

A RESEARCH ON TECHNOLOGY DEVELOPMENT CENTERS

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ABSTRACT

Technology Development Centers are the areas of research which give importance to the implementation dimension of the newly developed technologies. The aim of these centers is to develop new products and to advance product quality and production process in order to increase the national competition power in the national and international market. These centers are generally established in a planned manner and sometimes they are built in small size and called technoparks or technoplazas or they are built in bigger size and named technocities.

In this paper, based on a part of the research project carried out for Grater Istanbul Municipality (Gulersoy, N.Z. and others, 2007), the growth and expansion of Technology Development Centers from around the world and their programs will be discussed with regard to their main purposes. Within this paper, general evaluation of the Technology Development Centers in the world and in Turkey will be presented. The study shows that the technology and research development capacity are considered to be the main factors in regional economic growth and regional development.

Keywords: Technology Development Center, Technocity, Technopark, Economic Development

INTRODUCTION

Technology Development Centers are the areas of developing technology which give importance especially to the implementation dimension of newly developed technologies. The aim of these centers is to develop new products, to advance product quality and production process in order to increase national competition power in the national and international market. These centers are established generally in a planned manner and sometimes they are built in small size and called technoparks or technoplazas and they are built in bigger size and named technocities.

There are different descriptions for these centers made by different researchers and establishments accepted in the international literature.

In the general context of the research, besides the special names of the examples, they are called "Technology Development Centers or Technology Development Regions" in the general wording like they are described within the frame of regulations in our country.

Despite their differentiation, nearly all Technology Development Centers (although named as technology parks, techno parks, research parks, science parks, innovation centers, science and technology cities or towns) contain research facilities, laboratories, business incubators, education, business and service complexes under different shapes and dimensions. The majority of Technology Development Centers are focused on information technology (electronics and computers included), telecommunication, bio-technology and new materials and devices.

In Technology Development Centers there are seven main functions: Incubators, R&D units, social facilities, management units, lodging units (hotel, guesthouse), transport, telecommunication and infrastructure.

THE PROGRESS OF TECHNOLOGY DEVELOPMENT CENTERS IN THE WORLD

Technology Development Center/Technopark applications first started in the developed countries after the Second World War with the aim of developing new knowledge in science and technology.

Technology Development Centers were first created in the USA in 1940's as a new idea, but no important progress took place until the 1970's. The economic catastrophes due to the energy crisis in 1970's led the USA and Western countries seeking a new innovative approach. The financial shortage and crisis in the universities during that period had a major affect on the promotion of Technology Development Centers. It is possible to specify the 1990's as the explosion years in the expansion of the Technology Development Centers. Strong universities created closer links with industry and this resulted in the formation of new technology based firms. In the 1990's Technology Development Centers became an important tool of regional development. They started intensive operation, not only in developed countries but also in many developing countries as well.

In the research, the evolution of Technology Development Centers/Technoparks is summarized in four main periods;

1. The Establishment of Technology Development Centers (1950-1975)

The early Technology Development Centers were established in the 1950's. These are Silicon Valley (1951) and the North Carolina Research Triangle (1959). Other important Technology Development Centers established later are Sophia Antipolis in France (1969), and Heriot-Watt Science Park (1972) and Cambridge Science Park (1972) in the UK. In these years, the major reason for the increase in Technology Development Center applications is the increase in unemployment due to the diminishing of the conventional industries like coal mining, iron-steel, etc.

2. The Progress of Technology Development Centers in the Industrialized Countries (1975-1990's)

In need of recovering from the economic crisis in the 1970's, developed countries gave importance to build the Technology Development Centers by

injecting R&D results into applications, with the expectation of regional development, increased employment, better utilization of land and performing science based production. In the 1980's, important developments were made and some good results were obtained in the target subjects.

The basis of the economic and political reasons of the fluctuations and the fast changes in Technology Development Center establishments in 1980's is said to be dependant on the petroleum crisis of the 1970's.

On the other side, the cuts in university funding, public development commissions and the different pressures on the private companies at their local business affected the Technology Development Centers in their direction of growth. The unemployment rate among new graduates and the complaints from within the universities themselves caused the university administrations to cooperate with local governments to search for joint works together with the industry and to try for creating new job opportunities.

