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A Comparative Study on the Technopark Ecosystems for Region-Specific Approaches: The Case of Erciyes and Mersin

Bölgeye Özgü Yaklaşımlar İçin Teknopark Ekosistemlerine Karşılaştırmalı Bir Bakış: Erciyes ve Mersin Örneği

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ABSTRACT

Technoparks are seen as a means of strengthening the dynamics of the local/regional economy by attracting high-tech firms. However, studies focusing on technoparks in relation to the regional innovation systems are limited. The paper aims to explore technopark ecosystems, the role of universities, technopark management and regional actors, cooperation potentials and innovation processes, taking into account the specificity of the region in which it is located. The research was conducted in two city-regions taking into account the studies concentrated in Turkey's most developed metropolitan cities, and aimed to contribute to the gap in this field. For the purpose of the research, the interviews with relevant actors and the results of the workshop held in the next stage were combined with secondary data regarding city-regions. The results of this research support that technoparks as a policy tool for both innovation and regional development, cannot be proposed as a one-size fits all model. The case of Erciyes Technopark provided advantages through Kayseri's focus on production and export, its efforts to achieve structural transformation in the industry, strong social networks, entrepreneurial culture and loyalty to the city, the strong effect on the cities in its vicinity, and the power of political relations. Although Mersin Technopark is located in an important port city, its success is inhibited by the limited strength of the city's industrial infrastructure, and limited human capital capacity regarding the high immigration.

Keywords: Kayseri; Mersin; regional innovation system; technoparks.

ÖZ

Teknoparklar, yüksek teknoloji firmalarını çekerek yerel/bölgesel ekonominin dinamiklerini güçlendirmenin bir aracı olarak görülmektedir. Ancak bölgesel yenilik sistemleri bağlamında teknoparkları ele alan çalışmalar sınırlıdır. Bu makale, teknopark ekosistemlerini, üniversite, teknopark yönetimi ve bölge aktörlerinin rolünü, işbirliği potansiyellerini ve inovasyon süreçlerini, bulunduğu bölgenin kendine özgülüğünü gözeterek araştırmayı amaçlamaktadır. Araştırma, Türkiye'nin en gelişmiş metropol kentlerinde yoğunlaşan çalışmaları göz önüne alarak, farklı iki kent-bölgede yürütülmüş ve bu alandaki boşluğa katkı sunması amaçlanmıştır. Araştırmanın amacı doğrultusunda, ilgili aktörlerle yapılan görüşmeler ve sonraki aşamada düzenlenen çalıştay sonuçları, kent-bölgelere ilişkin ikincil verilerle desteklenmiştir. Bu araştırmanın sonuçları, teknoparkların hem inovasyon hem de bölgesel kalkınma için bir politika aracı olarak her yere uyan tek model olarak önerilemeyeceğini desteklemektedir. Erciyes Teknopark örneği, Kayseri'nin ihracat odaklı üretim yapısı, girişimcilik kültürü, güçlü sosyal ağları, çevre iller için yarattığı çekim gücü ve sahip olduğu politik ilişkiler ile avantajlar sağlamaktadır. Mersin Teknopark ise önemli bir liman kentinde yer alması ve Türkiye teknoparkları içinde performans açısından ilk ona girmesine rağmen, şehrin sanayi altyapısının sınırlı gücü ve yüksek göçle ilişkili insan sermayesi başarısını görece sekteye uğratmaktadır.

Anahtar sözcükler: Kayseri; Mersin; bölgesel yenilik sistemleri; teknopark.

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TMMOB Şehir Plancıları Odası

Introduction

There has been a growing interest in the subnational dimensions of innovation systems, because of a kind of dissatisfaction with their relevance at the national level since the 1990s (Cooke et al., 1997). On the other hand, interest of territorial models of innovation have highlighted the role of local upon the innovative performance of firms. Furthermore, Carrincazeaux and Gaschet (2015) pointed out that the industrial composition of regional economies, in terms of knowledge base, strongly influences regionally accessible performances. Asheim and Coenen (2005) have underlined the importance of the regional innovation system (RIS) as the institutional infrastructure supporting the production structure of a region. Chung (2002) demonstrated the importance of regional innovation systems in the larger national innovation system in Korea and pointed to the necessity of policies strengthening interaction between actors. Moreover, Ganau and Grandinetti (2021), suggested that regional innovation performance is associated with fewer formal inputs than the consensus holds. These studies all point to innovation as the result of the interaction between the varying dynamics of regions, actors, and institutions, whereas Cooke et al. (1997) considered regional context which is characterized by informal institutions such as norm, routines, trust. As Camps and Marques (2011) stated; norms, values and beliefs, which are the sources of social capital, develop with relationships and networks. Therefore, social capital is effective with dynamics embedded in the place such as trust, reciprocity, neighborliness, passion, citizenship or common stories.

Although the regional innovation approach points out that the ecosystems may differ from the advantages of the region's dynamics and infrastructure, it merges in the public-university-industry triple helix (Etzkowitz & Leydesdorff, 2003). According to Nooteboom and Stam (2008), the triple helix is embedded in the specific conditions of local infrastructure and institutions, and is difficult to apply to other regions. While interactions between different actors, networks, and collaborations are prominent in innovation, technology clusters and the decisiveness of space in knowledge production necessitate researches specific to different geographies. As Asheim and Isaksen (2002) argue that innovation dynamics are based on region-specific resources, it is important to investigate the externalities created by the regional structure. For example, Howells and Bessant (2012) pointed out that different collaborations can be established for innovation from different geographical perspectives and found that studies in this field were mostly focused on large metropolitan cities/regions. This trend is reflected in the fact that studies on innovation in Turkey have mostly been carried out in metropolitan cities such as Istanbul, Ankara, and Izmir. Meanwhile, governments see technoparks as a means of strengthening the dynamics of the local/regional economic environment by attracting high-tech firms (Brown, 2016). Therefore, the technopark model is still a widespread application, that is expected to support economic growth through knowledge and technology production. Theerannattapong et al. (2021) temper such expectations, arguing that studies focusing on technoparks in relation to their regional innovation systems (RIS) are limited; their evaluation of such studies indicated that the performance of technoparks was heavily dependent on these systems.

