POTENTIAL REGIONS FOR SMART SPECIALIZATION: A TAXONOMY OF TURKISH NUTS 2 REGIONS

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ABSTRACT

POTENTIAL REGIONS FOR SMART SPECIALIZATION: A TAXONOMY OF TURKISH NUTS 2 REGIONS

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This thesis aims to investigate the potential for regional development of the regions of Turkey. This research was conducted in the context of smart specialization, which is considered the most contemporary and valid regional development approach. In this context, the regions were analyzed under three main headings. Firstly, the sectoral clusters in the country were analyzed by using the distribution of labor force to sectors, and which clusters dominated in which regions were determined. Secondly, the innovation capacities of the regions were analyzed according to valid indicators. Thirdly, the openness of the regions was analyzed. Then, the factors separating and combining the regions were determined according to these three analyzes. Finally, for a meaningful taxonomy, hierarchical cluster analysis was conducted through the factors determined according to these three criteria. As a result, 2 in macro-level, 5 in mezzo-level and 11 in micro level; clusters were obtained in three different scales.

Keywords: Smart Specialization, Regional Development, Regional Innovation Capacities, Regional Clusters

ÖZ

AKILLI UZMANLAŞMA İÇİN POTANSİYEL BÖLGELER: TÜRKİYE DÜZEY 2 BÖLGELERİNİN BİR SINIFLANDIRMASI

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Bu tezde hedeflenen Türkiye bölgelerinin bölgesel gelişmeye yönelik potansiyellerinin araştırılmasıdır. Bu araştırma en çağdaş ve geçerli bölgesel gelişme yaklaşımı kabul edilen akıllı uzmanlaşma bağlamında yapılmıştır. Bu kapsamda bölgeler üç temel başlıkta analiz edilmişitir. İlk olarak iş gücünün sektörlere dağılımı kullanılarak ülkedeki sektör kümeleri analiz edilmiş, hangi kümelerin hangi bölgelerde baskın oldukları ortaya çıkarılmıştır. İkinci olarak bölgelerin inovasyon kapasiteleri geçerli göstergelere göre analiz edilmiştir. Son olarakta bölgelerin dışa açıklığı analiz edilmiştir. Daha sonra bölgeleri ayıran ve birleştiren faktörler bu üç analize göre belirlenmiştir. Son olarak, anlamlı bir taksonomi için, bu üç kritere göre belirlenen faktörler üzerinden hiyerarşik küme analizi yapılmıştır. Sonuç olarak, makro düzeyde 2, mezzo düzeyinde 5 ve mikro düzeyde 11 adet olmak üzere üç farklı ölçekte bölge kümeleri elde edilmiştir.

Anahtar Kelimeler: Akıllı Uzmanlaşma, Bölgesel Gelişme, Bölgesel İnovasyon Kapasiteleri, Bölgesel Kümeler

To my family…

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CHAPTER 1

INTRODUCTION

Traditional production factors, such as capital and labor, are no longer enough to enable successful competition in the environment of rapid technological progress and globalization. Knowledge and the innovative capacity of human beings have become factors of production. Innovation and technological advances in economically significant areas, for example, electronics, computers, telecommunications, and biotechnologies, and particularly in information and communication technologies (ICTs), have brought and will continue to bring unescapable impacts on local, regional, and national economic systems. Knowledge is increasingly presented as a crucial factor in the development of both society and the economy.

At the point where the regional development paradigms have reached today, endogenous development capabilities are essential. When this situation is combined with the characteristics of the information age in which we live, preserving the unique production capabilities of the regions and adapting the existing original knowledge to innovations, inventions and technological advances became inevitable for regional development. In addition, the increasingly globalized communicative world triggers the local commitment of economic activities. The crisis in 2008 highlighted the economic constraints in the world and led to the search for more efficient use of resources all over the world. The smart specialization approach emerged in such an environment and embraces the logic of strategic thinking. Regions will be able to make economic progress if they retain their own knowledge of production, natural resources, industrial assets, relative superiority and use it innovatively, and do so with a strategic prioritization.

In the above framework, the smart specialization approach towards regional development highlights certain concepts related to this logic. First, the industrial specialization of the regions plays a key role in such an approach. It is a distinctive feature for the region in terms of productive professional knowledge it contains, which region has unique qualities in which production area. On the other hand, the awareness of other regions with common specializations, their situation in relation to each other in terms of their activity in national and global markets, and the future of the regions should be analyzed in terms of ways to be drawn. Secondly, regional innovation capacities play a key role in adapting existing unique values to innovations, technological advances and inventions. The unique productive values of the regions can be effective when combined with appropriate innovation infrastructures through interventions. Thirdly, the importance of openness to the foreign market in order to consume the surplus value produced in the regions in the global market should be emphasized here.

In this study, the NUTS 2 regions in Turkey in three axes emphasized above, with a comprehensive and multifaceted analysis for regional development for smart specialization of regions aimed at a regional taxonomy demonstrating scientifically the current situation. For this purpose, activity groups operating in the country were first identified and named through the input-output relations of their products. Secondly, the assets and specialization levels of these activity groups in the regions were determined by the number of workers employed according to the activities. Thirdly, a comprehensive analysis of the innovation capacity of the regions is made in the light of the available data. Fourth, the openness of the regions was analyzed on the basis of export figures and the number of foreign owned firms. Fifth and lastly, hierarchical cluster analysis was conducted on the factors determined according to these criteria. As a result, 2 in macro-level, 5 in mezzo-level and 11 in micro level; clusters were obtained in three different scales.

In general, a detailed analysis on these three axes, and a three-scale regional taxonomy for smart specialization, are the unique aspects of this study. On the other hand, the

specialization of activity groups in the regions on the basis of total values and based on the input-output relations of products, and the naming of regional clusters of each scale based on the results of statistical analyzes are the other unique aspects of this study.

CHAPTER 2

THE CONCEPT

In this chapter, the concept of smart specialization in the context of regional development is discussed in detail. For this, firstly, how the theories of regional development have evolved until today is summarized. Secondly, what the concept is, how it has emerged, its origins, differences from old approaches, features, and theoretical arguments about the concept are discussed. Later, the relationship between smart specialization and European policies was discussed, and finally, empirical evidence on smart specialization was presented.

2.1. Evolution of Regional Development Theories towards Smart Specialization

The concept of regional development changes its meaning in parallel with the changes in the world. The concepts and theories of regional development, which gained importance after the Second World War, were constantly differentiated in parallel with the change in the dynamics of development. Regional economic development approaches can be examined historically in three different stages. These are the period from the Second World War to the 1970 crisis, the period from the 1970s to the 1990s, and the period after 1990 (Eraydın, 2004).

The first part can be defined as the traditional regional development approaches, the second part is the endogenous growth approaches and the third part is the regional development approaches under the effect of globalization.

2.1.1. Traditional Regional Development Theories

The destructive effects of the 1930 crisis and the Second World War required Keynesian welfare state policies. These policies are aimed at making the national state strong by providing a welfare state environment. This situation requires the elimination of regional inequalities. Therefore, the regional development, which started with the regional sciences immediately after the Second World War, emphasized primarily the interest in growth economies and the increasing regional inequalities.

In this regional development approach, which will continue until the 1970s, the aim was regional equality, national economic growth, investment support concentrated in less developed regions and infrastructural development. In this period, policies are in the discretion of central governments and national growth is in the foreground (Eraydın, 2002; 2004).

The theories such as the Economic Base Theory Growth Poles Theory, which we can call traditional regional growth theories, emerged in this period. In economic basic theory, there are two components of regional economic activities. These are the basic activities that are the source of exports, and the non-basic activities that remain in the local area that do not have the export capacity. Therefore, regional growth occurs according to the demand in exports. So the dynamics of growth are external (Hoyt, 1954; Douglass, 1955; Tekeli, 2008). Growth Poles theory focuses upon the large economic units of companies and industries because it sees them as tools of prosperity (Perroux, 1950 as cited in Plummer and Taylor, 2001).

2.1.2. The Shift from Traditional to Endogenous Growth Theories

Keynesian welfare nation-state regimes could be stayed up until the 1970s. With the collapse of the social welfare state after the crisis of 1970, traditional regional policies were replaced by new regional policies.

The transition from Keynesian welfare nation-state to Schumpeterian workfare post-national regime leads a shift from Keynesian aims and modes of intervention to Schumpeterian ones; a shift from a *welfarist* mode of reproduction of labor-power to a *workfarist* mode; a shift from the primacy of the national scale to a post-national framework in which no scale is predominant; a shift from the primacy of the state in compensating for market failures to an emphasis on networked, partnership-based economic, political and social governance mechanism (Jessop, 1990). The changes in the regulation mechanisms bring a paradigm shift in regional economic development.

Accordingly, the objectives of the new regional policies have focused more on local development, such as supporting the internal growth dynamics, increasing the capacities of regional economies, and improving the competitiveness of the regions (Eraydın, 2004).

After the 1970s crisis of traditional regional policies, there were many attempts to theorize the dynamics of regional development. These attempts were shaped under the influence of many old theories of local development. These theories had a common characteristic, which was their interest in the endogenous nature of growth (Eraydın, 2003).

New Industrial Spaces and Clusters

The crisis conditions of the 1970s necessitated changes in the production processes. To adapt to the change in demand, it is necessary to change the product in a short time and to do this for a large number of products. In this case, instead of defining the production process within a single unit, production is carried out by means of production networks where partners are changed, and therefore there is a unity of production units specialized in different subjects. This type of production structure necessitates the restructuring of large-scale companies, while also offering suitable facilities for small industrial units concentrated in a specific production branch (Eraydın, 2002).

To better understand the contemporary concepts of regional development such as regional clusters, innovative milieu, and regional innovation systems, the idea of the industrial district of propounded by Marshall about a century ago. The Marshallian idea of the industrial district is the keystone of the contemporary regional development theories because regional or territorial agglomeration (clustering) is seen as essential for providing innovation in the regions or territories.

The characteristics of the marshal industrial districts are presented in different ways. Becattini (2004) defines industrial district "as a socio-territorial entity which is characterized by the interactive presence of a community of people and a population of firms in one both historically and naturally bounded area." Becattini put emphasis on socio-economic organization and the division of labor that are the important characteristics of Marshallian Industrial districts (MIDs). Large numbers of firms specialized in a certain activity concentrate in a specific area and operate in a collaboration bringing them numerous economic advantages.

In a more detailed way, Rabellotti (1997) defines the term industrial district according to the four key elements:

I. A cluster of mainly small and medium enterprises that spatially concentrated and sectorally specialized (location and spatial factors)

II. A strong, relatively homogenous, cultural and socio background linking the economic agents and creating a common and widely accepted sometimes explicit but often implicit behavioral code (social and cultural factors)

III. An intense set of backward, forward, horizontal and labor linkages, based both on the market and non-market exchanges of goods, services, information and people (organizational and economic factors)

IV. A network of public and private local institutions supporting the economic agents in the clusters (institutional and policy factors)

New regional development theories or concepts are evolved from the idea of the Marshallian industrial district and each other, therefore; there may be some similarities and overlaps among the definitions. However, the distinctive feature of new industrial spaces is flexibility. In response to 1970 crisis, many small firms have successfully adapted to the flexible specialization system in order to tackle the uncertainties caused by the breakdown of formerly safe, stable and large market structure shaped by the Fordist mode of production (Piore and Sabel, 1984 as cited in Webb and Collis, 2000).

As it will be seen, the new style production organization made it necessary to respond easily to demand fluctuations in the world, to keep the production process open to continuous change and to make new production spaces with a variable scale. In other words, new industrial spaces emerged within this framework and the new production organization was defined by the concept of flexibility (Eraydın, 2002).

The emergence of new industrial districts reinforced the significance of region perception as a fundamental basis of economic and social life. A flexible production system encourages spatial clusters and integrations at the regional level. New industrial districts of northeast-central Italy; Silicon Valley; Baden-Wurttemburg and Bavaria; Orange County; Toyota City; London and New York financial districts; Los Angeles' garment district; Hollywood; Jutland; the metal cutters of the Haute Savoie; Sakaki and these type of other regions successfully responded to crisis of Fordism by adopting flexible system of production. Therefore, these regions gain acceptance as the center of the new type of flexible production system (Scott, 1988; Storper 1992; Sabel, 1994).

The clusters of industrial formations with intense relations have a tendency to choose close to one another to expedite the flow of goods and information and to benefit the external economies of infrastructure and labor markets (Scott and Storper, 1992).

The relations and synergies brought by the industrial clusters provide externalities. These externalities have been effective in defining regional development dynamics. Meanwhile, the increasing effects of globalization have made competition conditions

more challenging. This situation revealed that the advantages provided by the agglomeration economies were not sufficient for regional development (Eraydın, 2004).

2.1.3. Regional Development Theories in the Globalization Era

How globalization affects regional development dynamics can be explained by the following three observed trends. Firstly, the production units, which were advantageous at the beginning of the globalization process, could not sustain these advantages. Secondly, regions with low economic and social capacities were observed to remain outside this new global production system. Thirdly, developments in new global economies have made local regulation mechanisms inadequate (Eraydın, 2002).

Contrarily, connecting to global production networks may bring many advantages. Sharing knowledge, market opportunities and new production technologies through these networks may contribute to the competitiveness of the regions.

The framework outlined above has changed the dynamics of regional development. The significance of local conditions in the flexible production paradigm has been updated in this paradigm as local conditions, which are relative to global conditions. This new theorization, which links the success of globalization to local conditions, defines a competitive power that goes down to the regional and urban levels instead of the comparative advantage of the country (Henderson, 1991; Cooke, 1992 as cited in Eraydın, 2002).

The dynamics of regional development in the age of globalization are defined by concepts such as competitiveness, innovation and learning capacity. The concepts such as Innovative Milieu, Learning Regions and Regional Innovation Systems that centered the innovativeness for regional development emerged during this period.

Regional Innovation Systems, Innovative Milieu, and Learning Regions

The systems of innovation approach are theoretically based on the ground of the older related literature on industrial districts (Marshall) and more recent studies on clusters and innovative milieu.

The concepts of Innovative Milieu and Learning Regions are processed and expanded from flexible production and flexible specialization model (Plummer and Taylor, 2001).

The innovative milieu refers to an environment where companies, institutions, and other actors build relationships with each other, share knowledge, infrastructure, know-how, etc. This type of environment provides learning and innovativeness.

The approach of the innovative milieu focuses on the interaction of economic, sociocultural, political and institutional actors. These actors range from companies, customers, schools to research centers and local authorities. The intense interaction between these actors makes collective learning possible. Thus, the concept of milieu is not a contributor as a passive surface or territory, but an active resource and precondition for collective learning (Coffey and Bailly, 1996 as cited in Maskell and Malmberg, 1999).

The concept of regional innovation system was originated from the national innovation systems approach. In the 1980s the national innovation systems approach is articulated and developed, later on, it extended to the regional level and the regional innovation systems came to the agenda. (Asheim, Smith & Oughton, 2011). Especially after the 1990s, the concept of regional innovation systems gained popularity because of the emergence of new ideas that are related to knowledge-based economic activities in the regions.

There are four basic elements of regional innovation systems as firms, institutions, knowledge infrastructures, and innovative policy. The first element that comprises regional innovation systems is firms or companies have a crucial role in innovation

systems because of having the responsibility of generation and diffusion of knowledge as economic agents. Firms could be considered as learning organizations having interactions with other firms and institutions which operate in the same environment. Firms or companies also act as users, producers, collaborators and competitors in regional innovation systems. The second element is institutions as important actors influencing the creation, development, and utilization of new technologies. These institutions are universities, industrial R&D departments, and local or central government bodies. The third element is knowledge infrastructure that refers to both physical and organizational infrastructure fostering innovative activities. Moreover, knowledge infrastructure is used by firms, entrepreneurs and innovators have various forms such as science and technology parks, technology incubators, public technology transfer agencies, R&D institutions, laboratories, etc. The final element is an innovative policy that is developed for increasing learning capabilities and knowledge diffusion in regional innovation systems. Moreover, innovative policies provide interactions among firms, institutions and knowledge infrastructures and support regions by promoting the diffusion of technologies.

Isaksen (2001) defined four related concepts that are closely related to regional innovation: regional cluster, regional innovation network, regional innovation systems, and learning regions in a hierarchy. The first concept regional cluster means that the concentration of interdependent firms operating in the same or adjacent sectors in a specific geographic area. The second concept is regional innovation network refers to the increasing cooperation or agreements among firms promoted by trust, social norms, and conventions. The third concept is regional innovation systems also have the meaning of cooperation between firms and organizations for knowledge and development. The final concept is learning regions means that increasing organized cooperation with a wider range of civil organizations and public bodies connected to social and regional structures.

In fact, it is necessary to state and explain that the concept of the learning region is more than this definition above. Florida (1995) defines learning regions as places

where knowledge and ideas are accumulated and stored and explain its function as providing the infrastructure and the necessary environment for the flow of knowledge ideas and learning. He points out that in the new age of knowledge-oriented capitalism, regions have become the focus of knowledge production and learning. The learning region approach actually blends many previous theories and many concepts like innovation systems, institutional-evolutionary economics, innovation milieu, industrial districts, and industrial clusters (Morgan, 1997). All the ideas and concepts put forward by these theories are combined in learning region theory to define the conditions for achieving knowledge-based dynamic competitiveness (Eraydın, 2004).

2.2. Smart Specialization

Smart specialization defines a regional development approach that aims to transform the regional economy into a more competitive and sustainable economy, using the endogenous resources of the region, based on especially research and innovation capacities.

2.2.1. Different Definitions of Smart Specialization

There are several different definitions of smart specialization.

David et al. (2009: 1) defines smart specialization as follows:

> "Addressing the issue of specialization in the R&D and innovation is particularly crucial for the regions/countries which are not on a major science-technology frontier. Many would argue that these regions/countries need to increase the intensity of knowledge investments in the form of high education and vocational training, public and private R&D, and other innovation-related activities, which is certainly true in general. The question is whether the policy should spread that investment thinly across several frontier technology research fields, some in biotechnology, some in information technology, some

> in the several branches of nanotechnology, and, as a consequence, not making much of an impact in any one area, or whether there is a better alternative. A more promising strategy might be to encourage investment in programs that will complement the country's other productive assets to create future domestic capability and interregional comparative advantage. We have termed this strategy 'smart specialization'."

Castillo et al (2011: 2) argues that,

> "The prioritization is done at the regional level in a small group of sectors/technologies potentially competitive in international markets and generators of new activities with a competitive advantage over other locations."

According to Midtkandal & Sörvik (2012: 1),

> "Briefly, Smart Specialisation or RIS3 (Research and Innovation Strategies for Smart Specialisation) is a strategic approach to economic development through targeted support for research and innovation. It involves a process of developing a vision, identifying the place-based areas of greatest strategic potential, developing multi-stakeholder governance mechanisms, setting strategic priorities and using smart policies to maximize the knowledge-based development potential of a region, regardless of whether it is strong or weak, high-tech or low-tech."

