(54) Projects of two ABC CEDETAŞ and EKA firms were supported by Technology Development Foundation of Turkey. Two supported projects of EKA firm in İstanbul are still continuing.

(55) About 24 % of total professional electronics firms (9 firms) do some kind of subcontract works for other firms. About 38 % of İstanbul firms (5 firms) do subcontract work for other firms. Only 19 % of Ankara firms (4 firms) do subcontract work for others. One firm in Ankara had done this type of work in the past. EGES in İstanbul and NÜVE in Ankara do subcontract work for foreign firms. None of Kayseri and Bursa firms do subcontract works.

(56) İstanbul firms obtain components from direct import at the rate of 40%, importers from İstanbul (40 %), İstanbul market (20%). Ankara firms obtain components from direct import (50%), importers from Ankara (10 %), importers from İstanbul (10 %) and Ankara market (30 %). (İstanbul and Ankara markets mean firms who sell domestic goods) Bursa firm directly imports its component and Kayseri firms get their component from İstanbul market.

(57) About 46 % of İstanbul firms have informal information relations with friends at other electronics firms or universities. This ratio is about 77 % for Ankara firms.

(58) In İstanbul 62 % of firms -8 firms- get incentives. (3 firms get R§D, 5 firms get export incentive). This value is about 19 % -4 firms- in Ankara. (2 export, 1 technology credit, 1 investment incentive). None of Ankara firms get R§D incentive. For other regions, EMKO in Bursa and HES in Kayseri get incentives from state.

(59) Ankara firms sell their products to state at the rate between 20-30 %. Only 3 firms have no sales to public and 3 firms take this level at minimum. About 62 % of firms -13 firms- in Ankara are selling their products at different rates to state. Only 15 % of firms -2 firms- in İstanbul have commercial relations with state. Also 2 Kayseri firms have trade relations with state at the rate of 10-20 %.

(60) Two of relatively biggest firms in İstanbul (CEDETAŞ-EKA) are selling their products especially to military institutions among other public institutions. Also, several firms in Ankara (ETA, GATE, ORTANA) sell about 10-15 % of their products to the military.

(61) Especially big city centres and industrial centres such as İstanbul, İzmit, Kayseri, Bursa, İzmir, Konya, are important markets for Ankara firms.

(62) Kayseri and environment are the primary market for firms in Kayseri and Marmara and İstanbul are the primary markets for the firm in Bursa.

(63) About 46 % of firms -6 firms- in İstanbul have export activity. Only 33 % of firms -7 firms- in Ankara have an export activity. Export of Ankara firms is about 10 % of their total production. This value rises to average of 20 % for İstanbul firms.

(64) About 40 % of firms -5 firms- in İstanbul and 70 % of firms -14 firms- in Ankara take representation of foreign firms.

(65) Firms in Kayseri and Bursa have no foreign representations. Only one Kayseri firm is representative for several Turkish firms.

(66) In İstanbul, 77 % of interviewed firms -10 firms- take place in industrial site. Nearly 15 % of İstanbul firms -2 firms- take place within metropolitan area and one firm was located at the periphery of İstanbul. However in Ankara, 10% of firms -2 firms- take place in inner city industrial sites, other 10 % of firms -2 firms- take place in industrial site at the periphery. Remaining firms in Ankara (80 %) take place near to city centre. Two firms in Kayseri take place within metropolitan area and one Bursa firm takes place in industrial site.

(67) About 85 % of İstanbul firms are the owner of their workplaces. This ratio is about 80 % in Ankara. About 23 % of İstanbul firms (CEDETAŞ-EKA-EEC) own a complete building. Only one (EEC) building takes place within center. In Ankara, 29 % (ETA-TETA-ENERSİS-ELİMKO-PETAŞ-PCK) of firms own their buildings.

(68) In İstanbul, 77 % of the firms -10 firms- have all its activities within same building. In remaining firms, especially selling departments are located at different parts of the city. This is true for firms that are distant from centre. In Ankara, 52% of the firms -11 firms- have all its activities in same building. Five firms have head-offices apart from their production spaces. These are relatively biggest and oldest firms of Ankara (PETAŞ, ELİMKO, NÜVE, GATE, ELSİS). Four firms have another place for secondary production especially for mechanics (MEKO, ORTANA, ETA, PCK). Only one firm (ELSİM) has its selling department different from production location but this place is in same district. Buildings of PETAŞ and ELİMKO are used for other type of activities apart from production. In Kayseri and Bursa, all departments within firms take place within same building.

(69) About 31 % of the firms -4 firms- in İstanbul have an office in other cities. The offices take place mostly in Ankara and İzmir. On the other hand, about 67 % of firms -14 firms- in Ankara have another office at other city centres. These are all metropolitan areas and industrial centres of Türkiye. These firms all have offices in İstanbul. İzmir, Bursa, Kocaeli are the other cities. Bursa firm has vendors at 9 provinces. Only one Kayseri firm (HES) has an office in Ankara.

(70) Movement rates of these firms are so high. Among 80-85 % of all interviewed firms moved once in their history in Ankara and İstanbul. About 46 % of İstanbul firms (6) moved twice or more however this value is 19 % (4) for Ankara. Bursa firm has moved from city centre to industrial site. Kayseri firms have no movement

in their history. Only one firm (ERA) in İstanbul changed its region as it moved from Ankara to İstanbul in early 1980s.

(71) About 23 % of firms -3 firms- in İstanbul and 43 % of firms -9 firms- in Ankara have a decision to move from their places in future. Two firms in İstanbul have a decision to move industrial site and one firm has a decision of moving to Isparta. This is a personal decision. On the other hand in Ankara, 7 firms decided to move to industrial sites in future (5 firms to Temelli, 2 firms to Ostim) These 5 firms have a land in Temelli. One firm decided to move to Gölbaşı and one decided to move firm to İstanbul. This is totally a commercial decision.

(72) Primary factors for İstanbul firms in selecting their locations can be listed as; (Interviews)
- cheapness of land: 18 %
- environmental factors: 18 %
- appropriateness for electronics production: 24 %
- proximity to centre: 24 %
- proximity to subcontracting facilities: 10 %
- proximity to university: 6 %

In Ankara, these values are alike;
- cheapness of land: 0 %
- environmental factors: 28 %
- appropriateness for electronics production: 16 %
- proximity to centre: 44 %
- proximity to subcontracting facilities: 6 %
- proximity to university: 6 %

(73) These firms are ON, NEL, NÜVE, ELSİS firms in Ankara. These firms are considered as less technology based firms compared with other PE firms in Ankara.

(74) These firms are KARDİOSİS, ETA, ENERSİS, SİSTEK, MEKO, GATE. Also ELİMKO firm has a this kind of decision. These firms constitute about 33 % of total firms in Ankara. Also this condition is valid for two İstanbul firms (15 %) ERA and EKA that are relatively bigger firms in İstanbul.

(75) There are 5 departments (METU, BİLKENT, GAZİ, ANKARA, HACETTEPE) of electric- electronics engineering in Ankara and 4 departments (İTU, BOĞAZİÇİ, İSTANBUL, YILDIZ) in İstanbul by 1996. Also Bursa and Kayseri has one electronics engineering department. Capacities of these schools are about 800 students per year (Other schools are not included). (Ekin Dersanesi, Rehber Ajanda, 1996)

(76) These firms are BKS, ELİAR and BAYKON firms in İstanbul.

REFERENCES

_____, 1996. Ankara Sanayi Rehberi, Ankara Sanayi Odası, Ankara.

_____,1997. Araştırma ve Geliştirme İstatistikleri: 1990-1995, TC. D.İ.E Yayını, Ankara.

_____, 1998. A.S.O. Firma Listesi, Ankara sanayi Odası, Ankara.

_____, 1999. Boğaziçi KOSGEB Firma Listesi, Bogaziçi KOSGEB, İstanbul.

_____, 1978. Dördüncü Beş Yıllık Kalkınma Planı Elektronik Sanayii Özel İhtisas Komisyonu Raporu, Ankara.

_____, 1995. Ekonomist Yıllığı-1994, Ekonomist Dergisi, İstanbul.

_____, 1987. Elektronik Sanayiini Yönlendirme Komisyon Raporu, T.C. Sanayi ve Ticaret Bakanlığı, Ankara.

_____, 1995.Grolier Multimedia Encyclopedia, Electronic Arts, U.S.A..

_____, 1995. "Gümrük Birliği", Cumhuriyet Özel Ek, 19 Nisan 1995.

_____, 1998. İTÜ KOSGEB Firma Listesi, İTÜ KOSGEB, İstanbul.

_____, 1997. İGEME Firma Listesi, İhracatı Geliştirme Merkezi, Ankara.

_____, 1997. İstanbul Sanayi Odası Rehberi, İstanbul Sanayi Odası, İstanbul.

_____, 1997. İstanbul Sanayi ve Ticaret Rehberi, İstanbul Ticaret Odası, İstanbul.

_____, 1997. KOBİ Rehberi, T.C. Sanayi ve Ticaret Bakanlığı, KOSGEB Yayını, Hazırlayan: Mustafa Hilmi Çolakoğlu, Ankara.

_____, 1992. Malik Aviral ile Türkiye'de Elektronik Sanayiinin Sorunları Üzerine, Elektrik Mühendisliği Dergisi Sayı: 379, İstanbul.

_____, 1998. ODTÜ KOSGEB Firma Listesi, ODTÜ KOSGEB, Ankara.

_____, 1997. Otomasyon 97 Fuar Kataloğu, Bileşim Fuarcılık, İstanbul.

_____, 1998. Otomasyon 98 Fuar Kataloğu, Bileşim Fuarcılık, İstanbul.

_____, 1998(Eylül). TOBB Elektronik Sektörü Firmaları Kapasite Raporları, Ankara.

_____, 1991. Sanayi Kongresi, Elektronik Sanayii Sektör Raporu, TMMOB Makina Mühendisleri Odası, Ankara.

_____, 1995. Tedarikçi Listesi, Tesid Yayını, İstanbul.

_____, 1997. Türk Telekom Faaliyet Raporu-1996, Ankara.

_____, 1996. Türkiye Elektrik Elektronik Bilgisayar Kataloğu, Ankara.

_____, 1995. Türkiye Elektronik Sanayii Almanağı, Tesid Yayını, Publication No: 15, İstanbul.

_____, 1995. Türkiye Elektronik Sanayii Almanağı, Tesid Yayını, Publication No: 16, İstanbul.

_____, 1996. Türkiye Elektronik Sanayii Almanağı, Tesid Yayını, Publication No: 17, İstanbul.

_____, 1997. Türkiye Elektronik Sanayii Almanağı, Tesid Yayını, Publication No: 18, İstanbul.

_____, 1998 Temmuz., Elektronik Sanayii Firma Listesi, TOBB, Ankara.

_____, 1984. Türkiye Sanayi Rehberi, Türkiye Ticaret Sanayi, Deniz Ticaret Odaları ve Ticaret Borsaları Birliği, Ankara.

_____, 1992. Üçüncü İzmir İktisat Kongresi, Bilişim Çalışma Grubu Toplantısı, İzmir.

_____, 1992. Üçüncü İzmir İktisat Kongresi, Elektronik Sanayii Çalışma Grubu Toplantısı, İzmir.

_____, 1973. "Üçüncü Plan ve Elektronik Sanayii", Elektrik Mühendisliği Dergisi, sayı:193.

_____, 1994. Yedinci Beş Yıllık Kalkınma Planı Elektronik Sanayii Özel İhtisas Komisyonu Raporları, (Basılmamış Yayın)

_____, 1999. Yıllık İmalat Sanayi İstatistikleri-1996, T.C. D.İ.E. Yayını, Ankara.

_____, 1998. YTÜ KOSGEB Firma Listesi, YTÜ KOSGEB, İstanbul.

* Altay, Müjdat, 1996. "Elektronik Sektöründe ARGE'nin Önemi", Bilim ve Teknik Tergisi, sayı:347, s:66.

* Asheim B.T., Arne Isaksen,1997. "Location, Agglomeration and Innovation: Towards Regional Innovation System in Norway", European Planning Studies, Vol.5, No:3.

* Begg Ian, 1991. "High Technology Location and the Urban Areas of Great Britain: Developments in the 1980's", Urban Studies, vol. 28, no:6.

* Castells, Manuel.,1985. "Introduction" in High Technology Space and Society, ed by Manuel Castells, Sage Publ., London.

* Calori, Roland., 1992. " Effective Strategies in Emerging Industries", in the Strategic Management of Technologic Innovation, ed. by Ray Loveridge, and Martyn Pitt, John Wiley and Sons, Toronto.

* Camagni, R., 1991. "Introduction: From Local Milieu to Innovation Through Cooperation Networks", in Innovation Networks, Spatial Perspectives, ed. by, R. Camagni, Belhaven Press, London.

* Camagni, R., 1991. "Local Mileu, Uncertainty and Innovation Networks: Towards a New Dynamic Theory of Economic Space", in Innovation Networks, Spatial Perspectives, ed. by, R. Camagni, Belhaven , London.

* Cassiolato, J.E., 1992. " User-Producer Connection in HiTech: A Case Study of Banking Autoation in Brasil", in Hi-Tech for Industrial Development: Lessons From Brazilian Experience in Electronics and Automation, ed. by Hubert Schmitz and Jose Cassiolato, Routledge ,New York.

* Ceyhun, Yurdakul, 1984. "Türkiyesinde Elektronik Sanayiinin Durumu", Elektrik Mühendisliği Dergisi, sayı:312.

* Chakrabarti A.K., Halperin M.R., 1991., " Technical Performance and Firm Size: Analysis of Patents and Publications of U.S. Firms" in Innovation and Technological Change, ed. by Zoltan J.A., David, B.A., Harvester Wheatsheaf, U.K.

* Charles D.R. , 1990. " Technical Change and the Decentralised Corporation in Electronics Industry: Regional Policy Implications", in Technical Change and the Industrial Policy, ed. by Chapman K., Humphries G.

* Christy C.V., Ironside, R.G., 1990. " Promoting High Technology Industry: Location Factors and Public Policy" in Technical Change and the Industrial Policy, ed. by K. Chapman, G. Humphries., U.K.

* Cooke, P., Morgan, K., 1994. " The Creative Milieu: A Regional Perspective on Innovation", in The Handbook of Industrial Innovation, ed by Mark Dodgson, Roy Rothwell, Edward Elgar Publ., U.K.

* Copley B.H., 1990. "Technical Change in Latin American Manufacturing Firms: Review and Synteshis", World Development, vol. 18, no.11, pp: 1457-1469.

* Çubukçu Aydın, 1997. "Avrupa Türk Malı Kullanıyor", İSO Dergisi, sayı:375, pp:60-61.

* Dahlman, C.J., Larson B., Westphal, L.E., 1987. " Managing Technological Development: Lessons From the Newly Industrialising Countries", World Development, vol.15, no.6, pp:759-775.

* Daniel Todd, 1990. The World Electronics Industry, Routledge, New York.

* Dede, Okan Murat., 1994. Information Technologis, Their Effects and Position of Türkiye Towards These Technologies and Their Effects, Master's Thesis, METU, Ankara.

* Dixon A.J., Seddighi R., 1996, "An Analysis of R-D Activities in North East England Manufacturing Firms: The Results of A Sample Survey", Regional Studies, Vol30.3, pp 287-294.

* Dodgson, Mark., 1994. "Technological Collobration and Innovation", in The Handbook of Industrial Innovation, ed. by Mark Dodgson, Roy Rothwell, Edward Elgar Publ., U.K.

* Dodgson, M., Rothwell R., 1994. " Innovation and size of Firm", in The Handbook of Industrial Innovation, ed. by Mark Dodgson, Roy Rothwell, Edward Elgar Publ., U.K.

* Donkels Rik, Lambrecht Johan, 1997. "The Network Position of Small Businesses: An Explanatory Model", Journal of Small Business Management, April 1997, pp:13-25

* Ercan, H., Hokkacı İlyas, Oral Özay, 1988. Türkiye Elektronik Sanayii, EMO Yayını, Ankara.

* Ercan H., Hokkacı İ., Oral Ö.,1988. "Türkiye'de Elektronik Sanayii Üzerine Bir İnceleme", Elektrik Mühendisliği Dergisi, sayı: 352

* Eser, Uğur., 1993. Türkiye'de Sanayileşme, İmge Kitabevi, Ankara.

* Fairtlough, G., 1994. " Innovation and Organisation", in The Handbook of Industrial Innovation, ed by Mark Dodgson, Roy Rothwell, Edward Elgar Publ., U.K.

* Feldman, M.P.,1994. The Geography of Innovation, Kluwer Academic Publishers, Boston, U.S.A..

* Felsenstein D., Shachar, A,1988, "Locational and Organisational Determinants of RD Employment in High Technology Firms", Regional Studies, Vol:226, pp:477-486.

* Fischer M., Bertuglia C.S, 1995. Technological Change, Economic Development and Space, Springer- Verlag, Germany.

* Galhardi, M.A., 1994. Small High Technology Firms in Developing Countries, Avebury, Aldershot, 1994, U.K.

* Genosko,J.,1997. "Networks, Innovative Milieux and Globalisation: Some Comments on a Regional Economic Discussion", European Planning Studies, Vol.5, No.3.

* Glasmeier, Amy, 1991. "Technological Discontinuties and Flexible Production Networks: The Case Switzerland and The World Watch Industry", Research Policy, No:20.

* Gordon, Richard., 1991. " Innovation, Industrial Networks and High technology Regions", in Innovation Networks,Spatial Perspectives, ed. by, R. Camagni, Belhaven Press, London.

* Gregersen B, Johnson B., 1997. "Learning Economies, Innovation Systems and European Integration", Regional Studies, vol. 31.5, pp.470-490.

* Hall, Peter., 1994. Innovation, Economics and Evolution: Theoretical Perspectives on Changing Technology in Economic Systems, Harvaster Press, New York.

* Hayter, R., 1990. " Innovation Policy and Mature Industries: The Forest Production Sector in British Columbia" , in Technical Change and the Industrial Policy, ed by. K. Chapman, G. Humphries.

* Hilpert Ulrich., 1991., "Regional Policy in the Process of Industrial Modernization: The Decntralisation of Innovation by the Regionalisation of High-Tech?" , in Regional Innovation and Decntralisation: High Tech Industry and Government Policy, ed. by Ulrich Hilpert. 1991, Routledge, London.

* Hilpert Ulrich., 1991. The State, Science and Techno - Industrial Innovation, Routledge, New York.

* Isaksen, Arne., 1997. "Regional Clusters and Competetiveness: The Norwegian Case", European Planning, Vol. 5, No.1, pp:65-75.

* İlden, Süleyman., 1997. "Sadece ARGE Korunacak", İSO Dergisi, sayı:375, pp:62-63.

* Johne, F.A., 1985. Industrial Product Innovation: Organisation and Management, Croom Helm, Australia.

* Kaya, Nafiz., 1997. "Teknolojide Yaya Kalmak", Ekonom Dergisi, Eylül- Aralık, pp:49-52.

* Kırım Arman, 1990. Türkiye İmalat Sanayiinde Teknolojik Değişim, TOBB Yayını, Ankara, 1990.

* Kumar, N., Siddharthan N.S., 1994. "Technology, Firm Size and Export Behaviour in Developing Countries: The Case of Indian Enterpises", The Journal of Development Studies, vol. 31, no.2, pp:289-309.

* Lakshmanan, T.R., Okumura, Makoto,1995. "The Nature and Evolution of Knowledge Networks in Japanese Manufacturing", Papers in Regional Science, pp:63-86.

* Lall, Sanjaya. 1992., "Technological Capabilities and Industrialistion", World Development, Vo.20, No.2, pp:165-186.

* Leung Chi Kin, Wu, Chong Tong.,1995. "Innovation Environment, RD Linkages and technology development in Hong Kong", Regional Studies, vol. 29,6. pp:533-546.

* Maillat, D., Crevoiser, O. 1991. "Milieu, Industrial Organisation and Territorial Production System: Towards a New Theory of Spatial Development", in Innovation Networks, Spatial Perspectives, ed. by R. Camagni, Belhaven Press, London.

* Maillat, D., Lecoo, Bruno, Nemeti, Florean, Pfistr, Marc.,1994. "Technology District and Innovation: The Case of Swiss Jura Arc", Regional Studies, Vol.29.3 pp.251-263.

* Morgan K. ,1997. "The Learning Region: Institutions, Innovation and Regional Renewal", Regional Studies, vol.31-5,pp.491-503.

* Moulaert, Frank., Swyngedouw E.,1991. " Regional Development and Geography of the Flexible Production System" in Regional Innovation and Decentralisation: High Tech Industry and government Policy, ed. by Ulrich Hilpert, Routledge, London.

* Müftüoğlu, Tamer,1998. Küçük ve Orta Ölçekli İşletmeler, Ekonomik ve Sosyal Araştırmalar: 10, Turhan Kitabevi, Ankara.

* Nabseth, G.F.,1974. The Diffusion of New Industrial Processes: An International Study, Ray Publishment, New York.

* Özay Oral, Ercan Hakan, Hokkacı, İlyas., 1986., Türkiye Elektronik Endüstrisinin Kuruluşu, Gelişimi ve Planlaması Üzerine Bir İnceleme, TÜBİTAK Proje No: 657, Ankara.

* Perrin, Jan Claude., 1991. "Technological Innovation and Territorial Development: An Approach in Terms of Networks and Milieux"., in Innovation Networks, Spatial Perspectives, ed. by, R. Camagni, Belhaven Press, London.

* El-Bar Raphael, Felsenstein D., 1989. "Technological Profile and Industrial Structure: Implications for the Development of Sophisticated Industry in Peripheral Areas", Regional Studies, vol.23.3. pp: 253-266.

* Rath, Amitav., 1990. "Science, Technology and policy in the Periphery: A Perspective from the Centre", World Development, vol. 18, no.11, pp: 1429-1443.

* Renda, Yaprak., 1995. "Gümrük Birliğine Doğru Elektronik Sanayii", Bilim ve Teknik Dergisi, sayı: 331, s:32-35.

* Rosenfeld, S.A., 1997., "Bringing Business Clusters into Mainstream of Economic Development", European Planning Studies, Vol.5, No.1, pp:3-23.

* Roussal, P., Saad, K., Erickson, T., 1991. Third Generation R§D, U.S.A.

* Sako Mari., 1994. "Supplier Relationships and Innovation", in ThE Handbook of Industrial Innovation, ed. by Mark Dodgson, Roy Rothwell, Edward Elgar Publ., U.K.

* Saner, Deniz C., 1993. Zenginler Yoksullar ve Robotlar: Dünya Sistemi, Bağımlılık ve Türkiye, Bireşim Yayınları, İstanbul.

* Saren M., 1992. " Determinants, Processes and Strategies of Technological Innovation: Towards an Interactive Paradigm ", in The Stratgic Management of Technological Innovation, ed. by Ray Loveridge, and Martyn Pitt, John Wiley and Sons, Toronto.

* Saxenian Anna Lee,1991. "The Origins and Dynamics of Production Networks in Silicon Valley", Research Policy, No:20.

* Scherer, F.M., 1991., " Changing Perspectives on the Firm Size Problem" in Innovation and Technological Change, ed. by Zoltan J.A., David, B.A., Harvester Wheatsheaf, U.K.

* Scott John, T., 1991., " Research Diversity Induced by Rivalry", in Innovation and Technological Change, ed. by Zoltan J.A., David, B.A., Harvester Wheatsheaf, U.K.

* Simmie, James., 1998., "Reasons for the Development of Islands of Innovation", Urban Studies, vol. 35, No. 8, pp:1261-1289.

* Skoumal, S., 1973., Türkiye Elektronik Sanayii: Tahlil, İmkanlar ve Politikalar, İktisadi Kalkınma Vakfı Yayını, Ankara.

* Slatter, S., 1992. Gambling on Growth: How to Manage the Small High Tech Firm, John Wiley and Sons, England.

* Soyak, Alkan., 1996. Teknolojik Gelişme ve Özelleştirme, Kavram Yayınları, İstanbul.

* Sönmez, Mustafa., 1997. Bölgesel Eşitsizlik, Alan Yayıncılık, İstanbul.

* Stamer Jörg Meyer., 1995. "Micro Level Innovations and Comptetiveness", World Development, vol.23, no.1, pp:143-148.

* Storper M., 1985. " Technology and Spatial Production Relations: Disequilibrium, Interindustry Relationships, Industrial Development", in High Technology Space and Society, ed. by Manuel Castells, Sage Publications, U.S.A.

* Storper, M., Walker, R., 1989. The Capitalist Imperative, Basil Blackwell, U.S.A.

* Sweeney, G.P., 1985. "Innovation is Entrepreneur-Led", in Innovation Policies: an International Perspective, ed. by Gerry Sweney, Frances Printer, 1985, London

* Şenses, Fikret., 1993. "Sanayileşmede Bir Dönemeç: 1980'li Yıllar ve Ötesi", ODTÜ Gelişme Dergisi, sayı: 20 (4), s:529-548.