The findings of Lenger (2008) based on the case of Turkey, indicate that the major contribution to RIS comes from technoparks and university-industry joint research centers in which the university is the main actor, whereas technoparks might be taken into account as leading structures in facilitating the local productive forces into the RIS. While policymakers are generally more interested in universities, especially in terms of their contribution to the regional innovation system and entrepreneurship ecosystem (Feldman & Florida, 1994), Helmers (2019), argued that technoparks enhance the reputation of universities within the regional innovation system. Furthermore, Etzkowitz (2003) emphasized the importance of the public's involvement as a unifying actor in technopark ecosystems, beyond its role as a policy maker in innovation production.

Considering that the innovation is based on complex experiences and interactions between actors, it is critical that research conducted on technoparks focus on discovering the unique structure of each region. For this reason, the main motivation of this study is to analyze technoparks, which are seen as a tool for local/regional development and innovation, as parts of regional innovation systems. The main research question is to what extent the perfomance of technoparks linked to the regional features, in addition to the role of university and technopark management. In order to do that, the components of technopark ecosystem, potentials and obstacles for cooperations among actors regarding the regional characteristics are examined based on the interviews and outcomes of actor workshop conducted by researchers.

As the effects of globalization deepen, it is observed that the interactions between the center and the periphery have increased in cities that are already above a certain size in terms of population and economic density. According to Scott et al. (2001) the dynamics and new roles of such areas, whose hinterland is expanding in these dimensions and whose centers are cities, but which the concept of city is inadequate to define (Eraydın, 2012), can be understood at the regional scale. According to Scott and Storper (2003), "city-regions are the sites of dense masses of interrelated economic activities that also typically have high levels of productivity by reason of their jointly-generated agglomeration economies and their innovative potentials." In the economic geography literature (Marshall, 1890; Porter, 1990; Krugman, 2001), in-

dustrial actors concentrated in a region provide many positive externalities through the economies of scale, untraded dependencies, and information networks they create. In this context, city-regions stand out as place-dependent units that create suitable ground for regional innovation systems in development and economic growth, enable mutual interaction and cooperation of local actors, and reveal the internal potentials of regions (Genç et al., 2021). Since the studies on innovation have mostly concentrated on the most developed metropolian regions in Turkey, this research was constructed on technoparks in two city-regions (Kayseri and Mersin), which are among the top ten due to the technopark performance in Turkey for a comparative study.

The following sections outlines the methodology and processes of the research and data collection. The next section will present the findings obtained in an exploration of the selected technoparks' ecosystems, considering the region-specific actors and dynamics. In the conclusion, the findings will be discussed in relation to the literature and for further researches.

Methodology and Data

The establishment of technoparks in Turkey was mandated in 2001 through Law No. 4691 on Technology Development Zones. In 2021, there were a total of 92 technoparks in 56 provinces, of which 77 are active. The paper is structured based on a research project conducted between January 2019 and January 2021,[1] while the aim of the paper is to understand the innovation ecosystem of technoparks within the dynamics of the city-region, through qualitative research. Qualitative research and purposive sampling were preferred in order to understand a rich and complex structure in depth and to avoid missing originalities. Since it is important to have a comparative analysis for the region-specific outcomes, rather than focuses on an individual case, the study focused on technoparks located in two provinces in Anatolia (Kayseri and Mersin)[2] which were among the top ten in the 2018 technopark performance index (Table 1).

Table 1. Performance index for the top 10 technoparks

Rankings	Technology development zone
1	YTÜ Technology Development Zone
2	METU Technopolis Technology Development Zone
3	ITU Arı Technopolis Technology Development Zone
4	Ankara Technology Development Zone (CYBERPARK)
5	Mersin Technology Development Zone
6	Istanbul Technology Development Zone
7	Erciyes University Technology Development Zone
8	Western Mediterranean Technopolis Technology D. Z.
9	İzmir Technology Development Zone
10	TUBITAK Marmara Research Center Technopark

Source: Ministry of Industry and Technology of the Republic of Turkey, 2018.

During the data collection process, interviews and a workshop as a focus group technique were preferred. Semi-structured interviews were applied to selected technopark managers and academics who owned firms (11 academics) in the technopark. The reason for preferring semi-structured interviews in the data collection process is that, while defining the basic research framework for the participants, it also prepares the ground for an interview that allows for deeper, flexible, additional questions depending on the interaction with the participant. Also, the firms owned by academics were preferred because they are actors that bring together both the university and the sector. The academic firms that were interviewed were those that were listed by the university and technopark managements and responded to the appointment request. Semi-structured interviews with technopark management and academics helped to explore the innovation ecosystem of technoparks The main themes of the question groups in both interview processes were determined to be consistent with the aim of the project. The main question groups of the interviews conducted with Technopark managements are; a) Establishment process, organizational structure, regional incentives and obstacles, b) Company-Technopark relationship and reasons for location selection c) Collaborations (Type, companies and others within the Technopark, institutions etc., commercial and social networks, affinities, obstacles and supports etc.), d) Innovation Production Process-Local and Regional Actors and Dynamics. The main question groups of the interviews conducted with academic companies are; a) Establishment process, Technopark impact, incentives and barriers, b) Collaborations (Type, Technopark companies and others, institutions etc., commercial and social networks, affinities, obstacles and supports etc.), c) Innovation Production Process-Local and Regional actors and dynamics. Furthermore, a workshop which invited the actors of regional innovation system, was also organized online due to the pandemic on 21 October 2020. The aim of the workshop is to include other actors of the innovation ecosystem in the research process and to add the evaluations, opinions and experiences of the actors by sharing the research findings.