Foray et al. (2012: 11), who is widely cited in the literature, give the background of this notion,

> “The underlying rationale behind the Smart Specialisation concept is that by concentrating knowledge resources and linking them to a limited number of priority economic activities, countries and regions can become — and remain — competitive in the global economy. This type of specialization allows regions to take advantage of scale, scope, and spillovers in knowledge production and use, which are important drivers of productivity. In short, Smart Specialisation is about generating unique assets and capabilities based on the region's distinctive industry structures and knowledge bases.”

Three international institutions also bring definitions to the concept as follows:

JRC, 2012: 1,

> Smart Specialisation as a strategic approach that was developed to support and target R&D in sectoral economic growth now will be the basis for structural fund investment in R&D in European regions for the period 2014-2020. Moreover, smart specialization is composed of series of processes such as; developing a vision, identifying competitive advantages, setting strategic priorities and making use of smart policies to maximize the knowledge-based development potential of any region, strong or weak, high-tech or low-tech.”

EC, 2014: 2,

> The smart specialization is about identifying the unique characteristics and assets of each country and region, highlighting each region’s competitive advantages, and assembling regional stakeholders and resources around an excellence-driven vision of their future. Besides, it means strengthening regional innovation systems, maximizing knowledge flows and spreading the benefits of innovation throughout the entire regional economy.

OECD, 2013: 11,

> Smart specialization is the concentration of public resources in knowledge investments on particular activities in order to strengthen comparative advantage in existing or new areas, so as a regional policy framework for innovation-driven growth.

Additionally, the policy formulations of the concept are given in two sources as below:

Landbaso (2014: 132),

> Smart specialization implies that a member state or region identifies and selects –on the basis of a bottom-up and top-down priority setting process – a limited number of priorities for knowledge-based investments focusing on regions' strengths and comparative advantages.

Foray (2015: 1),

> Smart specialization concept describes the capacity of an economic system (a region for example) to generate new specialties through the discovery of new domains of opportunity and local concentration and agglomeration of resources and competences in these domains.

2.2.2. The Emergence of the Concept

The smart specialization concept was first sketched out in October 2007 by Dominique Foray and Bart van Ark, then developed in between the 2007 and 2009 years together with their co-authors Paul David, Bronwyn Hall and other members of an expert group named "Knowledge for Growth" (K4G). 'Knowledge for Growth' consists of a group of economists advising the European Commission about the way to a knowledge society.

It is stated the idea of smart specialization existed even though it was not actually mentioned, and it has been overwhelmed and repressed as a result of adherence to

ongoing in-novation policy research and practices in international policy forums for the last few decades (Foray et al, 2011).

Foray (2009) states that general thought about a new regional development policy was these following directions. A good, acceptable, respected policy would not support a specific sector or technology based on some priorities while targeting market failures. It was always dangerous to move away from such neutrality because it means predicting the future developments of markets and technologies. This would pave the way for wrong choices, economists and market distortions for economists. Therefore, it was better to avoid issues related to sectoral strategies and specialization. Any idea about the policy of specialization was a taboo, especially for the main policy institutions. However, the post-2008 crisis left very few open doors to the region and the country for economic recovery and resumption. This has led to the observation of coordination disorders in the innovation systems, as well as the large capacity differences between countries and regions, as well as a revision of above mentioned general opinion. Thus, the idea of smart specialization suddenly became visible.

Foray and Van Ark (2007) point out the number of non-offshore firms that carrying out R & D activities in Europe is decreasing and European firms carry out R & D activities outside Europe. They stated that the globalization of R & D activities in the world should not be against Europe. They explain the obstacles of Europe's attractiveness for any R & D activity, as fragmentation originating from nation-state borders and regions' general tendency for emulating successful regions' strategies. They argue that this current situation can be changed by changing the organization of R & D activities in Europe and made four recommendations. First of all, in order to create the centers of excellence that can be the pioneers in the world, and European policies need to be harmonized with the ability to reach out to the most appropriate technical and human resources by transcending nation-state borders. Secondly, it should be a more integrated European Research Area, which is not be limited by nation-states and can compete on an international level. Third, the European Research Area needs to be in a way that would benefit the countries and regions that can provide

a clear strategy and vision with the aim of creating original and distinctive modern areas of expertise for the future. Finally, regions that want to specialize in the same area need to adjust their investment decisions to allow them to create critical clusters that will attract R & D abilities from foreign countries. They ultimately suggest that smart specialization in a really integrated European Research Area will play a key role in attracting R & D to Europe.

Actually, some concepts such as entrepreneurial discovery process or locality-based innovation approach, which can, in fact, be considered as the basis for the concept of smart specialization, were discussed in long-standing international forums and in the literature. This issue will be discussed elaborately in the theoretical discussions section below. However, especially the 2007 crisis led to a serious debate on very invisible reasons. These reasons can be illustrated as transatlantic productivity gap, the need for a place-based approach to development that is now well visible, distortions in innovation systems in Europe and vulnerability of especially weaker regions in the face of crises.

Firstly, the main underlying reason for emerging out of such a concept is the productivity gap between Europe and the United States which became particularly visible after 1995. This is mainly due to the high level of investment that the US has made to the information and communication technologies which are today's most dominant general-purpose technologies, and high number of firms in the US economy in new growth sectors like information technology, biotechnology or nanotechnology (Ortega-Argiles, 2012).

European Commission (2008) states this situation as follows:

> "Business R&D expenditure in the EU is 30 % below that of the US, and the €60 billion gap has not narrowed in the last five years. But at individual company and sector levels, numerous EU companies have been investing as much in research as their US counterparts. To understand the R&D deficit, it is crucial to consider the industrial structure. The EU's deficit in R&D

> expenditure vis-a-vis the United States primarily reflects a spending shortfall in the production of IT goods and services. This shortfall, in turn, reflects the characteristics of enterprise structure and dynamics, specifically the constraints on the rapid growth of new, technology-based entrants in the EU compared to the US. There are reasonable grounds for concern that this pattern could repeat in emerging areas of innovation, such as biotechnology. In short, the R&D deficit appears to be a symptom, rather than the cause, of weakness in the EU's capacity to innovate. The real cause is, in fact, the structure and dynamics of the region's enterprises and industries." (Knowledge for Growth European Issues and Policy Challenges, EC, 2008)

Secondly, the new place-based approach for development has become significant especially after the Barca report (2009). Wolfe (2011) explains the new place-based development approach as follows:

> "According to the Barca Report, the rationale for Cohesion Policy in the European Union should not be that of financial redistribution from richer regions to lagging ones, or so-called convergence regions, as in the past. Rather the rationale should be to foster economic development in all places where economic efficiency exists through the provision of public goods and services. The Report labels this alternative notion, a "place-based" development policy. The place-based approach to economic development starts with two fundamental assumptions. First is that it assumes that the geographical context matters for regional development policy in the sense that context involves the distinctive cultural, social and institutional characteristics of a region. Second, the place-based approach to economic development assumes that "local knowledge" is critical for crafting effective regional development strategies. --Who knows what to do where and when-- can make a significant difference for the success of such policies. Tapping into and mobilizing this local knowledge requires facilitating the interaction of local groups with access to this knowledge and the external elites involved in policy formation at higher

levels of governance (Barca, McCann and Rodríguez-Pose 2011, 9; Gertler and Wolfe 2004)."

The third underlying reason is the complaints with regard to Europe's current research dynamics. Some concerns find a voice in the literature about the research base of Europe as 'too fragmented'. General complaints are on the repetition of research projects, weak competition among research groups and negative situation for Europe caused by the internationalization of R&D. Originating from these concerns there is a need for a route that generates the right conditions of competition and co-operation to support the emergence of world-class, specialized clusters so achieving agglomeration effects (Foray and Ark, 2007; Varblane et al., 2010).

Lastly, the 2007-2008 crisis and vulnerability of weak regions have led to a new search for solutions. Before the 2007-2008 crisis, in innovation policies, sectoral choices or specialization in certain sectors were not well received. The 2007-2008 financial crisis left many regions economically difficult conditions. They faced great difficulties in trying to revise their innovation systems for economic recovery. These difficulties can be listed as coordination failures in innovation systems, big capacity asymmetries among regions and countries, etc. Therefore, smart specialization concept has become very clear because of two apparent realities, first regions cannot do everything in science, technology, and innovation; second, they need to promote what should make their knowledge base unique and superior (Foray et al., 2011).

Discussions on all these interweaving issues paved the way for the emergence of the concept of smart specialization and helped to determine what the characteristics of the concept should be. The K4G group proposed a conceptual framework depending mainly a policy prioritization logic with the aim of improving EU growth, and they named the framework as smart specialization (McCann and Ortega-Argiles, 2015). In a very short period of time, smart specialization has spread rapidly, both as an academic concept and as a policy tool, and can be seen on the policy agenda of many countries now, along with the respectable academic literature.

2.2.3. Non-Spatial Logic of Smart Specialization

The concept of smart specialization was first considered as sectoral rather than spatially. However, then it was increasingly associated with regional growth problems, which are the source of growth problems in Europe and countries. Therefore, adopting this originally sectoral concept to the regional policy context brings many contradictions, and therefore there are many academic studies that address these contradictions (see Castillo et al, 2011; Iacobucci, 2012; Camagni and Capello, 2013; Morgan, 2013; McCann and Ortega-Argiles, 2013; 2015).

The logic of non-spatial smart specialization highlights three concepts. These are a domain, relevant size of the domain, and connectedness. The process of entrepreneurial discovery searches for innovation opportunities in a specific area. This process is important to identify and expose the potential opportunities of general-purpose technologies and to find new applications that will regenerate this targeted economic domain. The relevant size of this domain is important because it determines the width of sectors and activities related to this field. Thus, it determines the scale of new technological adaptations and information spillovers. Finally, the connectedness of domain is important because it will offer great learning advantages thanks to the link between the sectors and the multi-linked sectors (David et al., 2009; McCann and Ortega-Argiles, 2015).

In a similar vein, Castillo et al. (2011) describe the conceptual approach of smart specialization with three elements, namely, global context, specialization in technological domains or specific sectors, and lastly relatedness. Global context helps the perception of which specialization forms are parts of the global value chain and has a comparative advantage considering other locations. Specialization in specific sectors' technological domains addresses the focus of efforts for competitiveness.

Relatedness covers a systemic approach between domains, related variety of sectors and externalities and spillovers among them.

2.3. Smart Specialization in the Context of Regional Development

The concept of smart specialization is a way of thinking about the enhancement of local knowledge and increasing local learning capacity in essence. The discussion of local-based or spatial neutral policies has a much wider range than discussions of smart specialization merely. It is a significant point here that smart specialization takes place as a local-based policy rather than a space-neutral policy for regional development in the European Union Cohesion Policy (McCann and Ortega-Argiles, 2015).

Foray (2009) states that there is a new interest in regional development strategies that differs from the older approaches by focusing on innovation as the focal of a place-based approach to development policy which is multi-level in its governance structure and not tailored as one-size-fits-all. Rather, it is specifically bounded to the reality of the region. Regions have now seen as ground-zeros of economic competitiveness and social well-being in an unstable global environment. Innovation and a place-based approach are methods of using public funds with discretion to create strategies. So this circumstance brought up a question; how can a policy strategically focus on a clearer set of priorities? Another question is that, are there any alternatives to a policy that spreads the investment thinly among some pioneering technology research fields, while not making much of an impact in any particular area?

In this manner, Foray (2009) claims that smart specialization is a more promising strategy that appears to encourage investment programs that will supplement the region's all productive agents to form a future domestic potential and an inter-regional comparative advantage.

2.4. Theoretical Arguments

The concept of smart specialization will be debated for many years to come because it is a highly contested concept and even its builders concede that it is a perfect example of policy running ahead of theory. Although the sufficient theory is not developed yet, the idea of smart specialization has a good potential to become a central tool for the development of innovation policies, regional and local development strategies. Many opinions and statements about the concept have not been based on a reasonable amount of empirical founds. Rich experience in the practical application of such a concept already generates a decent platform for its application in different contexts and a variety of purposes (Foray et al., 2011).

2.4.1. Entrepreneurial Discovery Process

The theoreticians of smart specialization concede that the idea of smart specialization involves a great deal of complexity in practice, especially when selecting the most promising domains to specialize. At this point a task assigned to the entrepreneurial process of discovery. At first glance this can be seen as a new name for old laissez-faire thinking, however, theoreticians reject this perception. They point out that entrepreneurs in a broad sense (firms, higher education institutions, independent inventors and innovators) are in the best position to discover the domains of R&D and innovation in which a region is likely to be best given its existing capabilities and productive assets (Foray et al., 2011; Morgan, 2013).

Haussman and Rodrik are the first to mention the entrepreneurial discovery process to identify potential specializations (2003). In the neoclassical model of economic growth, the understanding that if poor countries may reach the most advanced technologies and their management systems respects the property rights, they will grow rapidly and converge to the advanced countries. Open economic conditions and reliable institutional structures are two basic conditions for them to avoid problems in this process. Their research on the surprisingly low growth performances of Latin American countries, despite reasonable openness and improvement of institutions, answers why investment responses are so stagnant with three statements. First and

foremost, there may be constraints on growth. Entrepreneurship may be limited by insufficient incentives to discover the costs of new activities, inadequate ownership of rights or inadequate access to imported technologies. Second, market-oriented reforms may have increased the mobility of firms. This may have reduced the incentives for firms to actually invest in new activities. This accelerates emulation and makes it unreasonable to cover the cost of new discoveries. In fact, if this is the case, the reforms have a greater yield in the short term than in the long term: New entrants benefit from the benefits of past cost discoveries, but when these are exhausted, the economy is pulled down by low efforts of innovation. Thirdly, reforms may have increased the efficiency of traditional sectors as well as potential new activities. In this case, resource costs for modern sectors will be increased (Hausmann & Rodrik, 2003).

Therefore, they argue that openness and advanced institutions in the economy will not be sufficient for investment in non-traditional activities and for new wave entrepreneurship. Learning of the production process of which is good to produce is the key to economic growth. The most important factor for future growth is to make the right investment decisions. Because it determines the type of specialization. Therefore, they make recommendations on the policies and tools of the administrations that support and promote the self-discovery process.

Similarly, Foray (2012) describes the entrepreneurial discovery process as an interactive process where market forces and the private sector discover and produce information about new activities and the state evaluates and strengthens the discoveries of these actors. And he sees the entrepreneurial discovery process as the main difference from the previous approaches to smart specialization.

Furthermore, Haussmann and Rodrik (2003) draw attention to two flaws in the free economy for developing countries. First, there is too little pre-planned investment and entrepreneurship. The second is that there is too much production diversity revealed. Then they argue that the optimal policy should be the balance of the two. This means

encouraging pre-planned investments and bringing production diversity to a rational level.

This proposal actually pointing to the underlying rationale behind the smart specialization idea although the concept does not emerge yet.

2.4.2. Expected Contribution of Smart Specialization to Regional Economic Development

What distinguishes smart specialisation from traditional industrial and innovation policies is mainly the process defined as “entrepreneurial discovery” - an interactive process in which market forces and the private sector are discovering and producing information about new activities and the government assesses the outcomes and empowers those actors most capable of realizing the potential (Foray, 2012; Haussmann and Rodrick 2003). Hence smart specialization strategies are much more bottom-up than traditional industrial policies. In addition, the focus of the choices is on the “enabling knowledge-based assets”, both public (e.g. education, public research) and private, not on particular industries. Another distinguishing feature of the smart specialization concept is that “policy-prioritization logic” which is well matched to promoting innovation in a wide variety of regional settings, and in particular in the heterogeneous environment of European Union (EU) regions (OECD, 2012; McCann and Ortega-Argiles, 2015).

2.4.3. Criticisms to Smart Specialization

2.4.3.1. Contextual Complexity

Jucevivcius and Galbuogiene (2014) claim that this new concept of local development has not yet been sufficiently developed in theory. They support this with a conceptual scheme that shows the contextual complexity of the concept (see Figure 2.1.).

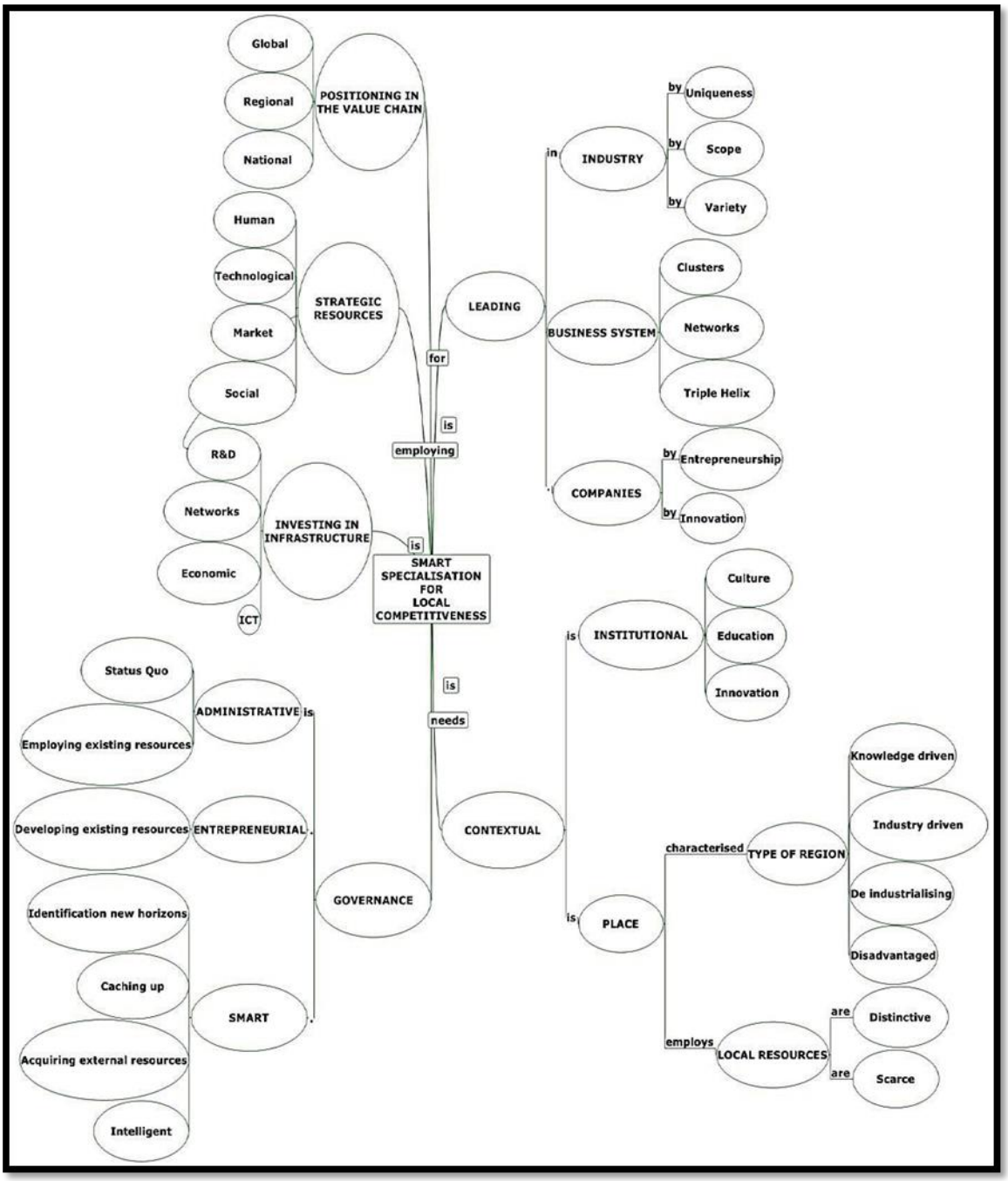


Figure 2.1. Complexity of contexts for Smart Specialization

Source: Jucevicius and Galbuogiene, 2014

2.4.3.2. Regional Policy Challenges of Smart Specialization

McCann and Ortega-Argiles argue that some economic geography should be considered in order to adapt the concept of smart specialization to the context of regional policy. According to them, the broad literature on the links between economic geography, entrepreneurship, and innovation unites on the six endorsed facts:

1. Entrepreneurship and innovation have a tendency to be higher in cities and regions which are densely populated in comparison to lower population density regions (Acs, 2002; Carlino et al., 2007 as cited in McCann and Ortega-Argiles, 2015)

2. Entrepreneurship and innovation have a tendency to be higher in regions that are more sectorally diversified. (Van Oort, 2004 as cited in McCann and Ortega-Argiles, 2015).