In the 1970-80 period, especially in countries like USA and Japan, industry started new R&D activity and close cooperation with universities and research establishments. As a result of these cooperation, very important technological developments were achieved in areas like information technology and software, new materials, bio-technology, new energy resources, space technology, flexible manufacturing systems, automation and robotics; smaller, cheaper new products with increased functions were produced, promoted and sold.

The achievements in new technologies in the USA and Japan forced European countries to move and these countries started to search for ways to compete in modern technologies. To create and develop new technologies they took some measures and gave importance to promotions, university-industry cooperation and worked to increase R&D activities. As a result of these actions, the Technology Development Center applications where the information exchange takes place between science and industry, gained more importance. With the emergence of the global market in the 1980's; East and South-East Asian countries were directed to obtain similar technologies and use them with the USA and Japan together with European Union Countries. This without any doubt became possible by allocating more resources and funding to R&D expenditures. It is known that, until 1980, with 12 in the USA, 7 in France and Belgium, and 2 in the UK totally there were a few dozen Technology Development Centers in the world.

Between the years 1980 and 1985, 47 technology parks were established in 5 European Countries. The Netherlands in Northern Europe in the mid 1980's, Italy in Southern Europe in 1984, and Hungary in Eastern Europe in 1988, established the first Technology Development Centers of their countries. Governments are giving direct and open support. The principal aim of the government was to encourage economic development through information based activities. The Government gave important support in France and Germany where they were in the front of the European science parks population. There were 3 Technology Development Centers in the country in the 1970's, but this increased to 55 in 1980's. That were the results of an important economic restructuring process (Sunman, 1989).

In the Asia-Pacific Region, all science parks were established after the beginnings of the 1980's (AURRP, 1998; IASP, 1998). Most of them are planned schemes of the governments which give financial support to the park entrepreneurs to facilitate technology development. Japan, Australia and China have big number of plans. The number of plans in Taiwan, Singapore, Southern Korea and Malaysia are less. As a last group with lesser number of plans, it is seen that Thailand, Philippines, Papua New Guinea, Brunei, and Vietnam. Indonesia, India and Sri Lanka have also started to build their own Technology Development Centers.

3. The Developments in Industrializing Countries (1990's)

Technology Development Centers also started to emerge in countries which are not industrialized. This was a rapid growth area in the 1990's. The Technology Development Centers in this period served the needs of industry and improved their physical standards. In the same period, different establishments started to emerge in the developed countries. The number of science park schemes of Germany, known as innovation centers, (Allesch & Fiedler, 1985) reached 68 by the end of 1988. It reached more than 100 at the beginning of the 1990's. The most important driving factor in the fast development is the attitude of local authorities who accept the innovation centers as the most powerful tool for traditional economic growth. Their aim is to create new entrepreneurs. To create technology and even new jobs is of secondary importance for them. (Sunman, 1989; Zhang, 2005).

In Japan, in the 1990's, science parks were the leading power in the regional high technology policy. By realizing the technopolis idea in the 1990's which was first mentioned by the Ministry of International Trade and Industry (MITI) in the 1980's; the target was to get a picture of the 21st Century. It can be seen that underlying target of this idea is local and regional development (Babacan, 1995). Many of these Technology Development Centers do not have a relationship with universities. According to studies made in 1990, only 10 out of 103 parks are somehow "related to universities". But none of them were established under university leadership (Masuda, 1995).

4. The 2000's

The objective of science and technology is to produce cheap and better quality products and thus facilitate the increase in general wealth by developing skilled human resources. Because of this, the countries harvesting the economic wealth produced by science and technology, are giving much importance to science and technology. Technological development gained more importance in the last century and became one of the basic conditions of human wealth and happiness. The economic, political and technological developments are guided according to the needs of an advanced technology society. The main driver in the developments in advanced technology is R&D activities (Castells, 1994).

Today the rank of countries in science and technology list is determined according to funds allocated to R&D in their GDP and the number of researchers per 10,000 jobs. The minimum requirement for this list is 1% R&D share in GDP and 15 researchers per 10,000 jobs. In developed countries these ratios are much higher than the minimum, but in contrast in the developing

countries these ratios are under the minimum (Castells and Hall, 1994). In the last 30 years, new trends are taking shape, to seek new ways to lead the findings of research into the applications. The new channel found for this: promotion of the Technology Development Centers (www.iasp.ws).