* Taymaz, Erol, 1993. "Sanayi ve Teknoloji Politikası Araçları: Amaç ve Araçlar", ODTÜ Gelişme Dergisi, sayı: 20 (4), s:549-580, 1993.

* Teubal M., Arnon, N., Trachtenberg M., 1987. "Performance in Innovation in Israeli Electronics Industry" in Innovation Performance, Learning and Government Policy, ed. by Morris Teubal, Wisconsin Press, England.

* Tornatzky, L.G., Fleischer, M., 1990. " The Context for Change: Organisation, Technology, Environment" in Process of Technological Innovation, ed. by L.G. Tornatzky, M. Fleischer, Lexington Books, Toronto.

* Tödtling F., 1992. "Technological Change at Regional Level: The Role of Location, Firm Structure and Strategy", Environment and Planning A, Vol: 24.

* Üçcan, Fikret., 1991. "Türkiye'de Teknoloji Müteşebbisliği ve İnovasyon", Asomedya, no.21, pp: 14-19.

* Villa L.S., Fischer M., 1995. "Technology, Organisation and Export Driven Research and Development in Austria's Electronics Industry", Regional Studies, Vol.29, No:1.

* Villa, L.S., Karlsson, C.,1996. "The Development of Sweden's RD intensive Electronics Industries: Exports, Outsourcing and Territorial Distribution", Environment and Planning A, vol. 28, pp:783-817.

* Walker, R. 1985. " Technological Determination and Determinisim: Industrial Growth and Location", in High Technology Space and Society, ed. by Manuel Castells, Sage Publications, U.S.A.

* Weinstein Art, 1994. "Market Definition in Technology Based Industry: A Comparative Study of Small Versus Non Small Companies", Journal of Small Business Management, October 1994, pp:29-35.

* Yücel, Fikret, 1997. "ARGE'nin % 20'si Elektronikten", İSO Dergisi, sayı:375, pp:58-59.

* Zoltan,J.A., Audretsch, D., 1991., "Innovation and Technological Change: An Overview" in Innovation and Technological Change, ed. by Zoltan J.A., David, B.A., Harvester Wheatsheaf, 1991, U.K.

* Zoltan,J.A., Audretsch, D., 1991., "R-D, Firm Size and Innovative Activity" in Innovation and Technological Change, ed. by Zoltan J.A., David, B.A., Harvester Wheatsheaf, 1991, U.K.

APPENDIX A

Table A. Classification of Electronics Industry According to the Industrial Coding System

CONSUMER ELECTRONICS	INDUSTRIAL CODES
* Black and White TV	38320101
* Colour TV	2
* Video Systems	5
* Video Player	10
* Radio	38320201
* Radio-Tape	2
* Radio-Gramophone	3
* Tape	4
* Auto Radio-Tape	5
* Music Set-CD Player	7
* Walkman	13
* Electronic Cash-Box	38250107
* Electronic Calculator	2
* Electronic Balance	38250606
* Electronic Weighbridge	7
TELECOMMUNICATION SUBSECTOR	
* Telephone	38320302
* Telephone Exchange	3
* Wireless Receiver- Transmitter	4
* Telem	7
* Kuramportor Systems	8
* Radio Link Systems	9
* Wireless Telephone	13
INDUSTRIAL ELECTRONICS	
A-) Signalling Devices, Alarm Systems	383204
B-)Electronic Systems	
* Electronic Automation Board	38320507
* Language Labs, Voice Systems	1
* Scoreboard	9
C-) Electronic Devices	
* Electronic Devices That are not Classified Elsewher	38320511
* Power Supply	8
* Convertor,Inverter, Uninterrupted Power Supply	3
* Signal Generator	12

Table A1 (Continued)

COMPUTER AND COMP. EQUIPMENT SUBSECTOR	
* Computer And Auxiliary Units	38250104
DEFENCE ELECTRONICS	
* Mine Detector	38320516
* Laser Distance Measurement Device	17
* Electronic Warfare Systems	18
* Military Communication Systems	383203
* Electronic Based Military Devices; Within	
* Electronic Devices That are not Classified Elsewh	38320511
COMPONENT SUBSECTOR	
A-) Components Used In Electronic Devices (Active Components)	
a-) Consumer Electronic Components	
* TV Auxiliary Equipment, Tuner, Remote Sensor	38320103
* Screen	4
* Video Player Auxiliary Equipment	6
* Ampflicator	38320209
* Loudspeaker- Microphone- Megaphone- Headphone	10
* Radio-Tape, Music Set Auxiliary Equipment	11
b-) Telecommunication Systems Component	
* Communication Devices Auxiliary Equipment	38320312
c-) Relay	38390804
d-) Circuit Elements	
* Integrated Circuits	38320513
* Diode	14
* Micro Electronic Circuit	19
* Auxiliary Equipment of Other Electr. Devices	10
B-) Components That Are Complementary to Electronic Devices	
(Passive Components)	
a-) Cables	383903
* Communication Cables	38390302
* Antenna, Signalling, TV Cables	3
* Cable Carrying Elements	6
b-) Antennas	
* TV Antenna, Satellite Antenna	38390701
* Antenna Power Systems	2
* TV Transmitter Antennas	3
* Antenna Exchange	4
* Telescopic Antenna	38320601
* Wireless Antenna	2
* Auto Antenna	3
c-) Audio-Video- Computer Cassettes- CD ROM's	38320504

APPENDIX B

Table B. Annual Production and Export Values of Electronics Sector Since 1970

YEARS	CONSUMER		TELECOMMUN.		COMPONENTS	
	PRODN.	EXPORT	PRODN.	EXPORT	PRODN.	EXPORT
1970	4.467	0.000	1.758	0.000	0.704	0.000
1971	6.540	0.000	2.645	0.000	0.595	0.000
1972	8.218	0.002	2.919	0.005	0.640	0.003
1973	16.303	0.000	2.560	0.002	0.717	0.002
1974	26.620	0.049	1.994	0.015	0.966	0.016
1975	39.280	0.005	2.016	0.031	0.841	0.007
1976	37.402	0.215	3.001	0.028	1.023	0.079
1977	34.360	0.200	5.430	0.080	1.046	0.061
1978	29.581	0.166	8.195	0.008	3.187	0.033
1979	27.329	0.148	6.632	0.000	2.557	0.194
1980	19.244	0.164	7.826	0.000	2.575	0.415
1981	26.192	0.474	10.647	0.008	3.492	0.095
1982	26.438	0.507	23.359	0.015	2.614	0.134
1983	50.814	0.216	29.192	0.323	4.174	0.177
1984	85.455	0.538	84.670	2.898	5.763	0.374
1985	88.057	2.895	70.774	3.887	7.158	1.174
1986	130.457	2.601	87.783	1.999	8.349	1.815
1987	111.850	4.116	92.107	3.423	9.440	2.453
1988	84.166	18.707	64.308	2.586	7.346	1.532
1989	100.137	21.710	31.639	4.517	6.004	1.104
1990	136.086	34.163	48.155	7.617	7.682	2.311
1991	159.098	43.257	78.887	8.904	9.048	3.126
1992	124.025	39.549	94.562	10.942	14.358	5.589
1993	124.178	33.958	92.222	12.967	11.551	6.260
1994	122.411	54.256	98.525	22.804	14.711	12.274
1995	133.703	66.554	83.968	24.759	16.069	11.928
1996	164.936	86.589	131.866	33.640	23.021	17.205
1997	213.385	114.731	138.529	28.684	27.094	12.990

Table B1 (Continued)

YEARS	PROF. ELECTR.		MILITARY		TOTAL ELECTR.	
	PRODN.	EXPORT	PRODN.	EXPORT	PRODN.	EXPORT
1970	0.185	0.000	0.000	0.000	7.114	0.000
1971	0.749	0.000	0.000	0.000	10.530	0.000
1972	0.920	0.000	0.000	0.000	12.697	0.010
1973	1.094	0.000	0.000	0.000	20.674	0.003
1974	1.230	0.016	0.000	0.000	30.811	0.098
1975	0.977	0.008	0.000	0.000	43.114	0.051
1976	1.297	0.049	0.000	0.000	42.724	0.372
1977	1.200	0.007	0.000	0.000	42.036	0.348
1978	1.143	0.000	0.000	0.000	42.105	0.207
1979	0.746	0.000	0.000	0.000	37.264	0.341
1980	1.501	0.025	0.000	0.000	31.145	0.604
1981	2.042	0.020	0.000	0.000	42.373	0.597
1982	1.558	0.026	0.000	0.000	53.969	0.682
1983	2.362	0.069	0.000	0.000	86.541	0.784
1984	3.426	0.485	0.000	0.000	179.314	4.295
1985	4.120	0.641	0.000	0.000	170.107	8.597
1986	4.354	0.582	NA	2.773	230.943	9.771
1987	6.591	0.512	NA	2.157	219.988	12.661
1988	7.549	0.321	NA	1.417	163.369	24.564
1989	6.265	0.298	5.420	1.483	149.465	29.112
1990	8.662	0.399	6.717	1.319	207.303	45.807
1991	8.936	0.131	7.836	1.635	263.805	57.052
1992	9.673	0.986	9.161	3.159	251.779	60.224
1993	12.166	1.241	17.069	5.366	257.185	59.793
1994	22.498	2.491	24.541	6.145	282.685	97.970
1995	24.759	2.872	24.397	8.044	282.895	114.157
1996	26.091	5.704	31.314	7.300	377.233	150.309
1997	40.592	7.308	34.347	7.452	453.947	171.164

APPENDIX C

Table C. Turkish Largest Electronics Producers

FIRM	MAIN ACTIVITY	LOC.	EMPLY.	ENGIN.	FOREIGN INV.
ASELSAN	MILITARY ELECTRONICS	ANKARA	2338	548	0
TELETAŞ	TELECOMMUNICATION	İSTANBUL	576	196	BEL 39% NETH 26%
BEKO	CONSUMER ELECTR.	İSTANBUL	1746	139	0
NETAŞ	TELECOMMUNICATION	İSTANBUL	1650	223	CANADA 51%
SİMKO	TELECOMMUNICATION	İSTANBUL	2631	694	GERMANY 75%
VESTEL	CONSUMER ELECTR.	İSTANBUL	1682	30	NETHERLAND 86%
VESTEL	COMPUTER EQUIPMENT	MANİSA	968	32	NETHERLAND 86%
PROFİLO	CONSUMER ELECTRONICS	TEKİRDAĞ	983	66	0
_	SECONDARY ACTIVITIES				
ASELSAN	COMPONENT - PROFF.ELECTR.				
TELETAŞ	ACTIVE COMPONENT				
BEKO	ACT. COMPONENT				
NETAŞ	PASS. COMPONENT				
SİMKO	MILITARY - PROF. ELECTR.				
VESTEL	COMPONENT				
VESTEL	CONSUMER ELECTR.				
PROFİLO	PROFF. ELECTR.				

APPENDIX D

Table D. List of Turkish Electronics Producers in 1998

FIRM NAME	FIELD OF ACTIVITY	LOCATION	EMPLOY.
PROFFESSIONAL ELECTRONICS FIRMS			
AJAN ELEKTRONİK SERVİS SANAYİ VE TİC.	UPS	İZMİR	30
ASTEK ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	EC. § ALARM SYS. AND DEVICE	İZMİR	18
BESTAŞ ELEKTRONİK OPTİK SAN. VE TİC. A	TAXIMETER	İSTANBUL	44
BURÇ ŞİRKETLER GRUBU	UPS	ANKARA	90
CEDETAŞ ELEKTROMEKANİK SAN. VE TİC. A.	EC. § ALARM SYS. AND DEVICE	İSTANBUL	128
DESİ OTO ALARM SAN. A.Ş.	VEHICLE ALARM SYSTEMS	İSTANBUL	23
DESTAŞ DİJİTAL ELEKTR. SAN. VE TİC. A.	TAXIMETER	İSTANBUL	17
DİKOMSAN ELEKTRONİK SAN. VE TİC. LTD.	ELECTR. FLOWMETER	İSTANBUL	9
E.O.C. ELEKTRONİK OTOMASYON CİH. SAN.	UPS	İSTANBUL	8
ECS ELEKTRONİK ELEKTRİK CİH. SAN.	EC. § ALARM SYS. AND DEVICE	ANKARA	214
EDS ELEKTRONİK DESTEK SAN. VE TİC. LTD	EC. § ALARM SYS. AND DEVICE	İSTANBUL	47
EGES ELEKTRİK ELEKTRONİK GEREÇLER SAN.	UPS	İSTANBUL	77
EKA ELEKTRONİK KONTROL ALETLERİ SAN. V	UPS	İSTANBUL	93
ELEKTRAL ELEKTROMEKANİK SAN. VE TİC. A	ELECTRONIC SIREN	İZMİR	40
ELEKTRONİK ELEKTROMEKANİK CİHAZLAR SAN	EC. § ALARM SYS. AND DEVICE	İSTANBUL	111
ELİAR ELEKTRONİK SAN. A.Ş.	NDUSTRIAL AUTOMATION SYSTEM	İSTANBUL	25
ELİMKO ELEKTRONİK İMALAT VE KONTROL Tİ	AUTOMATIC CONTROL SYSTEMS	ANKARA	127
ELKOM MÜHENDİSLİK SAN. VE TİC. A.Ş.	AUTOMATION SYSTEMS	ANKARA	24
ELMED ELEK. VE MEDİKAL SAN VE TİC. A.Ş	MEDICAL ELECTRONICS	ANKARA	16
ELSİS ELEKTRONİK SİSTEMLER SAN. A.Ş.	UPS	ANKARA	20
ELTEK ELEKTR. ELEKTROMEK. TEK. SAN. LT	EC. § ALARM SYS. AND DEVICE	ANKARA	15
EMEK İLERİ TEKNOLOJİ ÜRÜNL. SAN. VE Tİ	WIRELESS SOUND SYSTEMS	ANKARA	10
EMİKON ELEKTR. SAN. VE TİC. LTD. ŞTİ.	INDUSTRIAL CONTROL DEVICES	İSTANBUL	23
EMKO ELEKTRONİK SAN. VE TİC. A.Ş.	ASUREMENT AND CONTROL DEVIC	BURSA	45
EMSE ELEKTROMEK. SİST. END. SAN. VE Tİ	ELECTRONIC BOARDS	ANKARA	14
EN-KO ELEKTRONİK KONTROL SİSTEMLERİ SA	INDUSTRIAL AUTOMATION UNITS	İZMİR	49
ENDİKSAN ENDİKATÖR VE GEREÇ SAN. A.Ş.	TAXIMETER	İSTANBUL	125
ENDSİS ALARM SİSTEMLERİ A.Ş.	EC. § ALARM SYS. AND DEVICE	KAYSERİ	15
ENEL ENDÜSTRİYEL ELEKTR.SAN. VE TİC. I	UPS- INVERTER	İSTANBUL	20
ENERSİS ENERJİ SİST. SAN. VE TİC. A.Ş.	UPS- INTERCOM SYS.	ANKARA	84
EPROM ELEKTRONİK PROJE VE MİKRO BİLGİS	LINK SYSTEMS	ANKARA	22
ER ELEKTRONİK SAN. VE TİC. A.Ş.	EC. § ALARM SYS. AND DEVICE	İSTANBUL	165
ERA ELEKTRONİK SAN. VE TİC. A.Ş.	VEHICLE ALARM SYSTEMS	İSTANBUL	67
ERCE ELEKTRONİK SAN. VE TİC. LTD. ŞTİ.	UPS	ANKARA	8
F.H.R. ELEKTRO YAZILIM VE TİC. LTD. ŞT	SLIDING WORD SYSTEM	ANKARA	23
GATE ELEKTRONİK SAN. VE TİC. A.Ş.	RD TEST MEASUREMENT DEVICE	ANKARA	13
GENESİS GENEL ELK. SİST. TİC. LTD. ŞT	EC. § ALARM SYS. AND DEVICE	ANKARA	29
HATEL ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	EC. § ALARM SYS. AND DEVICE	İZMİR	9
HEMA ELEKTR. SAN. VE TİC. A.Ş.	TAXIMETER	ANKARA	54

Table D1 (Continued)

FIRM NAME	FIELD OF ACTIVITY	LOCATION	EMPLOY.
HES MAKİNA SAN VE TİC. A.Ş.	GASEOUS ALARM DEDECTOR	KAYSERİ	121
İNFORM ELEKTRONİK SAN. VE TİC. A.Ş.	UPS	İSTANBUL	115
İNTEK ELEKTRONİK TEKN. SAN. VE TİC. A.	TAXIMETER	ANKARA	26
İTEMAŞ ELEKTROMEKANİK SAN. VE TİC. A.Ş	CUT-OFF, TEMPORIZATOR	BURSA	54
KARDİOSİS KARDİOLOJİK TANI SİST. LTD.	MEDICAL ELECTRONICS	ANKARA	26
MAKELSAN ELEKTRONİK SAN. VE TİC. A.Ş.	UPS-INVERTER	İSTANBUL	
METER ELEKTRONİK SAN. VE TİC. A.Ş.	ASUREMENT AND CONTROL DEVIC	İSTANBUL	30
MOSTEK ELEKTRONİK SAN. VE TİC. LTD. ŞT	PERFORMANCE TEST DEVICES	ANKARA	15
NEL ELEKTRONİK CİHAZ İMALAT SAN. A.Ş.	MEDICAL ELECTRONICS	ANKARA	35
NÜVE SANAYİ MALZ. İMALATVE TİC. A.Ş.	INCUBATOR	ANKARA	51
OES ORTADOĞU ELEKTRONİK SAN. TİC. VE I	UPS	ANKARA	19
ON ELEKTRONİK LTD. ŞTİ.	ELECTRONIC BOARD, SCORBOARD	ANKARA	9
ORTANA ELEKTRONİK LTD. ŞTİ.	DIGITAL BOARDS	ANKARA	15
ÖNPA GÜVENLİK SİST. SAN. VE TİC. A.Ş.	EC. $ ALARM SYS. AND DEVICE	İSTANBUL	9
PANEL ELEKTRO SAN. VE TİC. LTD. ŞTİ.	AUTOMATION BOARDS	İSTANBUL	24
PCK ELEKTRONİK SAN. VE TİC. LTD. ŞTİ.	MEDICAL ELECTRONICS	ANKARA	38
PETAŞ PROF. ELEKTRONİK SAN. VE TİC. A.	MEDICAL ELECTRONICS	ANKARA	56
POLARİS ELEKTRONİK SAN. VE TİC. LTD.	D. CONTROL-MEASUREMENT DEVIC	İSTANBUL	16
POLİMEK ELEKTRONİK A.Ş.	EC. $ ALARM SYS. AND DEVICE	İZMİR	19
ROTA ELEKTRONİK SAN. VE TİC. LTD. ŞTİ.	TACOGRAPH	İSTANBUL	25
SAR ELEKTRONİK SAN. VE TİC. A.Ş.	HEAT CONTROL MODULES	İZMİR	102
SİNYALİZASYON ELEKTRONİK İNŞ SAN. VE T	EC. $ ALARM SYS. AND DEVICE	ANKARA	15
SİSEL ELEKTRONİK SAN. VE TİC. A.Ş.	D. CONTROL-MEASUREMENT DEVIC	İSTANBUL	22
SİSTEK ELEKTRONİK SİST. SAN VE TİC. LT	AUTOMATION CONTROL DEVICES	ANKARA	25
TAKOSAN ELEKTRONİK SAN. VE TİC. A.Ş. *	TAXIMETER	İSTANBUL	39
TEMA MÜHENDİSLİK ELEKTRONİK LTD. ŞTİ.	SCORBOARDS, SOUND SYSTEMS	ANKARA	9
TESTAŞ TÜRKİYE ELEKTRONİK SAN. VE TİC.	UPS	ANKARA	261
TETA ENDÜSTRİYEL ELEKTRONİK SAN. VE Tİ	EC. $ ALARM SYS. AND DEVICE	ANKARA	105
TROPHY RÖNTGEN SAN. A.Ş.	MEDICAL ELECTRONICS	BOLU	78
TUNÇMATİK JENERATÖR VE ELEKTRİK MOTORI	UPS- INVERTER	İSTANBUL	21
TÜMEL ELEKTRONİK SAN. TİC. VE LTD. ŞTİ	OMPUTER CONTROLLED AUT. SYS	İZMİR	40
TÜMEL ELEKTRONİK SAN. TİC. VE LTD. ŞTİ	UPS	İZMİR	40
TÜRK ŞEKER FAB. ELEKTROMEKANİK AYGIT E	LECTRONIC AUTOMATION SYSTEM	ANKARA	422
UL-TRA ULAŞIM VE TRAFİK SAN. VE TİC. L	EC. $ ALARM SYS. AND DEVICE	ANKARA	39
YESTAŞ GÜVENLİK SİSTEMLERİ SAN. VE TİC	EC. $ ALARM SYS. AND DEVICE	ANKARA	25
ZEKİ İLETİŞİM VE ALARM SİSTEMLERİ A.Ş.	EC. $ ALARM SYS. AND DEVICE	KAYSERİ	90
ZER KOLL. ŞTİ.	$ ALARM SYS. AND DEVICES-S	ANKARA	70
CONSUMER ELECTRONICS FIRMS			
ACUN KANTAR SAN.	ELECTRONIC WEIGHING DEVICES	İSTANBUL	8
AKENEZ TURİZM SAN. TİC. VE TAŞIMACILIK	TV FITTING $ RADIO	İSTANBUL	71
AKSA ELEKTRONİK SAN. VE TİC. LTD. ŞTİ.	TV FITTING $ RADIO	İSTANBUL	8
ARMADA ELEKTRONİK SAN. VE TİC. LTD. ŞT	RADIO	İSTANBUL	21
ARTEK PROSES İMALAT SAN. VE TİC. LTD.	ELECTRONIC WEIGHING DEVICES	ANKARA	12
ATMACA ELEKTRONİK SAN. VE TİC. LTD. ŞT	TV FITTING $ RADIO	İSTANBUL	19
AYBAT ELEKTRONİK İTHALAT İHRACAT LTD.	TV FITTING $ RADIO	ADANA	11
AYKAR ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	RADIO	İSTANBUL	5
AYTEKİN ELEKTRONİK VE TİC. A.Ş.	RADIO	ADANA	16
AYYILDIZ ELEKTRİKLİ EV EŞYALARI İMALAT	RADIO	İSTANBUL	21
BASTER TARTI VE ÖLÇÜ AL. SAN. VE TİC.	ELECTRONIC WEIGHING DEVICES	İZMİR	49

Table D2 (Continued)