3. Entrepreneurship and innovation have a tendency to be higher in regions that are less dominated by a few large companies (Chinitz, 1961; Duranton and Puga, 2001 as cited in McCann and Ortega-Argiles, 2015);

4. Entrepreneurship and innovation have a tendency to be higher in regions with large numbers of multinational companies which are globally engaged (McCann and Acs, 2011 as cited in McCann and Ortega-Argiles, 2015); and

5. Entrepreneurship and innovation have a tendency to be higher in regions with large market potential.

6. Lastly, over the last two decades, information and communication technologies' (ICTs') adoption, adaptation and application among a large variety of related activities or sectors have escalated the differences between

core and other regions. (McCann, 2008; McCann and Acs, 2011 as cited in McCann and Ortega-Argiles 2015)

Therefore, the arguments put forward by the general economic geography reveal that the logic of smart specialization is against the weak regions, but in favor of the core regions. Because the underdeveloped regions can show weak innovation and entrepreneurship performance for many reasons. These reasons may be structural, sectoral, behavioral or technological, as well as risk factors or financial flows (McCann and Ortega-Argiles, 2015).

Jucevivcius and Galbuogiene (2014) criticize the principal basis behind the concept which is that countries and regions can become more successful in the global economy by concentrating knowledge resources and connecting them to a limited amount of economic activities. This means the vertical application of activities for deeper specialization, however, it is so difficult for regions with scarce resources.

Such views have already been mentioned in the discussion of the regional innovation paradox. Oughton, Landabaso, and Morgan (2002) stressed that the spending needed by the backward regions to advance in innovation is much higher than in the advanced regions.

2.5. Smart Specialization in European Policy Context

The logic of smart specialization has been adopted by the European Commission, and the basic strategic approach has been adopted in line with the main objectives of the European Growth Agenda. European Commission published a strategy document for 2020 called Europe 2020 in 2010 two years after the recent crisis of 2008. To recover from the economic downturn, the European Union (EU) determined a road map on smart, sustainable and inclusive growth for their 2020 vision. With the intention of using EU's Structural Funds more efficiently and increasing synergies between

different EU, national and regional policies, as well as public and private investments, the European Commission wants national and regional authorities across Europe to prepare research and innovation strategies for smart specialization. In this direction, the European Commission (2014) defines its smart specialization strategy as follows:

> "Smart specialization strategy means the national or regional innovation strategies which set priorities in order to build competitive advantage by developing and matching research and innovation own strengths to business needs in order to address emerging opportunities and market developments in a coherent manner… Smart specialization strategies shall be developed through involving national or regional managing authorities and stakeholders such as universities and other higher education institutions, industry and social partners in an entrepreneurial discovery process."

As a strategic approach, it is expected from Smart Specialization to economic development through targeted support to research and innovation (R&I). Each region, whether it be strong or weak, high-tech or low-tech, goes through a transformative process that involves: developing a vision for growth; identifying its competitive advantage; setting strategic priorities; and making use of smart policies and actions (EC, 2014). Therefore 'Research and innovation strategies for smart specialization' (RIS3), as they are known, will be the basis for investments in R&I under the European Structural and Investment Funds (ESIF) for the 2014-2020 period.

In this scope to be applied in regions the six steps which are sketched out are defined as follows:

1.Analysis of the regional context and potential for innovation

2. Set up a sound and inclusive governance structure

3. Production of a shared vision about the future of the region,

4. Selection of a limited number of priorities for regional development,

5. Establishment of suitable policy mixes

6. Integration of monitoring and evaluation mechanisms (Foray et al., 2012)

In the context of European policy on Research, Technology, and Development, Foray defines the main characteristics of Smart Specialization with four items. Firstly, as stated by Adam Smith's statement that the degree of specialization is a function of the size of the market (Marimon and Graça Carvalho, 2008), one of the crucial conditions for specialization is the creation of a large research and innovation area, and this area should allow unrestricted competition. Secondly, smart specialization is primarily concerned with the generation of new knowledge in specializations that are unique to the region. In other words, it relates directly to the entrepreneurial process in the region. Accordingly, the search for smart specialization does not include a bureaucratic process, such as a plan, or a foresight study organized by a consultant firm. Third, the specific characteristics of General Purpose Technologies or Tools (GPTs) define a framework for clarifying the logic of the SS for regions that are less technologically advanced and less developed. When leading regions invest in an invention in these technologies, other regions should invest in the co-invention of the applications associated with these technologies. In this way, the regions enter into a realistic and feasible competitive arena in which a small number of actors play a role. The final characteristic of SS defined by Foray (2009), there exists a role for government policies. This role includes providing incentives to inspire entrepreneurs who are involved in the find of the correct specializations, evaluating the value of the identified specializations, identifying and supporting the investments that are complementary to the accurate specializations, and lastly bringing to an end investment which were supported before as part of promotion of the search for the correct specializations, but revealed to be incorrect later (Foray, 2009).

Additionally, McCann and Ortega-Argiles (2015) underline that Smart Specialization is a very important element in the European Cohesion Policy and draws attention to other elements. These are often problems such as constraints in institutions,

governance, cross-border co-operation, and absorption capacity, which are facing weaker regions trying to increase their economic capacity. Smart specialization strategies alone will not be enough for all these problems. Therefore, the designation of other strategic approaches and policies is a necessity for Europe.

2.6. Empirical Evidence of Smart Specialization

Empirical studies on smart specialization differ in two directions. The fact that the concept has the feature of a policy that precedes the theory, and that many countries have already entered the policy agenda has led to the overriding of the policy side of the concept. Therefore, the number of studies on observing smart specialization as a policy implementation process is numerous and is not mentioned in this study. On the other hand, empirical studies that can be evaluated in the context of the theoretical approach are examined in this study.

The study of Wintjes and Hollanders (2010) is significant as an example of studies investigating the characteristics and pathways of innovation in regions for smart specialization.

Wintjes and Hollanders (2010) stated that a regional knowledge-based economy has multidimensional aspects. It includes a variety of knowledge activities and multiple interactions among a range of actors including universities, research institutes, enterprises, knowledge workers and institutions. The spatial patterns and trends for the different aspects of the knowledge-based economy vary significantly across Europe. They see that smart specialization as a combination of excellence-based and place-based policies. The tension created by place-based and excellence-based innovation policies becomes more problematic at the national level. Therefore, these two ends have balances for different weights. Place-based innovation policy is crucial to increase synergies among co-evolving knowledge competences and stimulate smart specialization.

The study was conducted on NUTS 2 regions of 27 European Union countries through the diffusion of information in the region, absorption of external information, and accessibility of the region. In this study, a regional typology is developed by considering employment data, human resources, activities, technological and economic criteria. This regional typology consists of seven types of regions or innovation path-ways for smart specialization as follows:

1.Metropolitan knowledge-intensive services regions

2.Knowledge absorbing regions

3.Public knowledge centers

4.Skilled industrial Eastern EU regions

5. High-tech regions

6.Skilled technology regions

7.Traditional southern regions

Convergence and divergence figures across European regions through some underlying indicators of typology, and policy issues discussions for each type of region were the main outputs of the study.

Another important study investigating the pattern of innovation in regions is the work of Capello and Lenzi (2013). They aimed a territorial classification of innovative regions built on a new conceptual approach which infers the alternative modes of performing the different phases of the innovation process, rather than one single phase of the innovation process. As a result of the study, 262 NUTS2 regions of EU member countries classified in five distinct territorial patterns of innovation for future smart specialization policies. According to this study, all the European geography was divided into these five areas according to their innovative characters.

-European science-based area

-Applied science area

-Smart technological application area

-Smart and creative diversification area

-Imitative innovation area

Other regional taxonomy studies are examined in detail in the next chapter. However, there are also studies on the structural changes of industrial domains of regions in the context of smart specialization. For example, Piriainen et al. (2017) examined Offshore Wind Service Industry in four NUTS 3 regions from four countries around the North Sea (Denmark, Germany, Norway and the United Kingdom). In this study, the patent data of OWS and 7 related sectors were used and the statuses of the regions were determined according to 4 types of structural change required for smart specialization. This structural change typology consists of transition, modernization diversifications, the radical foundation of industries' structures.

Another important study for evaluating smart specialization as a regional innovation system is Baier, Kroll and Zenker's work in 2013. The study first introduces the concept of smart specialization and focuses on the possible consequences on regional innovation systems. They then propose three theses to investigate. These are:

1- The concept of SS contributes to more systemic regional development strategies.

2- SS strategies force regions to make strategy processes more clear, evidence-based and inclusive.

3- Implementation of SS strategies provides support for a better adaptation of regional resources, potentials, and challenges to regional innovation systems.

Therefore, the study methodically aims to draw conclusions about SS by analyzing the policy routes of different regions. They do this in three areas: Bavaria and Saxony Germany and Upper Austria region. For these three regions, in the past, present, and future, they examine the sectoral focus (in the region's economy), systemic features (internal and external sectors and relationships and relationships between actors), policy characteristics (setting priorities), coordination mechanisms, and advantages and possible contributions of smart specialization concept. The result is partially positive for the first and third thesis and positive for the second thesis. And accordingly, smart specialization strategies and implications for regions are interpreted.

CHAPTER 3

THE RESEARCH

In the previous chapter, regional development theories have been examined from a historical perspective, and how they have evolved through smart specialization has been examined. On the other hand, the dynamics underlying the smart specialization approach and how it emerges from these dynamics and the discussions about this concept have been examined within the framework of academic studies. As a result of this, what is the smart specialization as a regional development strategy and its main characteristics are presented.

Although smart specialization is a new topic for general regional economic development literature, studies on this topic in Europe are quite high. There exists a considerable amount of research defining, discussing and evaluating smart specialization for European Union and OECD regions in the literature. Studies on this issue in the rest of the world are scarce compared to Europe. In Turkey, there are only a few studies on smart specialization. Such a policy concept can be convenient for most of European countries and regions, however, convenience of concept for Turkey is quite open to discussion.

3.1. The Aim and Context

The main aim of this study to explore the regional development potentials of NUTS 2 regions of Turkey in the context of smart specialization.

In doing so, to discuss the expected contribution of smart specialization to regional development theories, to reveal which regions of Turkey having specializations in what clusters, and to analyze the current innovation capacities of the regions are other sub-targets of this work. As a result of these, it is aimed to make a meaningful

taxonomy of 26 NUTS 2 regions for smart specialization according to regional assets, industrial specializations, innovation capacities and openness to the global world.

3.2. Methods Used Former Related Studies

Some of the regional taxonomy studies have been interpreted in the previous section. Other similar studies are summarized in the table below, together with their study areas, methods, focuses, criteria they take into account and as a result their findings.

Table 3.1. *Summary of Former Related Studies*

Study / Case Area	Methodology / Focus	Measures / Indicators	Result
Navarro et al., 2008 / NUTS2 regions of EU-25	-Principal Component Analysis -Cluster Analysis / The ability of a region to generate and absorb knowledge, and it's capacity to transform R&D into innovation and economic growth.	-Socio-economic characteristics -Productive structure -Population -Education and human resources -Patent intensity -R&D expenditure / -Selected 21 variables	Obtained typology: 1.Restructuring industrial regions with strong weaknesses 2.Regions with a weak economic and technological development 3.Regions with average economic and technological performance 4.Advanced regions, with a certain industrial specialization 5.Innovative regions, with a high level of economic and technological development 6.Capital regions, with a certain specialisation in high value-added services 7. Innovative capital-regions specialized in high value-added services

Table 3.1. (continued)

Wintjes, R. & Hollanders, H. (2010) / NUTS2 Regions of EU-27	- Factor analysis on five groups of indicators under the five measures - Cluster Analysis (hierarchical) - Convergence & Divergence measuring (sigma-convergence) - To policy discussion; SWOT analysis for each type of region / - Regions' accessibility - Regions' capability to absorb external knowledge - Diffusion of knowledge in regions	- Employment - Human resources - Activity - Technology - Economy / Reduced by Factor Analysis: - Emp. share of medium-high and high-tech manufacturing - Emp. Share of services (in particular knowledge-int. services) - Tertiary educated workers in S&T occupations -Share of employees with completed secondary education - The activity rate of females and tertiary educated - EPO patent applications per million population - Share of university and government R D - Labor productivity in both industry and knowledge-intensive services	-Regional typology (seven types of regions or innovation pathways) for smart specialization: 1.Metropolitan knowledge-intensive services regions 2.Knowledge absorbing regions 3.Public knowledge centers 4.Skilled industrial Eastern EU regions 5. High-tech regions 6.Skilled technology regions 7.Traditional southern regions - Convergence and divergence figures across European regions through some underlying indicators of typology - Policy issues discussions for each type of region
Ajmone Marsan, G., and Maguire, K. (2011) / 240 OECD Regions	-Cluster Analysis (Ward's minimum variance method) / OECD regions categorization through innovation-related variables	Financial & Capital inputs -Human capital inputs -Interaction among actors -Tacit outputs -Economic outcomes -Innovation outputs / -Selected 12 variables according to measures	Eight clusters were developed into these three macro-categories: -Knowledge hubs -Industrial production zones -Non-S&T-driven regions

Table 3.1. (continued)

Capello, R., & Lenzi, C. (2013) / 262 NUTS2 regions of EU Member Countries	-Cluster Analysis (k-means) -PCA -ANOVA / Knowledge & innovation creation -Regional preconditions for knowledge creation - Inter-regional flows of knowledge & innovation - Regional preconditions for external knowledge and innovation acquisition	-Knowledge / R&D -GPTs Specialization -Generality/Originality -Product/Process & Marketing/Organizational innovation -Human Capital -Accessibility -Agglomerated regions -Entrepreneurship -Collective Learning -Cross-regional cognitive proximity -Industrial proximity -Receptivity, Creativity, Attractiveness / Above 20 indicators related measures above	-Five distinct territorial patterns of innovation for future smart specialization policies 1. European science based area 2. Applied science area 3. Smart technological application area 4. Smart and creative diversification area 5. Imitative innovation area
Danko, L., & Bednář, P. (2013) / Two voivodships in Poland	Analyzing regional conditions -Assessment of applied solutions / Key technology groups for each voivodships	-Nodal / Insular technologies -Endogenous / Exogenous technologies / -GDP per capita -Gross value added by section groups in voivodships	Detections on smart specializations in case voivodships

Table 3.1. (continued)

Montresor, S., & Quatraro, F. (2014) / EU-26 NUTS2 regions	- The proximity index based on Balassa's revealed comparative advantage (RCA) -Econometric models for hypotheses / Key Enabling Technologies	-Proximity of technologies -Patent figures -Employment and Gross Value Added R&D intensity / -Number of technological specializations -Average proximity of all Technologies -Number of technologies flagged as KET -The ratio between regional R&D expenditure and gross value added -Patent counts -GVA -Employment level	Regional Technological Advantages according to key enabling technologies
Piirainen, K. A., Tanner, A. N.,& Alkærsig, L. (2017) / Four NUTS3 regions from four countries around North Sea (Denmark, Germany, Norway and United Kingdom)	-Foresight Mapping (from Innovation Systems Approach by Andersen and Andersen, 2014) -Specialization Index of regions (Madsen and Andersen, 2010)) / Structural change typology and dynamics in the same industrial domain (Offshore Wind Service Industry – OWS)	-Regional patenting profile in OWS and relevant sectors - Regional strengths in OWS and relevant sectors / -Patent data of OWS and other seven relevant sectors	Determination of distinct patterns for each region in the typology of structural change for smart specialization -Transition -Modernization -Diversification -Radical foundation

Table 3.1. (continued)

Asheim at al., (2017) / Three Scandinavian Regions: North Denmark, Scania (Southern Sweden), More og Ramsdal (North-Western Norway)	/ New Path Development for economic diversification		Comparative Perspectives on Smart Specialization Strategies in Scandinavian Regions
Fischer et al., (2018) / Top 10 patenting countries	Revealed Technological Advantage index (RTA) / Technological profiling and specialization through only patenting figures	Technological Specialization / Technology Share (TS) Country Share (CS) Growth Rate (GR) of patent activity (2016 to 2012)	Four categories of technological domains, and their evaluation according to countries' capacity 1.Technological leadership 2.Strong capability 3.Potential capability 4.'Jockers'

3.3. Methodology and Research Design

Conceptual descriptions of smart specialization are made by different academics in close but different ways. These are given in the previous section. Among these conceptual descriptions, three concepts pertain to smart specialization are foreground. These are region-specific domains and their related variety, entrepreneurial discovery, and openness or global context. A meaningful classification of regions in the context of smart specialization requires a comprehensive analysis of regions. These three concepts guided how to analyze the regions in this context.

The method of this study can be explained in two main steps. The first is analyzing regions in terms of clusters and their specializations in the regions, innovation

capacities, and evaluation of the openness of regions. The second main part is the taxonomy of regions on the basis of analysis in the first part.