The Technology Development Centers whose aim is to introduce science and technology, started to be established first in the countries who are at the frontiers in science and technology, such as the USA, the UK, France, Germany and Japan. For this reason the USA, the UK, France, Germany, Italy, Russia, Japan, China and Israel are studied in more detail.

THE EVALUATION OF TECHNOLOGY DEVELOPMENT CENTERS IN THE WORLD

When the Technology Development Centers in the world are studied, it can be seen that 79.69% of the total area are technoparks, 2.31% are incubators which are known as business development centers, 1.38% are technology areas, 2.77% are academic centers and 13.85% are other areas (Table 1) (www.aspa.or.kr).

Table 1. Total Technology Development Centers in the world (www.aspa.or.kr)

World Total: 650	Technoparks	%79.69	(518/650)
	Incubators	%2.31	(15/650)
	Technology Areas	%1.38	(9/650)
	Academic	%2.77	(18/650)
	Others	%13.85	(90/650)

Technology Development Centers in Asian Continent

When the Technology Development Centers in the Asian Continent are examined, it can be seen that 78.63% of the total area are technoparks, 2.60% are incubators which are known as business development centers, 0.37% are technology areas, 1.49% are academic centers and 16.73% are other areas (Table 2), (www.aspa.or.kr).

Table 2. Total Technology Development Centers in Asian Continent (www.aspa.or.kr)

World Total : 650	Technoparks	78.62%	212/269
Asian Total : 269	Incubators	2.60%	7/269
	Technology Areas	0.37%	1/269
	Academic	1.49%	4/269
	Others	16.73%	45/269

Technology Development Centers in American Continent

When the Technology Development Centers in the American Continent are considered, it can be recognized that 83.33% of the total area are technoparks, 2.38% are incubators which are known as business development centers, 1.59% are technology areas, 2.38% are academic centers and 10.32% are other areas (Table 3), (www.aspa.or.kr).

Table 3. Total Technology Development Centers in American Continent (www.aspa.or.kr)

World Total : 650	Technoparks	83.33%	105/126
American Total : 126	Incubators	2.38%	3/126
	Technology Areas	1.59%	2/126
	Academic	2.38%	3/126
	Others	10.32%	13/126

Technology Development Centers in European Continent

When the technology development areas in the European Continent are studied, it can be seen that 78.80% of the total area are technoparks, 2.00% are incubators which are known as business development centers, 2.40% are technology areas, 4.00% are academic centers and 12.80% are other areas (Table 4).

Table 4. Total Technology Development Centers in European Continent (www.aspa.or.kr)

World Total : 650	Technoparks	78.80%	197/250
European Total : 126	Incubators	2.00%	5/250
	Technology Areas	2.40%	6/250
	Academic	4.00%	10/250
	Others	12.80%	32/250

Technology Development Centers in African Continent

When the Technology Development Centers in the African Continent are inspected, it can be seen that 80.00% of the total 5 areas are technoparks, 20.00% are academic centers (Table 5), (www.aspa.or.kr).

Table 5. Total Technology Development Centers African Continent (www.aspa.or.kr)

World Total : 650	Technoparks	80.00%	4/5
African Total : 5	Incubators	0.00%	0/5
	Technology Areas	0.00%	0/5
	Academic	20.00%	1/5
	Others	0.00%	0/5

When the continental distribution of Technology Development Centers are examined, it is found that European and Asian Continents ratios are similar, only American Technology Development Centers make 23% of all Technology Development Centers in the world and Technology Development Centers on the African Continent has only 1% share in the world.

When the Technology Development Centers in developed countries are examined, it is found that USA takes 30% share, China 18%, the UK 17%, Japan 15%, France 11%, Italy and Germany 4% and Israel takes a 1% share.

THE DISTRIBUTION OF TECHNOLOGY DEVELOPMENT CENTERS TO THE COUNTRIES

The USA

According to the research made by World Science Parks Association, most Technology Development Centers are in the USA, concentrated in the western and eastern states of the country. Generally they have a structure which is known as "spin-off" where the firms are established by ex-researchers from the universities. Today, in R&D activities around the world the USA has the biggest share; in the number of technoparks the USA is also at the top. The USA has 90% of all Technology Development Centers on the American Continent. American Technology Development Centers are developed with investment from the private sector (Table 6), (www.aspa.or.kr).