FIRM NAME	FIELD OF ACTIVITY	LOCATION	EMPLOY.
BESEL BATI ELEKTRONİK SAN. VE TİC. A.Ş	TV FITTING § RADIO	İSTANBUL	45
C.E.Y. ELEKTRONİK CİHAZLAR VE TÜKETİM	TV FITTING § RADIO	İSTANBUL	5
CG ELEKTRONİK SAN. VE TİC. A.Ş.	TV FITTING	İSTANBUL	63
CİHAN ELEKTRONİK SAN. A.Ş.	TV FITTING § RADIO	İSTANBUL	293
ÇORUKLAR ELEKTRONİK SAN. VE TİC. LTD.	TV FITTING § RADIO	İSTANBUL	30
DENSİ ENDÜSTRİYEL TARTI SİST. SAN.	ELECTRONIC WEIGHING DEVICES	İSTANBUL	11
DİGİ FİTER ELEKTRONİK SAN. VE TİC. A.Ş	ELECTRONIC CASHBOX	İSTANBUL	27
DOST ELEKTRONİK VE DIŞ TİC. LTD. ŞTİ.	RADIO FITTING	İSTANBUL	15
EFE AYDIN TARTI SİSTEMLERİ MADENCİLİ	ELECTRONIC WEIGHING DEVICES	AYDIN	6
EKOTEKNİK ELEKTRONİK SAN. VE TİC. LTD.	TV FITTING § RADIO	İSTANBUL	9
ELEKTROMAKS ELEKTRONİK CİHAZLARI SAN.	TV FITTING § RADIO-VİDEO	İSTANBUL	53
ELEKTROMEGA ELEKTRONİK CİH. SAN. VE Tİ	TV FITTING § RADIO	İSTANBUL	14
ELEKTROSET ELEKTRONİK CİHAZLAR İMALAT	TV FITTING	İSTANBUL	76
ELTA ELEKTR. TARTI SİST. SAN. VE TİC.	ELECTRONIC WEIGHING DEVICES	ANKARA	15
EMES EGE MAKİNA ELEKTRONİK SAN. VE TİC	TV FITTING § RADIO	İZMİR	190
ERTE ENDÜSTRİYEL ELEKTR. SAN. VE TİC.	ELECTRONIC WEIGHING DEVICES	İZMİR	12
ESCORT COMPUTER ELEKTRONİK SAN. VE TİC	RADIO	İSTANBUL	64
EVREN ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	RADIO	İSTANBUL	3
FANSET ASPİRATÖR SAN. VE TİC. LTD. ŞTİ	RADIO	İSTANBUL	32
FLASH ELEKTRONİK SAN. İTH. İHR. LTD. Ş	TV FITTING	İSTANBUL	8
FONSA ELEKTRONİK SAN. A.Ş.	TV FITTING § RADIO	İSTANBUL	21
GEMSAN EMAYE SAN. VE TİC. LTD. ŞTİ.	RADIO	İSTANBUL	9
GÜLER ELEKTRONİK SAN VE TİC. HASAN GÜL	RADIO	İSTANBUL	14
GÜLMENTUR ELEKTR. CİH. PAZARLAMA	TV FITTING	ADANA	15
GÜNEY ELEKTR. VE İNŞ. SAN. TİC LTD. ŞT	ELECTRONIC WEIGHING DEVICES	İÇEL	19
GÜR ELEKTRONİK MONTAJ SAN. ABDULLAH GÜ	TV FITTING § RADIO	İSTANBUL	31
GÜRPLAS PLASTİK EŞYA VE ELEKTRONİK SAN	TV FITTING § RADIO	İSTANBUL	43
GÜVENÇ ELEKTROMEKANİK SAN. VE TİC. A.Ş	ELECTRONIC CASHBOX	İSTANBUL	148
HANA ELEKT. TARTI SİST. SAN VE TİC. A.	ELECTRONIC WEIGHING DEVICES	İSTANBUL	16
HAT ELEKTRONİK CİH. SAN. VE TİC. A.Ş.	RADIO	İSTANBUL	34
HİSAR TERAZİ SAN VE LTD. ŞTİ.	ELECTRONIC WEIGHING DEVICES	İSTANBUL	6
İ.E.S. İZMİR ELEKTRONİK SAN VE TİC. A.	TV FITTING § RADIO	İZMİR	412
İHLAS TARSAN ELEKTR. CİHAZLAR İMALAT	ELECTRONIC WEIGHING DEVICES	İSTANBUL	158
İHTAŞ İHLAS ELEKTRONİK TİC. VE SANAYİ	TV FITTING	İSTANBUL	32
İMPER ELEKTRİK SAN. VE TİC. A.Ş.	TV FITTING § RADIO	İSTANBUL	45
İNTER ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	TV FITTING § RADIO	GAZİANTEP	108
İNTER MÜHENDİSLİK DANIŞMANLIK VE TİC.	ELECTRONIC CASHBOX	İSTANBUL	55
JAGUAR ELEKTRONİK SAN. VE TİC. LTD. ŞT	TV FITTING § RADIO	İSTANBUL	17
JVC ELEKTRONİK SAN. VE TİC. LTD. ŞTİ.	RADIO	İSTANBUL	8
KAMER ELEKTRONİK SAN. VE TİC. A.Ş.	RADIO	İSTANBUL	5
KOMO TEK ELEKTR. İMALAT SAN. İÇ DIŞ Tİ	TV FITTING § RADIO	İSTANBUL	26
KRAL ELEKTRONİK TİC. VE SAN. LTD. ŞTİ.	RADIO	İÇEL	6
KULELİ TERAZİ SAN. VE TİC. A.Ş.	ELECTRONIC WEIGHING DEVICES	İSTANBUL	8
MASTER ELEKTRONİK SAN. VE TİC. LTD. ŞT	TV FITTING § RADIO	GAZİANTEP	66
MESTAŞ MÜH. İNŞ. MAKİNA ELEKTRİK	ELECTRONIC WEIGHING DEVICES	ANKARA	22
MEVA END. TARTI VE KONTR. SİST. LTD. Ş	ELECTRONIC WEIGHING DEVICES	TRABZON	9
ONUR DIŞ TİC. VE ELEKTRONİK LTD. ŞTİ.	RADIO	İSTANBUL	15
ÖZAK ELEKTRONİK SAN. VE TİC. A.Ş.	TV FITTING § RADIO	İSTANBUL	198
ÖZENİŞ ELEKTRONİK SAN. VE TİC. LTD. ŞT	RADIO	İSTANBUL	7

Table D3 (Continued)

FIRM NAME	FIELD OF ACTIVITY	LOCATION	EMPLOY.
ÖZKAR ELEKTRONİK SAN. VE TİC. A.Ş	TV FITTING § RADIO	İSTANBUL	74
PARILTI ELEKTRONİK SAN. VE TİC. A.Ş.	TV FITTING § RADIO	İSTANBUL	146
SAR-BO ELEKTRONİK HÜSEYİN SARI	RADIO	İSTANBUL	8
SEGA - SEYİT MEHMET GÖVER	TV FITTING § RADIO	İSTANBUL	20
SERVET BASKÜL ÖLÇÜ VE TARTI AL. İMALAT	ELECTRONIC WEIGHING DEVICES	SAKARYA	8
SERVO ELEKTRONİK ADEM KORKMAZ	TV FITTING § RADIO	İSTANBUL	9
SERVO ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	RADIO	İSTANBUL	26
SİMTEL ELEKTRONİK SAN. VE TİC. A.Ş.	TV FITTING § RADIO	İSTANBUL	131
TAM ÇEKİ TARTI SİST. SAN. VE TİC. A.Ş.	ELECTRONIC WEIGHING DEVICES	İZMİR	38
TARTAN TARTI ALETL. SAN. VE TİC. LTD.	ELECTRONIC WEIGHING DEVICES	İZMİR	20
TBS TERAZİ VE BASKÜL TİC. LTD. ŞTİ.	ELECTRONIC WEIGHING DEVICES	İZMİR	6
TELAR ELEKTRONİK SAN. VE TİC. A.Ş.	TV FITTING § RADIO	İSTANBUL	19
TELESAN TELEVİZYON ELEKTRONİK SAN. VE	TV FITTING § RADIO	İSTANBUL	143
TELESAN TV ELEKTRONİK SAN. VE TİC. A.Ş	TV FITTING	BİLECİK	212
TELKOM ELEKTRONİK HABERLEŞME CİHAZLARI	RADIO	İZMİR	130
TEMSA TERMOMEKANİK SAN. VE TİC. A.Ş.	ELECTRONIC CASHBOX	ADANA	53
TEPE HIRDAVAT ELEKTRONİK SAN. VE TİC.	TV FITTING § RADIO	GAZİANTEP	11
TERBAS ELEKTR. MEKANİK TARTI SİST.	ELECTRONIC WEIGHING DEVICES	İZMİR	5
TERMAL ELEKTRONİK VE DEVRE ELEMANLARI	TV FITTING § RADIO	İSTANBUL	386
TESTAŞ TÜRKİYE ELEKTR. SAN VE TİC. A.Ş	ELECTRONIC CASHBOX	ANKARA	207
TRİSTAR ELEKTRONİK SAN. VE PAZARLAMA A	TV FITTING § RADIO	İSTANBUL	22
TUĞSAN RADYO VE TEYP İMALAT SAN.	RADIO	İSTANBUL	9
TUNAYLAR BASKÜL SAN. VE TİC. A.Ş.	ELECTRONIC WEIGHING DEVICES	İSTANBUL	48
TÜM ELEKTRONİK SİSTEMLER SAN. A.Ş.	ELECTRONIC WEIGHING DEVICES	İSTANBUL	41
TÜRK PHILIPS SAN A.Ş. PHILISAN	TV FITTING § RADIO-VİDEO	İSTANBUL	130
UĞURLU ELEKTRONİK- CENGİZ KÜÇÜKÖREN	TV FITTING § RADIO	İZMİR	39
VELSAN ELEKTRONİK SAN. VE TİC. A.Ş.	TV FITTING § RADIO	İSTANBUL	56
YILMAZ BASKÜL SAN.	ELECTRONIC WEIGHING DEVICES	İZMİR	11
YÜCEL KOMPENANT VE ELEKTRONİK SAN. VE	TV FITTING § RADIO	İSTANBUL	29
TELECOMMUNICATION SUBSECTOR FIRMS			
ADAM ELEKTRONİK LTD. ŞTİ.	EXCHANGE	İSTANBUL	19
ALLGON-BAŞARI TELEKOM. SAN. VE TİC. A.	EXCHANGE	ANKARA	92
ARKOM EL. ELEKTRONİK CİH. SAN.	TELEPHONE CONTOUR MACHINE	KOCAELİ	6
ARMADA ELEKTRONİK SAN. VE TİC. LTD. ŞT	TELEPHONE	İSTANBUL	33
ASEL HABERLEŞME CİH. TİC VE SAN. LTD.	WIRELESS SYSTEM	İZMİR	4
ATLAS ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	MICROPROCESSOR EXCHANGE	İSTANBUL	5
AYYILDIZ ELEKTRİKLİ EV EŞYALARI İMALAT	TELEPHONE	İSTANBUL	21
BAŞARI ELEKTRONİK SAN. VE TİC. A.Ş.	WIRELESS SETS	ANKARA	98
BİRLEŞİK TELEKOM SAN VE TİC. LTD. ŞTİ.	TELEPHONE	İSTANBUL	11
BMS ENDÜSTRİYEL ELEKTRONİK TELEKOM.	HF TELEPHONE	İSTANBUL	11
BO-Vİ BOGAZİÇİ VİDEO SAN. VE TİC. A.Ş.	WIRELESS TRANSMITTER-REC.	İSTANBUL	7
DE-KA-SE ÇIKARMA VE BASKI SAN. A.Ş.	TELEPHONE	İSTANBUL	65
DELTA ELEKTRONİK SAN. VE TİC. A.Ş.	TELEPHONE	İSTANBUL	34
DEŞİLMEZ TEKNİK MEHMET ZEKİ DEŞİLMEZ	EXCHANGE	İÇEL	9
EGESAN ELEKTRONİK SAN. VE TİC. LTD. ŞT	TELEPHONE CONTOUR MACHINE	İZMİR	5
ELEKTRO ELEKTRONİK SAN. VE TİC. A.Ş.	EXCHANGE	İSTANBUL	35
ELEKTROMAKS ELEKTRONİK CİHAZLARI SAN.	TELEPHONE	İSTANBUL	53
ELEKTROMEGA ELEKTRONİK CİH. SAN. VE Tİ	TELEPHONE	İSTANBUL	14
EMEC PLASTİK ELEKTRONİK SAN. VE TİC. K	TELEPHONE	İSTANBUL	46

Table D4 (Continued)

FIRM NAME	FIELD OF ACTIVITY	LOCATION	EMPLOY.
ERA ELEKTRONİK SAN. VE TİC. A.Ş.	MOBILE TELEPHONE	İSTANBUL	64
ERDEM TİC. KOLL. ŞTİ. PENİYAMİN TEKER	R/L SYSTEM	İSTANBUL	17
ERE ENERJİ TELEKOM. İNŞAAT SAN.	TELECOM EQUIPMENT	İSTANBUL	53
ERICCSON ÇUKUROVA TELEKOM A.Ş.	EXCHANGE	ANKARA	27
ESTAŞ EROZYON SAN. VE TİC. A.Ş.	WIRELESS	İZMİR	13
GEMSAN EMAYE SAN. VE TİC. LTD. ŞTİ.	WIRELESS	İSTANBUL	9
GEOTEKNİK ELEK. ELEKTR. SAN. VE LTD. Ş	TELEPHONE	ANKARA	
GÜÇLÜSES ELEKTRONİK SAN. TİC. VE LTD.	WIRELESS	İSTANBUL	12
GÜNEY ELEKTRONİK VE İNŞAAT SAN. TİC. I	PAGING DEVICE	İÇEL	19
GÜR ELEKTRONİK MONTAJ SAN. ABDULLAH GÜ	TELEPHONE	İSTANBUL	31
İLTEK TELEKOMÜNİKASYON SAN. VE TİC. A.	EXCHANGE	İSTANBUL	56
JARVEST ELEKTRONİK SAN. VE TİC. LTD. Ş	TELEPHONE	İZMİR	46
KAREL ELEKTRONİK SAN. VE TİC. A.Ş.	EXCHANGE- TELEPHONE	ANKARA	242
KOMO TEK ELEKTR. İMALAT SAN. İÇ VE DIŞ	TELEPHONE	İSTANBUL	26
KOMSİS ELEKTRONİK SİSTEMLERİ SAN. VE T	R/L TRANSMITTER-RECEIVER	İSTANBUL	5
KUMTEL TELEKOM SAN. A.Ş.	TELEPHONE	İSTANBUL	25
KUTLUHAN ELEKTRONİK SAN. VE TİC. LTD.	WIRELESS	İSTANBUL	70
MASTER ELEKTRONİK SAN. VE TİC. LTD. ŞT	TELEPHONE	GAZİANTEP	66
MİLKOM İNŞAAT TİC VE ELEKTRONİK LTD. Ş	TELEM	ANKARA	8
MULTİTEK ELEKTRONİK SAN. VE TİC. LTD.	EXCHANGE	İSTANBUL	11
ODES ORTADOĞU ELEKTRONİK SAN. VE TİC.	WIRELESS CALLING SYSTEM	ANKARA	7
ONUR DIŞ TİC. VE ELEKTRONİK LTD. ŞTİ.	TELEPHONE	İSTANBUL	16
ORTAŞ TELEKOM. SAN. TİC. A.Ş.	PUBLIC TELEPHONE- PAGING	ANKARA	16
OS-RA ELEKRONİK SAN. VE TİC. LTD. ŞTİ.	WIRELESS	İZMİR	8
PENTA ELEKTRONİK TELEKOM. PLASTİK	TELEPHONE	İSTANBUL	91
PROCOM ELEKTRONİK VE HABERLEŞME CİHAZL	TV TRANSMITTER SYSTEM	İZMİR	7
PROFİLO SAVUNMA GEREÇLERİ SAN. VE TİC.	MOBIL TEL. STATION	İSTANBUL	76
SAKİN TELEFON SAN. VE TİC. LTD. ŞTİ.	TELEPHONE-WIRELESS	İZMİR	19
SES ELEKTRONİK SAN VE TİC. LTD. ŞTİ.	WIRELESS	İSTANBUL	6
SETKOM İLERİ TEKN. ÜRÜNL. SAN VE TİC.	WIRELESS STATION	ANKARA	20
STFA SAVRONİK ELEKTRONİK SAN. VE TİC.	TELECOM SYSTEMS	İSTANBUL	50
ŞAHİN ELEKTRONİK MALZ. İMALAT MONTAJ V	TELEPHONE	İSTANBUL	21
TEKOFAKS ELEKTR. SAN. MÜMESSİLLİK VE T	EXCHANGE	İSTANBUL	77
TELESİS TELEKOMÜNİKASYON SİSTEMLERİ SA	ELECTRONIC EXCHANGE	ANKARA	95
TELPAŞ TELEKOMÜNİKASYON SAN. VE TİC. A	TELEPHONE CONTOUR MACHINE	İSTANBUL	75
TELSAN TELSİZ SAN. VE TİC. A.Ş.	WIRELESS	İSTANBUL	8
TESLA ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	EXCHANGE	İSTANBUL	9
TRİSTAR ELEKTRONİK SAN. VE PAZARLAMA A	TELEPHONE	İSTANBUL	22
UĞUR ELEKTRİK ELEKTRONİK SİSTEMLER TİC	TELEPHONE EXCHANGE	AFYON	9
ÜÇGEN TELEKOM.- ELEKTRONİK SAN. A.Ş.	TELEPHONE CONTOUR MACHINE	İSTANBUL	13
ÜNİVERSAL İLETİŞİM VE BİLGİSAYAR HİZM.	EXCHANGE	İSTANBUL	17
VELSAN ELEKTRONİK SAN. VE TİC. A.Ş.	TELEPHONE	İSTANBUL	10
VESTELKOM ELEK. HAB. CİH. İMALATI VE T	SATELLITE RECEIVER SYSTEM	İZMİR	489
YONCA PLASTİK SAN. VE TİC. A.Ş.	TELEPHONE	İZMİR	22
COMPONENT FIRMS			
3 M SANAYİ VE TİC. A.Ş.	TELEPHONE COMPONENTS	İSTANBUL	
AES ATOMİUM ELEKTRONİK SAN. LTD. ŞTİ.	TRUNK PARTS	İSTANBUL	11
AFA ELEKTRONİK SAN. VE TİC. A.Ş	LDOUDSPEAKER- DIAPHRAME	İZMİR	31
AKSAN KALIP SAN. VE TİC. A.Ş.	ELECTRONIC PARTS	İSTANBUL	28

Table D5 (Continued)

FIRM NAME	FIELD OF ACTIVITY	LOCATION	EMPLOY.
ALBAKOM KOLL. ŞTİ.	TV-RADIO PARTS	İSTANBUL	8
ALRİGHT HİZMET TASARIM ELEKTROMEKANİK	VARIOUS CABLES AND ELEMENTS	ANKARA	45
AMPER ELEKTRİK İNŞAAT SAN. A.Ş.	TELEPHONE DISTR. BOX	İSTANBUL	15
ANSAN METAL VE PLASTİK SAN. TİC. LTD.	ANTENNA DISH	İSTANBUL	11
ANTEN SAN. TİC. LTD. ŞTİ.	TV ANTENNA	İSTANBUL	9
ARGEL ELEKTRONİK SAN. VE TİC. A.Ş.	VARIOUS RELAY GROUPS	İSTANBUL	10
ARMAN ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	TV ANTENNA	ANKARA	6
ASTRA KABLO JALE ÖNCALLI	VARIOUS CABLES AND ELEMENTS	İSTANBUL	4
ATEK KABLO SAN. VE TİC. MEHMET AKBABA	VARIOUS CABLES AND ELEMENTS	KOCAELİ	40
ATEMPO SES VE IŞIK SİSTEMLERİ LTD. ŞTİ	STAGEBOX	ANKARA	27
AYDIN MÜH. VE TİC. LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	ANKARA	31
AYYILDIZ ELEKTRİKLİ EV EŞY. İMALAT	RECEİVER	İSTANBUL	21
BARBAROS ELEKTRONİK SAN. VE TİC. LTD.	LOUDSPEAKER	İSTANBUL	11
BARIŞ ELEKTRİK ENDÜSTRİSİ A.Ş.	ELECTR. PARTS	ANKARA	32
BASKI DEVRE SAN. VE TİC. LTD. ŞTİ.	PRINTED CIRCUIT	İSTANBUL	92
BAŞARI ELEKTRONİK SAN. VE TİC. A.Ş.	TV DECIPHER	ANKARA	122
BAŞKURT KABLO ÜRETİM VE PAZ. A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	7
BAŞOĞLU KABLO VE PROFİL SAN. VE TİC. A	VARIOUS CABLES AND ELEMENTS	İSTANBUL	178
BAZNA TİC. SADETTİN BAZNA	VARIOUS CABLES AND ELEMENTS	İSTANBUL	6
BESAN MAK. SAN. VE TİC. A.Ş.	VARIOUS RELAY GROUPS	İSTANBUL	4
BESTAŞ ELEKTRONİK OPTİK SAN. VE TİC. A	REMOTE SENSOR	İSTANBUL	40
BETKAR KABLO SAN VE TİC. LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	17
BİKSAN BİRLEŞİK KABLO SAN. VE TİC. A.Ş	VARIOUS CABLES AND ELEMENTS	İSTANBUL	33
BİRLEŞİK KABLO SAN. VE TİC. LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	6
BİRTAŞ MAKİNA OTOMOTİV SAN. VE TİC. A.	SOME ELECTORINC PARTS	İSTANBUL	58
BMS ENDÜSTRİYEL ELEKTRONİK TELEKOM.	HF UNIT	İSTANBUL	10
BO-Vİ BOGAZİÇİ VİDEO SAN. VE TİC. A.Ş.	VIDEO MULTIPLEXER	İSTANBUL	7
BOTECH ELEKTRONİK SAN VE TİC. LTD. ŞTİ	SATELLITE RECEIVER	İSTANBUL	31
BOTEL BOBİN TELİ KABLO SAN. A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	114
CİHAN ELEKTRONİK SAN. A.Ş.	TUNER- LOUDSPEAKER	İSTANBUL	293
ÇİFTEL ELEKTRONİK SAN. VE TİC. A.Ş. MU	SATELLITE RECEIVER	İZMİR	9
DATT MAKİNA VE ELEKTRONİK SAN. VE TİC.	CIRCUIT CARDS	ANKARA	7
DEKA ELEKTRONİK SAN. VE TİC. LTD. ŞTİ.	VARIOUS RELAY GROUPS	İSTANBUL	32
DELRON ELEKTRONİK SAN. VE TİC. A.Ş.	PRINTED CIRCUITS	MANİSA	28
DEMA RÖLE SAN. VE TİC. A.Ş.	VARIOUS RELAY GROUPS	İSTANBUL	56
DEMAŞ KABLO SAN.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	31
DEMES KABLO SAN. VE TİC. LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	20
DEMİRER KABLO TESİSLERİ SAN. VE TİC. A	VARIOUS CABLES AND ELEMENTS	BİLECİK	318
DENGE ELEKTRONİK BASKILI DEVRE MATBAAC	PRINTED CIRCUIT	İSTANBUL	38
DEŞİLMEZ TEKNİK MEHMET ZEKİ DEŞİLMEZ	COUNTOR- CAMPANA	İÇEL	8
DİSAN DİOD YARI İLETKEN SAN. VE TİC. A	DIOD	İSTANBUL	18
DİSAŞ DİSKONJOKTÖR VE ELEKTR. MALZ.	VARIOUS RELAY GROUPS	ANKARA	31
DTM ELEKTROTEKNİK SAN. VE TİC. A.Ş.	VARIOUS RELAY GROUPS	İSTANBUL	14
ECS ELEKTRONİK ELEKTRİK CİH. SAN.	VARIOUS CABLES AND ELEMENTS	ANKARA	214
EGE TELEVİZYON TÜP SAN. VE TİC. A.Ş.	TV TUBE	İZMİR	18
EGESAN ELEKTRONİK SAN. VE TİC. LTD. ŞT	CONTOUR DEVICE	İZMİR	4
EKAŞ ELEKTRİK MALZ. VE KABLO PAZARLAMA	CABLE TV MODIFIER	İSTANBUL	13
EKİNLER KONNEKTÖR SAN. VE TİC. LTD. ŞT	ELEKTROMECH. COMP.	İSTANBUL	125
EKİP ELEKTROMEKANİK KONSTR. İMALAT	VARIOUS CABLES AND ELEMENTS	ANKARA	34

Table D6 (Continued)