3.3.1. Analysis of Regions

3.3.1.1. Cluster Analysis

The identification of clusters that can be seen as sources of smart specialization or the initial focus for structural change of the economy. In this study, Feser and Bergman's approach (2000) was used to describe different clusters across the country. In fact, this method has been developed firstly by Czamanski (1974). This model was used as well as by Akgüngör et al. (2003) for the analysis of regional clusters in Turkey.

The determination of clusters should not be understood simply as sectoral concentrations in specific regions. Sectoral connections have been determined by using input/output tables in 2012 in order to reveal inter-sectoral network relations through trading patterns between various sub-sectors in different fields. Then, by using the employment data, it is determined which regions are concentrated in which sector clusters.

Data:

For cluster analysis, the 2012 input-output tables that recent data published by the Statistics Institute of Turkey were used. For the regional specializations of industry clusters, the employment data of Distribution of the Compulsory Insured Persons and Work Place by the Activity Groups and Provinces for the year 2012 published by Social Security Institution (SSI) was used. This employment distribution by these activity groups is arranged according to the European Classification of Economic Activities (NACE) Revision-2, while the sectors in the Input / Output tables are organized according to Classification of Products by Activity (CPA) 2008. Therefore, the classification of products by activities in the input-output tables, as commonly

used, were matched with NACE Rev. 2 activity groups classes. In this process, 99 NACE classes were collected in 64 CPA classes. Two classes of activity (L68A - Imputed rents of owner-occupied dwellings, and T - Services of households as employers; undifferentiated goods and services produced by households for own use) were then removed from this table to provide healthier analyzes. After this data arrangement, as a result, the analyzes in this study were performed according to these 62 activity groups. This matching table together with new numbering of CPA codes are shown in Appendix A.

Detail:

The 2012 Domestic Input-Output Table of Turkey gives the value of goods and services purchased by column industry j from row industry i. In other words, each cell, aij, in 64 X 64 Turkish inter-industry transaction matrix, T, gives the value of goods and services sold in 2012 by row industry I to column industry j. Using the table, for each industry, intermediate goods purchases and sales are calculated as a percentage of total goods and purchases and sales. Therefore, the functional relationship between any two industries, i and j, can be expressed as four coefficients (following Czamanski, 1974; Feser and Bergman, 2000; Akgüngör et al., 2003):

$x_{ij} = a_{ij} / p_j$, $x_{ji} = a_{ji} / p_i$, $y_{ij} = a_{ij} / s_i$, $y_{ji} = a_{ji} / s_j$

x_{ij} , x_{ji}: intermediate good purchases by j (i) from i (j) as a proportion of j's (i's) total intermediate good purchases. A large value for x_{ij} , for example, suggests that industry j depends on industry i as a source for a large proportion of its total intermediate inputs

y_{ij} , y_{ji}: intermediate good sales from i (j) to j (i) as a proportion of i's (j's) total intermediate good sales. A large value for y_{ij}, for example, suggests that i depends on industry j as a market for a large proportion of its total intermediate good sales.

Correlation Analysis

Correlation analysis permits the assessment of linkages between pairs of industries based on their total patterns of sales and purchases across multiple industries. Each column (x) in a matrix of x's, X, and gives the intermediate input purchasing pattern of the column industry. Each column (y) in a matrix of y's, Y, gives the intermediate output sales pattern of the column industry. The following four coefficients based on input-output flows describe the relative importance of the links, either for the supplying or for the receiving sector. Four correlations describe the similarities in input-output structure between two industries l and m:

r(x l ′x m) measures the degree to which industries l and m have similar input purchasing patterns

r(y l ′y m) measures the degree to which l and m possess similar output selling patterns, i.e. the degree to which they sell goods to a similar mix of intermediate input buyers

r(x l ′y m) measures the degree to which the buying pattern of industry l is similar to the selling pattern of industry m, i.e. the degree to which industry l purchases inputs from industries in which m supplies

r(y l ′x m) measures the degree to which the buying pattern of industry m is similar to the selling pattern of industry l, i.e. the degree to which industry m purchases inputs from industries in which l supplies.

L V Matrices

For each pair of industries, four coefficients above were calculated. Deriving the correlations from the first set of X and Y matrices and selecting the largest of the four between each pair of industries yielded a 62 by 62 symmetric matrix, L V. Each column of L V describes the pattern relative linkage between the column industry and all other manufacturing industries.

Principal Component Analysis (PCA)

Then, Principal Component Analysis (PCA) was used for data reduction or reduction dimension. In this study the difficulty of evaluating a 62x62 matrix of data necessitate PCA. Actually, the input-output relations with each of the sectors that operate in Turkey means to separate the meaningful and meaningless connections in order to healthy commented. PCA brings together sectors that are more interrelated with each other through the data of the purchase and sale of intermediate goods used in the manufacturing process of the sectors, resulting in cross-sectoral links. This allows us to evaluate data through groups of sectors with strong links rather than through 62 sectors. In this study, while the data of the purchase-sale values of intermediate goods used by the 62 sectors in the manufacturing process are reduced to 11 sectors with PCA, these 11 clusters still explain a very large part of the original data. The orthogonal rotation was demanded to find the clustering which is components or factors that are not correlated with each other. Therefore, the factor loadings are slightly higher than their initial values.

These 11 clusters emerged on the basis of input and output tables over the trade relations of firms in the country. In order to examine the status of these clusters in the NUTS 2 regions, employment data of the regions were used. In order to evaluate the situation of these 11 sector groupings in Turkish NUTS 2 regions, the European Cluster Observatory's 3-star method was used by applying the employment data of regions.

Three Star Analysis

This method prescribes that amount and quality of knowledge circulating and spilling over between firms located in a cluster is dependent upon the cluster's size, the degree to which it is specialized and the extent to which the locality (the region) is geared towards and focused upon production in the relevant industries comprising the cluster. These three factors, size, specialization and focus, reflect whether the cluster has

reached specialized critical mass' to develop positive spill-overs and linkages. The European Cluster Observatory shows the extent to which clusters have achieved this specialized critical mass by employing measures of these three factors as described below, and assigning each cluster 0, 1, 2 or 3 'stars' depending on how many of the below criteria are met (EU Cluster Observatory).

- Size: if employment reaches a sufficient share of total European employment, it is more likely that meaningful economic effects of clusters will be present. The 'size' measure shows whether a cluster is in the top 10% of all clusters in Europe within the same cluster category in terms of the number of employees. Those in the top 10% will receive one star.

- Specialisation: if a region is more specialized in a specific cluster category than the overall economy across all regions, this is likely to be an indication that the economic effects of the regional cluster have been strong enough to attract related economic activity from other regions to this location, and that spill-overs and linkages will be stronger. The 'specialization' measure compares the proportion of employment in a cluster category in a region over the total employment in the same region, to the proportion of total European employment in that cluster category over total European employment (see equation). If a cluster category in a region has a specialization quotient of 2 or more it receives a star.

- Focus / Dominance: if a cluster accounts for a larger share of a region's overall employment, it is more likely that spill-over effects and linkages will actually occur instead of being drowned in the economic interaction of other parts of the regional economy. The 'focus' measure shows the extent to which the regional economy is focused upon the industries comprising the cluster category. This measure relates to employment in the cluster to total employment in the region. The top 10% of clusters which account for the largest proportion of their region's total employment receive a star.

Regarding the above description framework of three-star analysis, the data used in this study necessitate some adjustments. This study uses the data of Distribution of the Compulsory Insured Persons and Work Place by the Activity Groups and Provinces for the year 2012. Firstly, the total employment of sector groups within the previously defined 11 clusters for every 26 NUTS2 regions in the country is calculated. Then customizations are shaped as below:

-For size star: If the share of cluster C employment in region R is higher than 10 percent of total cluster C employment, cluster C employment in region R gets a size star.

-For specialization star: The calculation of specialization here is the same with Location Quotient (LQ). The LQ is calculated by the ratio of the number of employees in a sector (ei) in region R to the number of employees in all sectors (EI) in region R, to the total number of employees in this sector (e), and the total number of employment in a higher region (E). In this study, total employment figures in the country are used for higher region employment figures (e and E). If a cluster in a region has an LQ value higher than 1.00, it gets a specialization star.

$$LQ = ei/EI \,/\, e/E$$

-For dominance star: If the share of cluster C employment in region R is higher than 10 percent of total region R employment, cluster C employment in region R gets a dominance star.

After all, a result was obtained according to the stars obtained from 26 clusters of 11 clusters. The regions have 3-star, 2-star and one-star clusters summarized with a table. The three-star analysis is important as it provides a three-way assessment of clusters of regions by size, dominance, and specialization.

3.3.1.2. Innovation Capacities of Regions

In order to evaluate the innovation capacity of the regions, 14 indicators have been identified within the framework of the data that can be accessed by examining the previous studies on this subject.

Data:

In this study, the most up-to-date data on these indicators are used. The sources, years and calculation methods of the data are presented below.

Table 3.2. *Indicators for Innovation Capacity Anlaysis*

Indicators	*Computation*	*Year*	*Source*
Human Resources in Science and Technology	*Share of HRST as a percentage of the total act. Pop.*	2016	EUROSTAT
Tertiary Education Level	*Share of tertiary-educated People as percentage in total*	2018	Turkish Statistical Institute
Doctorate Degree Graduates	*People with a Ph.D. per 1000 p.*	2017	Turkish Statistical Institute
Labor Power	*Share of the labor force as a percentage of total pop.*	2018	Turkish Statistical Institute
Population Density	*Population per km square*	2018	Turkish Statistical Institute
R & D Expenditure	*R and D expenditure per capita*	2017	Turkish Statistical Institute
Venture Records	*Venture records per 1000 p.*	2016	Turkish Statistical Institute
ICT Share in Ventures	*ICT related venture per 1000 registries*	2016	Turkish Statistical Institute
Self Employed and Employer	*Self-employed and employer share as percentage in tot. act. Pop.*	2018	Turkish Statistical Institute
Technopark	*Technopark counts in the region*	2018	TTA Turkey Advisory Services and Networking Website
Technology Transfer Offices	*Technology Transfer Office counts in the region*	2018	TTA Turkey Advisory Services and Networking Website

Table 3.2. (continued)

Incubation Centers and Accelerators	*Incubation Center and Accelerator count in region*	2018	TTA Turkey Advisory Services and Networking Website
Patent Applications and Registries	*Patent registries per 100.000 active people*	2018	Turkish Patent and Trademark Office
Utility Model Applications and Registries	*Utility model registries per million act. people*	2018	Turkish Patent and Trademark Office
Unique Design Applications and Registries	*Unique Design registries per million act. people*	2018	Turkish Patent and Trademark Office
Trademark Applications and Registries	*Trademark registries per million act. people*	2018	Turkish Patent and Trademark Office

The analysis of the innovation capacities of the regions was carried out by two different methods on the above 14 indicators.

In the first method, 14 indicators were evaluated separately for 26 regions. In the interpretation of the innovation capacity of the regions, descriptive statistics were used to interpret the selected indicators above. When interpreting the innovation capacities, minimum, maximum, average and standard deviation values of the regions were examined. Whether a region is sufficient for a particular indicator is decisive for the region's value for that indicator to be below or above the average value of all regions. The mean threshold values of the remaining 1 standard deviation range are considered as the average performing regions and named as Group 2. Regions below this range are referred to as Group 1 regions as low performing regions, and regions above this range as Group 3 regions as high performing regions. In addition, values outside the thresholds above and below 1.5 standard deviations of the mean were interpreted as extreme values and attention was drawn to these regions.

Group 1		Group 2		Group 3	
Regions		μ		Regions	
-1,5	-0.5		+0.5		+1,5
- Outlier	1 St. Dev. Range	0.5 St. Dev. Range	0.5 St. Dev. Range	1 St. Dev. Range	+ Outlier

Figure 3.1. Grouping Ranges of Regions for Each Indicator

After the computations and detailed evaluation of regions over these indicators, the values are normalized for taxonomy part of the study.

A composite index was established based on the normalized values of the regions for these indicators. The total values of the fourteen indicators were analyzed on this composite index to determine whether the regions had sufficient innovation capacity according to the mean value of the total values of all regions.

In the second method, these indicators are categorized under three headings based on Capello and Lenzi's (2012) approach to territorial patterns of innovation. For each category, the composite index created based on the normalized values of the regions for these indicators. Then, the qualifications of the regions were examined for each category.

This second part of the assessment was conducted to give an idea of the regions' characteristics in terms of their innovation capabilities. The data obtained from this section will then provide a deeper analysis of innovation capacities while evaluating the regions separately in the conclusion part.

Table 3.3. *Categorizations of Indicators according to Innovation Phases*

Territorial Preconditions of Knowledge Creation	**Territorial Preconditions of Innovation**	**Innovation Outputs**
Human Resources in Science and Technology	Venture Records	Patent Applications and Registries
Tertiary Education Level	ICT Share in Ventures	Utility Model Applications and Registries
Doctorate Degree Graduates	Self Employed and Employer	Unique Design Applications and Registries
Labour Power	Technopark	Trademark Applications and Registries
Population Density	Technology Transfer Offices	
R & D Expenditure	Incubation Centers and Accelerators	

3.3.1.3. Openness Evaluation of Regions

After the analysis of the clusters operating in NUTS 2 regions and the innovation capacity of these regions, thirdly, the openness of the regions was analyzed. This openness analysis was performed on the following two indicators.

Table 3.4. *Openness Indicators*

Indicators	*Computation*	*Year*	*Source*
Export Capacities	*Export per capita*	2017	Turkish Statistical Institute
Foreign Owned Companies	*Foreign-owned companies per million active people*	2017	The Union Of Chambers And Commodity Exchanges Of Turkey

3.3.2. Regional Taxonomy

Regional classifications are generally made on a single criterion. These criteria can be GVA, the number of patents, or urbanization rate and similar. More broadly, it can be

done by considering many indicators of a particular criterion. For example, if it is desired to classify according to economic criteria, a classification can be made by using many indicators (GVA, growth rates, unemployment rate, etc.).

In the literature on regional groupings related to innovation, there are two methodological approaches, qualitative and quantitative. While quantitative approaches are generally based on detailed case studies, quantitative approaches are generally based on scoreboard indices and cluster analyzes (Marsan and Maguire, 2011). Statistical cluster analyzes use variable groups of regions to group similar regions. Since all regions are different from each other, they perceive significant similarities and differences and group the regions. Therefore, it is preferred in this study.

In this study, a taxonomy method based on the three indicators described above, which is essential for smart specialization with a wider perspective, is used. Firstly, the three criteria that we explained in the previous sections are; Factor analysis was conducted to understand which indicators of regional industrial clusters, innovation capacities, and regional openness are the determining factors. As a second step, hierarchical cluster analysis was performed on the determinants of these three criteria. The aim is to classify the 26 NUTS 2 regions according to the similarities and differences according to the determining factors according to these three dimensions.

3.3.2.1. Factor Analysis

Firstly, factor analysis was conducted to determine which regional clusters were the determining factor. In the first part of this section, the three-star method used to determine the presence of clusters operating in the country in NUTS 2 regions based on input-output tables is mentioned. From the size, dominance and specialization data that emerged while applying this method, eleven cluster-based specialization values of the regions were used in the regional taxonomy study. Size and dominance data were not used because they were not comparable. Factor analysis was performed on the specialization (LQ) values of the regions belonging to eleven clusters. From these

eleven LQ values, three variables were excluded for analysis. Two factors were obtained from the remaining 8 variables. Secondly, factor analysis was conducted on sixteen indicators to evaluate the innovation capacity of the regions. Of these, fourteen variables remained significant and three factors were obtained. Thirdly and finally, factor analysis was performed on the openness indicators and an obtained factor was recorded. These six factors were evaluated and named in Chapter-five.

3.3.2.2. Cluster Analysis

Hierarchical clustering analysis was applied with Ward's minimum variance method on 6 factors obtained by factor analysis. As a result, 26 Turkey NUT 2 level regions have been clustered on three different levels. Obtained clusters, which are two macro-level, five mezzo-level and eleven micro-level, are named and evaluated in Chapter-Five.

CHAPTER 4

FINDINGS

In this part of the study, the results of the analyses performed according to the method explained in the previous section are presented. The findings are presented in three different categories as cluster analysis and their specializations in regions, the innovation capacity of regions and openness of regions.

4.1. Cluster Morphology of Turkish Regions

Firstly, the trade relations of firms operating in different sectors across the country with each other were analyzed through the input-output tables. The sector groups having the most input-output relationships with each other were identified and sector clusters were defined according to the sectors they contain. Clusters in the regions were analyzed by using employment data by sectors in the Level 2 regions based on these country-defined cluster drafts. The dominance, size, and specialization of these clusters in the regions were analyzed in separate categories. Thus, clusters in the regions were determined in detail.

4.1.1. National Templates of Clusters

As a result of principal component analysis, eleven factors emerged out. Each of them identified as a specific cluster according to dominant sectors it contains. All clusters comprise primary and secondary sectors, and these are identified by loading criteria described earlier.

Table 4.1. *Cluster Identifications and Eigenvalues*

Factor (Cluster Code)	Cluster Identification	Eigenvalues	% of Variance	Cumulative %
1	Construction	10,938	17,643	17,643
2	Financial services	9,053	14,601	32,244
3	Logistics and transportation	6,652	10,729	42,973
4	Agriculture and food	5,566	8,977	51,950
5	Machinery, motor vehicles, and equipment	5,292	8,536	60,486
6	Advertising and publishing services	3,785	6,104	66,590
7	Health services and pharmaceutics	3,430	5,533	72,123
8	Textile and chemicals	2,994	4,830	76,953
9	Traveling and accommodation	2,544	4,103	81,056
10	Infrastructure and urban services	2,384	3,845	84,901
11	New service economies	1,773	2,860	87,762

4.1.1.1. The Construction Cluster

In general, the construction cluster is the most identifiable clustering based on input-output data. The construction cluster is the largest cluster in terms of employment size and number of sectors it contains. The cluster consists of 18 sectors, out of which 13 are primary and 5 are secondary sectors. There are 320 thousand firms in 13 primary sectors and 3.3 million insured people work in these companies. Only primary sectors' (13 sectors) share in total employment is 27.3 percent. Together with the secondary sectors, there are 0.7 million firms and 5.2 million working people in these 18 sectors. All 18 sectors have a 43.6 percent share in total employment. In terms of the number of firms, the construction cluster's share in total is 46.4 percent.

Looking at the sectors that comprise the cluster, we see that the most dominant sector of the cluster is CPA coded M71 - Constructions and construction works with 0.951 loading value (the third highest in construction cluster), 186 thousand firms (26% of cluster's total firm number) and 1.8 million workers (34% of cluster's total employment). For more information, see Table 4.2.