Table 6. USA Technology Development Centers (www.aspa.or.kr)

Technology Centers	World	America Continent	U.S.A.
Technoparks	518	120	105
Incubators	15	4	3
Technology Regions	9	5	2
Academy	18	6	3
Others	90	13	13
Total	650	157	126



The UK

The UK is one of the leaders of the Technology Development Center movement. The most important feature of the centers known to be working in biotechnology and nanotechnology is that they are directed by government's scientific policies. They can use government funds for their activities in Technology Development Centers and in further phases, depending on the commercial future of projects, they can get increased support from the government. By utilizing this mechanism, great steps have been taken in the commercialization of the research. The UK Government had a policy of establishing enough numbers of Technology Development Centers and distributing them evenly throughout the country. The share of Technology Development Centers related to academic institutions is limited to 15% only as a result of this policy. This is only a managerial ratio and does not show that these Technology Development Centers are developed without any relation to universities or research establishments. On the contrary, it is always important for a Technology Development Center to be geographically close to a university or a research institute (Table 7) (www.aspa.or.kr).

Table 7. UK Technology Development Centers (www.aspa.or.kr)

Technology Centers	World	Europe	UK
Technoparks	518	197	51
Incubators	15	5	3
Technology Regions	9	6	1
Academy	18	10	5
Others	90	32	11
Total	650	250	71



France

In France, Technology Development Centers established with government leadership are working widely throughout the country. In their strategic plan, which is thought to be a useful tool to develop and to create activity and business in rural areas, important success has been achieved. France maintains 5th place in the ranking of R&D expenditures in the world and plans new investments to increase the number of Technology Development Centers. In technological investment planning, France encourages the private sector to take part in the management of Technology Development Centers in development. The government and the private sector share the management of 80% of all 47 Technology Development Centers. In new technology centers being planned, the intention is to increase the shares of academic areas and incubators (Table 8) (www.aspa.or.kr).

Table 8. France Technology Development Centers (www.aspa.or.kr)

Technology Centers	World	Europe	France
Technoparks	518	197	39
Incubators	15	5	2
Technology Regions	9	6	1
Academy	18	10	1
Others	90	32	4
Total	650	250	47



Germany

When Technology Development Centers in Germany are examined in their quantity and distribution, it is seen that they are lower than other developed nations. In Germany, they generally prefer to establish incubators and to grant technology investment promotions to firms. Due to the social and economic problems suffered after the unification of East and West Germany in 1989; it can be seen that Germany is lagging behind other developed nations. But with the investments already made or which are continuing in Germany, they are maintaining their claim to be the main technology developing country in Europe for the next 10 years. The technoparks in Germany cover 75% of all Technology Development Centers. They are mostly established within the university structure

and they are carrying out high technology researches with government-private sector support (Table 9) (www.aspa.or.kr).

Table 9. Germany Technology Development Centers (www.aspa.or.kr)

Technology Centers	World	Europe	Germany
Technoparks	518	197	12
Incubators	15	5	0
Technology Regions	9	6	2
Academy	18	10	1
Others	90	32	1
Total	650	250	16



Italy

When the general situation of Italy's Technology Development Centers is investigated, it seems similar to Germany's case. Technology Development Centers are not developed much because the R&D expenditures are less than expenditures of developed nations. Agriculture, genetic agriculture and control systems sectors are developed in Italy and they are the key element in the preparations of new Technology Development Center projects which will take them to the leadership in related markets. Governments started to work on the plans, and to allocate funds from the European Union, in this direction. In Italy, 70% of all Technology Development Centers are technoparks. The remaining 30% are academic sectors and small scale technology support centers of industry (Table 10) (www.aspa.or.kr).