The participants of the workshop were determined as the founding actors of the technoparks within the scope of the research (Figs. 1, 2), relevant stakeholders as a re-

[1] "Analysis of the Innovation Process of Technoparks in Different Regions in Turkey in the Relationship between Regional Development and Innovation", numbered SGA-2018-41427, carried out under the Istanbul Technical University's Scientific Research Projects Fund.

[2] Due to the aim of the research, Erciyes Technopark in Kayseri, as the traditional industrial center in the Central Anatolian region, and Mersin Technopark in Mersin, as a port city in the Mediterranean region, were selected.

sult of technopark manager interviews, and institutions and organizations responsible for policy and implementation tools in innovation production and participation was provided by invitation. A special importance was given to ensuring the participation of the technopark management company partners and all relevant institutions.The participants included the rectors and vice-rectors of the relevant universities,Technopark managers, representatives of the Development Agencies, KOSGEB (Small & Medium Enterprises Development Organization of Turkey), TÜBİTAK (The Scientific and Technological Research Council of Turkey), the Ministry of Science, Industry, and Technology of the Republic of Turkey, and the Chambers of Industry and Commerce. At the beginning of the workshop, the findings of the research were presented to the participants. The main themes of the companies' location selection in the technopark and their expectations from the technopark management, innovation production and university relations, collaborations between companies, and the effects of regional dynamics on the innovation production process were conveyed to the participants. In this Workshop, which was carried out for the entirety of the Research Project, all participants were given the right to speak. The basic questions that will provide input to the results of this article are; the distinctive features and unique ecosystems of the relevant city-regions in innovation production, positive externalities originating from geography, business culture, social and political networks, with reference to the Regional Innovation Systems components conveyed through presentations.In the following sections, technopark ecosystems were identified to explore the role of actors, potentials and obstacles for cooperation and innovation. Therefore, interviews and outcomes of the workshop are combined with secondary data related to the city-region. In the conclusion section, it is discussed on comparative insight for policy implications.

A Technopark in the Center of Entrepreneurship and Traditional Industry: Erciyes

Innovation Background and Local Dynamics

Erciyes Technopark is located in Kayseri, not only an important industrial center in Anatolia but also a historical trade center on the Silk Road. Shifts in the roles of the old industrial metropolises in the 1980s increased the importance of traditional industrial centers in Anatolia and were enshrined in development-oriented policies. National policies in order to integrate into the global economy were implemented in Turkey, whereas the importance of SMEs as prominent actors in flexible production, was one of the significant drivers of so-called Anatolian tigers. In this process, state support for Anatolian cities, in a similar fashion to the processes of late industrializing countries, played an important role in the development of the private sector. Unlike many Anatolian cities after the 2000s, in Kayseri, the involvement of businessmen in politics has been positively affected by politically supported capital accumulation (Buğra & Savaşkan, 2014) and urban policies.

In this context, as a traditional industrial center undergoing an innovation-oriented structural transformation today, Kayseri is home to 10% of the 500 largest industrial firms in Turkey. Moreover, there are three Organized Industrial Zones and one free zone located in the city. While textile production is the main industry of Kayseri, specialization in white appliances, basic metals, wood, and food industries are also present. The business culture and the existing production experiences which are embedded within the region, characterize an ecosystem with high entrepreneurship and success stories (Keyman & Koyuncu-Lorasdağı, 2020). The socio-economic development level among the country's cities is the 2nd stage. And the proportion of the young population is 15.80%. Erciyes University, the founding university of the technopark, is ranked 15th among 50 universities in the Entrepreneurial and Innovative University Index (TÜBİTAK, 2020), specializing in the field of engineering. However, the number of its postgraduate students constitutes only 2% of the nation's total (TÜBİTAK, 2020). 1% of patents in Turkey in 2019 were registered in Kayseri.

Identifying the Ecosystem: Organizational Structure and Actors

Erciyes Technopark was established in 2005 under the leadership of Erciyes University (1978). The location of the technopark is spatially connected to the city center and the founding university. The fact that the city has an airport with national and international flights and existing organized industrial zones (OIZ) increases the locational advantages of the technopark. An academic firm interview from the Electrical-Electronics Engineering Department said, "*I think the reason why Erciyes Technopark is among the top 10 is that some of the companies that can do research are in the Technopark and the industrial companies are close to the Technopark, so there is better cooperation (…) We can reach the OIZ in 10 minutes. It is easier to meet face to face.*" The actors involved in the technopark organization schema are shown in Figure 1. CYBERPARK (Ankara/Bilkent University), one of the three highest performing technoparks in Turkey, has acted as a mentor of Erciyes Technopark during the initial phase. Two other universities in Kayseri, Nuh Naci Yazgan University (2009) and Abdullah Gül University (2003), opened after the establishment of Erciyes Technopark, are also included in the management structure. AGU is also in the process of establishing the city's second technopark (Academic Firm Interviews, 2019). Local actors such as the Chamber of Commerce and Industry and Organized Industrial Zones, are the other stakeholders of the technopark. The actors of the technopark ecosystem have an opportunity for fostering cooperation, through the lead-

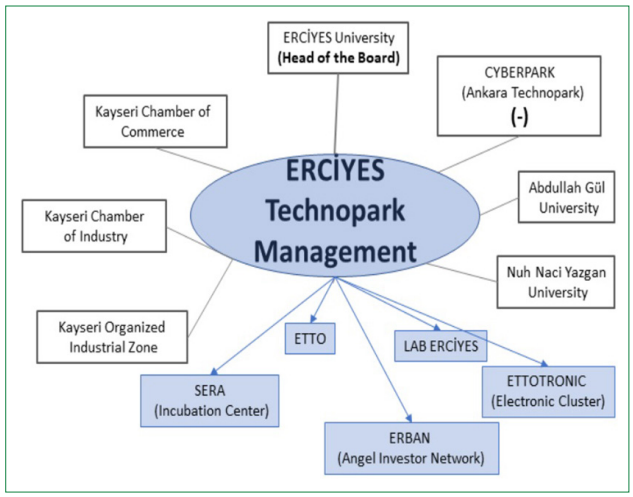

Figure 1. Erciyes technopark actors and ecosystem.