Table 4.2. *Subsectors of the Construction Cluster*

Cluster 1	Sector No	CPA code 2008	Product definition (CPA 2008)	Loading Values	N'of Work Place	N'of insured person
Primary Sectors	46	M71	Architectural and engineering services; technical testing and analysis services	**0,963**	17513	114673
	14	C23	Other non-metallic mineral products	**0,951**	12980	202306
	27	F	Constructions and construction works	**0,951**	185933	1789487
	7	C16	Wood and of products of wood and cork, except furniture; articles of straw …	**0,857**	11061	64067
	16	C25	Fabricated metal products, except machinery and equipment	**0,849**	31038	357841
	13	C22	Rubber and plastic products	**0,829**	11652	170217
	50	N77	Rental and leasing services	**0,824**	5853	30810
	15	C24	Basic metals	**0,807**	9063	164795
	18	C27	Electrical equipment	**0,766**	4565	98940
	26	E37-E39	Sewerage services; sewage sludge; waste collection, treatment and disposal etc.	**0,734**	3837	57181

Table 4.2 (continued)

	19	C28	Machinery and equipment etc.	**0,697**	16171	157293
	54	O84	Public administration and defense services; compulsory social security serv.	**0,653**	507	9869
	59	R93	Sporting services and amusement and recreation services	**0,634**	8094	48520
Secondary Sectors	30	G47	Retail trade services, except motor vehicles and motorcycles	**0,572**	263688	1112441
	4	B	Mining and quarrying	**0,535**	6698	141387
	44	L68B	Real estate services excluding imputed rents	**0,475**	8379	22930
	29	G46	Wholesale trade services, except motor vehicles and motorcycles	**0,458**	97009	511304
	23	C33	Repair and installation services of machinery and equipment	**0,378**	19755	155246
				TOTAL	713796	5209307

4.1.1.2. The Financial Services Cluster

The second identifiable cluster is financial services. This cluster contains 11 primary and 8 secondary 19 sectors in total. There are 605 thousand firms (39.4% of the total firm number in Turkey) and 3.75 million working people (31.4% of total employment) in these sectors. Only primary sectors' (11 sectors) share in total employment is 6.6 percent while it is 8 percent in total firm number.

When we look at the sectors of financial services cluster, in terms of loading criteria, firm count and employment figures altogether, the most dominant sector is M69-M70 CPA coded sector namely Legal and accounting services; Services of head offices; management consulting services. Loading value of this sector is 0.913 (the highest in cluster sectors), the firm number is 65 thousand and its employment is approximately 0.4 million.

Table 4.3. *Sub-sectors of the Financial Services Cluster*

Cluster 2	Sector No	CPA code 2008	Sector definition (CPA 2008)	Loading Values	N'of Work Place	N'of insured person
Primary Sectors	**45**	**M69_M70**	Legal and accounting services; Services of head offices; management consulting services	**0,913**	65492	373679
	43	**K66**	Services auxiliary to financial services and insurance services	**0,886**	9201	39070
	41	**K64**	Financial services, except insurance and pension funding	**0,877**	7192	89336
	47	**M72**	Scientific research and development services	**0,758**	541	9027
	60	**S94**	Services furnished by membership organizations	**0,732**	9018	36919
	61	**S95**	Repair services of computers and personal and household goods	**0,714**	11502	73061
	51	**N78**	Employment services	**0,668**	419	15480
	35	**H53**	Postal and courier services	**0,655**	1815	19570
	40	**J62_J63**	Computer programming, consultancy and related services; Information services	**0,655**	7465	97688
	39	**J61**	Telecommunications services	**0,646**	2743	14289
	44	**L68B**	Real estate services excluding imputed rents	**0,602**	8379	22930
Secondary Sectors	**53**	**N80-N82**	Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services	**0,585**	104610	806030
	42	**K65**	Insurance, reinsurance, and pension funding services, except compulsory social security	**0,565**	4355	24271
	62	**S96**	Other personal services	**0,506**	38794	313809

Table 4.3 (continued)

	55	P85	**Education services**	**0,472**	26845	491631
	54	**O84**	Public administration and defense services; compulsory social security services	**0,470**	507	9869
	30	**G47**	Retail trade services, except motor vehicles and motorcycles	**0,464**	263688	1112441
	9	**C18**	Printing and recording services	**0,447**	9190	68778
	28	**G45**	Wholesale and retail trade and repair services of motor vehicles and motorcycles	**0,356**	33723	132596
				TOTAL	605479	3750474

4.1.1.3. The Logistics and Transportation Cluster

The third identifiable cluster is logistics and transportation. This cluster has 7 primary and 5 secondary 12 sectors in total. There are 310 thousand firms (20.3% in total) and 2.2 million working people (18.6% in total) in these sectors. Primary sectors' share is 11.8 percent in total firm amount and 9.8 percent in total employment.

In terms of loading criteria, firm count and employment figures altogether, the most dominant sector in logistics and transportation cluster is H49 CPA coded Land transport services and transport services via pipelines sector. Its loading criteria is 0.940 (the highest in cluster sectors), its firm count 120 thousand and its employment is 0.6 million.

Table 4.4. *Subsectors of the Logistics and Transportation Sector*

Cluster 3	Sector No	CPA code 2008	Sector definition (CPA 2008)	Loading Values	N'of Work Place	N'of insured person
Primary Sectors	**31**	**H49**	Land transport services and transport services via pipelines	**0,940**	120073	611112
	34	**H52**	Warehousing and support services for transportation	**0,917**	16717	210538
	10	**C19**	Coke and refined petroleum products	**0,912**	371	9187
	28	**G45**	Wholesale and retail trade and repair services of motor vehicles and motorcycles	**0,805**	33723	132596
	32	**H50**	Water transport services	**0,758**	2433	27929
	2	**A02**	Products of forestry, logging, and related services	**0,687**	2581	36506
	4	**B**	Mining and quarrying	**0,629**	6698	141387
Secondary Sectors	**55**	**P85**	Education services	**0,535**	26845	491631
	35	**H53**	Postal and courier services	**0,526**	1815	19570
	29	**G46**	Wholesale trade services, except motor vehicles and motorcycles	**0,523**	97009	511304
	33	**H51**	Air transport services	**0,400**	175	7339
	42	**K65**	Insurance, reinsurance, and pension funding services, except compulsory social security	**0,357**	4355	24271
				TOTAL	312795	2223370

4.1.1.4. The Agriculture and Food Cluster

Another observed cluster is the agriculture and food cluster. It contains six primary and four secondary sectors. There are 160 thousand firms in 6 primary sectors and 1.2 million insured people work in these companies. Only primary sectors' (6 sectors)

share in total employment is 10.3 percent while all ten sectors' share in total employment is 24.5 percent.

A01 CPA coded Products of agriculture, hunting, and related services, C10-C12 CPA coded Food, beverages, and tobacco products and I CPA coded Accommodation and food services sectors are the most dominant three sectors of the cluster in terms of loading criteria.

Table 4.5. *Sub-sectors of the Agriculture and Food Cluster*

Cluster 4	**Sector No**	**CPA code 2008**	**Sector definition (CPA 2008)**	**Loading Values**	**N'of Work Place**	**N'of insured person**
Primary Sectors	**1**	**A01**	Products of agriculture, hunting, and related services	**0,919**	13009	90531
	5	**C10-C12**	Food, beverages and tobacco products	**0,914**	41151	426460
	36	**I**	Accommodation and food services	**0,802**	95044	620003
	57	**Q87_Q88**	Residential care services; social work services without accommodation	**0,790**	4882	46488
	8	**C17**	Paper and paper products	**0,741**	2009	41251
	3	**A03**	Fish and other fishing products; aquaculture products; support services to fishing	**0,718**	1132	8846
Secondary Sectors	**29**	**G46**	Wholesale trade services, except motor vehicles and motorcycles	**0,465**	97009	511304
	30	**G47**	Retail trade services, except motor vehicles and motorcycles	**0,463**	263688	1112441
	49	**M74_M75**	Other professional, scientific and technical services and veterinary services	**0,421**	6577	25168
	52	**N79**	Travel agency, tour operator and other reservation services and related services	**0,382**	6862	44412
				TOTAL	531363	2926904

4.1.1.5. The Machinery, Motor Vehicles and Equipment Cluster

The fifth observed cluster is machinery, motor vehicles, and equipment. The cluster consists of ten sectors, as five of them are primary and the other five are secondary. The five primary sectors contain 42 thousand firm and a half million employee. Together with five secondary sectors, total ten sectors have 116 thousand firms and 1.4 million employees. This means 11.5 percent of total employment in the country.

Table 4.6. *Sub-sectors of the Machinery, Motor Vehicles and Equipment Cluster*

Cluster 5	Sector No	CPA code 2008	Sector definition (CPA 2008)	Loading Values	N'of Work Place	N'of insured person
Primary Sectors	**21**	**C30**	Other transport equipment	**0,895**	1087	40418
	20	**C29**	Motor vehicles, trailers and semi-trailers	**0,841**	3188"	124728
	23	**C33**	Repair and installation services of machinery and equipment	**0,822**	19755	155246
	19	**C28**	Machinery and equipment n.e.c.	**0,645**	16171	157293
	17	**C26**	Computer, electronic and optical products	**0,629**	1785	33407
Secondary Sectors	**18**	**C27**	Electrical equipment	**0,587**	4565	98940
	22	**C31_C32**	Furniture and other manufactured goods	**0,525**	25234	181672
	26	**E37-E39**	Sewerage services; sewage sludge; waste collection, treatment, and disposal services etc.	**0,522**	3837	57181
	15	**C24**	Basic metals	**0,450**	9063	164795
	16	**C25**	Fabricated metal products, except machinery and equipment	**0,439**	31038	357841
				TOTAL	115723	1371521

4.1.1.6. The Advertising and Publishing Services Cluster

Advertising and Publishing Services Cluster is another observed cluster. It contains three primary and three secondary sectors. There are 37 thousand firm and 266 thousand working people in these six sectors. The cluster has a 2.4 percent share of total firm count and a 2.2 percent share of total employment.

The primary sectors are respectively advertising and market research services; publishing services; and lastly motion picture, video and television program production, sound recording, music publishing, programming and broadcasting services. These primary sectors have dominance in the cluster so that all three sectors have loading value greater than 0.8.

Table 4.7. *Sub-sectors of the Advertising and Publishing Services Cluster*

Cluster 6	**Sector No**	**CPA code 2008**	**Sector definition (CPA 2008)**	**Loading Values**	**N'of Work Place**	**N'of insured person**
Primary Sectors	**48**	**M73**	Advertising and market research services	**0,883**	5994	49912
	37	**J58**	Publishing services	**0,858**	1722	16681
	38	**J59_J60**	Motion picture, video and television program production services, sound recording and music publishing; programming and broadcasting services	**0,809**	2400	30314
Secondary Sectors	**9**	**C18**	Printing and recording services	**0,575**	9190	68778
	58	**R90-R92**	Creative, arts, entertainment, library, archive, museum, other cultural services; gambling and betting services	**0,389**	6148	26838
	61	**S95**	Repair services of computers and personal and household goods	**0,356**	11502	73061
				TOTAL	36956	265584

4.1.1.7. The Health Services and Pharmaceutics Cluster

The seventh cluster is health services and pharmaceutics. It has two primary and four secondary sectors. Despite the low number of sectors, it has, this clustering has a large share in the total number of firms and employment. The primary and secondary, total of six sectors has about 158 thousand firm and 1.4 million employees. This means 10.2 percent share in total firms and 11.4 percent share in total employment.

This cluster has only two, yet dominant, primary sectors. The first is C21 coded Basic pharmaceutical products and pharmaceutical preparations, and the second is Q86 CPA coded human health services.

Table 4.8. *Sub-sectors of the Health Services and Pharmaceutics Cluster*

Cluster 7	**Sector No**	**CPA code 2008**	**Sector definition (CPA 2008)**	**Loading Values**	**N'of Work Place**	**N'of insured person**
Primary Sectors	**12**	**C21**	Basic pharmaceutical products and pharmaceutical preparations	**0,874**	272	14095
	56	**Q86**	Human health services	**0,863**	19505	246520
Secondary Sectors	**53**	**N80-N82**	Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services	**0,583**	104610	806030
	51	**N78**	Employment services	**0,571**	419	15480
	22	**C31_C32**	Furniture and other manufactured goods	**0,562**	25234	181672
	40	**J62_J63**	Computer programming, consultancy and related services; Information services	**0,425**	7465	97688
				TOTAL	157505	1361485

4.1.1.8. The Textile and Chemical Cluster

The textile and chemical cluster contains three primary and two secondary five sectors in total. Three primary sectors contain 101 thousand firm and 1.3 million employees. Together with secondary sectors, the cluster has 115 thousand firms and 1.5 million employees.

C13-C15 CPA coded Textiles, wearing apparel, leather and related products sector is the most dominant sector of this cluster in terms of loading value, number of firms and working people. This sector has about 58 thousand firms, 0.95 million working people and the highest loading value with 0.865. This sector alone has 61 percent of the employment in the cluster.

Table 4.9. *Sub-sectors of the Textile and Chemical Cluster*

Cluster 8	**Sector No**	**CPA code 2008**	**Sector definition (CPA 2008)**	**Loading Values**	**N'of Work Place**	**N'of insured person**
Primary Sectors	**6**	**C13-C15**	Textiles, wearing apparel, leather, and related products	**0,865**	57715	945558
	11	**C20**	Chemicals and chemical products	**0,818**	4524	75509
	62	**S96**	Other personal services	**0,630**	38794	313809
Secondary Sectors	**8**	**C17**	Paper and paper products	**0,429**	2009	41251
	13	**C22**	Rubber and plastic products	**0,350**	11652	170217
				TOTAL	114694	1546344

4.1.1.9. The Traveling and Accommodation Services Cluster

The ninth cluster is traveling services. It contains five sectors, two of them are primary and three of them are secondary. There are 112 thousand operating firm and 0.72

million working people in these sectors. The cluster's share in a total number of firms is 7.3 percent, and it is 6 percent in total employment.

H51 and N79 coded sectors, namely Air transport services and Travel agency, tour operator and other reservation services and related services, are primary sectors of the cluster. The striking point in this cluster is that coded the Accommodation and food services sector. Despite its low loading value (the fourth highest), this sector has a large number of firms and employee. 0.62 million out of 0.72 million people are working in this sector (86% of the cluster's total employment).

Table 4.10. *Sub-sectors of the Traveling and Accommodation Services Cluster*

Cluster 9	**Sector No**	**CPA code 2008**	**Sector definition (CPA 2008)**	**Loading Values**	**N'of Work Place**	**N'of insured person**
Primary Sectors	**33**	**H51**	Air transport services	**0,811**	175	7339
	52	**N79**	Travel agency, tour operator and other reservation services and related services	**0,787**	6862	44412
Secondary Sectors	**3**	**A03**	Fish and other fishing products; aquaculture products; support services to fishing	**0,517**	1132	8846
	36	**I**	Accommodation and food services	**0,437**	95044	620003
	60	**S94**	Services furnished by membership organizations	**0,357**	9018	36919
				TOTAL	112231	717519

4.1.1.10. The Infrastructure and Urban Services Cluster

This cluster has only four sectors, two of them are primary and two of them are secondary. There are 66 thousand operating firm and 0.62 million working people in these four sectors. The cluster's share is 5.2 percent in total employment in Turkey.

D35 and E36 CPA coded sectors are primary sectors which are namely electricity, gas, steam and air conditioning; and natural water, water treatment, and supply services.

These two sectors are the dominating sectors of the cluster with the first two highest loading values they own. The remaining two sectors are secondary sectors of the cluster. These are education services and scientific research and development services which we can call other urban services. Education services are the largest sector of the cluster in terms of employment.

Table 4.11. *Sub-sectors of the Infrastructure and Urban Services Cluster*

Cluster 10	**Sector No**	**CPA code 2008**	**Sector definition (CPA 2008)**	**Loading Values**	**N'of Work Place**	**N'of insured person**
Primary Sectors	**24**	**D35**	Electricity, gas, steam and air conditioning	**0,904**	37564	100958
	25	**E36**	Natural water; water treatment and supply services	**0,716**	1196	16091
Secondary Sectors	**55**	**P85**	Education services	**0,434**	26845	491631
	47	**M72**	Scientific research and development services	**0,411**	541	9027
				TOTAL	66146	617707

4.1.1.11. The New Service Economies Cluster

The last and hardest identifiable sector is new service economies. This cluster has no primary sector. It consists of four secondary sectors, and they all have loading values low than 0.5. In terms of firm count and employment, this cluster has the smallest share. Its share is 1.3 percent in both total firm count and total employment.

Sectors of the cluster are respectively other professional, scientific and technical services and veterinary services; computer, electronic and optical products; products of forestry, logging, and related services; and printing and recording services. All four sectors have 20 thousand firms and 164 thousand employees in total.

Table 4.12. *Sub-sectors of the New Service Economies Cluster*

Cluster 11	Sector No	CPA code 2008	Sector definition (CPA 2008)	Loading Values	N'of Work Place	N'of insured person
Secondary Sectors	**49**	**M74_M75**	Other professional, scientific and technical services and veterinary services	**0,463**	6577	25168
	17	**C26**	Computer, electronic and optical products	**0,443**	1785	33407
	2	**A02**	Products of forestry, logging, and related services	**0,394**	2581	36506
	9	**C18**	Printing and recording services	**0,367**	9190	68778
				TOTAL	20133	163859

4.1.2. Regional Clusters with Employment Data

In this part of the study, sector clusters that were previously revealed on a country basis were examined by 26 NUTS2 regions. This examination was made in three steps. Firstly the size of the clusters in regions, secondly the dominance of clusters in regions, and lastly specializations of clusters by regions are analyzed.

4.1.2.1. Size

When the share of sector clusters in the country is examined according to the employment shares in the regions. 18 clusters that can get the size star to exceed the threshold of 10%.