Table 10. Italy Technology Development Centers (www.aspa.or.kr)

Technology Centers	World	Europe	Italy
Technoparks	518	197	11
Incubators	15	5	0
Technology Regions	9	6	0
Academy	18	10	1
Others	90	32	6
Total	650	250	16



Japan

Accepted as a tool of development, the main target of Technology Development Centers established in Japan is to create an evenly distributed technological development over the whole country by the joint investments of government and the private sector. The Japanese suffer under difficult geographical conditions and scarcity of land and they have interconnected the important cities of the country by Shinkansen. Japanese Technology Development Centers are among the most important technology development regions in the world. They are working on projects to solve the problems encountered in civil life which makes them different than some other countries (USA and Israel, etc.) which are working on military projects. The structure of the Japanese 64 Technology

Development Centers is: 70% technoparks and 30% other technology development areas. The main reason is the majority of technology centers developed in Japan is in the industrial body (Table 11) (www.aspa.or.kr).

Table 11. Japan Technology Development Centers (www.aspa.or.kr)

Technology Centers	World	Asia	Japan
Technoparks	518	212	40
Incubators	15	6	1
Technology regions	9	1	0
Academy	18	4	1
Others	90	45	22
Total	650	268	64



China

The Technology Development Centers established in China are in the form of new cities with government support. Because of this strategic plan, there seems an even distribution throughout the states. According to official statements, the centers in the west of the country are not suitable for Technology Development Centers because of climatic conditions. Many technoparks and technocities are in the process of establishment around the east coast. In 2005, there are about 100 new Technology Development Centers being built. The Technology Development Centers in China makes the 30% of Technology Development Centers in Asia and in general they are not academic but instead they are built in cooperation with industry in the investment areas. China plans to increase its share in Technology Development Centers in Asia to 50% with new planned Technology Development Centers (Table 12), (www.aspa.or.kr).

Table 12. China Technology Development Centers (www.aspa.or.kr)

Technology Centers	World	Asia	China
Technoparks	518	212	68
Incubators	15	6	1
Technology Regions	9	1	0
Academy	18	4	0
Others	90	45	7
Total	650	268	76



Israel

The Technology Development Centers in Israel are mostly in industrial districts. All investments are either government or private sector supported and the main targets are either commercialization of products or are related to the defense industry. A big portion of the defense industry is making investments through the firms in Technology Development Centers. In addition, the new designs and products are opened to the world market and attract financial resources. Through the strategic agreements of the government with Technology Development Centers in America, these centers achieve a substantial amount of

skilled labor and information. 55% of Israel's Technology Development Centers are industrial technoparks. To increase the number of Technology Development Centers; technoparks and incubators are going to be supported by the Israeli Ministry of Labor (Table 13) (www.aspa.or.kr).

Table 13. Israel Technology Development Centers (www.aspa.or.kr)

Technology Centers	World	Asia	Israel
Technoparks	518	212	1
Incubators	15	7	0
Technology Regions	9	1	0
Academy	18	4	0
Others	90	45	2
Total	650	269	3



THE GROWTH OF "TECHNOLOGY DEVELOPMENT REGIONS" IN TURKEY

The Technology Development Center movement came on the agenda as an idea first in the 1980's and started to take place in the "National Development Plans" in Turkey. The Technology Development Center phenomenon started to be spoken of in the environment of university-industry cooperation discussions; as a solution to the industrialization and commercialization of university research findings. The first steps regarding Technology Development Centers was taken in 1991 and two "Technology Development Centers" were opened in METU and ITU with the support of KOSGEB as an "innovation center".

The continuing implementations of Technology Development Centers around the world in 1990's increasingly have caused the subject to be discussed at length in Turkey. After long discussions and efforts the No: 4691 "Technology Development Regions Law" was passed in June 26, 2001 from the Grand National Assembly of Turkey, which gave the subject a legislative base.

The idea of establishing Technology Development Centers has been developed by the decisions of State Planning Organization (DPT) in 1980; and the establishment of Technology Development Centers in biotechnology, space research and satellite technology, electronics, regenerative energy resources, new materials, oceanography, iron and coal technology, animal feeding and plant growing, and food technology fields.

With the directives of DPT, five Technology Development Centers were chosen to be built in ITU (1985-1997), Aegean University (1988), Anatolian University (1990), TUBITAK MAM (Marmara Research Center) and METU (1992). Four universities together with KOSGEB and TUBITAK-MAM alone have established their first phase centers.