Source: Technopark management interview, 2019.

ership of technopark management. In addition, the culture of entrepreneurship and philanthropy in Kayseri has contributed to the development of economic opportunities for the technopark. Interviewees from both firms of academics and technopark management emphasized this in particular: "*The physical facilities of the technopark were also improved in Kayseri thanks to philanthropy (…) The people of Kayseri had an impact as well as the state*" (Academic Firm Interviews, 2019). Social networks and untraded relations can trigger many positive externalities in the production of innovation in the region.

An examination of the ecosystem units within the technopark reveals its approach to the creation of its brand and sub-ecosystem units. Alongside the positive interactions between the technopark and Erciyes University, there are the technology transfer office (ETTO) supporting firms and academicians, ETTOSOFT and ETTOTRONIC supporting software and electronic clusters, and LAB-ERCIYES and an Incubation Center consisting of three stages (Pre-Sera-After Greenhouse) within the structure of the technopark ecosystem. Technopark initiatives and venture capitalists are also included within the ecosystem through the Angel Investor Network ERBAN.

Academic-owned firms constitute 37% of the total number of firms in the technopark. Faculty from the electrical engineering-electronics, mechanical engineering, agriculture, and medical departments of the university constitutes the majority of academic firms. The sense of belonging which is expressed as "being from Kayseri", is also a major factor in choosing to locate in the technopark for large and/or well-established firms. In addition, firms owned by academics from many universities are in the neighbouring provinces of Kayseri, have also located in Erciyes Technopark, and technopark in Kayseri has become a hub for its region. The firms, which have opened branches in Istanbul or abroad in order to increase their profitability, have established within the city and expressed it as a term of "*falling into my homeland*" related to embeddedness (Technopark Management Interview, 2019). Geckin (2015) also stated that the capital accumulation process in Kayseri is based on the city's unique socio-cultural dynamics and emphasized that local social networks, and attachment to the place constitute this uniqueness.

Exploring the Cooperation among Actors

The geography of Erciyes Technopark has numerous advantages in terms of accessibility, historical background, entrepreneurial culture, existing manufacturing industry, the potential of human capital, and socio-cultural and political affinities. These features also facilitate the establishment of cooperation among the actors within the region. The sector matching in the technopark with the city's industrial structure also contributes to the development of the technopark ecosystem through industry collaborations. Peldek and Gültepe (2017) noted that the area's advanced industrial structure has a positive effect on the ability to meet the needs of the real sector and the commercialization of research. Furthermore, Özcan (1995) revealed the prominence of social networks in Gaziantep, Denizli, and Kayseri in the effect of local cultural characteristics and social relations in business-based networks established by small firms. In our research, we also have similar outcomes which highlight the importance of social networks and untraded dependencies within the region. An academic firm interview from the Mechanical Engineering Department said, "*Kayseri produces 80% of steel doors in Turkey. I am from Kayseri and the eight/ten biggest firms in this market are owned by my friends. I founded my firm based upon demand from them*". In addition, it was stated in the interviews that the common synergy and bilateral relations created by the academic staff of the engineering faculty were also effective in the establishment of companies in the technopark. The common theme expressed in all interviews is that academics work with graduate students to carry out projects in their companies. These education-based dependencies create opportunities for students to establish a company in the technopark or develop their own projects when they graduate. One interviewee from the Computer Engineering Department stated: "*I especially direct my graduate students for the personnel required for the R&D centers in Kayseri*" (Academic Firm Interviews, 2019).

An academic firm owner interviewed from the Department of Electrical and Electronics Engineering said, "*There is a demand from the public sector, but we prefer not to cooperate with such entities because we don't want to spend time and money on the bureaucratic procedures*" (Academic Firm Interviews, 2019). Collaborations with the private sector ensure commercialization and create an encouraging environment for firms in the development of new products. It was similarly stated in all interviews that the relations established between regional industries and technopark firms were multidisci-

plinary, consultancy and project-based partnerships. However, interviewees also emphasized the lack of financial support during transitions from prototype to mass production, but they also noted the facilitating effect of firms with strong capital structures in the region. On the other hand, despite the strong industrial potential in Kayseri, interviewees explained that the private sector in cooperation with the firms owned by academics does not consider the cost of R&D sufficiently: "*There may also be large-scale firms among those that come for consultancy. But this is not Istanbul; there may be some problems in terms of vision or capacity. The firms here are trying to close deals cheaply*," and "*Firms intend to employ academics without paying any fees if possible*" (Academic Firm Interviews, 2019).

The representative of the Development Agency explained the reason for the firms to locate in the technopark: "*Firms are not good at establishing cooperation and sharing knowledge; they are here to use different benefits*" (Workshop, 2019). While academics can only open a firm in a technopark legally, there are advantages to being in a technopark for accessing funds, tax exemptions, prestige, etc. However, academic-associated firms also noted a low level of cooperation within the technopark, considering the importance of cognitive proximity: "*The firms we associate with in the Technopark are small-scale (…) Actually, we cannot agree with them on the vision of big projects*," therefore "*We cooperate more with firms outside the technopark; which we have similar perspective*" (Academic Firm Interviews, 2019).