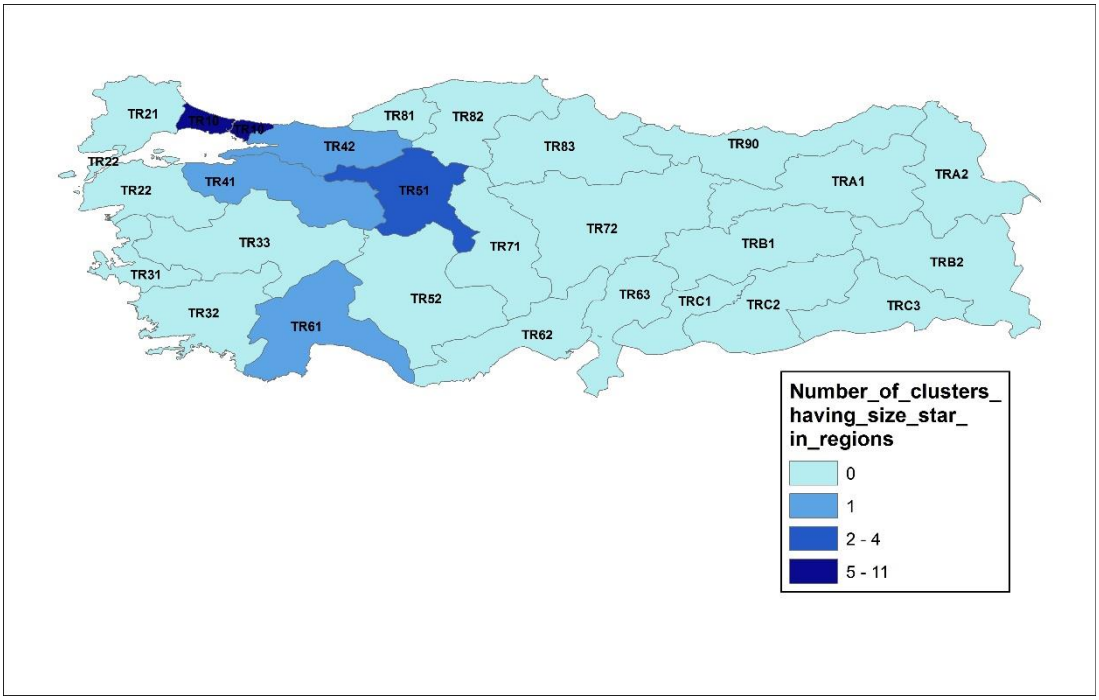


Figure 4.1. Number of clusters having size star in regions

Source: Map created by author

Analysis of the size of the sector clusters in the regions coincides with Istanbul's dominance in the country. In all of the 11 clusters previously determined, TR10 Istanbul is the region that has the largest share with the employment it provides. On the other hand, the TR51 Ankara region can receive the size star in 4 of the 11 clusters. These clusters were Financial Services, Advertising and Publishing Services, Health Services and Pharmacy, and lastly as Infrastructure and Urban Services.

The leading role of Istanbul in the country and the fact that Ankara is the capital city make these results normal. Therefore, other results from this analysis are more striking.

The other two regions except Istanbul are TR41 (12.66%) and TR42 (11.22%) regions, which have the largest share in the country for motor vehicles and equipment cluster and can get the size star by exceeding the threshold of 10 percent.

The analysis emerges out another remarkable result for TR61 region. The only two regions in the Travel and Accommodation services group are the TR61 region with Istanbul. The important role of Antalya in the country in the tourism sector is consistent with these results.

4.1.2.2. Dominance

When we analyze the dominance of sector clusters to other sector clusters in the same region, we see that the first 4 clusters identified by cluster analysis across the country are seen as the dominant sector clusters in all regions. These clusters, which are the dominant sector cluster in all regions, appear as a construction cluster, financial services, logistics and transportation services, and finally as a cluster of agriculture and food.

When we look at the dominant cluster numbers of the regions, we see that there are at least 4 clusters dominating the TR 22 region and the maximum of 7 clusters in 5 different regions. These regions are TR10, TR31, TR51, TR63 and TR72 regions.

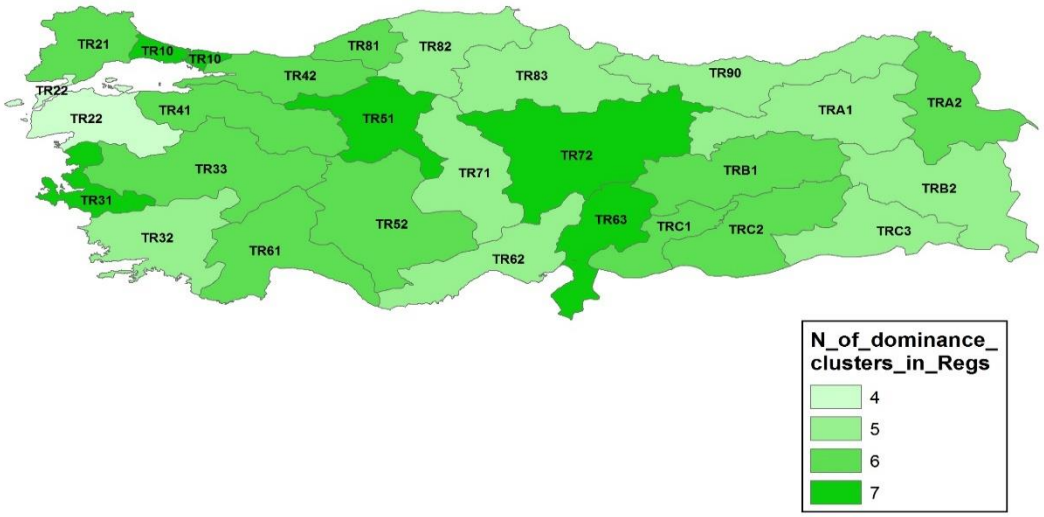


Figure 4.2. Number of clusters having dominance star in regions

Source: Map created by author

The quantity of dominant sector clusters indicates that total employment in a region is more evenly distributed to sectoral clusters and is an expression of sectoral diversity in the region. Therefore, it is reasonable to see the sectoral diversity in the densely metropolitan areas, in other words, economic activity intensive places, such as Ankara, Istanbul, and Izmir. The results coincide with this judgment.

4.1.2.3. Specialization

The map below shows the most specialized sector clusters in the regions, while on the other hand, it shows the degree of specialization through location quotients.

When it comes to the degree of specialization, Traveling and Accommodation cluster in the TR61 region and Textile and Chemicals cluster in TR21 region stands out.

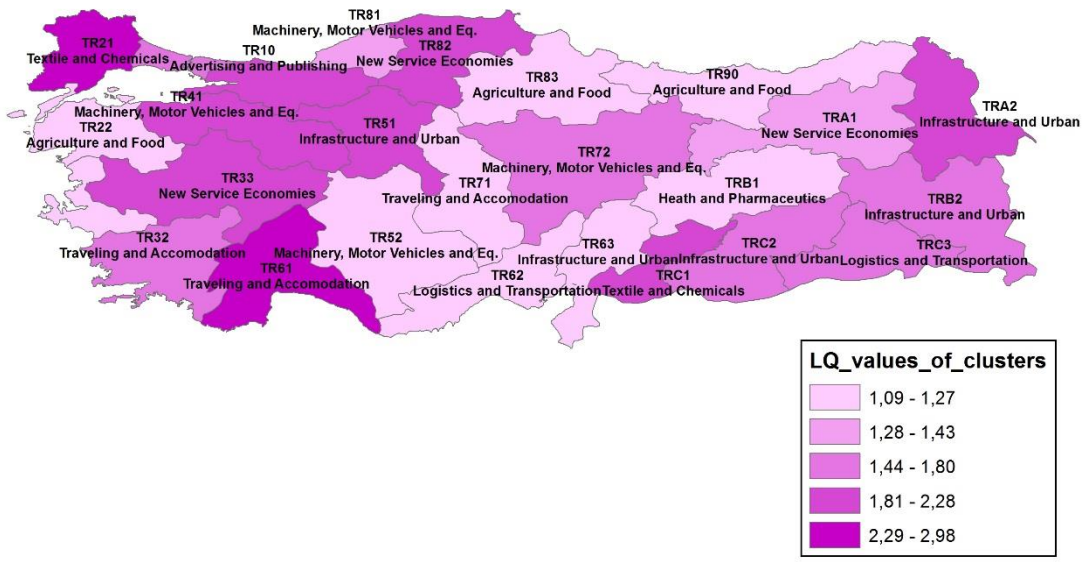


Figure 4.3. Highest LQ valued clusters in regions

Source: Map created by author

When we examine the specialization of the regions on the basis of localization coefficients, some regions show remarkable features. The TR 21 region shows a deep specialization in the Textile and Chemicals cluster. However, unlike most other regions, it has a single cluster where the coefficient of locality is over 1. Therefore, it is highly dependent on this sector. Another region in the same situation is the TR C1 Gaziantep region for the same cluster.

Contrary to this situation, the regions with strong sectoral diversity are TR 10 Istanbul, TR 51 Ankara, and TR 62 Adana and Mersin regions. Istanbul was able to receive expertise in 8 clusters, Ankara in 7 clusters and Adana, Mersin region in 6 clusters.

4.2. Innovation Capacities of Turkish Regions

The innovation practice can be conceptualized by a logical sequence of stages as a linear process. This sequence begins from the creation and acquisition of information to the commercialization of the new idea or product. In general, although the basic logic of this linear innovation process based on science or research is accepted, it is stated in many studies that it does not fully explain the innovation system in today's production processes and needs to go beyond it (Martinez-Roman et al., 2011;Wintjes and Hollanders, 2011; Capello and Lenzi, 2012).

When it comes to the innovation capacity of the regions, the innovation process varies primarily according to the local conditions of the regions. These local conditions may include many factors, from the technical infrastructure of the regions to the use of information and communication technologies, from social interactions between local actors to tacit and codified knowledge in the region. Furthermore, the relations of stakeholders in the regions' innovation with other regions, whether they are open to the global economy, are also important for the acquisition and possible adaptation of new information and technology.

Therefore, modeling of the innovation process can be done in different ways according to the varying weights of the various factors involved in the process.

Wintjes and Hollanders (2011) link the capacity of regions to benefit from new technology and innovation to many institutional and socio-economic factors, as well as information activities in the region. And they argue that the position of regions against new technology and innovation is shaped according to the three characteristics of the region. These three characteristics are the accessibility of the region, the absorption ability of the region, and the diffusion ability of the region. The accessibility of a region is related to the infrastructure, connectivity and institutional quality of the region. On the other hand, the region's learning ability is related to its social, entrepreneurial and human capital, its research, development and innovation capabilities, and its industrial setting. Finally, the diffusion ability of the region is related to the trading ability of the region, the mobility of factors, the intensity of the relations between science and technology activities and commercial and industrial activities.

This modeling, rather than linear innovation process modeling, suggests that new knowledge and technology will not directly and automatically bring about commercial success. All of the components in the above conceptual framework are important for innovation success.

Another model proposed as an alternative to the linear innovation model is the paradigm of territorial patterns of innovation (Capello, 2012). This paradigm shows a feature that more closely interprets the relationship between the stages of innovation and local conditions. It emphasizes the spatial approach, taking into account the performance of local conditions at each innovation stage.

The innovation process involved in this approach involves three stages. The first step is the provision of regional preconditions for the production of information. These preconditions include educational competences, human capital, accessibility, and urban externalities, etc. The second is the provision of regional preconditions for

innovation. The preconditions for innovation include entrepreneurial activity and collective learning requirements, dissimilar to knowledge production preconditions. And this stage reveals the creativity of the region. The third stage is innovation itself in terms of both product and process. Different regional innovation patterns are formed according to their competence in these stages.

Capello and Lenzi (2012) mention three different territorial patterns of innovation based on the literature on this subject. These are endogenous innovation pattern, creative application pattern and imitative innovation pattern.

The first pattern has the characteristic predicted by the endogenous development paradigm, which emerges with the most direct progress of the stages. In the first stage, the regional preconditions for the production of knowledge are necessary, followed by the regional preconditions for innovation in the second stage. This process ends with innovation. This innovation pattern labeled as *"endogenous innovation pattern in a scientific network".* The second pattern is *"creative application pattern"* described by the existence of enough creative competences in terms of picking external knowledge for turning it to local innovation despite the lack of internal knowledge. The third pattern is *"imitative innovation pattern"* characterized by the innovation of region is only possible by adopting external innovations. The regions in this type of pattern lack local preconditions in terms of knowledge creation and innovation (Capello and Lenzi, 2012).

A similar approach was used in this study to evaluate the innovation capacity of the regions. Because it is evident that not all regions have succeeded in the stages required for the process, to begin with, the creation of new knowledge and end with economic growth. This situation necessitated the evaluation of the stages according to the local situation of each region. Therefore, in line with the above conceptual framework, the indicators to be used when analyzing the innovation capacity of the regions are gathered under these three stages. Then, 26 NUTS 2 regions in the country were evaluated according to these three territorial patterns of innovation.

4.2.1. Territorial Preconditions of Knowledge Creation

The literature examining innovation and knowledge production together with regions generally divided the regions into two as core and periphery. The regions hosting high-tech sectors and intensive R D activities are called core regions, while the other regions are seen as adapters of the core regions that are driving the economy (Foray 2009; Foray et al., 2009; Pontikakis et al., 2009). Hereby, to obtain production specificities, possible adaptions can come true according to regions' knowledge domains.

In this context, the creation of the knowledge in the region is the first step of the process ongoing with the transformation of the knowledge produced into innovation, the increase of the productivity in production and ultimately the regional growth.

In the literature, the regional preconditions for knowledge creation are often associated with diversity of activities which provide possible specializations in thin sub-sectors; large human capital pools; wide labor markets because of the urban size; the availability of progressive education facilities and research centers; synergies and complementarities and trust thanks to proximity; and as a necessity of globalizing world, the trans-territorial linkages (Capello and Lenzi, 2012).

In this study, some of the above issues are analyzed in other sections. Under this heading, human capital, educational competencies and labor power are emphasized. In the light of the available data, the human resources in science and technology, the level of education in the regions, the number of people with a doctorate, the labor force in the regions and the population density in the regions were analyzed.

4.2.1.1. Human Resources in Science and Technology

Human resources in science and technology (HRST) shows the active population in the age group 15-74 that is classified as HRST (i.e. having successfully completed an education at the third level or being employed in science and technology) as a percentage of the total active population aged 15-74.

Table 4.113. *Grouping of Regions according to descriptive statistics of HRST*

Descriptive Statistics						
2016	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
HRST	26	11	39	586	22,52	6,034
Regions	**Group 1**		**Group 2**		**Group 3**	
Std. Dev.	**< -1,5 Std. Dev.**	**-1,5 - -0,5 Std. Dev.**	**-0,5 - +0,5 Std. Dev.**		**0,5 - +1,5 Std. Dev.**	**> +1,5 Std. Dev.**
	TR A2	TR A1	TR 21	TRC1	TR 22	TR 10
	TR B2	TR C2	TR 32		TR 31	TR 51
		TR 71	TR 33		TR 41	
		TR 82	TR 52		TR 42	
			TR 62		TR 61	
			TR 63		TR B1	
			TR 72			
			TR 81			
			TR83			
			TR90			
			TRC3			

When the share of human resources in the science and technology sector is analyzed, TR 51 Ankara region shows the highest performance with a share of 39 percent. with 32.7 percent share, TR 10 Istanbul region poses two regions which greatly exceeds the average of Turkey together with the Ankara region. TR22 Balikesir, Canakkale; TR31 Izmir; TR41 Bursa, Eskisehir, Bilecik; TR42 Kocaeli, Sakarya, Düzce, Bolu, Yalova; TR61 Antalya, Isparta, Burdur and TRB1 Malatya, Elazig, Bingöl, Tunceli regions are other high performing regions.

On the other hand, TRA2 Agri, Kars, Igdir, Ardahan and TRB2 Van, Mus, Bitlis, Hakkari regions are two regions with low-end values, well below the national average. TR71 Kirikkale, Aksaray, Nigde, Nevsehir, Kirsehir; TR82 Kastamonu, Çankiri, Sinop; TRA1 Erzurum, Erzincan, Bayburt; TRC2 Sanliurfa and Diyarbakir regions are other regions with poor performance.

The remaining regions indicate close values to the mean value of all regions.

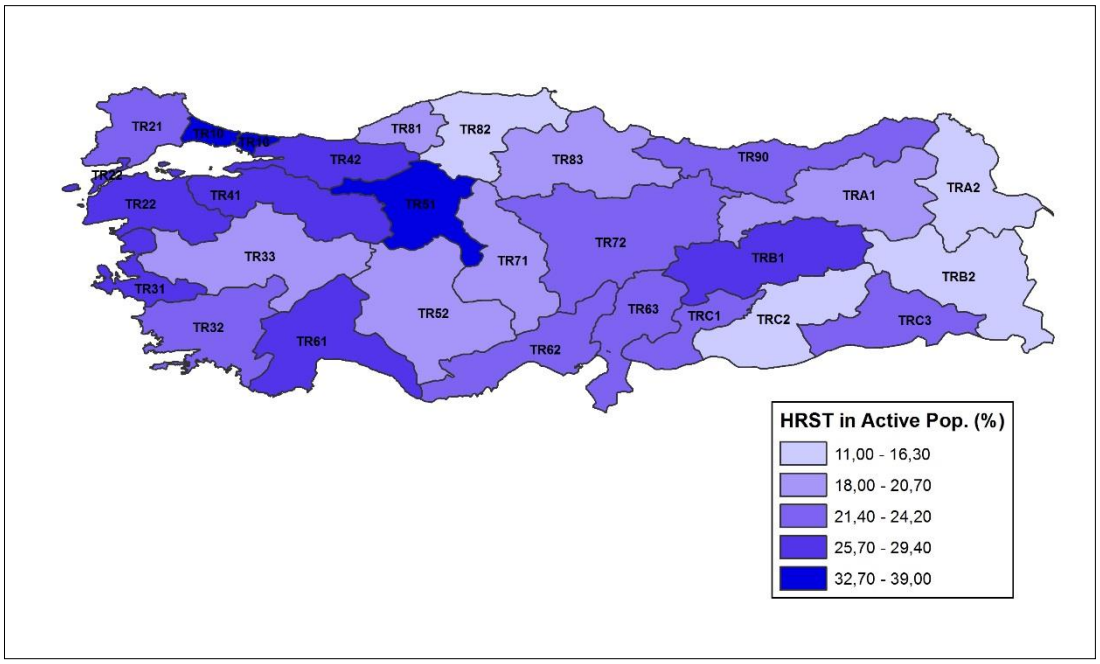


Figure 4.4. Human Resources in Science and Technology as a share of active Population
Source: Map created by author

4.2.1.2. Tertiary Education

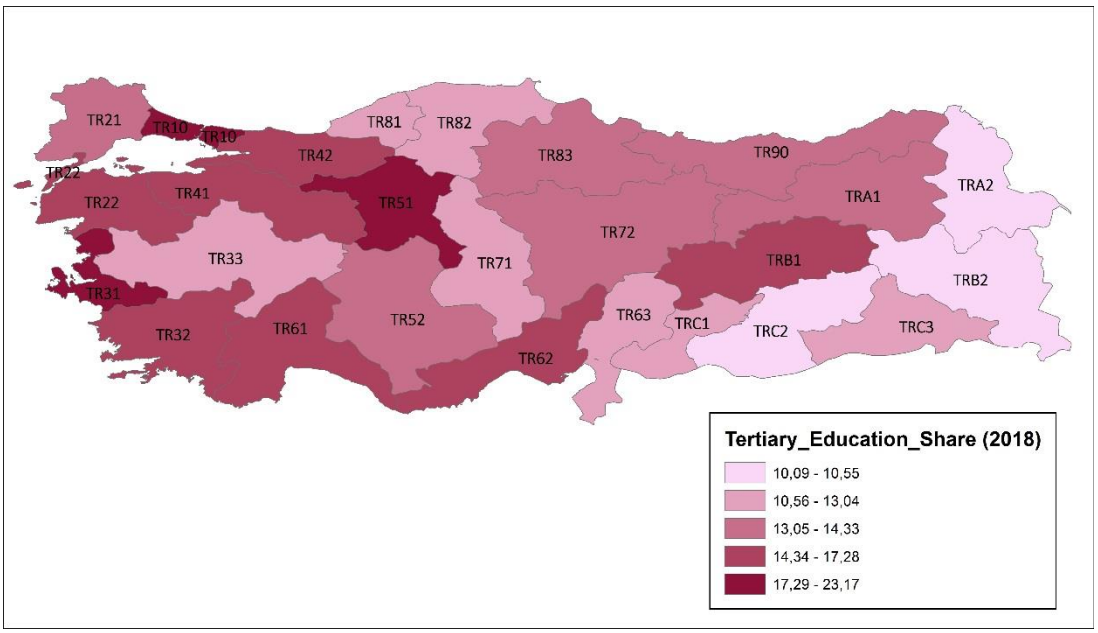


Figure 4.5. Tertiary Education Share in total population

Source: Map created by author

The three most populated cities in the country, Istanbul, Ankara, and Izmir, are at the forefront with the high university graduation share in total. TR32 Aydin, Denizli, Mugla; TR41 Bursa, Eskisehir, Bilecik and TR61 Antalya, Isparta, and Burdur are other regions with high university graduates.