A short history of development of Technology Development Centers/technology development regions in Turkey is summarized below:

In addition, the Technology Development Centers/regions finished their structuring and started working effectively and examined in the context of this analysis are below (2009):

- Middle East Technical University, METU Technocity TDR (Technology Development Region)
- TUBITAK-MAM Technopark TDR
- Ankara TDR, Cyberpark, Bilkent University
- Hacettepe University TDR
- Istanbul Technical University, ITU Ari Technocity TDR
- Istanbul University TDR
- Yıldız Technical University TDR
- Gebze Organized Industrial District Technopark TDR
- Kocaeli University TDR
- Eskişehir TDR
- Izmir Technopark Trade Inc. (İTAŞ)
- Selçuk University TDR
- West Mediterranean Technocity TDR
- Erciyes University TDR
- Trabzon TDR
- Çukurova TDR
- Erzurum Ata Technocity TDR
- Mersin TDR
- Ulutek TDR
- Lakes District TDR

It can be seen that when we look at the goals of the Technology Development Centers and Technology Development Regions; the experiment in Turkey is made up of two extremes. One extreme is Technology Development Regions offer only a research place and consultancy to the firms, and the other extreme is Technology Development Regions offer the all possibilities of an urban life where they themselves are forming independent towns still under construction (METU-Technopolis and TUBITAK-MAM Technoparks). In building these Technology Development Centers, the most active actors are universities. The most important reason for this is that neither private sector nor government sector is much interested in research activities. For this reason, universities are taking responsibility more than anybody else in Turkey in the establishment of Technology Development Regions, and their expenditures to R&D are more than that of the private sector in contrast to developed countries.

When the sources of investment are analyzed, four groups are found:

- The first group of Technology Development Regions has more weight of the private sector in the leadership: The Aegean Free Zone Technology Development and Transfer Zone (ESB-TGTM), Izmir Technology Development Center Inc. (İTAŞ), Anatolian Technology Research Park (ATAP) and Gebze Organized Industrial District Software houses Free Zone Project (GOSBYESBP) are part of this group.

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- Istanbul University TDR
- Yıldız Technical University TDR
- Gebze Organized Industrial District Technopark TDR
- Kocaeli University TDR
- Eskişehir TDR
- Izmir Technopark Trade Inc. (İTAŞ)
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- The second group of Technology Development Centers was established by university-government cooperation like KOSGEB Technology Development Centers.
- Third group Technology Development Centers are METU Technopolis, ITU Ari Technocity which are built with the leadership of the universities.
- The fourth group Technology Development Centers was built by a central government establishment under government leadership like TUBITAK-MAM-TGM Technology Development Center, Istanbul-Pendik-Kurtköy High Technology Industrial Park Project (IPKYTSP).

TECHNOLOGY DEVELOPMENT REGIONS IN TURKEY: GENERAL EVALUATION

In the table above, the establishment date, size, place and number of firms in these Technology Development Regions (TDR) are shown according to the research carried out in 2007, that this paper is based on (Gülersoy, at. all., 2007).

The Distribution of TDR'S According to their Establishment Date

Of the present 22 TDR's; 2 established in 1992 (9 %), 3 in 2002 (14 %), 7 in 2003 (32 %), 4 in 2004 (18 %), 4 in 2005 (18 %) and 2 in 2006 (9 %).

The Area of TDR

Out of the data available from 19 TDR's, 8 of them are less than 50 ha, 5 in between 50-100 ha, 1 in between 100-200 ha and 5 of them are greater than 200 ha.

Location

Out of the data available from 19 TDR's, 16 TDR are in campus of the parent University (84%).

Sector Distribution of firms present in TDR's

The distributions of firms present in TDR's according to the sectors they are operating are prepared for 16 TDR's out of total 22 because of data availability reasons. From the total 226 firms present in TDR's, 87 are in software (39%), 52 electronics-computers (23%), 57 information (25%), 7 medical (10%), 6 defense (3%), 5 materials (3%), 4 telecommunications (2%), 3 mining (1%), 2 environment (1%) and 1 firm in food sector (Table 15).

Managerial models of TDR's are developed in four groups according to the managerial models taking main or leading entrepreneur in the establishment of TDR's. In the literature, five different groups can be recognized: University led, Government supported, University-government-private sharing, private sector and non-profit organizations (Zhang, 2005). As mentioned before, only four of these groups are presented in Turkey.