FIRM NAME	FIELD OF ACTIVITY	LOCATION	EMPLOY.
ELECTRON ELEKT. VE ELEKTRO. SAN VE TİC	VARIOUS RELAY GROUPS	İSTANBUL	23
ELEKTRA ELEKTRONİK SAN. VE TİC. LTD. Ş	BOBBIN	İSTANBUL	29
ELEKTRO MONTAJ ERDAL ACAR	VARIOUS RELAY GROUPS	İSTANBUL	88
ELEKTRONİK DİZGİ SAN. A.Ş.	PRINTED CIRCUIT	İSTANBUL	21
ELİS ELEKTRİK SAN. VE TİC. LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	116
ELKİ ELEKTRİK ALİ RIZA ERDOĞAN	VARIOUS CABLES AND ELEMENTS	İSTANBUL	9
ELKOMSAN ELEKTRONİK KOMPONENT SAN. VE	VARIOUS CABLES AND ELEMENTS	İSTANBUL	19
ELMEKSAN ELEK. MALZ. SAN VE TİC. A.Ş.	VARIOUS RELAY GROUPS	İSTANBUL	14
ELPA ELEKTRİK MALZ SAN VE TİC, A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	79
EMA TESİSAT VE END. CİH. SAN. VE TİC.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	18
EMEC PLASTİK ELEKTRONİK SAN. VE TİC. K	BUZZER	İSTANBUL	46
EMEK KABLO SAN. VE TİC. LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	16
EMES EGE MAKİNA ELEKTRONİK SAN. VE TİC	TV TUBE	İZMİR	190
EMFA ELEKTRİK MALZEME FAB. A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	52
EMGE KOLL. ŞTİ.	WIRELESS PARTS	ANKARA	27
EMİN MÜHENDİSLİK LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	18
EMOPAR ELEKTROMEK. OTOMOTİV PARÇA SAN.	VEHICLE ANTENNA	İSTANBUL	56
EMSA ELEKTRONİK VE MEKANİK SAN. VE TİC	VARIOUS RELAY GROUPS	İSTANBUL	22
ENSA ELEKTRONİK SAN. VE TİC. A.Ş.	TV TUBE RENEWAL	ANKARA	70
ENTES ELEKTRONİK CİH. İMALAT VE CİH.	VARIOUS RELAY GROUPS	İSTANBUL	81
ER ELEKTRONİK SAN. VE TİC. A.Ş.	TV TRANSFORMATOR	İSTANBUL	165
ER-AL ELEKTROTEKNİK LTD. ŞTİ.	VARIOUS RELAY GROUPS	İSTANBUL	21
ERDEM ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	AMPFLIKATOR-ANNOUNCE SYS.	İÇEL	26
ERDEM TİC. KOLL. ŞTİ. PENİYAMİN TEKER	CROPROCESSOR CONTROL CIRCUI	İSTANBUL	17
ETA ELEKTRİK TELEKOM. TAHHÜT TİC.	VARIOUS CABLES AND ELEMENTS	KOCAELİ	203
ETİ ELEKTROTEKNİK SAN. VE TİC. A.Ş.	VARIOUS RELAY GROUPS	İSTANBUL	134
ETK KABLO SAN. VE TİC. A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	14
EVREN ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	TUNER- RADIO KIT	İSTANBUL	3
FONO-FİLM TİC. LTD. ŞTİ.	VIDEO CASETTES	İSTANBUL	5
FONSA ELEKTRONİK SAN. A.Ş.	REGULATED CIRCUIT	İSTANBUL	21
FÜZE ELEKTRONİK VE MADENİ EŞYA SAN. LT	TV ANTENNA	İSTANBUL	58
GEMTA GENEL ELEKTRONİK SAN. VE TİC. A.	VARIOUS RELAY GROUPS	ANKARA	133
GRANİT ULUSLARARASI TİC VE ELEKTRONİK	TAPE CASETTES	İSTANBUL	95
GÜÇLÜSES ELEKTRONİK SAN. TİC. VE LTD.	AMPF.-LOUDSPEAKER-MICROPHONE	İSTANBUL	12
GÜMAKSAN KAZIM GÜZEL-İSMET KIVRAK	VARIOUS CABLES AND ELEMENTS	İZMİR	83
GÜN KABLO SAN VE TİC. LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	75
GÜVEN TV ANTENLERİ ÖMER GÜVEN	TV ANTENNA-MODIFIER	İZMİR	6
HAKAN METAL SAN. A.Ş.	TV ANTENNA	İZMİR	18
HATİPOĞLU ELEKTRONİK SAN.	MICROFON- COLON	AMASYA	8
HELGİN KABLO SAN.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	24
HES HACILAR ELEKTRİK SAN. VE TİC. A.Ş.	VARIOUS CABLES AND ELEMENTS	KAYSERİ	633
HESFİBEL FİBER OPTİK VE ELEKTRONİK SAN	VARIOUS CABLES AND ELEMENTS	KAYSERİ	245
HONTEL KABLO SAN. VE TİC. A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	434
HOPARLÖR SAN. MESUT SÜBAKAN	LOUDSPEAKER	İSTANBUL	46
HOPSAN ELEKTRONİK SAN. VE TİC. LTD. ŞT	LOUDSPEAKER	İSTANBUL	13
İHLAS HOLDİNG A.Ş.	CASSETTE	İSTANBUL	301
İLETİŞİM KABLO VE SAN. VE TİC. A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	8
İMPEK ELEKTRONİK LTD. ŞTİ.	RECEİVER	İSTANBUL	16
İMTES İMALAT TEKNOLOJİSİ SAN. VE TİC.	WIRELESS PARTS	ANKARA	13

Table D7 (Continued)

FIRM NAME	FIELD OF ACTIVITY	LOCATION	EMPLOY.
İSKA İSTANBUL KABLO SAN	VARIOUS CABLES AND ELEMENTS	İSTANBUL	37
İZKA KABLO METAL END. VE TİC. A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	180
KALEPORSELEN ELEKTROTEKNİK A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	332
KANDIRA KABLO SAN. HÜLYA ÖZEL	VARIOUS CABLES AND ELEMENTS	KOCAELİ	78
KARADENİZ ANTEN SAN. VE TİC. LTD. ŞTİ.	TV ANTENNA	İZMİR	11
KAVEL KABLO A.Ş.	VARIOUS CABLES AND ELEMENTS	BİLECİK	28
KAVEL KABLO VE ELEKT. MALZ. A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	197
KEPKEP İLETİŞİM SİST. İMALAT SAN.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	7
KISMET GALVANİZ ENDÜSTRİ VE TİC. A.Ş.	TRUNK CONNECTION PARTS	İSTANBUL	19
KLAS KABLO VE ELEKTRİK MALZ. SAN. VE T	VARIOUS CABLES AND ELEMENTS	İSTANBUL	230
KLEMSAN KLEMENS SAN. VE TİC. A.Ş.	PRINTED CIRCUITS	İZMİR	90
KOMSA KOMPONENT SAN. A.Ş.	PRINTED CIRCUIT-FILM CIRCUIT	İSTANBUL	222
KOMSİS ELEKTRONİK SİST. SAN. VE TİC.	PANEL ANTENNA	İSTANBUL	5
KUNT ELEKTRONİK SAN. VE TİC. A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	40
KUTLUHAN ELEKTRONİK SAN. VE TİC. LTD.	WIRELESS ANTENNA	İSTANBUL	70
KÜÇÜKLER UYDU ANTEN İMALATI ŞABAN KÜÇÜ	ANTENNA DISH	İSTANBUL	5
MAKSAN KABLO SAN. VE TİC. LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	36
MARMARA TEKNİK TİC. VE SAN.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	15
MEKSAN ELEKTRONİK SAN. VE TİC. A.Ş.	PULSER CIRCUIT CARD	İSTANBUL	35
MEPA SAN. VE TİC. KOLL. ŞTİ.	DIMMER	İSTANBUL	79
Mİ-JU FİLTRE İMALAT SAN VETİC. LTD. ŞT	MONITOR FILTERS	İZMİR	9
MİLKOM İNŞ. TİC VE ELEKTRONİK LTD. ŞTİ	TV ANTENNA PARTS	ANKARA	8
MULTİ TELEKOM SAN. VE TİC. A.Ş.	VARIOUS CABLES AND ELEMENTS	GAZİANTEP	27
MURAT ELEKTRONİK KOMPONENT SAN. VE TİC	VARIOUS CABLES AND ELEMENTS	İSTANBUL	45
NASA ELEKTRONİK CEVDET GÜLBAHAR	TV ANTENNA-MODIFIER	İSTANBUL	8
NETA ELEKTRONİK CİH. SAN. VE TİC. A.Ş.	ATELLITE ANTENNA-TV MODIFIE	İSTANBUL	125
NEVZAT ULUSAL AYDINLATMA SAN.	VARIOUS CABLES AND ELEMENTS	ANKARA	9
NİDAİ ORHAN	RADIO-TAPE PARTS	İSTANBUL	2
NURSAN ELEKTRİK DONANIM SAN VE TİC. A.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	428
NURSAN OTOMOTİV KABLO SAN. VE TİC. A.Ş	VARIOUS CABLES AND ELEMENTS	İSTANBUL	7
ODEON COMPACT DISC MÜZİK SAN. A.Ş.	COMPACT DISC	İSTANBUL	13
OĞULTÜRK İNŞAAT MAKİNA ELEKTRİK SAN.	TELEPHONY BOX	ANKARA	12
OKYANUS ELEKTRONİK SAN. VE TİC. A.Ş. *	PORTABLE ANTENNA	İSTANBUL	46
ORAŞ ENDÜSTRİ TESİSLERİ SAN. VE TİC. A	VARIOUS CABLES AND ELEMENTS	ANKARA	45
OS-RA ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	TV ANTENNA-MODIFIER	İZMİR	8
ÖNAYSAN METAL SAN. VE TİC. LTD. ŞTİ.	TV PARTS	İSTANBUL	150
ÖREN KABLOLARI SAN. VE TİC.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	10
ÖZ İNTERDEKA TELKOM İNŞ VEMAK. SAN. A.	VARIOUS CABLES AND ELEMENTS	İÇEL	22
ÖZAK ELEKTRONİK SAN. VE TİC. A.Ş.	TV ADAPTER	İSTANBUL	192
ÖZGÜN KABLO VE ELEKTRİK MALZ. SAN.	VARIOUS CABLES AND ELEMENTS	KOCAELİ	157
ÖZTEMPO ELEKTRONİK SAN. VE TİC. LTD. Ş	TV ANTENNA-MODIFIER	İSTANBUL	12
PACKARD ELEKTRİK SİST. LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	642
PANÇ ELEKTRONİK SAN. VE TİC. A.Ş.	LOUDSPEAKER-AMPFLIKATOR	İSTANBUL	20
PETKAB KALO SAN. VE TİC. LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	18
PLAKSAN PLAK SAN. A.Ş.	MAGNETIC BANTS	İSTANBUL	82
PROCOM ELEKTRONİK VE HABERLEŞME CİHAZI	TRANSPOSER	İZMİR	7
RATEK ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	TARNSMITTER-TRANSPOSER	İSTANBUL	10
REÇBER KABLO SAN.VE TİC. LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	15
REGSAN ELEKTRONİK SAN. VE TİC. LTD. ŞT	TV ANTENNA	İSTANBUL	15

Table D8 (Continued)

FIRM NAME	FIELD OF ACTIVITY	LOCATION	EMPLOY.
REHAU POLMERİ KİMYA SAN. A.Ş	MAGNETIC BANTS	BİLECİK	176
REM RENKLİ ELEKTR. MALZ. SAN TİC. LTD.	REMOTE SENSOR	İZMİR	12
RYMSAT PROF. TV ANTENNA SİSTEMLERİ SAN	TV ANTENNA	ANKARA	14
S.N.S. ELEKTRONİK SAN. VE TİC. A.Ş.	DC ADAPTER	İZMİR	27
SAMET KALIP VE MADENİ EŞYA SAN. VE TİC	VARIOUS CABLES AND ELEMENTS	İSTANBUL	326
SANKA SAN. KABLOLARI A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	38
SAR EL ELEKTRONİK SAN. VE TİC. A.Ş.	TUNER-CONTROL MODULE	İZMİR	90
SAR ELEKTRONİK SAN. VE TİC. A.Ş.	TUNER-CONTROL MODULE	İZMİR	102
SAR-BO ELEKTRONİK HÜSEYİN SARI	ADAPTER	İSTANBUL	8
SATEL ELEKTRİK MONTAJ SAN. VE TİC. A.Ş	SATELLITE TV ANTENNA	ANKARA	7
SEDA MANYETİK SAN. VE TİC. A.Ş.	AUDIO- COMPUTER CESETTES	İZMİR	7
SEGA - SEYİT MEHMET GÖVER	DIMMER	İSTANBUL	20
SELKO SAN. İNŞAAT VE TİC. A.Ş.	VARIOUS RELAY GROUPS	ANKARA	25
SERA MANYETİK BANT SAN. VE TİC. A.Ş.	VIDEO-AUDIO CASETTES	İSTANBUL	27
SERVO ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	AMPFLIKATOR- COLON	ESKİŞEHİR	19
SET ELEKTRONİK KOLL. ŞTİ. ŞENER AKGÜN	SATELLITE RECEIVER	İZMİR	34
SETKOM İLERİ TEKN. ÜRÜNL. SAN VE TİC.	WIRELESS ANTENNA	ANKARA	20
SNS ELEKTRONİK SAN VE TİC. A.Ş.	VARIOUS RELAY GROUPS	İZMİR	27
SOMTEL KABLO SAN. VE TİC. LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	8
SÖYLETİRLER ELEKTRONİK SAN. VE TİC. LT	TV ANTENNA § PARTS	TEKİRDAĞ	81
SPOT ELEKTRONİK SAN. VE TİC. LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	6
STAR KABLO SAN. VE TİC. LTD. ŞTİ.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	19
STD OTOMASYON VE ÜRETİM SİSTEMLERİ LTD	VARIOUS CABLES AND ELEMENTS	İSTANBUL	20
SÜPERTEKNİK OTOM. KONTROL ELEM. SAN. A	VARIOUS RELAY GROUPS	İSTANBUL	34
ŞAHİN ELEKTRONİK MALZ. İMALAT MONTAJ V	TELEPHONY CAPSULE	İSTANBUL	21
T.T. İMALAT ONARIM VE DONATIM SAN. MÜ	TV ANTENNA	ANKARA	530
TAMGÖR TELEVİZYON- TAMER BALKAN	TV ANTENNA § PARTS	İZMİR	27
TEKOM ELEKTROMEKANİK SAN. VE TİC. LTD.	VARIOUS CABLES AND ELEMENTS	İZMİR	32
TELE ÇANAK ELEKTRONİK SAN. VE TİC. LTD	ELECTRONIC ANTENNA	İSTANBUL	14
TELESET ELEKTROMEKANİK SAN. VE TİC. A.	VARIOUS CABLES AND ELEMENTS	MANİSA	110
TELETEK ELEKTRONİK ATİLLA TEZOL	TV ANTENNA § PARTS	İSTANBUL	18
TELFLEKS OTOMOTİV SAN. VE TİC. LTD. ŞT	ELECTRONIC PARTS	İSTANBUL	15
TELMEK TELEKOMÜNİKASYON MEKANİK SAN. V	SOME ELECTRONIC PARTS	ANKARA	10
TELSAN TELSİZ SAN. VE TİC. A.Ş.	WIRELESS SUSTAINANCE UNIT	İSTANBUL	8
TELTEKS TELEFON KABLOLARI SAN. VE TİC.	VARIOUS CABLES AND ELEMENTS	KOCAELİ	21
TEMPA PANO SAN. VE TİC. LTD. ŞTİ.	VARIOUS RELAY GROUPS	İSTANBUL	115
TERMAL ELEKTRONİK VE DEVRE ELEMANLARI	BOBBIN- TRANSFORMATOR	İSTANBUL	400
TETSAN TRAKYA ELEKTRİK TİC. VE SAN. A.	VARIOUS RELAY GROUPS	KIRKLARELI	285
TEVSAN ELEKTRONİK- ENVER KÖSEN	TV ANTENNA	İZMİR	35
TOSUN DAYANIKLI TÜKETİM MAMÜLLERİ PAZ	TV ANTENNA § PARTS	İZMİR	41
TRON ELEKTRONİK SAN. VE TİC. LTD. ŞTİ.	TV MODULATOR	İSTANBUL	16
TÜMKA KABLO SAN. A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	82
TÜMSAN ELEKTR. MAKİNA VE PARÇA SAN. VE	RESISTANCE HOLDER	İSTANBUL	48
TÜNİK ELEKTROMEKANİK SAN. A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	112
TÜRK PHILIPS SAN A.Ş. PHILISAN	CALE TV AMPFLIKATOR	İSTANBUL	130
TÜRK SIEMENS KABLO VE ELEKTRİK SAN. A.	VARIOUS CABLES AND ELEMENTS	BURSA	726
TÜRKKABLO ANONİM ORTAKLIĞI	VARIOUS CABLES AND ELEMENTS	KOCAELİ	553
ULUERSAN TİC. İSMAİL ULUER	LOUDSPEAKER	İSTANBUL	5
UNİVERSAL HOPARLÖR ANTEN VE KABLO END.	LOUDSPEAKER	KOCAELİ	9

Table D9 (Continued)

FIRMNAME	FIELDOFACTIVITY	LOCATION	EMPLOY.
URT-ULUSAL İLETİŞİM RADYO TELEVİZYON	SATELLITE ANTENNA FITTING	İSTANBUL	63
UZAY ELEKTRONİK CİHAN KARAKAŞ	TV ANTENNA S PARTS	ÇANAKKALE	25
UZELLİ KASET SAN. VE TİC. A.Ş.	CASETTES	KIRKLAREL	32
ÜNAL ELEKTRONİK BASKI DEVRE SAN. VE Tİ	RINTED CIRCUIT- UNDERCARRIAG	İSTANBUL	124
ÜNİFİL ELEKTRONİK SAN. VE TİC. A.Ş.	SENSOR	İSTANBUL	26
ÜNİKA ÜNİVERSAL KABLO SAN. A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	50
ÜNTEL KABLOLARI SAN. VE TİC. A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	99
ÜNÜVAR ELEKTRONİK SAN. VE TİC. A.Ş.	VARIOUS RELAY GROUPS	İSTANBUL	63
ÜSTÜN MAK. SAN VE TİC. LTD. ŞTİ.	VARIOUS RELAY GROUPS	İSTANBUL	59
VATAN KABLO METAL END. VE TİC. A.Ş.	VARIOUS CABLES AND ELEMENTS	TEKİRDAĞ	50
VENÜS ELEKTRONİK CİHAZ VE ELEKTRİK MAL	TV TUBE	İZMİR	13
VESTELKOM ELEK. HAB. CİH. İMALATI VE T	TUNER-CONTROL MODULE	İZMİR	489
YENİÇAĞ ELEKTRONİK SAN. VE TİC. LTD. Ş	TV-SATELLITE ANTENNA	İSTANBUL	83
YILMAZ KABLO SAN. A.Ş.	VARIOUS CABLES AND ELEMENTS	İSTANBUL	24
YURT ELEKTRONİK SAN. VE TİC. LTD. ŞTİ.	TV ANTENNA EXCHANGE	İSTANBUL	20
ZATEL PRES DÖKÜM SAN. VE TİC. A.Ş.	TELECOM. PARTS	İSTANBUL	84
MILITARY ELECTRONICS FIRMS			
EAE ELEKTRONİK ALETLER END. A.Ş.	DISTANCE DEDECTIVE SYS.	İSTANBUL	22
EKA ELEKTRONİK ÜRETİM A.Ş.	EDECTOR- SECONDARY EQUIPMEN	İSTANBUL	113
HAVELSAN HAVA ELEKTRONİK SAN VE TİC. A	WAR SIMULATOR SYSTEMS	ANKARA	349
İNTEK ELEKTRONİK TEKN. SAN. VE TİC. A.	RADAR-SHOOTING CONTROL SYS.	ANKARA	21
İNTER MÜHENDİSLİK DANIŞMANLIK VE TİC.	LAZER SHOOTING SYSTEM	İSTANBUL	55
MARCONİ KOMÜNİKASYON A.Ş.	MILITARY WIRELESS	ANKARA	119
MİKES MİKRODALGA ELEKTRONİK SİST. SAN.	AIRCRAFT ELECTRONICS	ANKARA	90
PROFİLO SAVUNMA GEREÇLERİ SAN. VE TİC.	ILITARY COMMUNICATION SYSTEM	İSTANBUL	76
SANTEK ELEKTR. SAN. VE TİC. LTD. ŞTİ.	PANZER ELECTRONIC SYSTEMS	ANKARA	27
STFA SAVRONİK ELEKTRONİK SAN. VE TİC.	AVIONIC SYSTEM	İSTANBUL	50
STFA SAVRONİK ELEKTRONİK SAN. VE TİC.	AVIONIC SYSTEM	ESKİŞEHİR	20
TEKNOLOJİ TİC. ELEKTRONİK SAN. A.Ş.	STANCE DEDECTIVE SYS.-DEDECT	İZMİR	45
TESTAŞ TÜRKİYE ELEKTR. SAN VE TİC. A.Ş	MILITARY EQUIPMENT	ANKARA	207
THOMSON TEKFEN	RADAR	ANKARA	45
TRANSVARO ELEKTRON ALETLERİ SAN. VE T	DISTANCE DEDECTIVE SYS.	İSTANBUL	38
YÜNEL ELEKTROMEKANİK SİSTEM VE TESİSLE	DEDECTOR	ANKARA	23
COMPUTER FITTING FIRMS			
4K BİLGİ İŞLEM SAN. TİC VE PAZ. LTD. Ş	COMPUTER FITTING	İSTANBUL	9
BİLGİ ELEKTR. TİC. VE SAN. A.Ş.	COMPUTER FITTING	İSTANBUL	9
BİLTAM MÜMESSİLLİK DIŞ TİC. VE SAN A.Ş	MODEM	İSTANBUL	10
BİMSAN ELEKTR. BİLGİ İŞLEM MAKİNALARI	COMPUTER EQUIPMENT	İSTANBUL	6
BOĞAZİÇİ BİLG. PROG. TİC VE SAN. A.Ş.	COMPUTER FITTING	İSTANBUL	23
ÇAĞDAŞ BİLG. VE EĞİTİM HİZM. SAN	COMPUTER FITTING	ANKARA	7
ÇİZGİ ELEKTRONİK SAN. VE TİC. LTD. ŞTİ	COMPUTER FITTING	İSTANBUL	11
DATA TEKNİK SİLG. SİST. TİC VE SAN. A.	COMPUTER FITTING	İSTANBUL	16
ELEKTRA BİLG. VE YAZILIM MÜH. SAN. Tİ	COMPUTER FITTING	ANKARA	25
ESCORT COMP. ELK. SAN VE TİC. LTD. ŞTİ	COMPUTER FITTING	İSTANBUL	147
ESTAŞ EROZYON SAN. VE TİC. A.Ş.	COMPUTER FITTING	İZMİR	13
GÜNEŞ BİLGİSAYAR A.Ş.	COMPUTER FITTING	İSTANBUL	30
HOBİM BİLGİ HİZMETLERİ A.Ş.	COMPUTER FITTING	İSTANBUL	36
INTERCOM BİLG. İTH. İHR. TİC. LTD. ŞTİ	COMPUTER FITTING	ADANA	7
İST BİLGİSAYAR SAN. VE TİC. A.Ş.	COMPUTER FITTING	İSTANBUL	8

Table D10 (Continued)

FIRMNAME	FIELDOFACTIVITY	LOCATION	EMPLOY.
JÜPİTER ELEKTRONİK LTD. ŞTİ.	MODEM	İSTANBUL	6
PC BİLGİSAYAR SİST. TİC VE SAN. LTD. Ş	COMPUTER FITTING	ADANA	10
PC DANIŞMAN ELEKTRONİK SAN LTD. ŞTİ.	COMPUTER FITTING	İSTANBUL	10
PROTOKOM BİLG. YAZILIM DONANIM	COMPUTER FITTING	ANKARA	8
ROLVA BİLG TİC. PAZ. LTD. ŞTİ.	COMPUTER FITTING	ANTALYA	5
TEDS DON. VE YAZ. SAN VE TİC. LTD.ŞTİ.	COMPUTER FITTING	İZMİR	4
VERİSOFT BİLGİ İŞLEM TİC. SAN. LTD. ŞT	ENCYRPT ENTER DEVICE	İSTANBUL	10
VESKOM KOMP. KOMÜN. TİC. A.Ş.	COMPUTER FITTING	İSTANBUL	14
YAŞAR BİLGİ İŞLEM VE TİC. A.Ş.	COMPUTER FITTING	İZMİR	94

APPENDIX E

Table E. Turkish Professional Electronics Producers in 1998

ANKARA	ACTIVITY	EMPLOYEES	ENGINEERS	PLACE	DATE
BURÇ	1	90	16	SİNCAN	1976
ECS	1-5	214	19	OSB-SİNCAN	1973
ELİMKO	2	127	22	EMEK/ÖVEÇLER	1976
ELKOM	2-3	24	4	KIZILAY	1988
ELMED	4	16	3	OSTİM	1995
ELSİM	3	14	2	DİKMEN	1982
ELSİS	1	27	4	ULUS	1971
EMEK	2	10	3	ÖVEÇLER	1991
EMSE	5	14	4	OSTİM	1993
ENERSİS	1-3-7	84	25	KÜÇÜKESAT	1982
EPROM	5	22	4	KIZILAY	1984
ETA	2-3	17	8	BALGAT	1984
F.H.R.	5	23	4	Y.MAHALLE	1993
GATE	2	55	19	Ç. EMEÇ/SİNCAN	1989
GENESİS	3	29	1	İSKİTLER	1991
HEMA	1	94	9	POLATLI	1986
İNTEK	1	26	5	KÜÇÜKESAT	1993
KARDİOSİS	4	26	8	BALGAT	1988
MEKO	2	25	8	KIZILAY	1984
MOSTEK	2	15	3	BALGAT	1988
NEL	2	41	10	KIZILAY	1985
NÜVE	4	51	4	ESENBOĞA 22.KM	1976
OES	1	30	5	ŞAŞMAZ	1987
ON	5	9	3	K.ESAT	1991
ORTANA	5	15	4	TUNUS CAD.	1992
PCK	4	38	4	ÖVEÇLER	1993
PETAŞ	4-6	71	12	EMEK/B.SANAYİ	1977
SİSTEK	2	25	3	SEYRAN	1984
ŞEKER	2	422	28	ETİMESGUT	>>1987
TESTAŞ	1-6	121	25	ESK.YOLU 9.KM	1975
TETA	3	105	41	İLKER MAH.	1981
ULTRA	5	39	4	OSTİM	1992
UTES	3	24	2	İSKİTLER	1984
YESTAŞ	3-5	25	4	KIZILAY	1956
ZER	3-5	70	9	ULUS	1956
BETA	*4*			*ODTÜ KOSGEB*	*1997*
EGİS	*2*	*1*	*1*	*ODTÜ KOSGEB*	*1996*
EKON	*5*			*ODTÜ KOSGEB*	*1996*
GATEMAK	*2-3*	*4*	*2*	*ODTÜ KOSGEB*	*1995*
IZCOM	*5*			*ODTÜ KOSGEB*	*1997*
KARUZEL	*2-4*			*ODTÜ KOSGEB*	*1997*
MEDİSPO	*4*	*4*	*3*	*ODTÜ KOSGEB*	*1996*
POWEX	*2*			*ODTÜ KOSGEB*	*1996*
BURSA					
EMKO	1-2-6	45	9	OSB-DEMİRTAŞ	1986
İTEMAŞ	1	48	3	OSB-İNEGÖL	