Table 4.14. *Grouping of Regions according to descriptive statistics of Tertiary Education Share*

Descriptive Statistics						
2018	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Tertiary	26	10	23	375	14,43	3,000
Regions	**Group 1**		**Group 2**		**Group 3**	
Std. Dev.	**< -1,5 Std. Dev.**	**-1,5 - -0,5 Std. Dev.**	**-0,5 - +0,5 Std. Dev.**		**0,5 - +1,5 Std. Dev.**	**> +1,5 Std. Dev.**
		TR 33	TR21	TR22	TR 32	TR 51
		TR 71	TR52	TR42	TR 41	TR 10
		TR 82	TR63	TR62	TR 61	TR 31
		TR A2	TR72	TRB1		
		TR B2	TR81			
		TR C1	TR83			
		TR C2	TR90			
		TRC3	TRA1			

On the other hand, TR 33, TR 71, TR 82, TR A2, TR B2, TR C1, TR C2, and TR C3 regions are well below the country average as shown in the table above.

4.2.1.3. Doctorate Graduates

When we examined the 26 regions in the number of doctorate graduates per 1000 people, we observe that the average rate in Turkey is lower. TR 51 The Ankara region is well above the national average with 8 PhDs per 1000 inhabitants. The TR 10 Istanbul and TR 31 Izmir regions follow the Ankara region. What is striking here is that the TRA1 Erzurum, Erzincan and Bayburt region performs well with these three metropolitan regions.

Table 4.15. *Grouping of regions according to descriptive statistics of people with PhD per 1000 person*

Descriptive Statistics						
2017	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Doctorate	26	1	8	74	2,84	1,375
Regions	**Group 1**		**Group 2**		**Group 3**	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
		TR33	TR21	TR41	TR10	TR51
		TR63	TR22	TR52	TR31	
		TRA2	TR32	TR61	TRA1	
		TRB2	TR42	TR72		
		TRC1	TR62	TRB1		
		TRC2	TR71			
		TRC3	TR81			
			TR82			
			TR83			
			TR90			

TR 51 The Ankara region is well above the national average with 8 PhDs per 1000 inhabitants. The TR 10 Istanbul and TR 31 Izmir regions follow the Ankara region. What is striking here is that the TRA1 Erzurum, Erzincan and Bayburt region performs well with these three metropolitan regions.

As can be seen from the map below, all regions in the southeast of the country are underperforming in terms of the number of people with a Ph.D. In all of these regions, the number of doctorates per 1000 people is between 0.98 and 1.80.

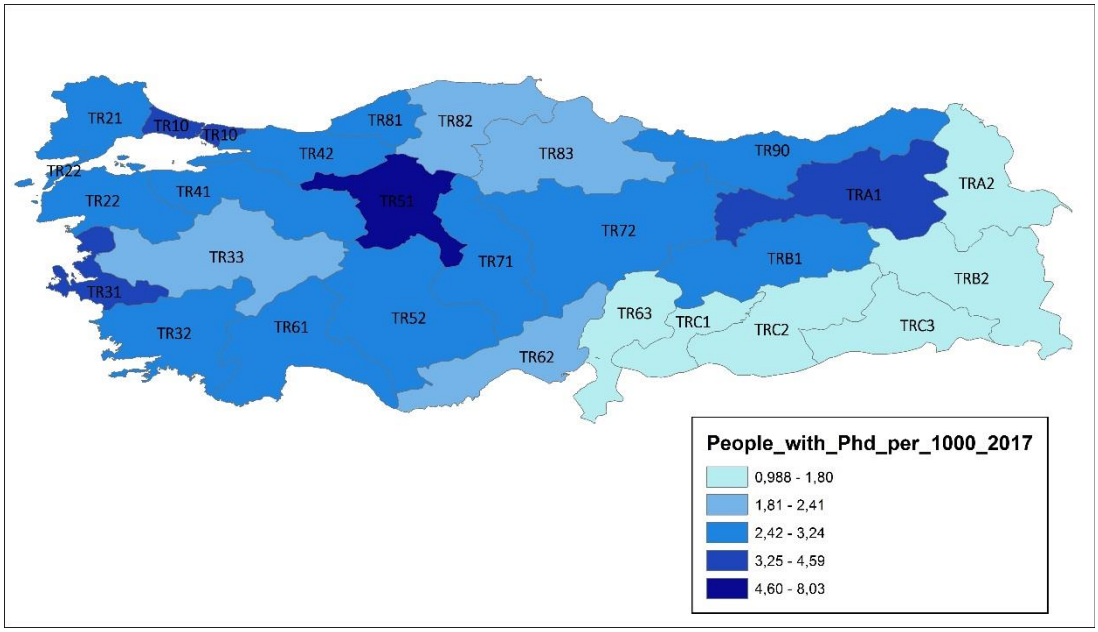


Figure 4.6. People with PhD per 100 person

Source: Map created by author

4.2.1.4. Labor Power

When the labor force participation rates are examined, TRC3 is the lowest extreme value with 40.7 percent and the highest extreme value is TR 21 Tekirdag, Edirne, Kirklareli with 59.7 percent.

When the map is examined, it is observed that the labor force participation rate is high in the coastal regions and low in the inner regions. Although TR22 Balikesir, Canakkale; TR62 Adana, Mersin; TR81 Zonguldak, Karabük and Bartin regions are coastal regions, low labor force participation rates attract attention.

When the map is examined, it is observed that the labor force participation rate is high in the coastal regions and low in the inner regions. Although TR22 Balikesir, Canakkale; TR62 Adana, Mersin; TR81 Zonguldak, Karabük and Bartin regions are coastal regions, low labor force participation rates attract attention.

Table 4.16. *Grouping of regions according to descriptive statistics of labor force share in total population*

Descriptive Statistics						
2018	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Labour	26	41	60	1351	51,97	4,231
Regions	**Group 1**		**Group 2**		**Group 3**	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
	TRC3	TR22	TR52	TR33	TR10	TR21
		TR63	TR62	TR41	TR31	
		TR72	TR71	TR51	TR32	
		TRA1	TR81	TRB1	TR42	
		TRB2	TRA2		TR61	
		TRC1			TR82	
		TRC2			TR83	
					TR90	

When the map is examined, it is observed that the labor force participation rate is high in the coastal regions and low in the inner regions. Although TR22 Balikesir, Canakkale; TR62 Adana, Mersin; TR81 Zonguldak, Karabük and Bartin regions are coastal regions, low labor force participation rates attract attention.

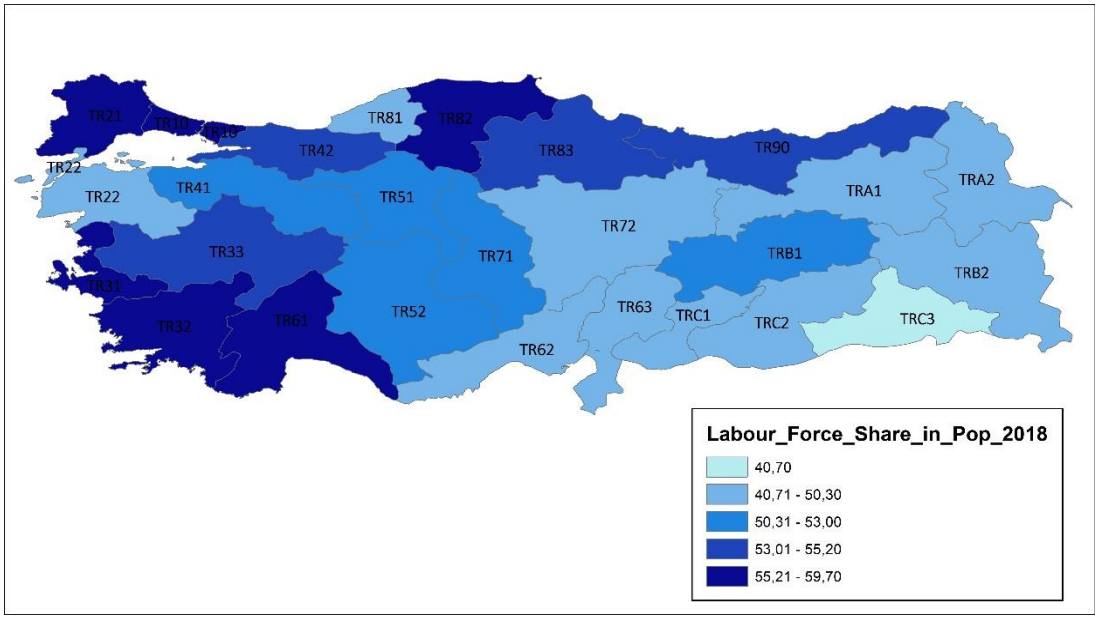


Figure 4.7. Labor force share in popuation

Source: Map created by author

4.2.1.5. Population Density

Table 4.17. *Grouping of regions according to descriptive statistics of population density*

Descriptive Statistics						
2018	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Pop_Dens	26	27	2900	5503	104,00	74,500
Regions	**Group 1**		**Group 2**		**Group 3**	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
		TR52	TR21	TR62	TR41	TR10
		TR71	TR22	TR63	TR42	TR31
		TR72	TR32	TR81	TRC1	TR51
		TR82	TR33	TRC2		
		TRA1	TR61			
		TRA2	TR83			
		TRB1	TR90			
		TRB2	TRC3			

When the population densities of the regions are examined, the three big cities, Istanbul, Ankara, and İzmir, come to the foreground with extreme values. These regions are again high economic activity TR41 Bursa, Eskisehir, Bilecik; TR42 Kocaeli, Sakarya, Düzce, Bolu, Yalova; TRC1 Gaziantep, Adiyaman, Kilis regions are followed.

For the remaining regions, high density is observed in coastal and western regions and low density is observed in inner and eastern regions.

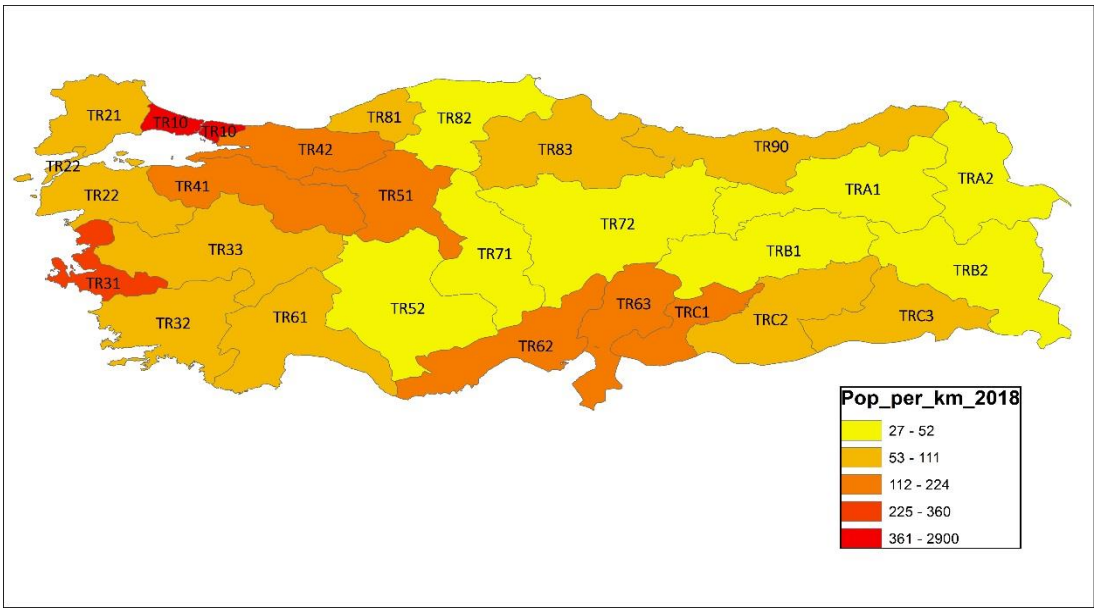


Figure 4.8. Population Density 2018

Source: Map created by author

4.2.1.6. Research and Development Expentidure per capita

The available data of R & D expenditure per capita is prepared for NUTS 1 regions. This data was adapted to the Level 2 regions for this study. Therefore, interpretation of the data according to Level 2 regions will not be very healthy. However, interpretation according to Level 1 regions provides us with meaningful ideas for sub-regions.

Table 4.18. *Groupings of regions according to the R&D Expenditure*

Descriptive Statistics						
2017	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
RD_Exp	26	58	1239	7392	284,31	317,541
Regions	**Group 1**		**Group 2**		**Group 3**	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
		TR61	TR21		TR10	TR51
		TR62	TR22		TR41	TR52
		TR63	TR31		TR42	
		TR81	TR32			
		TR82	TR33			
		TR83	TR71			
		TRC1	TR72			
		TRC2	TR90			
		TRC3	TRA1			
			TRA2			
			TRB1			
			TRB2			

When the data set is examined, TR 5 West Anatolia region is the leading one. It is understood from other indicators that the share of the Ankara sub-region is high. TR 5 West Anatolia region TR 4 East Marmara region and TR 1 Istanbul region follow TR 5 Region. On the other hand, the TR C Southeast Anatolia region has the lowest R & D expenditure per capita. There is no significant difference in the values in all remaining regions for this dataset.

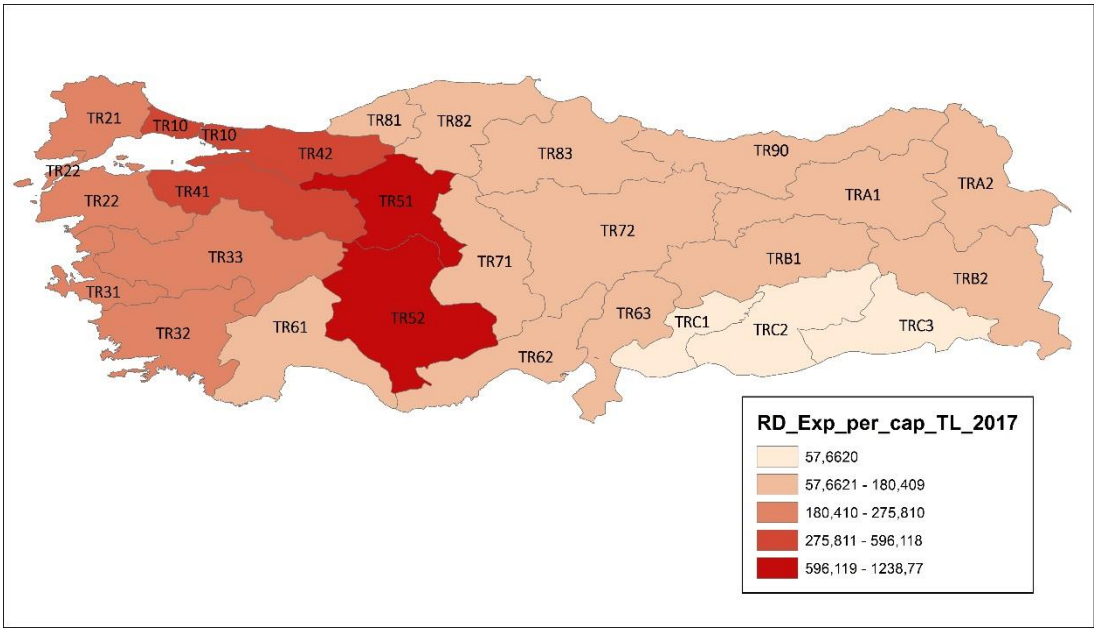


Figure 4.9. R&D Expenditure per capita in 2017

Source: Map created by author

4.2.2. Territorial Preconditions of Innovation

Capello and Lenzi (2012) stated that local knowledge does not directly transform into innovation and that this information should be used creatively in order to do so. Pontikasis et al. (2009) emphasized that the smart specialization approach also confirms this idea in a similar vein. According to smart specialization, the region's success in innovation lies in the discovery of new areas of specialization according to the area of knowledge that is shaped by the region's capabilities and the accumulation of human capital.

At this point, the industrial structure of the region, clustering relations, and knowledge and competencies, as well as entrepreneurial skills come to the fore. Therefore, the indicators of the regions related to entrepreneurship and the infrastructures to accelerate the entrepreneurial process were analyzed under this heading.

4.2.2.1. Venture Records and ICTs

Table 4.19. *Groping of regions according to venture records*

Descriptive Statistics						
2016	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Venture	26	24	60	1089	41,90	10,224
Regions	Group 1		Group 2		Group 3	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
	TRA2	TRA1	TR62	TR33	TR21	TR32
	TRB2	TRB1	TR63	TR41	TR22	TR61
	TRC3	TRC2	TR71	TR42	TR31	TR10
			TR72	TR52	TR51	
			TR81	TR90		
			TR82			
			TR83			
			TRC1			

Throughout the country, venture records are falling from west to east. When the venture records for the year 2016 are examined, TR10 Istanbul; TR32 Aydin, Denizli, Mugla; TR61 Antalya, Isparta, and Burdur regions have the highest values with approximately 60 initiatives per 1000 people in 26 regions. These regions TR 51 Ankara; TR21 Tekirdag, Edirne, Kirklareli; TR22 Balikesir, Çanakkale, and TR31 Izmir regions are followed by approximately 50 venture records in 1000 people.