Moreover, Kayseri Technopark is trying to expand its strong local networks through collaborations with regional and supra-national actors, including the European Enterprise Network TR 72 and the Azerbaijan National Academy of Sciences. However, technopark managers indicated that the establishment of international collaboration on R&D has slowed down due to the lack of foreign language skills of the staff and engineers in the city.

Within the framework of the role of the university, the already existing infrastructure of the university (equipment, laboratories, etc.) present significant opportunities to develop new products, especially for academic firms that can access these resources easily. As stated in the company interviews: "*The reason why Erciyes Technopark is in the top 10 is not only the success of the technopark. Erciyes is also in the top 10 as a research university (…) Medicine, Science, Engineering faculties dragged the university (…) The physical facilities of the university were also improved thanks to the philanthropists in Kayseri*". However, it is highlighted that new graduates in the field of engineering are not as qualified as they were in previous years, which was a critical issue in terms of human capital. According to Kurtuluş (2012), who comprehensively examined the industrial development process of the town of Hacılar in Kayseri Province within the framework of regional dynamics and actors, the city's inability to attract skilled labour and its lack of R&D personnel were the most important factors limiting the development of technology infrastructure. In the workshop, representatives of the Kayseri Chamber of Industry and the Kayseri Organized Industrial Zone also stated that the university plays an important role in innovation, especially in the context of providing skilled labour by their graduates. On the other hand, in addition to its emphasis on human capital, the representative of the Development Agency noted that the lower technology level of industry in the region, compared to that of more developed cities, negatively affected innovation performance within the technopark.

A Technopark in the City Experiencing the Regional Innovation System: Mersin

Innovation Background and Local Dynamics

Mersin is the export center of its region, as being Turkey's second largest port and first established free zone. The socio-economic development level among the country's cities is the 3rd stage.There are three Organized Industrial Zones in the city which host eight of the 500 largest firms in Turkey. Although the number of medium-high technology companies has increased, the city's export structure is still dominated by low-tech industry based on agricultural production. In the Çukurova Development Agency 2017–2023 Strategic Plan, it is stated that the share of agriculture, livestock ındustry and food manufacturing sectors in Mersin's total annual exports is approximately 67% percent. It also defines an ecosystem that is relatively low in terms of human capital stock, with a 1,7 % share of nationwide postgraduates (TÜİK, 2022). The proportion of the young population is 14.80%. However, the four universities in the city are important actors that strengthen Mersin's innovation ecosystem. Mersin Technopark, established in 2006, and the agriculture sector-oriented Tarsus Technopark are both affiliated with Mersin University. Although the location of Mersin Technopark is located within the university, it is not well connected to both the city and the university.

Likewise, the Çukurova Development Agency, established in 2006, is a key actor in the innovation ecosystem, promoting the regional innovation system strategies carried out in Mersin for 15 years. The Mersin Regional Innovation Strategy Project was Turkey's first regional innovation strategy project carried out with the financial support of the EU 6th Framework Program between 2005–2008. The Mersin Governorship, METU Technopolis, Mersin University, Mersin Tarsus Organized Industrial Zone, and Mersin Chamber of Commerce and Industry are important actors involved in this project's process. Aimed at the innovation-oriented development of Mersin with its current sectoral potentials, the EU project has uncovered several significant problems, including the lack of venture capital and angel investors in the city and institutions supporting the technology infrastructure, as well as the inadequacy of the cooperation among actors.

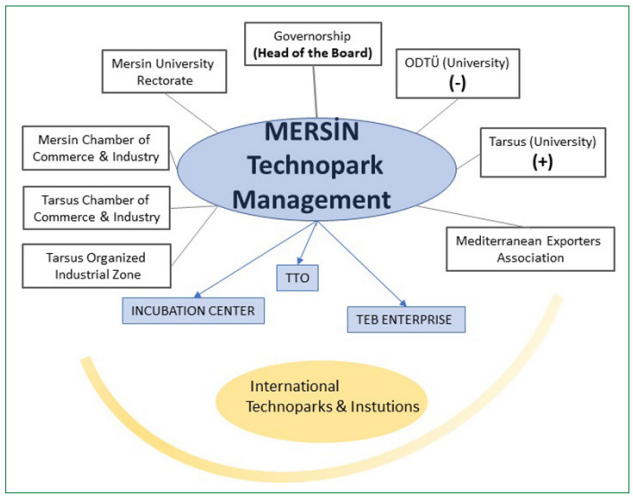

Figure 2. Mersin technopark actors and ecosystem.

Source: Technopark management interview, 2019.

Identifying the Ecosystem: Organizational Structure and Actors

The chair of Mersin Technopark's board is not the founding university but the governorship of Mersin (Provincial Administration) (Fig. 2). METU Technopark, which is the first technopark established in Turkey with its highest performance, was the mentor of Mersin Technopark, while in 2019 Tarsus University joined the actors of Mersin Technopark. Considering the role of the university to provide graduates as employees, the absence of the Department of Computer Engineering was identified as to cause of the lack of R&D personnel since the main industry is software in technopark.

Moreover, in interviews with technopark management and firms, the lack of experts in the IT sector in the city was emphasized as a critical shortcoming. Approximately 30% of the existing firms within the technopark are owned by academics. Interviewees from these firms, operated by faculty from the Departments of Electrical and Electronics Engineering, Mechanical Engineering, Environmental and Chemical Engineering, and Medicine, stated that they were not looking for alternative locations because they could only legally operate within the technopark. Interviewees also revealed that faculty members of the electrical-electronics department, along with research assistants and graduate students, actively worked in the technopark. The entrepreneurial structure of academic firms, developed through multidisciplinary collaborations, has an important place in the technopark ecosystem.