Private sector led TDR's: Izmir TDR, Eskişehir TDR (ATAP), and GOSB Technopark; University-government led TDR's: KOSGEB Technology Development Centers; University led TDR's: METU Technopolis, ITU Ari Technopolis, Hacettepe University TDR, Yıldız University TDR, Kocaeli University TDR; Selçuk University TDR, Erciyes University TDR; Central government research center led TDR's: TUBITAK-MAM TDR.

Table 15. Sector Distribution of firms present in TDR's

	METU TECHNOPOLOIS TDR	TUBITAK-MAM TDR	IZMIR TECHNOPOLOIS INC. (ITAS)	ANKARA TDR	GOSB TECHNOPOLOIS TDR	ITU ARI TECHNOPOLOIS TDR	HACETTEPE UNIV. TDR	YILDIZ TECH. UNIV. TDR	ESKIŞEHİR TDR	KOCAELI UNIV. TDR	ISTANBUL UNIV. TDR	SELÇUK UNIV. TDR	ANTALYA TECHNOPOLOIS TDR	ERCIYES UNIV. TDR	TRABZON TDR	ÇUKUROVA TDR	ERZURUM ATA TECHNOPOLOIS TDR	MERSİN TDR	GÖLLER RÖLİGESİ TDR	ULUTEK TDR	GAZIANTEP UNIV. TDR	ANKARA UNIV. TDR	
SOFTWARE	■		■		■	■			■	■			■										
INFORMATION			■	■	■	■	■		■			■	■						■				
DEFENCE	■		■	■	■	■				■													
ELECTRONIC	■		■	■	■	■	■		■			■	■										
MEDICAL BIOLOGY	■		■	■	■	■	■					■	■			■							
TELECOMMUNICATIO	■		■	■	■	■	■					■	■			■							
ADVANCED	■		■	■	■	■			■														
HEALTH	■																						
ENVIRONMENTAL	■			■		■	■			■											■		
FOOD				■								■											
MINING							■		■														
AUTOMOBILE					■	■	■																
DESIGN			■		■	■																	
BUILDING				■																			
COMPUTER									■														
MACHINE DESIGN												■											
CHEMISTRY																			■				
ROBOT DESIGN																				■			
ENERGY																				■			
PLASMA																				■			
AUTOMATION																				■			
MARBLE																				■			

Evaluation of Legal, Managerial, and Financial Aspects of the Technology Development Centers in Turkey

The Promotions and Advantages Given to the TDR's in Legislation

The legal regulations concerning the establishment, operation and control of TDR's are the No: 4691 Law on the TDR's issued in July 6, 2001 and TDR Application Regulation dated June 19, 2002 in Turkey. With these legal instruments, important advantages are given to the firms working in these TDR's, university and government staff working in these TDR's and to the managing body of the TDR.

These advantages are:

- The wages of researchers, software specialists and R&D personnel are exempt from income tax and corporate tax until the date 31.12.2013.
- The applicable laws and regulations about labor are the general law and related regulations in Turkey: The Law No: 4875 "Direct Foreign Investment" and Law No: 4817 "The Law on the Working Permits of Foreigners" are valid in these TDR's. Foreign managers and skilled R&D staff can be employed in these TDR's.
- The personnel of government and universities whose work is needed as R&D researcher in these regions can work part-time or full-time with the permission of their employers. The income of part-time working university staff is not included in the University Revolving Fund.
- The personnel employed full-time in TDR's are permitted to work without any wages from the government but their relationship with their position in their former agency continues. The retirement rights gained with No: 5434 "Law of Retirement Fund for Government Officers" is held if the conditions of the 31st paragraph are obeyed. The special items of the Law No: "2547 Higher Education Law", paragraph 36 cannot be applied.
- The teaching staff of universities can carry out work in the firms present in TDR's according to the Law No: 2547 paragraph 39 for a temporary period with the permission of the University Administrative Board. If they are permitted to obtain their wages from the university, their income from these firms is kept outside of the University Revolving Fund.
- The teaching staff can establish a company, can take shares from an already existing company or they can work in the management of these companies to commercialize their research findings with the permission of University Administrative Board.
- If the necessary expenditures for the establishment of TDR's for land procurement, construction of infrastructure and managerial building, cannot be covered by the management company, they may be covered from the ministries budget; within the limitation of the fund in the budget.
- The management company is exempted from any tax, levies and duties related to this Law on TDR's. They do not pay sewage water fees to the Municipalities if TDR's are operating their own sewage water filtration facility. In the activities in these TDR's General accounting Law, No: 832 Control Law and Law No: 2886 Government Procurement Law is not applied.