Table E1 (Continued)

İSTANBUL	ACTIVITY	EMPLOYEES	ENGINEERS	PLACE	DATE
BAYKON	2	32	7	BOSTANCI	1991
BESTAŞ	1	44	5	4. LEVENT	1986
BKS	2	8	2	BEYKOZ	1992
CEDETAŞ	3-7	128	30	SULTANBEYLİ	1958/1984
DESİ	3	23	3	ESENLER	1990
DESTAŞ	1	17	1	ZEYTİNBURNU	1989
DEVOTRANS	1	16	1	TOPKAPI	1990
DİKOMSAN	1	9	1	4. LEVENT	1993
EDS	1-3	47	12	ÜMRANİYE	1990
EEC	3-5	111	33	BEYOĞLU	1982
EGES	1	105	11	BAĞCILAR	1974
EKA	1-2-7	93	25	AYAZAĞA	1977
ELİAR	2	26	11	1. LEVENT	1984
EMİKON	2	23	4	ÜMRANİYE	1985
ENDİKSAN	1	125	9	DOLAPDERE	1991
ENEL	1	20	4	ÜMRANİYE	1985
EOC	1	8	1	KARTAL	1992
ER	3-6	165	8	AVCILAR	1986
ERA	5	67	6	4. LEVENT	1968
ESİT	2	125	15	ÜMRANİYE	1987
İNFORM	1	110	11	ÜMRANİYE	1979
MAKELSAN	1	25	4	KADIKÖY	1978
METER	2-6	30	2	HADIMKÖY	1972
ÖNPA	3	9	2	MECİDİYEKÖY	1992
POLARİS	2	18	4	GÜNGÖREN	1993
ROTA	5	25	3	ZEYTİNBURNU	1993
SİSEL	2	41	6	KARAKÖY	1989
TAKOSAN	1-6	39	4	GÜNGÖREN	1986
TUNÇMATİK	1	21	3	ÜMRANİYE	1969
1 FİRM	*2*			*YILDIZ KOSGEB*	*1997-1998*
BAKS	*2*			*İTÜ KOSGEB*	*1996*
BİLCO	*2*			*BOĞAZİÇİ KOSGEB*	*1997*
BİMED	*4*			*BOĞAZİÇİ KOSGEB*	*1998*
MESTAŞ	*5*			*İTÜ KOSGEB*	*1996*
TEKNOFİL	*4*			*BOĞAZİÇİ KOSGEB*	*1998*
TELECON	*5*			*İTÜ KOSGEB*	*1997*
VİSTEK	*2*			*BOĞAZİÇİ KOSGEB*	*1998*
İZMİR					
AJAN	1	30	2	SAN.SİT.KISIKKÖY	
ASTEK	3	18	2	KARŞIYAKA	
ELEKTRAL	5	40	4	OSB-ÇİĞLİ	1978
ENKO	2	49	8	OSB-ÇİĞLİ	1982
HATEL	5	9	2	ÇANKAYA	
POLİMEK	3	19	4	KARŞIYAKA	
TÜMEL	1-2	40	8	ÇAMDİBİ	1988
KAYSERİ					
AAZ ZEKİ	3	30	4	TAŞHAN	1988
ENDSİS	3	15	2	BANKALAR CAD.	1990
HES	3	21	2	HACILAR YOLU	1990

NOTE:

1: ST. EQUIPMENT 2: INDUSTRIAL ELECTR. 3: SECURITY-ALARM SYS. 4: MEDICAL ELECT.

5: OTHER PROF. DEVICES 6: COMPONENT 7: ELECTRICITY SECTOR

APPENDIX F

Table F. Employment Values of Different Regions

	ANKARA	İSTANBUL	İZMİR	OTHER	TÜRKİYE
PROF.ELECTRONICS EMPLOYMENT	2037	1510	205	232	3984
	51 %	38 %	5 %	6 %	100 %
ELECTRONICS EMPLOYMENT	7601	23848	2590	7770	41809
	18 %	56 %	6 %	20 %	100 %
MANUFACTURING EMPLOYMENT (*)	41254	302116	91226	602204	1036830
	4 %	29 %	9 %	58 %	100 %

(*) indicates 1996 values (S.I.S., 1999)

APPENDIX G

Table G. Closed and Transformed Professional Electronics Firms Since 1973

1973-84	
CLOSED FIRMS	TRANSFORMED FIRMS
MADAH: Ankara-medical	ALFAGAMMA: Ankara
MEDİKAL: Ankara-medical	GAMA: Ankara
SESA:Ankara	
GEOTEKNİK: Ankara	
DATA: İstanbul	
ULUTAŞ: İstanbul-medical	
SELÇUK DEMET- İstanbul	
ANADOLU: İzmir	
1984-98	
CLOSED FIRMS	TRANSFORMED FIRMS
SİGMATEK: Ankara	SELER LAB.- Ankara
BEHİÇ GÜLBAHAR- Ankara	YESA- Ankara
SİNYAL SAN. - İstanbul	UNITRONIX- İstanbul
ARFEN- İstanbul	
HİLKAT BOLULU- İstanbul	
GENEL- İzmir	
BAŞARAN-İzmir	

* Table derived from; Skoulman,1973, DPT,1977, Ankara Sanayi Rehberi, 1984, UCCE Lists-1998.

APPENDIX H

Table H. Professional Electronics Trader Firms in Türkiye in 1997

ANKARA	İSTANBUL	İZMİR	OTHER PLACES
ELECTRONIC MEDICAL DEVICES			
AMS-GENTEK-KAS	BALKAN-BS-BUCK-CENFA	SİBEL- TEMPA	
RAYSAS-TESST-TELEMAK	HATİPOĞLU-İLK UMUT		
	KUMOVA- LUKOVA- MEDA		
	REM RÖNTGEN- SÖNMEZ		
AUTOMATION- MEASUREMENT CONTROL			
BİLKON-EBİ-ELİSA	AEG-AKAL-AKBİL-AKTİF	BESA- BEST	AEG ETİ (K.eli)
EMO-ERSEL-GÜL-HERAUS	ALFATEK- ALP TEKNİK		PEKEL (Manisa)
MATES-MÜSAN-PROMIS	AMEKS-ARES-BAŞAR-CİM		SLIM (Bursa)
RAYSEL-SİSPA-SYS	CONTROL TECHNIQUES		TAŞDEMİR (G.antep)
TEKNİM-TEST-TOPAZ	COULTER-ÇİZGİ-DEĞİRMEN		
ZAFER	DÖNÜŞÜM-EKPAR-ELAR		
	ELEKON-ELEKS-ELEKTRA		
	ELEKTRO- ELEKTROTEK		
	ELIOP-ELMAK-ELTEM-EMO		
	EMPATEK-ENTEK-ENTES		
	ERKMAN-GMG-GOLDEN-GTS		
	HACI AYVAZ-İSOT-KEMCO		
	KONTEL-LONCA-MANİSALI		
	KONTROL SİSTEMLERİ		
	MEBUM-MEKSAN-MİKROHOST		
	MİNOR-NUR-ODAK-OMRON		
	ONUR-PROEKS-PROTEK-SAM		
	SAMSON-SANPA-SCHNEIDER		
	SETRA-SİMTEK-SOVTUR-TED		
	TEKFEN-TEKTRONİK-TEST		
	TETRA-WESTINGHOUSE		
	ZET NIELSEN		
SECURITY- ALARM SYSTEMS			
BIÇAK-BIOS-ELTEK	ALARKO-ALKAN-ALKON-ANT		
EMPA-EMT-METAŞ	AREL-BEŞEL-BİLGİ-DESİ		
ORBİT-SELER-WILCO	E.F.-ELEKTRO-ELEKTROMOTİV		
	ELEKTROPANÇ-ELEKTROTOP		
	ERELSAN-ESİN-FORS-GSD		
	GÜVENLİK VE İLETİŞİM		
	HONEYWELL-ODEONIST		
	ORAŞ-ÖZ-PANASONIC-RMS		
	SEMTECH-SPARTAKÜS-ŞENER		
	TEGE-TEKNİK ATILIM		
	TRANSAWKA-UTIMPEKS		

Table I. Name and Adesses of Interviewed People

	NAME OF PERSON	JOB IN THE FIRM	ADRESS
ANKARA			
ELSİS	RECEP GÖRÜR	FOUNDER/SHAREHOLDER	EGE SOK. UÇAR TİCARET MERKEZİ 5/370 ULUS
OES	HARUN GÜL	FOUNDER/OWNER	GERSAN SANAYİ SİTESİ İSTANBUL YOLU 13.KM NO: 92
ELİMKO	MALİK AVİRAL	FOUNDER/SHAREHOLDER	8. CADDE 68. SOKAK NO: 16 EMEK (BUREAU)
GATE	TURGAY MALERİ	FOWNDER/OWNER	ÇETİN EMEÇ BULVARI 8. CAD. NO: 10/7-8-11 ÖVEÇLER
MEKO	ADNAN ÖZTÜRK	R§D MANAGER	PARİS CAD. NO: 12/5 KAVAKLIDERE
MOSTEK	HALDUN MIDOĞLU	FOUNDER/ OWNER	OĞUZLAR MAH. 4. SOK. 18/B BALGAT
NEL	CAHİT ERKURT	SHAREHOLDER	SÜMER SOK. 42/1 KIZILAY
SİSTEK	ERDOĞAN YETİŞKEN	FOUNDER/OWNER	BALLIBABA SOK. NO: 49 SEYRANBAĞLARI
ETA	HÜRSEL KENDİR	SHAREHOLDER	NASUH AKAR MAH. 6. SOK. NO: 3 BALGAT
TETA	HALDUN ÜLGEN	FOUNDER/SHAREHOLDER	NACİ ÇAKIR MAH. 10. SOK. NO: 34 İLKER- ÇANKAYA
ENERSİS	AYDIN GÜRPINAR	FOUNDER/ SHAREHOLDER	GEZEGEN SOK. NO: 13 GAZİOSMANPAŞA
ELSİM	OSMAN HÖKE	FOUNDER/ OWNER	SALKIMSÖĞÜT SOK. NO: 30/A DİKMEN
UTES	BURHAN TOKGÖZ	FOUNDER/ OWNER	KAZIM KARABEKİR CAD. KÜLTÜR ÇARŞISI NO: 7/95
YESTAŞ	UĞUR YERTUT	OWNER	HATAY SOKAK 20/2-4 KIZILAY
PETAŞ	TEOMAN AKIŞ	FOUNDER/SHAREHOLDER	71. SOK. NO: 21 EMEK (BUREAU)
K.SİS	ZİYA İDER	FOUNDER/ OWNER	METU ACADEMICIAN IN ELECTRONICS DEPT.
NÜVE	CAHİT ERKURT	SHAREHOLDER	SÜMER SOK. 42/1 KIZILAY (BUREAU)
PCK	KAYHAN KAYAN	R§D MANAGER	ÇETİN EMEÇ BULVARI 4. CADDE NO:14 ÖVEÇLER
EPROM	FATİH AHISKA	FOUNDER/OWNER	KARANFİL SOK. 21/6 KIZILAY
ON	ORHAN AYDIN	FOUNDER/OWNER	15. SOK. NO: 65 KIRKKONAKLAR- GAZİOSMANPAŞA
ORTANA	UMUT AYDIN	FOUNDER/OWNER	TUNUS CAD. 50A/16 KAVAKLIDERE
EGİS	İSMAL SAFA ATAY	OWNER	METU KOSGEB NO: 606
MEDİSPO	BANU ÖZDEMİR	SHAREHOLDER	METU KOSGEB NO: 305
KAYSERİ			
AAZ	ZEKİ AVCI	OWNER	CAMİKEBİR MAH. PARK CAD. TAŞ İŞHANI NO: 4/50
ENDSİS	AYHAN ŞAHİN	FOUNDER/OWNER	BANKALAR CAD. SAMURAĞA İŞHANI KAT:1
HES	OSMAN BAYRAKTAR	PRODUCTION MANAGER	HACILAR YOLU 12. KM.

Table I1 (Continued)

	NAME OF PERSON	JOB IN THE FIRM	ADRESS
İSTANBUL			
EGES	ERGİN ÇÖL	PRODUCTION MANAGER	MAHMUTBEY TAŞOCAĞI YOLU NO:9 BAĞCILAR
ROTA	HİLMİ GÖK	FOUNDER/ OWNER	DEMİRCİLER SİTESİ 1. CAD. ZEYTİNBURNU
EKA	SELİM ALGUADİŞ	FOUNDER/SHAREHOLDER	BÜYÜKDERE CAD. AYAZAĞA ASFALTI 3. YOL NO: 19
BAYKON	SERDAR BÜYÜKÜSTÜN	GENERAL MANAGER	BOSTANCI SANAYİ SİTESİ ÇİLEK SOK. NO: 10 BOSTANCI
BKS	TUNÇ TURALI	FOUNDER/OWNER	ÇİFTLİK CADDESİ NO:41/1 KAVACIK
ESİT	BAYRAM AKKAYA	PRODUCTION MANAGER	MÜHÜRDAR CAD. NO:91 KADIKÖY (BUREAU)
ELİAR	MEHMET TAYGUN	FOUNDER/SHAREHOLDER	SÜLÜN SOK. NO: 18 1. LEVENT
POLARİS	LEMAN ÇIRAKMAN	SHAREHOLDER	ESKİ LONDRA ASFALTI NO: 85/A GÜNGÖREN
SİSEL	GÜNHAN ÜNSAL	FOUNDER/OWNER	OKÇUMUSA CAD. MİDİLLİ SOK. ALHAN KAT:5 KARAKÖY
CEDETAŞ	SERDAR ÇELİK	GENERAL MANAGER	OSMANGAZİ MAH. FATİH CAD. YANYOL NO: 25 KARTAL
EEC	KEVORK BENLİOĞLU	GENERAL MANAGER	TARLABAŞI BULVARI TURAN CAD. 126 TAKSİM
EDS	ASUMAN ŞULAN	PUBLIC RELATIONS MANAGER	İSTANBUL ÇARŞISI E BLOK KAT:1 ÜMRANİYE
ERA	OĞUZ ÇİTÇİ	FOUNDER/SHAREHOLDER	ESKİ BÜYÜKDERE CAD. NO: 49/A 4. LEVENT
BURSA			
EMKO	AYHAN ISPALAR	FOUNDER/OWNER	DEMİRTAŞ ORGANİZE SAN. BÖLGESİ KARANFİL SOK.
OTHER PEOPLE THAT WERE INTERVIEWED ARE;			
	TAYFUN AKIN	ASSOC PROF. DR.	METU ELECTRONICS ENGINEERING DEPT.- ANKARA
	ÜNAL ALKAN	TESID GENERAL SECRETARY	BAĞDAT CADDESİ 477/4 SUADİYE- İSTANBUL
	MUSTAFA KAPLAN	COORDINATOR IN BOĞAZİÇİ KOSGEB	BOĞAZİÇİ ÜNİV. KUZEY KAMPÜSÜ HİSARÜSTÜ- İSTANBUL
	ABDULLAH ÖZDEMİR	CHAMBER OF ELECTRIC ENGINEERS	CUMHURİYET CAD. 283/2 ENGİNHAN HARBİYE- İSTANBUL
	HARUN ÖZERDEM	SALES MANAGER OF WILCO FIRM	FETHİYE SOK. 6/11-13 GAZİOSMANPAŞA- ANKARA
	ALİ YİĞİT	CHAMBER OF ELECTRIC ENGINEERS	IHLAMUR SOK. 10/1 YENİŞEHİR- ANKARA
	ATACAN YÜCELEN	COORDINATOR IN İTU KOSGEB	İTÜ KAMPÜSÜ AYAZAĞA- İSTANBUL

APPENDIX J

CONSTRUCTED STRUCTURE OF FIRM INTERVIEWS

1. To Determine General Structure of Firms

1.1 Firm Specific Information:
* Date of Establishment?
* What are the primary opportunities, aims and limitations of the firm?
* What was the status of firm at the establishment period?
* Give historical development line considering status of firm and labour force within the firm.
* What are the turning points of the firm within its business life and effects of these in business life of the firm?
* Give information on basic entreprenueral functions of firm such as; administration, financing, marketing, production peculiarities.

1.2 Personnel Relations:
* Give knowledge on production process within the firm.
* Do firm owner or founder participate to the any phase of production?
* Give broad knowledge on experiences of managers, engineers and other employee within the firm?
* What are the educational level of all firm personnel? From which schools they graduated?

1.3 Technological Level of Firms:
* Is technology generation process independent?
* Is local design process exist? What is its share in marketed goods if exist?
* Is there formal R$D department in the firm? What is the contribution of this department to innovation process of the firm?
* What are other technology gathering facilities apart from R$D? Give explanation on these facilities
* How innovation process occur in the firm?
* Does your firm firm have license agreements?
* Does your firm export technology?
* Does your firm have patent or trademark?
* Evaluate technological level of the firm.

2. To Determine Network Relations

2.1 Investment and Production Relations:
* Do you have information contacts in pre investment period? If exists, whom do you contact with, characteristics of these contacts and their places?
* Do the firm do subcontract work? If exists to whom? What

kind of work is it? Give any special knowledge on the subject.
* Do the firm give subcontract work to other firms? If exists to whom? What kind of work is it? Any special knowledge on this subject.
* Do the firm have any other type of contact or relation with subcontract firms?
* What is the meaning of distance to the firm considering subcontract relations?

2.2 Technology and Information Linkages:

* Do the firm has a relation / collaboration with a university? Give specific knowledge on this subject.
* Do the firm have a relation / collaboration with a research or science institution? Give specific knowledge on this subject.
* Do you have a relation / collaboration with any other firm in these subjects?

Common education programmes
Labour exchange
Product development
Subcontract R§D
Formal information exchange
Informal information exchange
Several types of informal relations

* Do you have formal / informal technological information exchange with friends of other professional electronics firms? How this effects the performance of the firm?
* Do you utilise internet in your business? How internet effects the performance of the firm?

2.3 General Policy Relations:

* Are incentives sufficient that are given to this sector? Why?
* What kind of incentives did you take? Are you still taking incentives?
* Give broad information on all type of relations with governmental institutions.
* Which governmental institution do you have tight and strategic relations? Explain this subject.
* Do you have relations with several institutions that are related with electronics industry? Give knowledge on these institutions and relations.

3. To Determine Market Structure and Market Relations

* Give broad knowledge on products of firms and their market opportunities.
* What kind of input does the firm use? Give special knowledge on maintaining inputs.
* Does the firm have any export activity? Broad knowledge on this subject
* Give broad knowledge on customer type and market structure within Türkiye.
* Give explanation on marketing structure and strategies of the firm.
* Does the firm have after sales services? What is the importance and meaning of after sales services to the firm.
* Give spatial knowledge on market relations of the firm.
* Does the firm have technical information exchange with customers? How this is occurring and what are the benefits and results?

* What does proximity to customer mean to your firm. Evaluation on it.
* Does firm have any representation? What are the benefits of it and why do you take this type of work? Did you take any type of representation in past? Give knowledge on it.

4. To Understand Locational Choice of Firms

4.1 At Regional Level:
* Were there any specific reason for locating in that province?
* What were the advantages or disadvantages of your region in starting period of establishment?
* What are the present advantages or disadvantages of your region considering production, technology gathering, accessibility to markets and finding labour force?
* How existence of big firms in the region effect your overall performance?
* Are cultural and recreational facilities in your region important factors for the personnel? Explain.

4.2 At Urban Level:
* Is there any movement since the establishment. Give knowledge on the subject.
* Are there positive and negative factors that arise from location of the firm? Give broad information on the subject.
* Do you think to move in future? Give brief knowledge on the subject.
* Do you have any other bureaus in other cities? Give brief knowledge on the subject.
* Where activities apart from production take place? Give characteristics of these types of works.

5. To understand Future of Firms

* What are the shortcomings
* What are the future aims
* Evaluate future of your firm and the sector

APPENDIX K

GENERAL KNOWLEDGE ON INTERVIEWED PROFESSIONAL ELECTRONICS FIRMS

This appendix is about general knowledge on individual firms that take place in this study.

Ankara firms are;

ELSİS: It was established as a research firm in 1971 within MİMAŞ Holding company. Then the firm entered telecommunication sector. It invented a microprocessor controlled telephone device in 1985. At the marketing stage of this product, its import became free then firm changed its activity to power electronics. When mother company was closed up, this firm was separated from the company in 1994. Now the firm is in recovering period.

OES: Firm was established in 1987, but started production in 1992. Between these periods, founder was working in Aselsan. This firm is producing various models of UPS with trademark of "Gess".

ELİMKO: It was established in 1976. Firm had no production and had research activities on R§D and marketing between 1976-1978. It entered into production of automatic control devices, sensors, thermocouple devices in 1978. After 1982-83 period, complete automation systems were started to produce in the firm. It is one of the most famous producers of automatic control devices in Türkiye.

GATE: It was established in 1989 as a trader firm. Then it took place in METU KOSGEB with an electronic project. It is now producing detecting systems of electronic card defects. Also this firm specialised in repairing activities. Besides these, firm is giving engineering services to factories. It has a sister firm named GATEMAK specialised on machinery in METU KOSGEB.

MEKO: It was started with producing electronic industrial weighing systems and devices in 1983. User friendly systems were designed and produced in this firm and by this way, sales were increased. Since 1983 they produced about 250-300 electronic weighing system. After 1988, they entered into factory automation branch. When firm was introduced with module PLC's, they decided not to produce weighing systems anymore. They left their own designed cards and they changed their activities through system

design and production. Philosophy of the firm becomes fitting of qualified equipment and establishment of automation systems.

MOSTEK: It was established in 1988 by 2 engineers. Former production of the firm was the lifting command boards. Then they do a subcontracted work of electronic cards of identity card covering machines for another electronics firm. After then, they changed their production type and entered into the design and production of performance test devices for heater and refrigerator producers. Once they worked with ARÇELİK, they had a chance to enlarge their works with the help of this experience.

NEL-NÜVE: These firms take place in same company. First, NÜVE was established in 1977 to produce laboratory devices because of lack of foreign currency. Then NEL NÜKLEER was established. NEL was established to produce electronic thermostat for NÜVE in 1985. After then, NEL expanded its works and became an industrial electronics producer.

SİSTEK: It was established in 1985. Founder of the firm had established another firm in 1978. Firm became as a representative of SIEMENS in field of programmable logic control's. Then firm began to produce digital control devices, microprocessor supported control devices, servo motor controls and so on.

ETA: It is producing civil and military security systems under TARGET group of firms. Firm was established in 1984. It can be considered as a software based firm. Main activities of the firm are design and production of electronic security systems and production of control and automation software. Also the firm is active in engineering support.

TETA: It was established in 1981 as a personal firm and became a group of firms in 1988. It has 6 firms in it. There are two electronics producers within the group. TETA and TETATEK firms take place in same building. At the beginning, firm was the representative of various foreign electronics firms. Then with the help of this experience, firm started to produce magnetic cards, bar cod readers, auto park electronic systems, electronic access systems, personal control systems and so on.

ENERSİS: It is a group of 4 firms. This firm was started in 1982 and its former activities were production of UPS and language laboratories. Between 1985-1987, ENERSİS was designed first Turkish UPS. Main activity of the firm was changed after 1987. Firm was entered into building automation systems. After works of Hilton (1987) and Cairo Mövenpick Hotel (1988), firm became very experienced in this field. It is still producing UPS, also dealing with commitment works. Also there is a firm (ELEKTROSİS) dealing with production of electric boards within the group.

ELSİM: It was established in 1982 to produce alarm panels, communication-alarm modules after a government rule that ordered all banks, jewel shops and public institutions who

have pay offices to establish their own security systems integrated with police stations. Founder of the firm was not electronics engineer but firm was started as a hobby and continued till present.

UTES: This firm is the first car alarm systems producer in Türkiye. It was established in 1984 by chance and grew so much until 1990. Founder of the firm was one of the famous food trader in Ankara. In 1990, firm had about 940 vendors all around Türkiye. After this period, they did not able to manage this kind of huge work and new firms emerged after break up of this firm. Firm is still producing car alarm systems in an unobtrusive way.