Although Mersin Technopark has a multi-stakeholder founding actor scheme, interviewees from the technopark management noted that the units and organizations supporting the incubation and commercialization processes in the technopark ecosystem were not sufficient. They also emphasized a lack of access to funds necessary for R&D activities. However, Mersin Technopark ranks in the first ten high ones according to the technopark performance index of the Ministry, due to the internationalization, which occurred mainly through the efforts of the technopark management to develop international cooperation. It was also indicated that the presence of two foreign-capital firms (of Middle Eastern origin) with high export shares impacted the performance of the technopark.

Exploring the Cooperation among Actors

Çukurova Development Agency pointed out that there has been sectoral incompatibility with the industrial structure of the city and technopark firms makes cooperation difficult (Workshop, 2020). The interviewed academic firms stated, "*We can cooperate with big firms outside Mersin*"; "*(…) industry sector in Mersin do not estimate our projects, and we cannot cooperate with them"; "No firm wants to spend money for R&D in Mersin"; "We thought that we would get closer with industry when we located within the technopark, but it did not happen; perhaps this could be due to industry in Mersin"* (Academic Firms interviews, 2019). Indeed, interviews with academic firms in Mersin revealed that the public sector was an important actor in the commercialization of innovations: "Being in the Technopark makes it easier to receive research funding from public institutions" (Academ Firm Interviews, 2019). Technopark firms indicated that they had the ability to take part in "EU projects, Ministry of Industry and Technology of the Republic of Turkey projects, and URGE projects" through the active efforts of technopark management.

Interviewees also noted that cooperation between the firms within the technopark ecosystem was not sufficient. One interviewee explained the reason for this insufficiency: "*Although being an academic makes it easy to cooperate, a lack of trust among the firms to be cooperated with, prevents joint project activities*" (Academic Firm Interviews, 2019). Interviewees also indicated that cooperation between firms within and outside of the technopark was established through social networks, that project partnerships were made with entities in provinces outside of Mersin such as Niğde, Adana and Muğla, and that cooperative agreements were made for consultancy and training with technoparks in İzmir, Ankara, and Istanbul.

Additionally, the technopark's management attempted to provide for knowledge transfer through international networks in the innovation ecosystem that could be arranged through local networks. The Mersin Technopark is a member of the World Technoparks Association (Malaga), the International Science Parks Association (England), and the Science Parks Association (Asia), as well as associations in many countries such as Italy, Belgium, Lithuania, Estonia, South Korea, China, and Portugal. Those from the technopark firms also stated that the effect of technopark management on the performance of the technopark was higher than that of the university management and other actors.

In the workshop, representative of the Çukurova Development Agency argued that a lack of human resources was the preeminent problem of the Mersin innovation ecosystem, remarking on the importance of human capital in innovation process, "*We think that investing in people alongside the building is necessary. R&D personnel, engineers, skilled labour…*" (Workshop, 2020). The representative also stated that the agency supported all sectors without preconditions by providing financial support in line with the targets of regional innovation systems, but that innovative SMEs were not included in the ecosystem.

Discussion: Comparative Evaluation of Technopark Ecosystems in the Context of City-Region Dynamics

In order to compare the two technoparks, the ecosystem of the technoparks, the role of the university, the collaborations inside and outside the technoparks, and regional dynamics were considered following the approach of Wolfe and Vatne (2011) in their study (Table 2). Based on the regional innovation system, they identified the region as a meso-level political unit, whereas they put forward networks as linkages among actors, learning as an institutional aspect, and interaction as collective practices. This comparison aimed to understand how the factors in innovation processes differed under the varying dynamics of the city-regions, where the technoparks were located. Therefore, this paper is try to highlight the diversity of regional innovation characteristics of regions against the one-size fits all policies. Also, Amin (1999) states that instead of one-size fits all policies, local based, focusing on historically embedded relationships and the endogeneous potentials of the region will trigger regional development and highlights the importance of an institutional thickness in regional innovation production (Genç et al., 2021). As Massey et al. (1992) and Hansson et al. (2005) posited, are technoparks "high-tech fantasies," or do they become a driver for innovation through their interactions with the cities/regions they are located in?

The regional innovation system emphasizes the importance of cooperation among the actors in the innovation process, as well as the region's production structure, human capital, and informal institutions including business culture, norms, routines, social networks. As Howells and Bessant (2012) argued, differences in the forms and dynamics of interaction and cooperation among the actors in different cities/regions also affect innovation performance. For this reason, an attempt to explore the relative performances of technoparks, whose number is increasing rapidly in Turkey, through the dynamics and ecosystems of the regions they are located in, will make a significant contribution to the creation of target-oriented regional development strategies.

Within the scope of this study, Kayseri, where Erciyes Technopark is located, is observed to be close to Mersin but ahead in many indicators related to innovation production such as socio-economic development, population density, youth population, university graduation, gross domestic product per capita, gross domestic product city ranking, R&D expenditure, R&D employee. On the other hand, in terms of immigrant and especially international immigrant rates, it receives three times more immigration than Mersin. Of the two Technopark examined, Erciyes Technopark is five times larger in the area and three times larger in terms of the number of firms than Mersin Technopark.[3] Although the parks differ in the total number of firms, the proportion of firms founded by academics is around 30% in both, which is a sign for the motivation and potential of academic spin-offs (Technopark Management Interview, 2019). However, the location of the two technoparks within the urban macroform and their connection with other urban functions also differ from each other. Mersin Technopark displays a disconnected relationship with the organized industrial zones located in the direction of Tarsus, due to the effect of the linear form of the city. However, it is seen that the export potential of international companies located in Mersin port is reflected in the performance of the technopark. On the other hand, Erciyes Technopark has the advantage of being close to the university, city center and transportation connections with the city. Strong collaborations between spin-offs companies at Erciyes University and companies located in the organized industrial zone also increase these advantages.