Tax Exemptions

The tax exemptions applied in Turkey are not similar to the other successful Technology Development Center applications in the world. R&D activities are important items in the companies costs therefore there are promotions for these expenditures in the world. Because of this long period, high risk and capital hungry R&D investments can be realized. On the other side, during the start up period governments can give low interest "Venture Capital Credits and Grants".

In cases in the USA, Europe and Israel, the government gives 40% to 80% support to investment projects and additionally applying tax exemptions. For similar applications, in the 2006 budget of Turkish Ministry of Industry and Trade, about 3 million Euros is allocated, and this does not seem to be enough for 22 Technology Development Regions.

Other Supports

TÜBİTAK (TİDEB) R&D Support

The Technology Tracking and Evaluating Directory (TİDEB) which is a branch of TÜBİTAK (Turkish Scientific and Technological Research Association) can grant R&D support. They can cover up to 60% of the R&D costs of new product development or development of production technologies as a grant. In calculating the support ratio, to be present in a TDR is an important criteria which increases the ratio.

TTGV R&D Support

The TTGV (Technology Development Fund of Turkey) was established with the aim to develop the technological infrastructure and technological power of Turkey and to help Turkish Industry to increase their competitive power in international markets. The TTGV can give long period loans up to the 50% of the total project cost to the industrial and software establishments for "technological product and process innovation". Up to now, the TTGV has supported 240 technological development projects with 95 million USD.

KOSGEB, gives very important support to SME's (Small and Medium Size Establishments) to increase the effectiveness and share of SME's in covering the economic and social needs of the country, to increase the power and the level of competitiveness, to realize integration in industry in line with economic developments. The support schemes are: Technology R&D support, consultation and training support, information nets and e-business support, CE marking test and analysis support, market research support for foreign markets, trade fair participation support, export orientation support, and new entrepreneur support.

"The Support for Technology R&D" is supporting the firms present in TDR's. The goal and the frame are, to support the firms owning new ideas and inventions in science and technology by the technological and R&D support scheme. This aims to establish and develop a technological level in order to be able to compete in national and international platforms and to allow new product production or development.

There was a single statement amendment to the Law No: 3065 in 2003. "The entrepreneurs active in TDR according to the related No: 4691 TDR Law, they are exempted from VAT, for their products (only produced in these regions) related to systems management, data management, business applications, sector, mobile, internet and military command and control software; for the duration they are exempted from income or corporate tax." This amendment added VAT exempts to income and corporate tax exemptions.

CONCLUSION

The development of strategies in steps is important in the establishment and area selection of Technology Development Centers. For a country in the first level of development, there may not be many alternatives, because as Castells says "all eggs are in the same basket". Skilled and educated labor; advanced transport and information flow networks like airports, auto routes and telecommunication; are generally concentrated in the most advanced region of the country and this is the industrial or national capital. For Turkey this is Istanbul. These special properties suggest that technology development centers, science and technology parks should be built around the city. Bu these areas generally, with the effects of high population and economic development, have important problems like traffic jams, loss of a lot of time in transport, expensive rents, high living costs and air pollution and because of these reasons, though they are attractive for Technology Development Centers, the negative sides carry more weight. These negative factors can stop investment in these areas. The solution to this problem is to build one or more Technology Development Centers on the periphery of the city, but with a high prestige and a quality environment.

The area selection criteria are closely related to the geography of the country. According to classical development theory, the differences increase in development and when developed they tend to decrease. At this point, the infrastructure (auto routes, modern railways, airports) is largely positioned in the industrially developed region. High quality level services; both productive (banks, auxiliary services, etc.) and consumer services (schools, universities, hospitals, shopping centers, and restaurants, etc.) are spread not only in the metropolitan area but in other peripheral cities as well.

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