YESTAŞ: It is the oldest PE firm in Türkiye that was established in 1956. Firm was established as a personal firm, then come today with this structure. It is producing fire warning detectors and satellite receiver systems. Also it is the trader of access control systems. It is not a technology based firm.

PETAŞ: It was established in 1977 with taking rights of Medical Electronics Ltd. by 2 engineers. After 1986, it was started to produce printed circuits as it had the necessary equipment for this type of production. After 1994 crisis, they left trade activities that means 30 % of their total capital and insisted on full production. They are producing and specialised in cardiology devices, physical cure devices, electrocer devices.

KARDİOSİS: Firm was established in 1988 by a METU academician. Its aim was to design and produces PC based electrocardiography system. No production was done until 1990. Know-how was given to EBİ firm and this firm held out the production. After then, they started production. In 1994 they took place in METU KOSGEB. In mid 1998, some parts of production and marketing activities were transferred to TEPA firm. About 40 % share of this firm belongs to KARDIOSIS. Firm holds out 70 % of stress ECG market and 50 % of Interpretative ECG market in Türkiye.

PCK: It was established in 1993 by two brothers. One brother left the firm and established ELMED, another medical electronics firm in Ankara in 1995. Firm is rapidly growing but its organisational structure did not develop much since 1993. It produces kidney stone crusher device. About 60 % of its production is being exported.

EPROM: It was established in 1984 by a geology engineer as a hobby. It is producing audio-visual systems. Products were microwave link systems and electronic studio equipment. Firm uses its own trademark "EPROM"

ON: It was established in 1992. Firm was located in METU KOSGEB between 1994-1996. It was started as an engineering firm. From 1994, it began to produce scoreboards. From 1997, firm entered into traffic sector and started to make a subcontract work for ULTRA. Within this project, design of counter traffic lights belongs to this firm.

ORTANA: This firm is another scoreboard firm. It was started in METU KOSGEB in 1992. After some common businesses with ASELSAN and other big firms, it gained the ability of qualified production. It has also another sister firm named TASK, dealing with detecting repairing service of electronic board defects.

Also there are two infant firms that take place in METU KOSGEB. These firms are;

EGİS: Only employee in the firm is the founder himself. It has efforts to produce digital vision systems used for industrial applications. Founder of the firm's aim is to enlarge within 5 years and employ up to 10 persons in the firm.

MEDİSPO: It is an infant firm that was established in 1997 and takes place in METU KOSGEB. It is producing Rio-cardio monitors, also doing fitting of plastic medical devices. It has another medical electronics based sister firm named KARUZEL that takes place in same KOSGEB.

İstanbul firms are;

EGES: It was established in 1974 by 2 engineers. It was producing regulators at the beginning. Firm was started to produce UPS in 1982. First Turkish induction oven was produced by this firm in 1984. Because of a recession within firm, organisation structure of the firm was restructured in 1996. It is one of the biggest UPS producers in Türkiye.

ROTA: It was established in 1993. Firm is specialised in taximeters and tachometers. It started to produce smart cards in 1994.

EKA: This company is a group of firms. It has 6 firms and 2 of them are active in electronics production. One is specialised in power electronics and other is specialised in military electronics. Firm was established in 1975 as a personal firm and turned into join-stock company in 1977. New firms emerged in different names. In 1990, founder of EKA became the owner of the firm again. It had 4 projects that were supported by TDFT. Firm gained a technology prize from Technology Development Foundation in 1997.

BAYKON: It was established in 1987 but it started production in 1991. In this period, they gave some engineering services and do market research. It has been active in electronic weighing systems and measurement control devices since that period.

BKS: It was established in İTU KOSGEB in 1991. Firm was carried to Beykoz from KOSGEB. Firm continued its activities till now with no serious change. It is now producing electronic devices for automation.

ESİT: It is the most famous firm in electronic weighing systems in Türkiye. It was established in 1984 by two

engineers. It was active in different types of electronics until 1985. From that period, the firm started to specialise in electronic weighing systems. In 1988, the firm produced first Turkish load cell.

ELİAR: It was established in 1984 by 4 engineers. Firm was started as a sister firm of CEDETAŞ. Firm was separated from the group and developed its own production structure one year later. Firm is producing microprocessor controlled industrial units.

POLARİS: It was started as a personal firm in 1993 and its organisational style continued till the present. Firm is producing control devices and automation solutions. It started producing electronic sliding word system for hospitals in 1997. It has also a sister firm named TAYF producing thermo units.

SİSEL: Firm was started as a trader in 1989. It became the vendor of ELİMKO (Turkish biggest control device producer in Ankara) in 1992. After this period, depending on their experiences, this firm started production in the areas ELİMKO was weak. It produces under ENDA trademark and has a sister firm as a trader in free zone in İstanbul.

CEDETAŞ: (ABC Cedetaş, Enser): CEDETAŞ is group of firms that have two firms dealing with electronics production. ABC CEDETAŞ is active in automation electronics and ENSER is active in security systems. Besides there are also lighting firm, an engagement firm and internet service firm within the group. CEDETAŞ was established in 1958 but it began to active in electronics sector in 1984. It was producing UPS until 1996. System engineering and after-sales services are the engines of firm. Production is done on fitting activities. For example, ENSER arranges its own design on imported ready alarm boards. Firm is specialised on systems. ABC Cedetaş has a project support from TDFT.

EEC: This firm is also a member of a group and this group has three firms in it. These are active on electronic ballast (lighting sector), fire alarm systems and building automation systems. Firm was started electronics production with fire alarm systems in 1982. Firm is specialised on security systems.

EDS: It was established in 1990 in order to give production and engineering support to various electronic firms. Then it began to produce UPS and security systems devices. After sometime of production, the firm began to import electronics security devices. It still continues on production of alarm panels, gas detectors, Japan stove displayer, internal sirens etc. Firm produces end products as well as investment products.

ERA: It was established at 1968 in Ankara in order to produce language laboratories. They produced about 600 laboratories. They started to produce electronic ballasts for TCDD in 1973. Firm entered to production of video and sound systems in 1979. Firm was carried to İstanbul in

1984 and in 1988 they began to produce automotive electronics equipment. Also, they have started producing electronic ballasts for households since 1990.

Kayseri firms are;

AAZ: It was established in 1988. It is producing PC based alarm panels and alarm-communication modules for security systems of banks, jewel shops, factories and other workplaces.

ENDSİS: Firm was established in 1990. It is producing alarm systems for households. Also this firm is representative of various Turkish electronics firms for Kayseri and its periphery. This firm also produces less technology based electronics systems as building voice and intercommunication systems.

HES ELEKTROMEKANİK: This firm takes place in HES group that produces a wide range of products from detergents to fibre optic cable. This firm is producing gas detectors. It was established depending on the electronics experience of HES-FİBEL (fibre optic producer within group) and started to produce gas detectors for its own company. Then it started to enlarge its works. Firm was established in 1990.

One Bursa firm is;

EMKO: It was established in 1986 to produce measurement control systems, sensors and devices. In 1990 it was turned into join stock company. Despite its location, this firm is one of the famous and successful industrial electronics firms in Türkiye.

APPENDIX L

Table L. Summarised Information on Personnel Relations of Interviewed Firms

	OWNER PARTICIPATION	EDUCATION BACKGROUND	EXPERIENCE
ANKARA			
ELSİS	EXISTING	1975 METU TEACHER	NO
OES	EXISTING	1985 METU	IN ASELSAN
ELİMKO	TO DESIGN PROCESS	1974 METU	NO
GATE	EXISTING	1988 METU	IN ASELSAN R§D
MEKO	EXISTING	1982 METU	NO
MOSTEK	TO R§D	1983 METU	EXISTED- ANK.
NEL	LIMITED PARTICIPATION	1975 METU	EXISTED- ANK.
SİSTEK	TO DESIGN PROCESS	1978 METU	EXISTED- ANK.
ETA	TO R§D	1982 METU	AT ABROAD
TETA	EXISTING	1980 METU	EXISTED- ADANA
ENERSİS	TO DESIGN PROCESS	1972 METU	EXISTED- ANK.
ELSİM	EXISTING	1982 H.TEPE PHYSICS	EXISTED- ANK.
UTES	LITTLE	FOOD TRADER	NO
YESTAŞ	EXISTING	1990 FINE ARTS	NO
PETAŞ	LIMITED PARTICIPATION	1970 METU	EXISTED- ANK.
KARDIOSIS	TO DESIGN PROCES	1982 METU TEACHER	NO
NÜVE	EXISTING	1975 METU	EXISTED- ANK.
PCK	EXISTING	1982 HACETTEPE	NO
EPROM	TO R§D	1984 A.Ü. GEOLOGY	NO
ON	EXISTING	1989 METU	NO
ORTANA	EXISTING	1989 METU	EXISTED- ANK.
EGİS	*EXISTING*	*1991 METU*	*EXISTED- ANK.*
MEDİSPO	*EXISTING*	*1987 METU*	*EXISTED- ANK.*
İSTANBUL			
EGES	LIMITED PARTICIPATION	1972 İTU	EXISTED- İST.
ROTA	LIMITED PARTICIPATION	1989 İTU	EXISTED- İST.
EKA	EXISTING	1975 ROBERT COLLEGE	EXISTED- İST.
BAYKON	TO DESIGN PROCESS	1978 İTU	EXISTED- İST.
BKS	EXISTING	1987 İTU	EXISTED- İST.
ESİT	TO R§D	1977 İTU	EXISTED- İST.
ELİAR	LIMITED PARTICIPATION	1983 BOĞAZİÇİ	NO
POLARİS	TO DESIGN PROCESS	1980 İTU	EXISTED- İST.
SİSEL	EXISTING	1986 ULUDAĞ-İTU	NO
CEDETAŞ	EXISTING	1958 YILDIZ TEKNİK	EXISTED- İST.
EEC	NO	1982 İTU	EXISTED- İST.
EDS	LIMITED PARTICIPATION	1983 İTU	EXISTED- İST.
ERA	EXISTING	1972 METU	EXISTED- ANK.
KAYSERİ			
AAZ	EXISTING	1988- BOĞAZİÇİ	NO
ENDSİS	EXISTING	1989- E.Ü.	NO
HES	LİMITED PARTICIPATION	INDUSTRIALIST	EXISTED-İST.
BURSA			
EMKO	TO DESIGN PROCESS	1983- METU	EXISTED- ANK.

Table L1 (Continued)

	ENGINEER BACKGROUND	ENGINEERS EXPERIENCE	TECHNICIAN BACKGROUND
ANKARA			
ELSİS	METU- HACETTEPE- İTU	STARTED HERE	ANKARA § ENVIRONMENT
OES	METU	MIXED	ANKARA
ELİMKO	METU-HACETTEPE- 2 İTU	MIXED	ANKARA
GATE	METU- BİLKENT	MIXED	ANKARA
MEKO	METU- HACETTEPE	STARTED HERE	ANKARA
MOSTEK	METU	MIXED	ANKARA
NEL	HACETTEPE- GAZİ	MIXED	ANKARA § ENVIRONMENT
SİSTEK	2 METU + 1 H.TEPE	MIXED	ANKARA § ENVIRONMENT
ETA	METU	STARTED HERE	ANKARA
TETA	METU	MIXED	ANKARA
ENERSİS	METU 50 % - ANKARA	MIXED	ANKARA
ELSİM	KONYA	STARTED HERE	ANKARA
UTES	GAZİ	STARTED HERE	ANKARA § ENVIRONMENT
YESTAŞ	METU-HACETTEPE-İTU	STARTED HERE	ANKARA § ENVIRONMENT
PETAŞ	METU 80 %+ H.TEPE	MIXED	ANKARA
KARDIOSIS	METU 85 %- ULUDAĞ- ANADOLU	STARTED HERE	ANKARA § ENVIRONMENT
NÜVE	METU	MIXED	ANKARA § ENVIRONMENT
PCK	METU-BİLKENT-HACETTEPE	FROM OTHER FIRMS	ANKARA § ENVIRONMENT
EPROM	METU	STARTED HERE	ANKARA
ON	METU	STARTED HERE	ANKARA
ORTANA	METU	STARTED HERE	ANKARA § ENVIRONMENT
EGİS	*METU*	*FROM OTHER FIRMS*	*NO TECHNICIAN*
MEDİSPO	*METU*	*FROM OTHER FIRMS*	*ANKARA*
İSTANBUL			
EGES	İTU-YILDIZ	MIXED	İSTANBUL
ROTA	İTU-YILDIZ	MIXED	İSTANBUL
EKA	İSTANBUL+ 2 METU	MIXED	İSTANBUL
BAYKON	İSTANBUL	MIXED	İSTANBUL
BKS	İTU	MIXED	İSTANBUL
ESİT	İTU- BOĞAZİÇİ-YILDIZ-METU	MIXED	İSTANBUL
ELİAR	BOĞAZİÇİ-İTU-YILDIZ	MIXED	İSTANBUL
POLARİS	İTU-ULUDAĞ	STARTED HERE	İSTANBUL
SİSEL	ULUDAĞ-İTU	STARTED HERE	İSTANBUL- THRACE
CEDETAŞ	İSTANBUL 95 % + 3 METU	MIXED	İSTANBUL
EEC	İTU-YILDIZ	MIXED	İSTANBUL
EDS	İTU-YILDIZ-KOCAELİ	MIXED	İSTANBUL
ERA	İTU-YILDIZ-BOĞAZİÇİ-KONYA	MIXED	İSTANBUL
KAYSERİ			
AAZ	ERCİYES-BOĞAZİÇİ	MIXED	KAYSERİ-INNER ANATOLIA
ENDSİS	ERCİYES	STARTED HERE	KAYSERİ-INNER ANATOLIA
HES	İTU-METU-ERCİYES	1-5	KAYSERİ-INNER ANATOLIA
BURSA			
EMKO	İTU-ULUDAĞ	MIXED	BURSA- KOCAELİ

APPENDIX M

Table M. Various Technological Characteristics of Interviewed Firms

	OWN DESIGN CAPABILITY	FORMAL R§D	LICENSE	INNOVATION PROCEDURE
ANKARA				
ELSİS	EXISTING -100 %	NO	NO	OWN DESIGN
OES	EXISTING- 100 %	NO	NO	OWN DESIGN
ELİMKO	EXISTING- 100 %	EXISTING	NO	OWN DESIGN
GATE	EXISTING	EXISTING	NO	EFFORT ON SYSTEM WORKS
MEKO	EXISTED IN PAST	EXISTING	NO	OWN DESIGN
MOSTEK	EXISTING- 100 %	NO	NO	ADAPTATION+ OWN DESIGN
NEL	EXISTING- 100 %	EXISTING	NO	STANDART PRODUCT
SİSTEK	EXISTING -100 %	EXISTING	NO	OWN DESIGN
ETA	EXISTING- 100 %	EXISTING	NO	OWN DESIGN
TETA	EXISTING- 100 %	EXISTING	NO	OWN DESIGN
ENERSİS	EXISTING- 100 %	EXISTING	NO	OWN DESIGN + SYS. WORKS
ELSİM	EXISTING - 100 %	NO	NO	STANDART PRODUCT
UTES	NOT MUCH OWN DESIGN	NO	NO	STANDART PRODUCT
YESTAŞ	EXISTING+FITTING	NO	NO	OWN DESIGN
PETAŞ	EXISTING- 100 %	EXISTING	NO	OWN DESIGN
KARDIOSIS	EXISTING -100 %	EXISTING	NO	OWN DESIGN
NÜVE	EXISTING- 100 %	EXISTING	HOW TRANSFER	ADAPTATION+ OWN DESIGN
PCK	EXISTING	EXISTING	NO	ADAPT LOCAL CONDITIONS
EPROM	EXISTING- 100 %	EXISTING	NO	OWN DESIGN
ON	EXISTING- 100 %	NO	NO	OWN DESIGN
ORTANA	EXISTING - 100 %	NO	NO	OWN DESIGN
EGİS	*EXISTING*	*NO*	*NO*	*OWN DESIGN*
MEDİSPO	*EXISTING*	*NO*	*FOREIGN COLL.*	*OWN DESIGN*
İSTANBUL				
EGES	EXISTING - 100 %	EXISTING	NO	OWN DESIGN
ROTA	EXISTING	NO	NO	OWN DESIGN
EKA	EXISTING- % 70	İTU KOSGEB	IN PAST	ADAPTATION+ OWN DESIGN
BAYKON	EXISTING- 100 %	NO	NO	ADAPTATION+ OWN DESIGN
BKS	EXISTING-100 %	EXISTING	NO	OWN DESIGN
ESİT	EXISTING- 100 %	EXISTING	NO	OWN DESIGN
ELİAR	EXISTING- 100 %	NO	NO	OWN DESIGN
POLARİS	EXISTING - 100 %	NO	NO	ST. PRODUCT+ OWN DESIGN
SİSEL	100 % ON SOFTWARE	EXISTING	NO	ADAPTATION+ OWN DESIGN
CEDETAŞ	100 % AT FITTING	EXISTING	EXISTING	ADAPT LOCAL CONDITIONS
EEC	EXISTING- 100 %	NO	NO	MARKET FEEDBACK IS IMP.
EDS	EXISTING- 40 %	NO	NO	ADAPT LOCAL CONDITIONS
ERA	EXISTING	EXISTING	NO	ADAPT LOCAL CONDITIONS
KAYSERİ				
AAZ	EXISTING- 90 %	EXISTING	NO	STANDART PRODUCT
ENDSİS	EXISTING- 70 %	EXISTING	NO	STANDART PRODUCT
HES	EXISTING- 100 %	EXISTING	NO	OWN DESIGN
BURSA				
EMKO	EXISTING- 100 %	EXISTING	NO	ST. PRODUCT+ OWN DESIGN

Table M1 (Continued)

	PATENT CONDITION	ISO INSCRIPTION	UTILISING INTERNET
ANKARA			
ELSİS	TRADEMARK	-	NOT MUCH USING
OES	TRADEMARK	-	NOT EFFECTIVE USING
ELİMKO	TRADEMARK	ISO 9001	INFORMATIONAL USE
GATE	TRADEMARK	ISO 9002-AQAP	LITTLE USING
MEKO	TRADEMARK	-	FOR MIXED PURPOSES
MOSTEK	TRADEMARK	-	FOR MIXED PURPOSES
NEL	TRADEMARK	APPLIED FOR IT	FOR MIXED PURPOSES
SİSTEK	TRADEMARK	-	TECHNO. GATHERING
ETA	NO	-	TECHNO. GATHERING
TETA	TRADEMARK	-	FOR MIXED PURPOSES
ENERSİS	APPLIED FOR IT	-	LITTLE USING
ELSİM	TRADEMARK	-	TECHNO. GATHERING
UTES	TRADEMARK	-	TECHNO. GATHERING
YESTAŞ	TRADEMARK	-	FOR MIXED PURPOSES
PETAŞ	TRADEMARK	ISO 9001	INFORMATIONAL USE
KARDIOSIS	TRADEMARK	ISO 9001	FOR MIXED PURPOSES
NÜVE	TRADEMARK	APPLIED FOR IT	FOR MIXED PURPOSES
PCK	APPLIED FOR IT	-	INFORMATIONAL USE
EPROM	TRADEMARK	-	TECHNO. GATHERING
ON	TRADEMARK	-	TECHNO. GATHERING
ORTANA	TRADEMARK	-	FOR MIXED PURPOSES
EGİS	*NO*	-	*FOR MIXED PURPOSES*
MEDİSPO	*NO*	-	*TECHNO. GATHERING*
İSTANBUL			
EGES	TRADEMARK	ISO 9001	FOR MIXED PURPOSES
ROTA	TRADEMARK	-	NOT EFFECTIVE USING
EKA	TRADEMARK	ISO 9001	FOR MIXED PURPOSES
BAYKON	TRADEMARK	-	TECHNO. GATHERING
BKS	NO	-	FOR MIXED PURPOSES
ESİT	TRADEMARK	ISO 9001	INFORMATIONAL USE
ELİAR	TRADEMARK	-	TECHNO. GATHERING
POLARİS	TRADEMARK	-	INFORMATIONAL USE
SİSEL	TRADEMARK	APPLIED FOR ISO	FOR MIXED PURPOSES
CEDETAŞ	NO	-	INFORMATIONAL USE
EEC	TRADEMARK	ISO 9001	MARKETING USE
EDS	TRADEMARK	ISO 9001	INFORMATIONAL USE
ERA	TRADEMARK	-	TECHNO. GATHERING
KAYSERİ			
AAZ	TRADEMARK	-	NO
ENDSİS	TRADEMARK	-	NO
HES	TRADEMARK	FOR CABLE PROD.	LITTLE USING
BURSA			
EMKO	TRADEMARK	ISO 9001	FOR MIXED PURPOSES

APPENDIX N

Table N. Supplier and Subcontracting Relations of Interviewed Firms

	ORIGIN OF COMPONENTS	OTHER INPUTS	SOFTWARE	TAKE SUBCONT. WORK
ANKARA				
ELSİS	İSTANBUL MARKET	NO	OWN	NO
OES	IMPORT+ ANKARA MARKET	-	-	NO
ELİMKO	IMPORT+ ANKARA MARKET	-	OWN	NO
GATE	IMPORTING		OWN	NO
MEKO	IMPORTING	PLC	OWN	NO
MOSTEK	IMPORT+ ANKARA MARKET	-	OWN	EXISTED IN PAST
NEL	IMPORT+ ANKARA MARKET		OWN	TO NÜVE
SİSTEK	ANK. 80 %- İST 20 %	PLC- SIEMENS	OWN	NO
ETA	IMPORT+ ANKARA MARKET	ACCESS CONTR. SYS.	OWN	NO
TETA	IMPORT+ ANKARA MARKET	-	OWN	NO
ENERSİS	IMPORTING	-	OWN	NO
ELSİM	IMPORT+ ANKARA MARKET	-	OWN	NO
YESTAŞ	IMPORT+ ANKARA MARKET	SCREW- İZMİR	-	EXISTING
UTES	FROM IMPORTERS	-	-	NO
PETAŞ	IMPORTING	-	OWN	R.CIRCUIT TO 20 FIRM
K.OSİS	ANK. 75 %, IMPORT 25 %	VLSI CHIP-BELGIUM	OWN	NO
NÜVE	IMPORTING	-	OWN	TO A FRENCH FIRM
PCK	IMPORT+ ANKARA MARKET	-	OWN	NO
EPROM	IMPORT+ ANKARA MARKET	-	OWN	NO
ON	IMPORT+ ANKARA MARKET	-	OWN	TO ULTRA
ORTANA	IMPORTING	-	OWN	NO
EGİS	*IMPORTING*		*OWN*	*NO*
MEDİSPO	*IMPORTING*	*NO*	*OWN*	*NO*
İSTANBUL				
EGES	IMPORT § İST. MARKET	-	OWN	TO GERMAN UPS FIRM
ROTA	İSTANBUL MARKET	-	OWN	NO
EKA	IMPORTING	-	-	NO
BAYKON	IMPORT § İST. MARKET	-	OWN	NO
ESİT	IMPORTING	-	OWN	NO
BKS	IMPORT § İST. MARKET	-	OWN	NO
ELİAR	IMPORT § İST. MARKET	-	OWN	NO
POLARİS	İSTANBUL MARKET	PH-METER - GERM.	OWN	TO MACHINERY FIRM
SİSEL	IMPORT § İST. MARKET	FOLIO	OWN	NO
CEDETAŞ	NO USE	READYMADE PRODUCTS	OWN	OWN GROUP
EEC	FROM IMPORTERS IN İST.	SENSOR	OWN	ILLUMUNATOR FIRMS
EDS	FROM IMPORTERS IN İST.	-	-	CEDETAŞ-ASELSAN
ERA	İSTANBUL'DAN	-	-	AUTOMOTIVE IND.
KAYSERİ				
AAZ	İSTANBUL MARKET	-	OWN	NO
ENDSİS	İSTANBUL MARKET	-	NO NEED	NO
HES	IMPORT+ İST. MARKET	-	NO NEED	NO
BURSA				
EMKO	IMPORTING	-	OWN	NO

Table N1 (Continued)