The diversity of actors in the two technopark ecosystems fosters the potential for effective cooperation. First of all, it is noteworthy that technoparks in Ankara, which were among the top three parks in performance rankings during the establishment process of both technoparks, were also founding actors. In terms of the institutional aspect, the experience transferred in this process was important for the formation of technoparks within the initial stage and for the innovation-oriented restructuring of traditional industrial centers in Anatolian cities. In addition, Erciyes Technopark is seen as a regional focus where firms from nearby cities such as Yozgat and Nevşehir choose to locate, which is important for enhancing regional collaborations. The ecosystem of technoparks covers the main business organizations of the region, in addition to the university. However, the role of the university has differentiated into two technoparks. Although there are many criteria for the success of technoparks, previous empirical studies have emphasized the role of universities (Carayannis & Campbell, 2012; Arnkil et al., 2010; Giuliani & Arza, 2009; Fabrizio et al., 2017; Santos & Mendonca, 2017, Silva et al., 2020; Löfsten et al. 2020). Although universities' academic performance, relations with public institutions and the private sector, global linkages and cooperations are important, the presence of the founding university in the decision-making process in the technoparks' management facilitates resource sharing, collaboration and enables the flow of knowledge. The effectiveness of the university is apparent in its support for

Table 2. Comparison of two technoparks

	Kayseri	**Mersin**
Location	Anatolian region/ TR 72	Mediterrenian region/ TR 62
Socia-economic development	0,560 / level 2	0,416 / level 3
Population density ranking	32. city	21. city
Youth Population	15,80%	14,80%
Education (graduate degree)	18,73%	17,60%
Migration (international)	0,90%	3,80%
GDP (per capita)	7579 $	7447 $
GDP ranking (per capita)	13	10
R&D expenditure	1,50%	1,20%
R&D employee	2%	1,80%
Area (m²)	281.000	56.000
Number of firms	230	77
Dominant sector	Software-informatics	Software-informatics
Number of incubators	57 (25%)	7
Number of academic spin-offs	69 (30%)	24 (31%)
Organizational structure and technopark ecosystem	* Local institutional actors, Universities, professional chambers, OIZ' * Chairman of the board- Erciyes University (provincial administration) * CYBERPARK (Ankara) technopark in the establishment process * Effective and professional management * Active ıncubation center * The existence of sub-units that support the commercialization stages	* Local institutional actors, Universities, professional chambers, OIZ's * Chairman of the board - Governorship * ODTÜ (Ankara) technopark in the establishment process * Effective, individual performance-based structuring * Incubation center * Ecosystem sub-units within the technopark are not yet mature.
Cooperation with the University	* Physical, financial and human resources of the university are strong * The fact that the dominant actor in the organizational structure is the university increases cooperation * In cooperation with the university, human resource-qualified workforce is more important than formal cooperation.	* Cooperation with university administration is relatively weak * The absence of relevant departments at the university for collaborations * In cooperation with the university, human resource-qualified workforce is more important than formal cooperation.
Inter-firm cooperation	* Existence of collaborations between academic spin-offs * Informal and trust-based collaborations with firms * Production and marketing cooperation with non-technopark firms is high.	* Only project-based collaborations between academic spin-offs * Technopark management's support for sector-oriented cooperation * Production and marketing cooperation is high with technopark firms.
Local and regional dynamics	* Medium-high tech industry * Production and export oriented traditional industrial city * Hosting 10% of the top 500 companies * Entrepreneurship and business culture * Strong local networks, trust-based relationships * Commercialization potential suitable for real sector needs	* Agriculture-based and low-tech industry structure * The first city to attempt to implement the RIS * Free Zone and Port Advantage * Human capital-Inadequate number of graduates * High rate of immigration and change in population pattern * Expectation of public support in commercialization

the entrepreneurship of its graduates apart from the establishment of firms by academics. Participants of the study in both technoparks estimated that the greater value of their respective universities' presence in the park lay in the provision of university graduates as qualified human resources and R&D personnel rather than in formal cooperation with the university. In addition, as Cansız (2017) noted in his study, it was often mentioned that the priorities of industry and academics are different and that the transfer of university problems to technoparks did not result in the expected success.

It has been remarked that regarding knowledge transfer between firms as a problem slows down cooperation and knowledge dissemination, as the fact that firms within the technopark see each other as competitors inhibits collaboration. For this reason, it is understood in both technoparks that collaborations outside the technopark and beyond, especially outside the region, are preferable. The factors that lead firms in both technoparks to cooperate also differ. Boschma (2005) mentioned the critical importance of social and relational proximities in the establishing collaboration and innovation. Thus, local networks based on trust are foundational for cooperation in the innovation geography (Malecki, 2011; Grossetti, 2008; Buğra & Savaşkan, 2014; Keyman & Koyuncu-Lorasdağı, 2020). Also, as suggested by Maskell et al. (1998) and stated by Bathelt et al. (2002, p. 12) trust exists in local milieus as something inherited, that any 'insider' will benefit from by default. In particular, "*I am from Kayseri*" is an important factor through kinship and friendship for constructing collaboration in the case of Erciyes. Keyman and Koyuncu-Lorasdağı (2020) have expounded upon the power of social networks, trust and reputation in Kayseri. In the example of Mersin, it is apparent that the socio-cultural structure of the city has changed due to immigration, and that subsequent weaknesses have emerged in terms of human capital. On the other hand, interviewees noted that the sectoral formation in Mersin Technopark, which does not match the industrial structure of the region, constituted an important obstacle to cooperation.