	SUBCONTRACTOR NAME OR PLACE	SUBCONTRACTED WORKS
ANKARA		
ELSİS	DISSENTED FIRMS	PLATE-MILLING-PAINTING
OES	FIRM IN SAME SITE	TRANSFORMER, PRINTED CIRCUIT, BOX
ELİMKO	2 İST.,2 ANK.,PETAŞ,ASELSAN	BOX-MECHANICS-PRINTED CIRCUIT
GATE	ANKARA-İSTANBUL	MECHANICS
MEKO	SISTER FIRMS+ PANEL(İST)	BOARDS
MOSTEK	OSTİM-PETAŞ-İSTANBUL	MECHANICS-PRINTED CIRCUIT
NEL	ANKARA	PRINTED CIRCUIT
SİSTEK	İST.-SİTELER-OSTİM-NEIGHBOR	BOX-MECHANICS-PRINTED CIRCUIT
ETA	OSTİM	MECHANICS
TETA	OSTİM-SİTELER	BOX-MECHANICS-PRINTED CIRCUIT
ENERSİS	TABLOSAN-3 FIRMS IN ANKARA	BOX- BOARDS
ELSİM	ANKARA FIRMS	MECHANICS-PRINTED CIRCUIT
UTES	B.SANAYİ-OSTİM-YENİMAHALLE	PLASTICS-PRINTED CIRCUIT
YESTAŞ	ÜNAL-VERAP-TERA	BOX-PRINTED CIRCUIT- TYPE SETTING
PETAŞ	2 B.SANAYİ + 1 ATASANAYİ	BOX-PLASTICS-MECHANICS
KARDIOSIS	TELMEK AND 10 OSTİM FIRMS	MECHANICS
NÜVE	2 ANKARA FIRMS + NEL	PRINTED CIRCUIT
PCK	1 OSTİM-1 DEMİR SANAYİ	MECHANICS- PAINTING
EPROM	OSTİM	MECHANICS- SILVER COVERAGE
ON	TELMEK-DELRON-YENİAY	MECHANICS-PRINTED CIRCUIT
ORTANA	TELMEK- DELRON	MECHANICS-PRINTED CIRCUIT
EGİS	*NO*	*NO*
MEDİSPO	*OSTİM AND PETAŞ*	*BOX - PRINTED CIRCUITS*
İSTANBUL		
EGES	4 İSTANBUL FIRMS	MECHANICS, CABINETS
ROTA	İSTANBUL	BOX-PRINTED CIRCUIT
EKA	İSTANBUL-TÜMEL	ALL TYPE OF WORKS
BAYKON	ESKİŞEHİR- İSTANBUL	MECHANICS- TALAŞLI İMALAT
BKS	PANEL+ 2 MOULDING FIRMS	MOULDING- SAWDUST WORKS- PANEL
ESİT	2 İSTANBUL FIRMS	MECHANICS
ELİAR	FIRM AT 4. LEVENT	MECHANICS
POLARİS	İST FIRMS	BOX
SİSEL	3 İSTANBUL- 1 ANKARA FIRM	TRANSFORMER, PRINTED CIRCUIT, BOX
CEDETAŞ	GÜÇBERK- EDS	PLC FITTING
EEC	ÖZAK-TAKOSAN-İSTANBUL FIRM	FITTING AND TESTING
EDS	NO	-
ERA	İSTANBUL FIRMS	MECHANICS-BOX
KAYSERİ		
AAZ	1 KAYSERİ, 1 İSTANBUL FIRM	BOX- PAINTING-PLAKET
ENDSİS	NO	-
HES	OWN	-
BURSA		
EMKO	3 FIRMS IN BURSA	MECHANICS-PAINTING-CASING

APPENDIX O

Table O. Summarised Information on Technology Based Linkage Structures of Firms

	UNIV.COLLOBORATION	FIRM COLLOBORATION	R§D PARTNERSHIP
ANKARA			
ELSİS	NO	WITH 2 RESEARCH FIRMS	2 RESEARCH FIRMS
OES	NO	NO	NO
ELİMKO	METU ON FUZZY CONTROL	NO	WITH METU
GATE	BİLKENT+ ANADOLU UNI.	WITH ITS JUNIOR FIRMS	JUNIOR FIRMS
MEKO	NO	WITH PLC FIRMS	NO
MOSTEK	NO	NO	NO
NEL	NO	NO	NO
SİSTEK	NO	NO	NO
ETA	NO	HAVELSAN § TEXAS INC.	EXISTING
TETA	TRIED, NOT SUCCESSFUL	DONE R§D AT PAST	NO
ENERSİS	NO	NO	NO
ELSİM	NO	NO	NO
UTES	WANTED, NOT POSSIBLE	NO	NO
YESTAŞ	NO	NO	NO
PETAŞ	NO	NO	NO
KARDIOSIS	GROW IN METU KOSGEB	NO	TÜBİTAK BİLTEN
NÜVE	NO	NO	NO
PCK	TRIED, NOT SUCCESSFUL	WITH IMPORT FIRM	NO
EPROM	NO	NO	NO
ON	GROW IN METU KOSGEB	NO	WITH SİNTEK
ORTANA	GROW IN METU KOSGEB	WITH TASK AND ASELSAN	NO
EGİS	*PLACE AT KOSGEB*	*NO*	*NO*
MEDİSPO	*PLACE AT KOSGEB*	*WITH 2 KOSGEB FIRMS*	*A GERMAN FIRM*
İSTANBUL			
EGES	NO	NO	NO
ROTA	NO	NO	NO
EKA	WITH ITU KOSGEB	TÜMEL, A FOREIGN FIRM	TÜMEL (in past)
BAYKON	NO	NO	NO
BKS	GREW IN ITU KOSGEB	INFORMATION RELATIONS	NO
ESİT	NO	NO	NO
ELİAR	TRIED, NOT SUCCESSFUL	WITH A SOFTWARE FIRM	S.CONTRACT FIRMS
POLARİS	NO	WITH A SOFTWARE FIRM	NO
SİSEL	NO	COMMERCIAL WITH ELİMKO	NO
CEDETAŞ	NO	NO	NO
EEC	TRIED, NOT SUCCESSFUL	NO	NO
EDS	NO	NO	NO
ERA	WITH ITU ON DESIGN	NO	NO
KAYSERİ			
AAZ	ERCİYES FOR INF.§ TEST	INF.RELATIONS WITH İST.	NO
ENDSİS	NO	WITH WHOM IT REPRESENTS	NO
HES	WITH METU AND TTGV	NO	NO
BURSA			
EMKO	WITH ULUDAĞ UNIV.	NO	NO

Table 01 (Continued)

	RELAT. WITH RES.INST.	SUBCONTRACT R§D	COMMON EDUCATION PROG.
ANKARA			
ELSİS	NO	EXISTED IN PAST	NO
OES	NO	NO	NO
ELİMKO	NO	NO	REPRESENTATIVES
GATE	DENSE WORK AT TÜBİTAK	NO	WITH SISTER FIRM
MEKO	NO	NO	WITH PLC FIRMS
MOSTEK	TRIED, NOT SUCCESSFUL	ARÇELİK IN PAST	NO
NEL	NO	NO	NO
SİSTEK	EXISTED 6 YEARS AGO	NO	NO
ETA	PROJECTS WITH TÜBİTAK	WITH ABROAD	WITH ABROAD
TETA	NO	WITH 3 DEF. FIRMS	PREPARING
ENERSİS	NO	NO	NO
ELSİM	NO	NO	NO
UTES	NO	NO	NO
YESTAŞ	NO	NO	NO
PETAŞ	HAS TECHNOLOGY AWARD	NO	NO
KARDIOSIS	WITH TÜBİTAK BİLTEN	FOR VLSI PROCESSOR	NO
NÜVE	NO	NO	NO
PCK	NO	NO	WITHIN ISO INSCRIPTION
EPROM	NO	NO	NO
ON	ENGINEER AT TÜBİTAK	NO	SİNTEK (ULTRA PARTNER)
ORTANA	NO	NO	NO
EGİS	*NO*	*NO*	*NO*
MEDİSPO	*NO*	*NO*	*NO*
İSTANBUL			
EGES	NO	NO	PERS. SENT MEETINGS
ROTA	NO	NO	NO
EKA	DENSE INFORM. EXCHANGE	FOR THOMSON IN PAST	FOR MARKETING
BAYKON	WITH UME (Gebze)	NO	NO
BKS	NO	NO	NO
ESİT	WITH UME and TÜBİTAK	NO	PERSONEL SENT TO UME
ELİAR	INFORMATION EXCHANGE	PRODUCT FOR ŞİŞECAM	PERSONEL SENT MEETINGS
POLARİS	WORKED IN TUBİTAK	NO	NO
SİSEL	NO	NO	NO
CEDETAŞ	NO	NO	NO
EEC	FOLLOWING PUBLICATIONS	FOR ASELSAN IN PAST	SECTOR FIRMS AND KOSGEB
EDS	NO	NO	PERSONEL SENT ABROAD
ERA	NO	NO	NO
KAYSERİ			
AAZ	NO	NO	NO
ENDSİS	NO	NO	WHOM IT REPRESENTS
HES	WITH TDFT	NO	WITHIN GROUP
BURSA			
EMKO	EXISTING WITH TÜBİTAK	NO	NO

Table 02 (Continued)

	INFORMAL RELATIONS	INFORMATIONRELATIONSWITHCUSTOMERS
ANKARA		
ELSİS	NO	MEDIATED WITH VENDORS
OES	DENSE	EXISTING
ELİMKO	DENSE	NOT PERFECT
GATE	WITH JUNIOR FIRMS	IT IS INSTUTIONALISED
MEKO	SOMETIMES	ON CUSTOM DESIGN PRODUCTS
MOSTEK	DENSE	CUSTOMERS ARE EDUCATED
NEL	EXISTING	EXISTING
SİSTEK	DENSE	ALWAYS
ETA	DENSE WITH METU	FEEDBACK EXISTING
TETA	EXISTING	WITH SOME CUSTOMERS
ENERSİS	RARE	FEEDBACK IS SO IMPORTANT
ELSİM	WITH STATE INST.	STANDART
UTES	RARE	NOT VERY OFTEN
YESTAŞ	NO	ALWAYS AND IMPORTANT
PETAŞ	NO	EXISTING
KARDIOSIS	WITH METU	FEEDBACK EXISTING
NÜVE	EXISTING	MEDIATED WITH VENDORS
PCK	NO	ALWAYS
EPROM	NO	CUSTOMERS ARE EDUCATED
ON	RARE	ON CUSTOM DESIGN PRODUCTS
ORTANA	RARE	EXISTING
EGİS	*NO*	*EXISTING*
MEDİSPO	*EXISTING*	*NOT DEFINED*
İSTANBUL		
EGES	RARE	EXISTING
ROTA	NO	EXISTING
EKA	EXISTING	ALWAYS
BAYKON	EXISTING	EXISTING AND IMPORTANT
BKS	EXISTING	EXISTING
ESİT	WITH UNIV. FRIENDS	EXISTING
ELİAR	NO	EXISTING AND SO IMPORTANT
POLARİS	EXISTING	EXISTING AND IMPORTANT
SİSEL	EXISTING	EXISTING AND IMPORTANT
CEDETAŞ	NO	TIGHT RELATIONS
EEC	NO	EXISTING BUT NOT PERFECT
EDS	NO	SOMETIMES
ERA	NO	SOMETIMES
KAYSERİ		
AAZ	RARE	STANDART
ENDSİS	WHOM IT REPRESENTS	RECOMMENDATIONS ARE DONE
HES	WITHIN GROUP	EXISTING
BURSA		
EMKO	WITH METU FRIENDS	EXISTING AND SO IMPORTANT

APPENDIX P

Table P. Transaction Relations of Interviewed Firms

	PRODUCT AND SERVICE CATEGORY	PRIMARY CUSTOMER TYPE
ANKARA		
ELSİS	UNINTERRUPTED POWER SUPPLY	INSTITUTIONS+ FIRMS
OES	UNINTERRUPTED POWER SUPPLY	END USERS+ COMPUTER FIRMS
ELİMKO	MEASUREMENT DEVICES+ SENSORS	INDUSTRIAL FIRMS
GATE	FAULT DETECTION SYSTEMS	INDUSTRIAL FIRMS + MILITARY
MEKO	AUTOMATION SYSTEMS	INDUSTRIAL FIRMS
MOSTEK	PERFORMANCE TEST DEVICES	REFRIGERATOR-OWEN PRODUCERS
NEL	INDUSTRIAL TEST DEVICES	INDUSTRIAL FIRMS
SİSTEK	PROCESSOR CONTROLLED DEVICES	IND. FIRMS+ SYSTEM ESTABLISHERS
ETA	SECURITY-SHOOTING SYSTEMS	SECURITY INSTITUIONS+ FIRMS
TETA	SECURITY SYSTEMS	INSTITUTIONS+ FIRMS
ENERSİS	UPS- BUILDING AUTOMATION SYS.	HOTELS+ COMPUTER FIRMS
ELSİM	ALARM PANEL, SIREN,MODULES	POLICE+ BANKS+ JEWEL SHOPS
UTES	AUTO ALARM DEVICES	END USERS
YESTAŞ	FIRE WARNING DEDECTOR	INSTITUTIONS+ CONTRACTORS
PETAŞ	MEDICAL ELECTRONIC DEVICES	HEALTH INSTITUTIONS
KARDIOSIS	EKG DEVICE+ RUNNING BAND	HEALTH INSTITUTIONS
NÜVE	BASIC LABARATORY DEVICES	HEALTH INSTITUTIONS+ LABS
PCK	MEDICAL ELECTRONIC DEVICE	HEALTH INSTITUTIONS
EPROM	TV-AUDIO STUDIO DEVICES	TV-RADIO'S+UNIVERSITY+POLICE
ON	LED PANEL+ SCORBORD	INSTITUTIONS+SCHOOLS+FIRMS
ORTANA	LED PANO+ ELECTRONIC BOARD	FIRMS+AIRPORTS+MILITARY
EGİS	*DIGITAL VISUAL SYSTEMS*	*INDUSTRIAL FIRMS*
MEDİSPO	*RIO CARDIO MONİTÖR*	*HEALTH INSTITUTIONS*
İSTANBUL		
EGES	POWER ELECTRONICS	INSTITUONS+ FIRMS+ END USERS
ROTA	TACOGRAPH	TRANSPORT FIRMS+ END USERS
EKA	UPS+MOTORCONTROL+SP. DEVICES	INSTITUTIONS+ FIRMS+ MILITARY
BAYKON	MEASUREMENT§ CONTROL DEVICES	INDUSTRIAL ENTERPRISES
BKS	MEASUREMENT§ CONTROL DEVICES	INDUSTRIAL FIRMS
ESİT	ELECTRONIC WEIGHING SYSTEMS	INSTUTIONS+ INDUSTRIAL FIRMS
ELİAR	INDUSTRIAL PROCESS CONTROL	INDUSTRIAL FIRMS
POLARİS	CONTR.DEVICES, AUTOMATION SYS.	CONST/IND. FIRMS+ PUBLIC INS.
SİSEL	VARIOUS ATUOMATION DEVICES	INDUSTRIAL FIRMS
CEDETAŞ	COMMITMENT+ SYSTEM PRODUCTS	INSTITUTIONS+CONTRACTORS+MILIT.
EEC	ALARM+ SECURITY SYS. PARTS	FIRMS+VENDORS+CONTRACTORS
EDS	SECURITY SYSTEM PARTS	ELECTRONIC FIRMS+ DEALERS
ERA	AUTOMATIVE ELECTRONICS	AUTOMATIVE FIRMS + DEALERS
KAYSERİ		
AAZ	ALARM CONTROL PANEL	ND USERS+ BANKS+ SHOPS+ FACTORIE
ENDSİS	ALARM AND SECURITY SYSTEMS	END USERS+ BANKS+ FIRMS
HES	GAS DEDECTOR	SEVERAL FIRMS
BURSA		
EMKO	CONTR.DEVICES, AUTOMATION SYS.	INDUSTRIAL FIRMS

Table P1 (Continued)

	REGIONAL MARKET CONCENTRATION	MARKET INSTITUTION CONCENTRATION
ANKARA		
ELSİS	İST. 45%, ANK. 25%, İZMİR 10%	PRIVATE SECTOR 79 %, PUBLIC 21 %
OES	EAST, SOUTHEAST ANATOLIA	COMPUTER FIRMS 60%
ELİMKO	İSTANBUL AND MARMARA 48 %	SYSTEM WORKS 10 %, DEALERS 90 %
GATE	DISPERSED	PUBLIC 50%
MEKO	DISPERSED	INDUSTRIAL FIRMS
MOSTEK	İST. -MARMARA 52 %, ANK 7 %	CONSUMER DURABLE PRODUCERS
NEL	DISPERSED	FOOD,CHEMICAL,TEXTILE FIRMS
SİSTEK	DISPERSED	PUBLIC 10 % (ETİBANK,ŞEKER FABR.)
ETA	ANKARA	ARMY+ ASELSAN+ MILITARY INDUSTRY
TETA	ANKARA, METROPOLS	PUBLIC 35-40 %
ENERSİS	ANKARA,İSTANBUL,ANTALYA	HOTELS, END USERS
ELSİM	22 PROVINCE EXCEPT ANK.,İST.	PUBLIC 30%, PRIVATE SECTOR 70%
UTES	İSTANBUL BASED 35 CITY CENTER	DEALERS+ AUTO ELECTRIC FIRMS
YESTAŞ	ANKARA 60 %	C.TORS 30%, DEALERS 30%, PUBLIC 40%
PETAŞ	İST. 11%, ANK. 5%, OTHER 84%	STATE 67 %, PRIVATE INSTITUTIONS 22 %
KARDIOSIS	İST.30%, ANK. 20%, OTHER 50%	PRIVATE SECTOR 70%
NÜVE	32 BIG CITY CENTER	HOSPITALS- LABARATORIES
PCK	EXPORT 75 % , ANADOLU 20 %	UNIVERSITY-FOUNDATION HOSPITALS
EPROM	INNER ANATOLIA, MARMARA,EGE	LOCAL RADIO-TV-UNIVERSITY B.CASTING
ON	İSTANBUL 60 %, ANATOLIA 40 %	SCHOOLS 50-55 %
ORTANA	ANKARA+ İSTANBUL+ MARMARA	MILITARY 30%,PUBLIC 30%,PRIVATE 40%
EGİS	*ANKARA- MARMARA*	
MEDİSPO		
İSTANBUL		
EGES	İSTANBUL, MARMARA 60 %	INDUSTRIAL FIRMS 65 %
ROTA	İSTANBUL, MARMARA	DEALERS 50 %, END USERS
EKA	İSTANBUL 70 %	PRIVATE 80 %, PUBLIC 20 %
BAYKON	İSTANBUL 85 %	INDUSTRIAL FIRMS 100 %
BKS	İSTANBUL, ADAPAZARI	FIRMS
ESİT	MARM. 65 % INNER ANAT. 20 %	INDUSTRIAL FIRMS 90 %
ELİAR	(İST.-MARMARA-THRACE) % 75	GLASS-TEXTILE-PAINT FIRMS
POLARİS	İSTANBUL 70 % - MARMARA	CONCRETE PROD. 35%, CONSTR. FIRMS 30%
SİSEL	İSTANBUL 70 % - MARMARA	MACHINERY, PLASTICS PRODUCERS 75 %
CEDETAŞ	İSTANBUL 80 %	PUBLIC 50 %
EEC	İSTANBUL 80 %	FIRMS 21% LIGHT FIRMS 43% VENDORS 11%
EDS	MARMARA	DEALERS 60 %, FIRMS 40 %
ERA	İSTANBUL, MARMARA	AUTOMATIVE FIRMS 85 %
KAYSERİ		
AAZ	INNER AND S.EAST ANATOLIA	END USER INSTUTIONS
ENDSİS	INNER AND EAST ANATOLIA	END USERS 60 %, FIRMS 40 %
HES	DISPERSED	PRIVATE FOR DED. PUBLIC FOR CABLE
BURSA		
EMKO	MARMARA- DISPERSED	AUT.,DURABLE,DEFENCE,RUBBER PRODUCERS

Table P2 (Continued)

	EXPORT ACTIVITY	EXISTING REPRESENTATION
ANKARA		
ELSİS	INDIRECTLY 10%	EXISTING
OES	INDIRECTLY YES	FOR ITALIAN ARIS FIRM
ELİMKO	INDIRECTLY 5-10 %	FOR 11 FOREIGN FIRMS
GATE	ABOUT 25 BILLION T.L	FOR VARIOUS FIRMS
MEKO	INDIRECTLY TO 3.WORLD	NO
MOSTEK	IRAN	NO
NEL	NEGLIGIBLE	FOR 10 FIRMS
SİSTEK	-	FOR 4 FOREIGN FIRMS
ETA	ISRAEL-GERMANY	FOR 5 FOREIGN FIRMS
TETA	EXISTING 10%	FOR 15 FIRMS (6 COUNTRIES)
ENERSİS	SYSTEM EXPORT 10%	FOR 3 FIRMS
ELSİM	-	EXISTING
UTES	-	NO
YESTAŞ	TURKISH COUNTRIES	FOR AN ITALIAN FIRM
PETAŞ	NEGLIGIBLE	NO
KARDIOSIS	10% OF PRODUCTION	NO
NÜVE	EXISTING	FOR 47 FOREIGN FIRMS
PCK	EXISTING	FOR GERMAN WOLF COMPANY
EPROM	NEGLIGIBLE	FOR 13 FIRMS (3 COUNTRIES)
ON	LITTLE TO ISU	NO
ORTANA	NEGLIGIBLE	NO
EGİS	-	*NO*
MEDİSPO	*NEGLIGIBLE*	*NO*
İSTANBUL		
EGES	25 % M. EAST-EUROPA	NO
ROTA	NEGLIGIBLE	NO
EKA	U.K..- FRANCE- ISRAEL	FOR 8 FOREIGN FIRMS
BAYKON	-	1 USA FIRM
BKS	-	NO
ESİT	5 % TO NEIGHBORS	NO
ELİAR	INDIRECTLY YES	NO
POLARİS	INDIRECTLY YES	NO
SİSEL	IRREGULAR TO 7 COUNT.	1 FRENCH FIRM
CEDETAŞ	KAZAK-RUSSIA	FOR 5 FOREIGN FIRMS
EEC	RUSSIA-ROM-EGYPT	NO
EDS	ENGLAND- GERMANY	17 FIRMS FROM 7 COUNTRIES
ERA	EC COUNTRIES	NO
KAYSERİ		
AAZ	10 % TO U.K § U.S.A.	FOR VARIOUS FIRMS
ENDSİS	5 % RUSSIA-A.BAIJAN	FOR 9 TURKISH FIRMS
HES	NO FOR DEDECTORS	NO
BURSA		
EMKO	-	NO

APPENDIX R

Table R. Relations of Interviewed Firms With State, Public and Civil Institutions

	INCENTIVES	RELATIONS WITH STATE	MEMBERSHIPS
ANKARA			
ELSİS	NO	CUSTOMER BY 5-10 %	ASO
OES	NO	-	ASO
ELİMKO	INVESTMENT INCENTIVE	CUSTOMER BY 40 %	TESİD-ASO
GATE	R§D INCENTIVE	CUSTOMER BY 50 %	ASO
MEKO	NO	-	ASO
MOSTEK	NO	-	ASO
NEL	NO	COMPULSORY RELATIONS	TESİD-ASO
SİSTEK	NO	COMPULSORY RELATIONS	ASO
ETA	NO	TIGHT WITH TURKISH ARMY	ASO-SASAD-İMMİB
TETA	NO	CUSTOMER BY 40 %	ASO
ENERSİS	NO	-	TESİD-ASO
ELSİM	NO	CUSTOMER BY 50 %	ASO
UTES	NO	CUSTOMER BY 20 %	ASO-NEPA
YESTAŞ	NO	-	ASO
PETAŞ	NO	CUSTOMER BY 30 %	TESİD-ASO
KARDIOSIS	EXPORT INCENTIVE	CUSTOMER BY 30 %	ASO
NÜVE	NO	CUSTOMER BY 20 %	TESİD-ASO
PCK	EXPORT,R§D INCENTIVE	COMPULSORY RELATIONS	ASO
EPROM	NO	CUSTOMER: UNIVERSITY+POLICE	ASO
ON	NO	CUSTOMER BY 50 %	ASO
ORTANA	NO	CUSTOMER BY 60 %	ASO
EGİS		*KOSGEB RELATION*	*ASO*
MEDİSPO	*ENTREPRENEURSHIP INC.*	*KOSGEB RELATION*	*ASO*
İSTANBUL			
EGES	EXPORT INCENTIVE	CUSTOMER BY 5 %, EXPORT REL.	İSO-TESİD
ROTA	NO	-	İSO-TESİD
EKA	R§D INCENTIVE	EXPORT AND R§D RELATIONS	TESİD-İSO
BAYKON	NO	-	İSO- UME
BKS	NO	-	İSO
ESİT	EXPORT INCENTIVE	CUSTOMER BY 15 %, EXPORT REL.	TESİD- İSO-UME
ELİAR	NO	-	İSO
POLARİS	NO	CUSTOMER BY 5 %	İSO
SİSEL	EXPORT INCENTIVE	EXPORT RELATIONS	İSO
CEDETAŞ	MONETARY INCENTIVE	CUSTOMER BY 50 %	İSO
EEC	R§D INCENTIVE	-	TESİD-İMMİB-İSO
EDS	R§D INCENTIVE	CUSTOMER	TESİD-İSO
ERA	EXPORT INCENTIVE	-	TESİD-İSO
KAYSERİ			
AAZ	NO	EXPORT RELATIONS	KSO
ENDSİS	NO	MILITARY CUSTOMER BY 10 %	KSO
HES	EXPORT,R§D INCENTIVE	-	KSO
BURSA			
EMKO	R§D INCENTIVE	-	TESİD-BSO