Studies in the literature have emphasized that all successful technopark ecosystems have strong management and support the innovation ecosystem by establishing collaborations among the actors (Audretsch & Feldman, 1996; Audretsch, 2002; Cabral, 1998; Albahari et al., 2016). In the two cases examined in this study, it is clear that management at both technoparks played an important role in fostering the effectiveness of the units within the technopark and supporting internal and external collaborations.

Although participants emphasized the role of the university and management in the success of technoparks, it is clear that factors such as the industrial structure of the region and sectoral matching, entrepreneurship and business culture, social networks, and human capital also have a great impact. In this context, Erciyes Technopark provided advantages through Kayseri's focus on production and export, its efforts to achieve structural transformation in the industry, strong social networks, entrepreneurial business culture and loyalty to the city, the strong effect on the cities in its vicinity, and the power of political relations. Although Mersin Technopark is located in an important port city, its success is inhibited by the limited strength of the city's industrial structure, high immigration, and limited human capital capacity. It also suffers limitations arising from its region, such as the relatively weak cooperation between intra-regional actors. For this reason, Mersin Technopark presents a case in which public support is crucial, and where firms attempt to make up for a lack of local connections with international ones. It has been determined that Erciyes Technopark's model is more advantageous, in particular in the commercialization process through the business culture and industrial structure within Kayseri, while Mersin Technopark requires more public support for its industrial structure.

Mersin is of special importance as the first city that attempted to implement a regional innovation system in Turkey. Of course, there may be many reasons behind the failure to install and develop this system effectively. It is important to note that a technopark-oriented implementation of the Regional Innovation System strategies does not alter the ecosystem structure in the region and that there is a need for measures designed to address regional deficiencies and strengthen relations between actors. On the other hand, during the workshop, representatives of KOSGEB (Small & Medium Enterprises Development Organization of Turkey) highlighted the importance of human capital in regional strategies for innovation. As stated in the interviews, the issue of human capital is the weakness of the innovation ecosystem in developing city-regions such as Mersin and Kayseri. In particular, interviewees noted that university graduates held important potential in this sense and that improvements in the quality of university education were necessary. The two case studies demonstrate that the positive externalities provided by the regions depend on business culture, political and social networks rather than industrial structure, technology and human capital.

Conclusion

Studies of which features of technoparks contribute to the development of innovation (Albahari et al., 2016; Brown, 2016), as well as ones dealing with the relationship between technoparks and regional innovation systems through a consideration of city-region dynamics are limited (Theerannattapong et al., 2021). However, it is clear that innovation is concentrated in certain geographies. Despite the number of

[3] Moreover, 50% of the firms in Erciyes Technopark and 69% of those in Mersin Teknopark are in the software sector.

successful examples, it has also been questioned whether technoparks, which have been established in 56 provinces and whose numbers have increased rapidly since the 2000s in Turkey, are an effective policy. In particular, exploring the ecosystem of technoparks within their city-regions is an important research area based on the two assumptions. First, technoparks should not be analysed as a closed box, but considered as an innovation agency within the regional innovation system. Secondly, it should also be taken into account technoparks due to the diversity of regional innovation characteristics for diverse policy responses. This study aims to interpret how the innovation ecosystems of technoparks related to the dynamics of the city-regions in which they are located, through an examination of technoparks located in two city-regions that offer different economic, social, political, and spatial characteristics.

Upon evaluation of the technoparks in terms of the role of the university, the support of the public sector, the performance of technopark management, and cooperation for innovation, it is apparent that cooperation is the area that requires the most improvement. However, it turns out that different collaborations can be established for innovation under different geographies and that such cooperation is not independent of place. We realize it from the responses of academic spin-offs, since their collaborative actions are based on the social-relational proximity. This study has found, that while universities were among the founding actors of both technoparks, their involvement had a relatively limited effect on the performance of the technoparks. While the level of formal cooperation between universities and firms for R&D activities was low, the importance of university graduates in terms of the human resources of the region has been put forward. In addition, based on the results of research, incubation center practices that will bring together academics, firms, and especially young entrepreneurs, should be expanded. Another important finding was that Erciyes technopark, reaped the positive contribution of its region's industrial structure and entrepreneurship-based business organization, while Mersin required public support for commercialization due to the lack of sectoral matching within the region. The literature provides evidence that successful technopark ecosystems have strong management teams which support the innovation ecosystem by fostering the interactions among the actors (Audretsch, 2002; Cabral, 1998; Albahari et al., 2016). Therefore, in any examination of technoparks, supportive roles of technopark management, actors of the ecosystem and regional dynamics should be mutually taken into account.

As Albahari et. al (2016) said that the studies of heterogeneity of technoparks are still the initial phase, and the research on this area are promising. The results of this research underlined that technoparks as a policy tool for innovation cannot serve as a uniform model (Mian & Hulsink, 2009; Moulaert & Sekia, 2003; Albahari et al., 2016; Rodriguez-Pose & Hardy, 2014). In this framework, instead of one and the same technopark model for each region, it will be an effective policy to develop different technopark models that take into account the smart specialization approach, sectoral matching, the role of universities and enhancing collaboration among the actors, based on regional characteristics. The potential role of regional development agencies has been proposed during the workshop, concerning the importance of developing region-specific models for technoparks, rather than the typologies with respect to the year of establishment. However, since there should be policy coordination at the national and sub-national level, deconcentration and increasing power of the central government makes it difficult to have room for regional actors. On the other hand, it is important that innovation-based regional policies should focus on improving interactions not only between intra-regional actors but also strengthening inter-regional and global connections. This research contributes to the literature and policy-making process, in particular, two city-regions, outside the most developed metropolitan cities of Turkey for further researches on technoparks. Regarding future studies, it will be very valuable for the development of alternative approaches to a uniform technopark model. For further research, we should also ask the question how technoparks would help for transformation of the region into regional innovation system.

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