Table R1 (Continued)

	RELATIONS WITH ASELSAN
ANKARA	
ELSİS	ENGINEERS WENT THERE, THEY SUBCONTRACT SOME WORK TO IT
OES	-
ELİMKO	ENGINEERS WENT THERE, SOMETIMES ASELSAN IS CUSTOMER
GATE	ASELSAN IS CUSTOMER
MEKO	THEY GET SUPPORT SOMETIMES
MOSTEK	-
NEL	INFORMATION RELATIONS
SİSTEK	FOUND STRATEGIC COMPONENT WITH HELP OF ASELSAN
ETA	TIGHT WORK RELATIONS
TETA	-
ENERSİS	-
ELSİM	ASELSAN IS COMPETITOR
UTES	ASELSAN IS COMPETITOR
YESTAŞ	FOUND STRATEGIC COMPONENT WITH HELP OF ASELSAN
PETAŞ	INFORMATION RELATIONS
KARDIOSIS	-
NÜVE	INFORMATION RELATIONS
PCK	-
EPROM	ASELSAN IS COMPETITOR
ON	DONE A SPECIAL WORK FOR ASELSAN IN PAST
ORTANA	WILL DONE COMMON WORK IN FUTURE
EGİS	-
MEDİSPO	-
İSTANBUL	
EGES	-
ROTA	-
EKA	INFORMATION RELATIONS
BAYKON	-
BKS	-
ESİT	-
ELİAR	-
POLARİS	-
SİSEL	-
CEDETAŞ	-
EEC	-
EDS	DO SOME WORK
ERA	-
KAYSERİ	
AAZ	-
ENDSİS	NO- WITH ARMY FORCES IN ANKARA
HES	NO- WITH ARMY FORCES IN ANKARA
BURSA	
EMKO	-

APPENDIX S

Table S. Intra Metropolitan Locational Aspects of Interviewed Firms

	DISTRICT	LOCATION	OWNERSHIP	OTHER BUREAUS
ANKARA				
ELSİS	ULUS	INDUSTRIAL SITE INSIDE	RENTAL	-
OES	ŞAŞMAZ	INDUSTRIAL SITE	OWNER	-
ELİMKO	EMEK/ÖVEÇLER	INSIDE CITY	OWNER	-
GATE	BALGAT/SİNCAN	INSIDE CITY	OWNER	İSTANBUL
MEKO	KIZILAY	INSIDE CITY CENTER	OWNER	-
MOSTEK	BALGAT	INSIDE CITY	RENTAL	-
NEL	KIZILAY	INSIDE CITY CENTER	OWNER	İSTANBUL
SİSTEK	KÜÇÜKESAT	INSIDE CITY	RENTAL	-
ETA	BALGAT	INSIDE CITY	OWNER	ESKİŞEHİR
TETA	İLKER (DİKMEN)	INSIDE CITY	OWNER	*
ENERSİS	G.O.P.	INSIDE CITY	OWNER	İSTANBUL-ANTALYA
ELSİM	DİKMEN	INSIDE CITY	OWNER	-
UTES	İSKİTLER	INDUSTRIAL SİTE INSIDE	OWNER	İSTANBUL
YESTAŞ	KIZILAY	INSIDE CITY CENTER	OWNER	İSTANBUL
PETAŞ	EMEK/B.SANAYİ	INDUSTRIAL SITE	OWNER	İST.-İZMİR-ADANA
KARDIOSIS	BALGAT	INSIDE CITY	RENTAL	İSTANBUL-İZMİR
NÜVE	ESENBOĞA 22.KM.	OUTSIDE CITY	OWNER	İSTANBUL
PCK	ÖVEÇLER	INSIDE CITY	OWNER	İSTANBUL
EPROM	KIZILAY	INSIDE CITY CENTER	OWNER	İSTANBUL
ON	SEYRANBAĞLARI	INSIDE CITY	OWNER	İSTANBUL-İZMİR
ORTANA	TUNUS CADDESİ	INSIDE CITY CENTER	OWNER	İSTANBUL
EGİS	*KOSGEB*	*AT KOSGEB*	*RENTAL*	-
MEDİSPO	*KOSGEB*	*AT KOSGEB*	*RENTAL*	-
İSTANBUL	*:İST.-İZMİR-BURSA-ANTALYA-ADANA			
EGES	BAĞCILAR	INDUSTRIAL SITE	OWNER	ANKARA- KONYA
ROTA	ZEYTİNBURNU	INDUSTRIAL SITE	OWNER	-
EKA	AYAZAĞA	INDUSTRIAL SITE	OWNER	ANKARA-İZMİR
BAYKON	BOSTANCI	INDUSTRIAL SITE	OWNER	-
BKS	BEYKOZ	FAR FROM CENTER	OWNER	-
ESİT	ÜMRANİYE	INDUSTRIAL SITE	OWNER	İZMİR
ELİAR	1. LEVENT	INSIDE CITY	RENTAL	-
POLARİS	GÜNGÖREN	INSIDE CITY	OWNER	KADIKÖY
SİSEL	KARAKÖY	INSIDE CITY CENTER	RENTAL	-
CEDETAŞ	SULTANBEYLİ	OUTSIDE CITY	OWNER	-
EEC	BEYOĞLU	INSIDE CITY CENTER	OWNER	ANKARA
EDS	ÜMRANİYE	INDUSTRIAL SITE	OWNER	-
ERA	4. LEVENT	INDUSTRIAL SITE	OWNER	-
KAYSERİ				
AAZ	TAŞHAN	INSIDE CITY	RENTAL	-
ENDSİS	BANKALAR CAD.	INSIDE CITY	RENTAL	-
HES	HACILAR ROAD	OUTSIDE CITY	OWNER	ANKARA
BURSA				
EMKO	DEMİRTAŞ OSB	INDUSTRIAL SITE	OWNER	VENDORS IN 9 PROV.

Table S1 (Continued)

	OTHER UNITS	LOCATION MOVEMENT	IN FUTURE
ANKARA			
ELSİS	HEAD OFFICE AT MALTEPE	KIZILAY-KÜÇÜKESAT-MALTEPE-ULUS	TO OSTİM
OES	SAME BUILDING	YENİMAHALLE- ŞAŞMAZ IN 1995	-
ELİMKO	HEAD OFFICE AT EMEK	EMEK-GÜZİN SOKAK-ÖVEÇLER	TO GÖLBAŞI
GATE	PRODUCTION AT SİNCAN	-	TEMELLİ, BİLKENT
MEKO	MECHANICS- ÖVEÇLER	ON SAME STREET	TO OSTİM
MOSTEK	SAME BUILDING	KIZILAY- BALGAT IN 1992	PERHAPS TEMELLİ
NEL	SAME BUILDING	-	TEMELLİ
SİSTEK	SAME BUILDING	KIZILAY- KÜÇÜKESAT IN 1995	-
ETA	LATHE AT OSTİM	KURTULUŞ- BALGAT 1994	SISTERFIRM HERE
TETA	2 STORES AT OSTİM	KUZGUN-MESNEVİ-İLKER MAH. IN 1997	-
ENERSİS	SAME BUILDING	KÜÇÜKESAT- GAZİOSMANPAŞA IN 1993	-
ELSİM	MARKETING AT NEIGHBORH	DEMET-KIZILAY- SOKULLU IN 1996	-
UTES	SELLING AT ISTANBUL	WITHIN SAME SITE	-
YESTAŞ	SAME BUILDING	MOVEMENT WITHIN KIZILAY DISTRICT	-
PETAŞ	HEAD OFFICE AT EMEK	GMK BULVARI- BÜYÜK SANAYİ	TEMELLİ
KARDIOSIS	MARKETING AT KOLEJ	METU KOSGEB- ÖVEÇLER IN 1997	TEMELLİ
NÜVE	PRODN. ESENBOĞA	FROM KIZILAY TO ESENBOĞA ROAD	-
PCK	MECHANICS AT OSTİM	PARİS CADDESİ- ÖVEÇLER IN 1996	-
EPROM	FITTING IN ISTANBUL	GROW IN SAME BUILDING	TO İSTANBUL
ON	FITTING IN ISTANBUL	KOSGEB - KÜÇÜKESAT IN 1997	-
ORTANA	MECHNICS AT OSTİM	FROM METU KOSGEB TO TUNUS CAD.	-
EGİS	*IN KOSGEB*	-	*TO ÖVEÇLER*
MEDİSPO	*IN KOSGEB*	-	*TO A NEW PLACE*
İSTANBUL			
EGES	SAME BUILDING	GÖZTEPE-LEVENT-İKİTELLİ-BAĞCILAR	-
ROTA	SAME BUILDING	-	-
EKA	SAME BUILDING	SİRKECİ-KARAKÖY- LEVENT IN 1984	-
BAYKON	SAME BUILDING	KABATAŞ- BOSTANCI	-
BKS	SAME BUILDING	FROM İTU KOSGEB TO BEYKOZ	-
ESİT	SELLING DEPT. KADIKÖY	KADIKÖY- ÜMRANİYE	-
ELİAR	MECH-STORING 4. LEVENT	M.EKÖY-BALMUMCU-LEVENT IN 1993	TECHNOPARK(?)
POLARİS	SAME BUILDING	BAHÇELİEVLER- GÜNGÖREN	INDUSTRIAL SITE
SİSEL	SELLING AT FREE ZONE	5 TIMES IN THE SAME DISTRICT	TO ANADOLU
CEDETAŞ	SELLING DEPT. BEŞİKTAŞ	FROM DIFFERENT DISTRICTS IN 1989	-
EEC	SAME BUILDING	FINDIKLI-ŞİŞHANE-BEYOĞLU IN 1995	-
EDS	SAME BUILDING	-	-
ERA	SAME BUILDING	ANKARA- İSTANBUL IN MID 1980'S	-
KAYSERİ			
AAZ	MARKETING SAME DISTRICT	-	-
ENDSİS	SAME BUILDING	-	-
HES	WITHIN SAME COMPLEX	-	-
BURSA			
EMKO	SAME BUILDING	CITY CENTER - IND. ZONE IN 1995	-

APPENDIX T

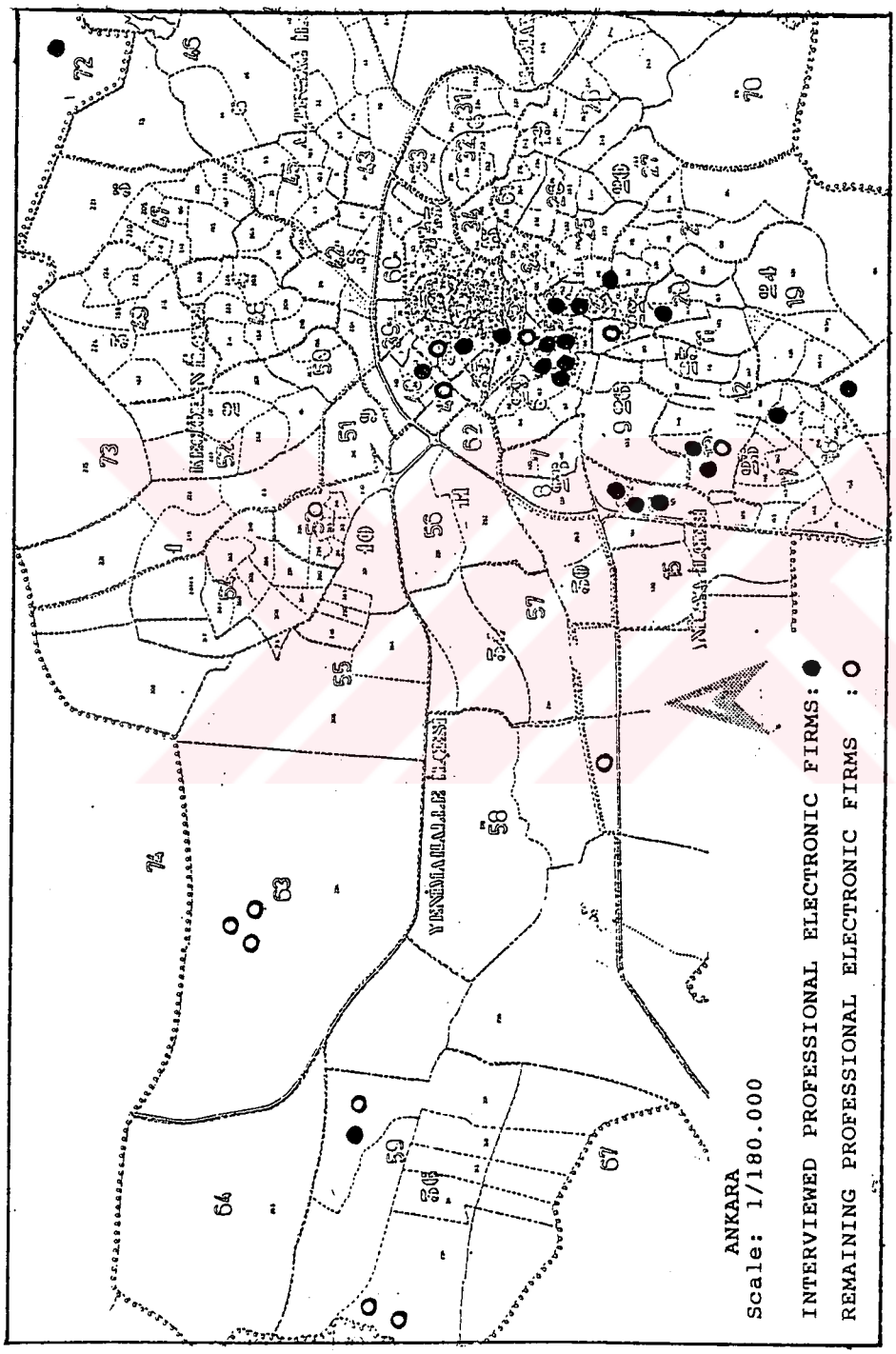

Figure T. Intra Metropolitan Location of Ankara Firms

APPENDIX U

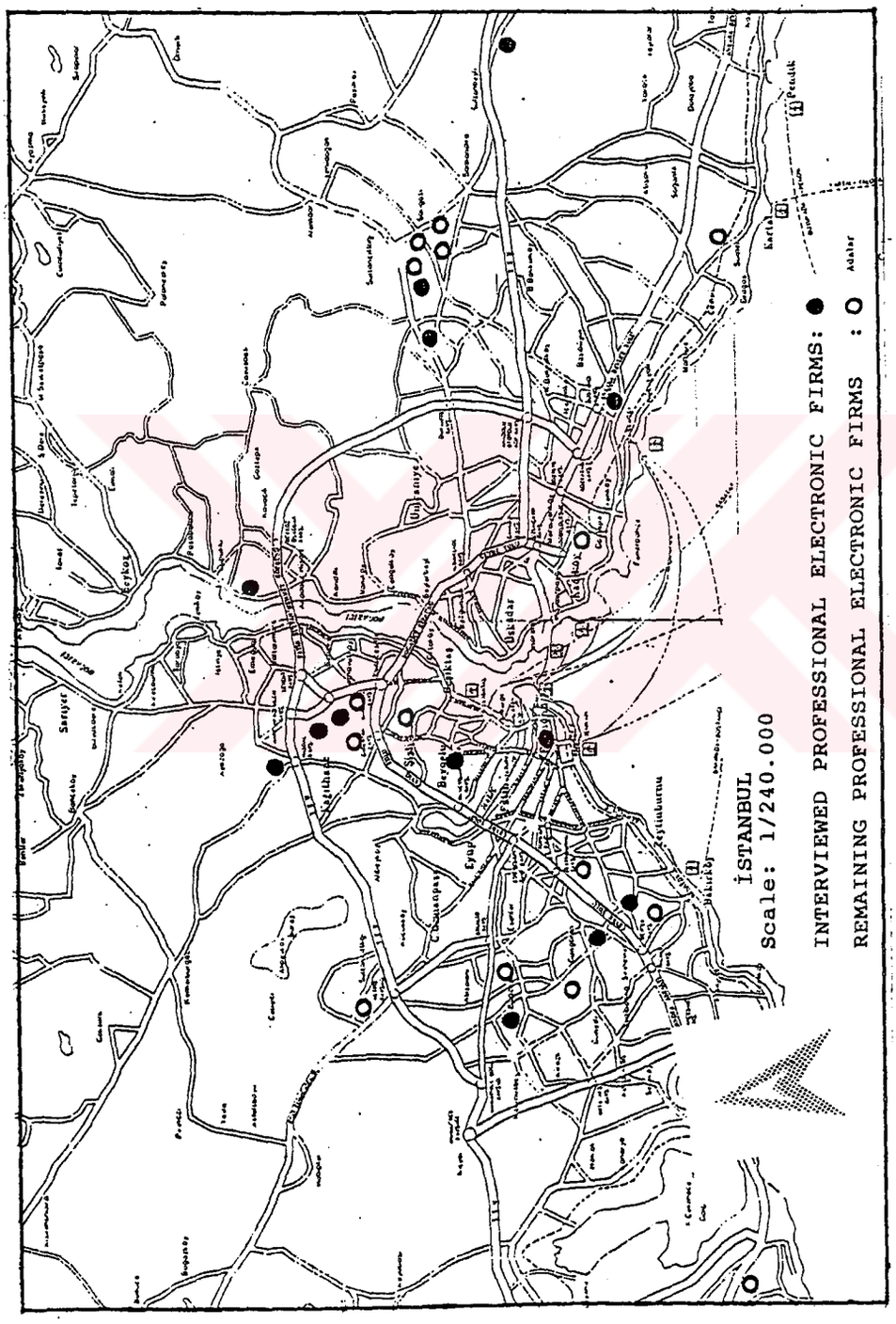

Figure U. Intra Metropolitan Location of İstanbul Firms

APPENDIX V

Table V. Former Activities of Firms, Present Conditions and Their Future Aims on Production

	FORMER ACTIVITY	PRESENT ACTIVITY	OTHER PRODN.
ANKARA			
ELSİS	RESEARCH FIRM	PRODUCER	-
OES	PROUDCER	PRODUCER/ REPRESENTATIVE	-
ELİMKO	PRODUCER	PRODUCER/ REPRESENTATIVE	-
GATE	TRADER	PRODUCER/ UPKEEPER	MACHINERY
MEKO	PRODUCER	PRODUCER/ SYSTEM WORKS	-
MOSTEK	ELECTRONICS PRODN.	PRODUCER	-
NEL	PRODUCER	PRODUCER/ REPRESENTATIVE	-
SİSTEK	PRODUCER	PRODUCER/ REPRESENTATIVE	-
ETA	RESEARCH FIRM	PRODUCER/ SYSTEM WORKS	-
TETA	PRODUCER	PRODUCER/ REPRESENTATIVE	-
ENERSİS	PRODUCER	PROD./SYSTEM WORKS/COMMITEE	-
ELSİM	PRODUCER	PRODUCER/ REPRESENTATIVE	-
UTES	PRODUCER	PRODUCER	-
YESTAŞ	GENERAL PRODUCER	PRODUCER/ REPRESENTATIVE	-
PETAŞ	PRODUCER	PRODUCER	PRINTED CIRCUIT
KARDIOSIS	PRODCER/ RESEARCH FIRM	PRODUCER/ REPRESENTATIVE	-
NÜVE	PRODUCER	PRODUCER/ REPRESENTATIVE	-
PCK	PRODUCER	PRODUCER/ REPRESENTATIVE	-
EPROM	PRODUCER	PRODUCER/ REPRESENTATIVE	-
ON	ENGINEERING FIRM	PRODUCER	-
ORTANA	PRODUCER	PRODUCER	-
EGİS	*PRODUCER*	*PRODUCER*	-
MEDİSPO	*PRODUCER*	*PRODUCER*	-
İSTANBUL			
EGES	REGULATOR PRODCER	PRODUCER	-
ROTA	PRODUCER	PRODUCER	-
EKA	PRODUCER	PRODUCER/ REPRESENTATIVE	ELECTRICS SECTOR
BAYKON	TRADER	PRODUCER/ REPRESENTATIVE	-
BKS	PRODUCER	PRODUCER	-
ESİT	ELECTRONICS PRODN.	PRODUCER	-
ELİAR	FIRM IN CEDETAŞ	PRODUCER	-
POLARİS	PRODUCER	PRODUCER	THERMO ELEMENTS
SİSEL	TRADER	PRODUCER/ REPRESENTATIVE	-
CEDETAŞ	PROJECT DESIGNER	PRODUCER/ COMMITER	ELECTRICS SECTOR
EEC	PRODUCER	PRODUCER	ELECTRICS SECTOR
EDS	ENGINEERING FIRM	PRODUCER/ REPRESENTATIVE	-
ERA	LABAROTORY PRODUCER	PRODUCER/ REPRESENTATIVE	ELECTRICS SECTOR
KAYSERİ			
AAZ	TRADER	PRODUCER	-
ENDSİS	TRADER	PRODUCER/ REPRESENTATIVE	-
HES	CABLE PRODUCER	PRODUCER	CABLE PRODUCTION
BURSA			
EMKO	PRODUCER	PRODUCER	-

Table V1 (Continued)

	DECISION FOR FUTURE
ANKARA	
ELSİS	KEEP THEIR CURRENT SITUATION
OES	MORE ACTIVE IN THEIR SUBBRANCH
ELİMKO	ORGANISING FOR MASS PRODUCTION
GATE	ORGANISING FOR MASS PRODUCTION
MEKO	SYSTEM WORKS INSTEAD OF PRODN.
MOSTEK	MORE ACTIVE IN THEIR SUBBRANCH
NEL	PRODN. IN DIFFERENT SUBBRANCH
SİSTEK	MORE ACTIVE IN SYSTEM WORKS
ETA	MORE ACTIVE IN THEIR SUBBRANCH
TETA	MORE ACTIVE IN THEIR SUBBRANCH
ENERSİS	ORGANISING FOR MASS PRODUCTION
ELSİM	PRODN. IN DIFFERENT SUBBRANCH
UTES	KEEP THEIR CURRENT SITUATION
YESTAŞ	MORE ACTIVE IN THEIR SUBBRANCH
PETAŞ	MORE ACTIVE IN THEIR SUBBRANCH
KARDIOSIS	MORE R$D ORIENTED RESEARCH FIRM
NÜVE	MORE ACTIVE IN THEIR SUBBRANCH
PCK	MORE ACTIVE IN THEIR SUBBRANCH
EPROM	MORE ACTIVE IN THEIR SUBBRANCH
ON	PRODN. IN DIFFERENT SUBBRANCH
ORTANA	MORE ACTIVE IN THEIR SUBBRANCH
EGİS	MORE ACTIVE IN THEIR SUBBRANCH
MEDİSPO	MORE ACTIVE IN THEIR SUBBRANCH
İSTANBUL	
EGES	MORE ACTIVE IN THEIR SUBBRANCH
ROTA	KEEP THEIR CURRENT SITUATION
EKA	MORE ACTIVE IN THEIR SUBBRANCH
BAYKON	MORE ACTIVE IN THEIR SUBBRANCH
BKS	MORE ACTIVE IN THEIR SUBBRANCH
ESİT	MORE ACTIVE IN THEIR SUBBRANCH
ELİAR	MORE ACTIVE IN THEIR SUBBRANCH
POLARİS	PRODN. IN DIFFERENT SUBBRANCH
SİSEL	ORGANISING FOR MASS PRODUCTION
CEDETAŞ	MORE ACTIVE IN THEIR SUBBRANCH
EEC	MORE ACTIVE IN THEIR SUBBRANCH
EDS	ORGANISING FOR MASS PRODUCTION
ERA	MORE ACTIVE IN THEIR SUBBRANCH
KAYSERİ	
AAZ	MORE ACTIVE IN THEIR SUBBRANCH
ENDSİS	PRODN. IN DIFFERENT SUBBRANCH
HES	MORE ACTIVE IN THEIR SUBBRANCH
BURSA	
EMKO	MORE ACTIVE IN THEIR SUBBRANCH

CIRRUCULUM VITAE

Okan Murat Dede was born in Erzurum on 1969. He received his B.S. degree in City and Regional Planning from Middle East Technical University in June 1991. He received Master Degree in Regional Planning from the same university in October 1994. He worked as assistant in City and Regional Planning Department in Middle East Technical University from 1992 to 1993. Then he worked as assistant in City and Regional Planning Department in Gazi University from 1994 to 1998. Since then he has been a teaching assistant in Architecture Department in Erciyes University, Yozgat Engineering and Architecture Faculty. His main areas of interest are information technologies and spatial dynamics of technology based production.