Regions with the lowest performance in terms of entrepreneurship rates are TRA2 Agri, Kars, Igdir, Ardahan; TRB2 Van, Mousse, Bitlis, Hakkari and TRC3 Mardin, Batman, Sirnak, Siirt regions are lagging behind with approximately 25 initiatives per 1000 people.

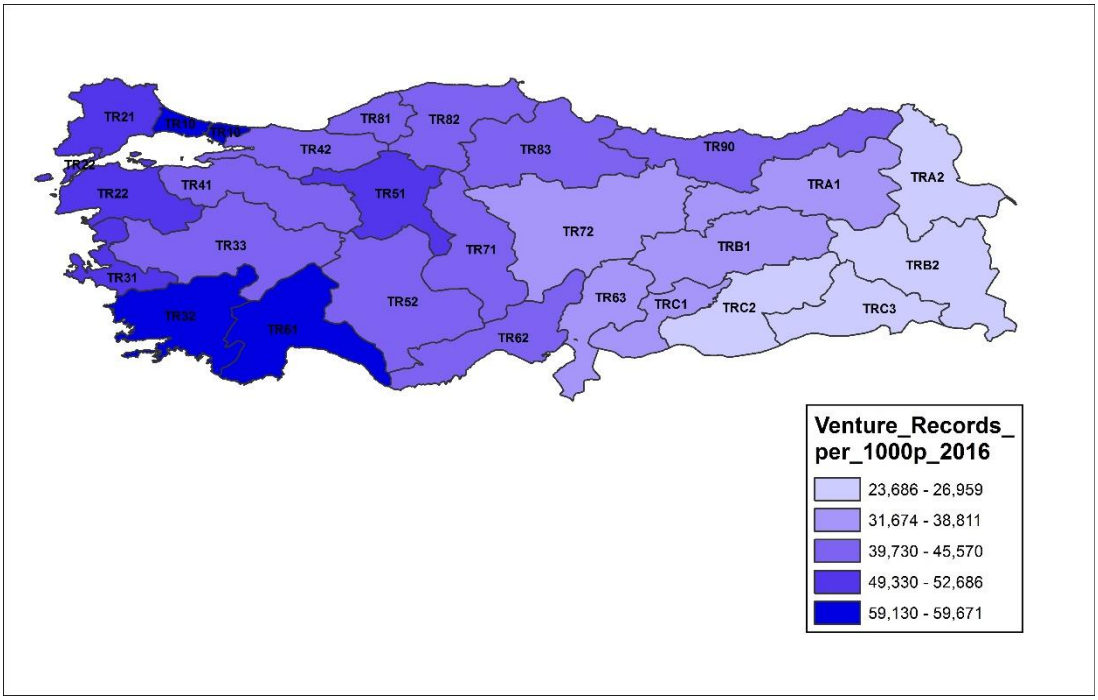


Figure 4.10. Venture Records per 1000 people

Source: Map created by author

Regarding the use of information and communication technologies, which is essential for smart specialization, the share of ICTs in new initiatives throughout the country remains very low.

TR 10 Istanbul region and TR 51 Ankara region have the highest values with approximately 20 information and communication technology records per 1000 enterprise records. On average of 26 regions, this value is only 9.

The striking point for this indicator is TRB2 Van, Muş, Bitlis, Hakkari; TRC2 Sanliurfa, Diyarbakir and TRC3 Mardin, Batman, Sirnak, Siirt, although the total number of enterprises is low, the share of information and communication technologies in these regions is above the national average.

Table 4.20. *Grouping of regions according to descriptive statistics of ICT share*

Descriptive Statistics						
2016	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
ICT_share	26	5	22	238	9,14	4,211
Regions	Group 1		Group 2		Group 3	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
		TR22	TR21	TR31	TRB2	TR10
		TR32	TR42	TR41	TRC2	TR51
		TR33	TR61	TRA1	TRC3	
		TR52	TR62	TRA2		
		TR71	TR63			
		TR72	TRB1			
		TR81	TRC1			
		TR82				
		TR83				
		TR90				

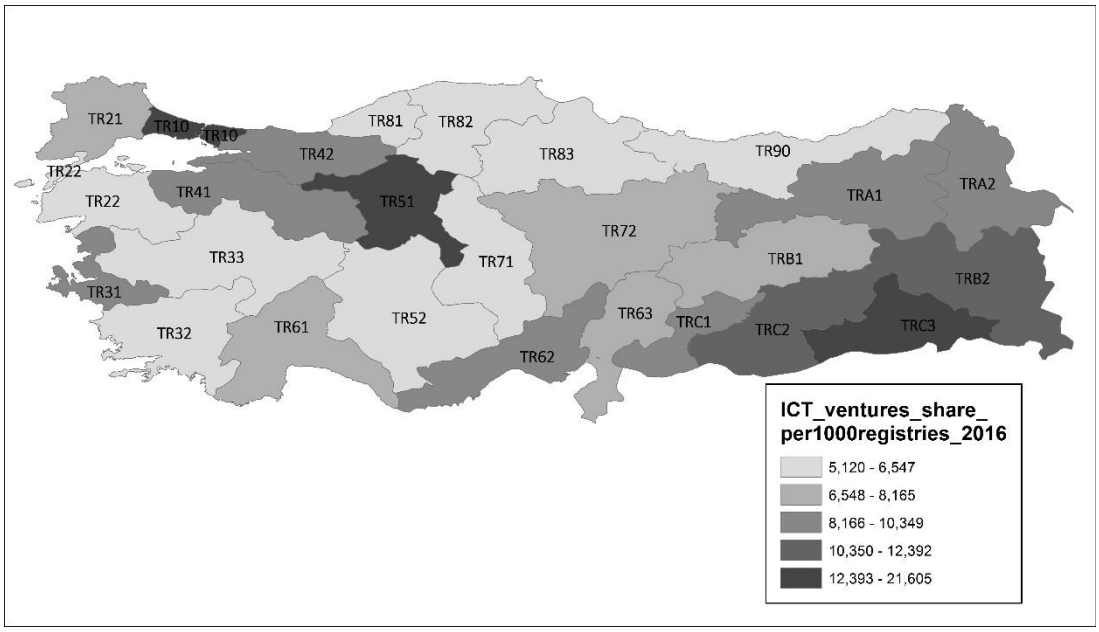


Figure 4.11. ICT ventures per 1000 registries

Source: Map created by author

4.2.2.2. Self Employed and Employer Share in Labor

The high proportion of self-employed and employers is parallel to the entrepreneurial culture of the region.

TR90 Trabzon, Ordu, Giresun, Rize, Artvin, Gümüshane regions with the highest rate of 35.7 percent are the regions with the highest value.

When we look at other regions, TR10 Istanbul; TR41 Bursa, Eskisehir, Bilecik; TR42 Kocaeli, Sakarya, Düzce, Bolu, Yalova; TR51 Ankara and TRC3 Mardin, Batman, Sirnak, and Siirt regions are well below the national average. This can be explained by the large scale of enterprises operating in these regions.

Table 4.21. *Grouping of regions according to descriptive statistics of self-employment, employer share*

Descriptive Statistics						
2018	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Self_Emp	26	15	36	601	23,12	4,366
Regions	Group 1		Group 2		Group 3	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
	TR51	TR10	TR61	TR33	TR21	TR90
	TRC3	TR31	TR72	TR52	TR22	
		TR41	TRB2	TR63	TR32	
		TR42	TRC1	TRA1	TR71	
		TR62	TRC2	TRB1	TR81	
					TR82	
					TR83	
					TRA2	

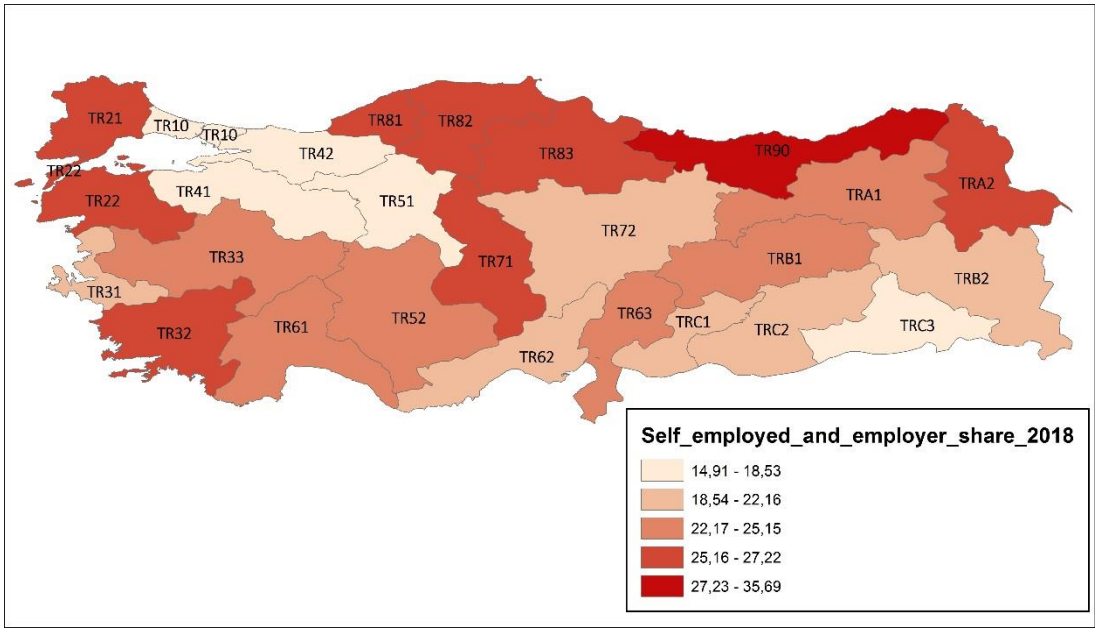


Figure 4.12. Self-empleyment and employer share

Source: Map created by author

4.2.2.3. Techno parks

Regional smart specialization strategies envisage a role for key knowledge producers Higher Education Institutions (HEIs) and Research Organizations (ROs) in the strategy design, implementation and capacity building. While HEIs form an economic sub-system in their own right that builds the long term knowledge base in the regional, national and European economies, they can also play an important role in the RIS3. The same applies to ROs. Smart specialization as regional policy needs the identification of partners with same expertise and interests. To be able to complete this task; the contribution of HEIs and ROs in the environment which contains businesses and supporting agents. For example, locally based clusters within techno parks. Also Universities can be crucial "Smart" players and the collaboration between European Commissions assets is a critical step to exploit their potential for innovation. (European Commission, The role of Universities and Research Organizations as drivers for Smart Specialisation at the regional level, 2014).

Table 4.22. *Grouping of regions according to descriptive statistics of techno parks*

Descriptive Statistics						
2018	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Technop	26		7	52	2,00	1,980
Regions	Group 1		Group 2		Group 3	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
	TR81	TR22	TR21	TR62	TR31	TR10
	TR82	TR32	TR41	TRB1	TR72	TR42
	TRA2	TR33	TR61	TRC2	TR83	TR51
	TRC3	TR52				
		TR63				
		TR71				
		TR90				
		TRA1				
		TRB2				
		TRC1				

According to data from the website of Advisory Services and Networking Technology Transfer Accelerator Turkey, there are 52 technoparks in Turkey as of 2018.

TR42 Kocaeli, Sakarya, Düzce, Bolu, Yalova and TR51 Ankara regions stand out with 7 technoparks. TR10 is followed by the Istanbul region and 6 technoparks. On the other hand, TR81 Zonguldak, Karabuk, Bartin; TR82 Kastamonu, Çankiri, Sinop; TRA2 Agri, Kars, Igdir, Ardahan, and TRC3 Mardin, Batman, Sirnak, and Siirt regions have no technoparks.

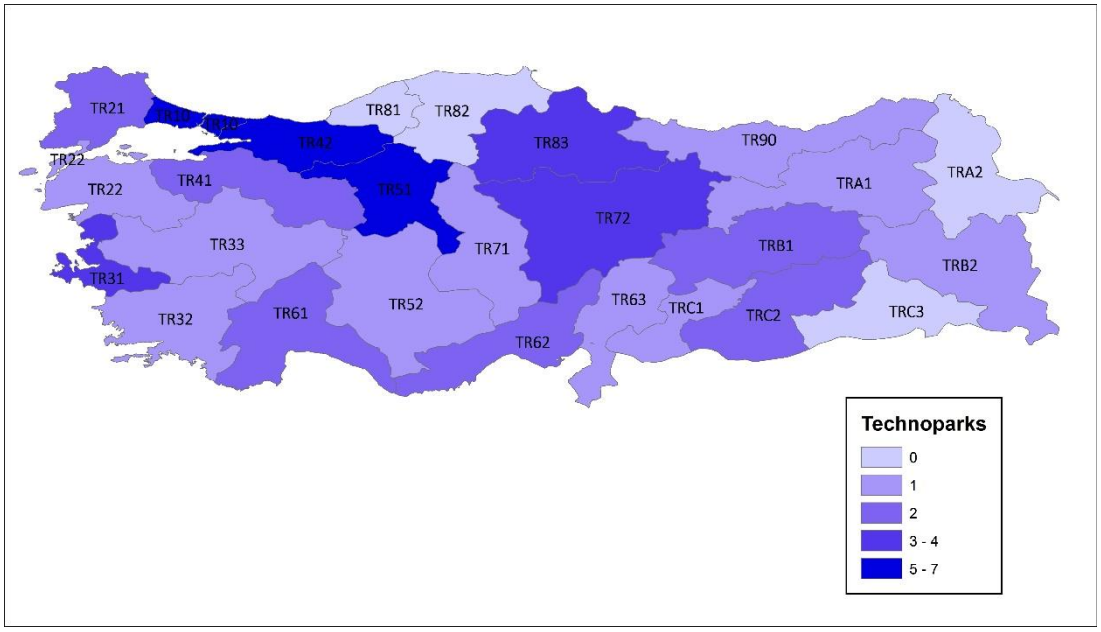


Figure 4.13. Techno Parks in NUTS 2 Regions (2018)

Source: Map created by author

4.2.2.4. Technology Transfer Offices

When we look at technology transfer offices, there 66 in total nationwide. TR 10 Istanbul region at the cutting edge of the other 25 regions with 17 offices.

The closest region to Istanbul is TR 51 Ankara, which has 9 offices. As can be seen from the table above, there are no technology transfer offices in 7 regions.

Table 4.23. *Grouping of regions according to descriptive statistics of TTOs*

Descriptive Statistics						
2018	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
TTOs	26		17	66	2,54	3,669
Regions	Group 1		Group 2		Group 3	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
		TR22	TR32	TR21	TR31	TR10
		TR81	TR33	TR41	TR42	TR51
		TR82	TR61	TR52		
		TRA2	TR62	TR72		
		TRB2	TR63			
		TRC2	TR71			
		TRC3	TR83			
			TR90			
			TRA1			
			TRB1			
			TRC1			

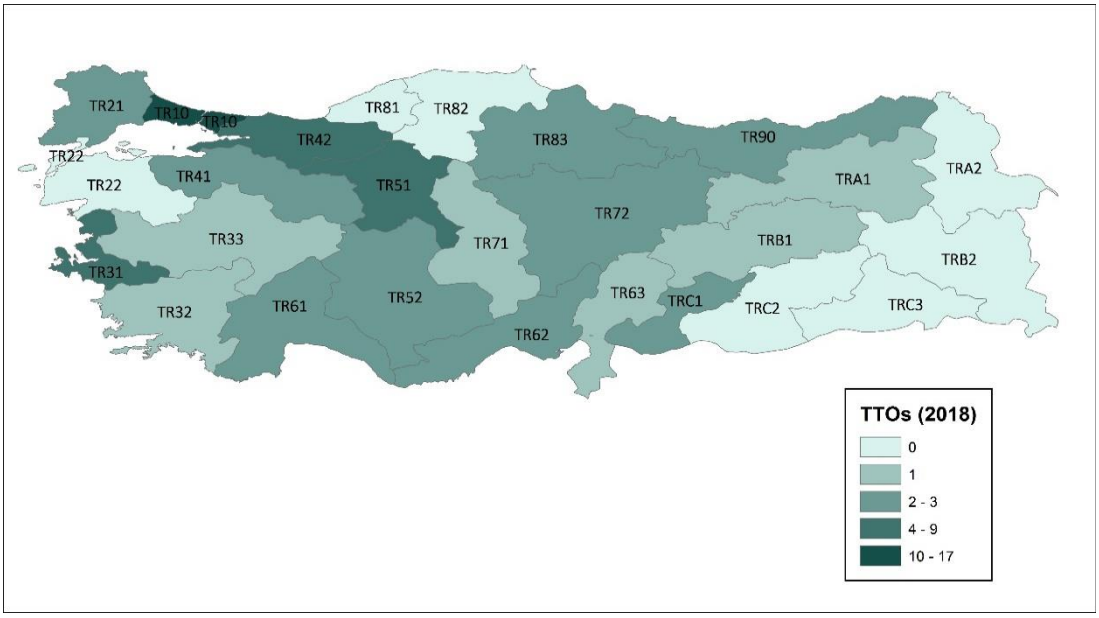


Figure 4.14. TTOs in NUTS 2 Regions (2018)

Source: Map created by author

4.2.2.5. Incubation Centers and Accelerators

Business incubation is a business support process that accelerates the successful development of start-up and fledgling companies by providing entrepreneurs with an array of targeted resources and services. These services are usually developed or orchestrated by incubator management and offered both in the business incubator and through its network of contacts. A business incubator's main goal is to produce successful firms that will leave the program financially viable and freestanding. These incubator graduates have the potential to create jobs, revitalize neighborhoods, commercialize new technologies, and strengthen local and national economies.

Table 4.24. *Grouping of regions according to descriptive statistics of Incubation Centers and Accelerators*

Descriptive Statistics						
2018	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Incubation	26		23	51	1,96	5,111
Regions	Group 1		Group 2		Group 3	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
	TR21	TR81	TRB1	TR41	TR31	TR10
	TR22	TR82	TRC1	TR52		TR51
	TR32	TR83		TR72		
	TR33	TR90				
	TR42	TRA1				
	TR61	TRA2				
	TR62	TRB2				
	TR63	TRC2				
	TR71	TRC3				

Critical to the definition of an incubator is the provision of management guidance, technical assistance and consulting tailored to young growing companies. Incubators usually also provide clients access to appropriate rental space and flexible leases, shared basic business services and equipment, technology support services and assistance in obtaining the financing necessary for company growth.

There are 51 incubation centers in only 8 regions in the country. Similar to the number of technology transfer offices, TR 10 Istanbul region is at the forefront in the number of incubators and accelerators. TR 51 Ankara region again follows the Istanbul region with 13 incubation centers. There are 6 incubator centers in TR 31 Izmir, 3 in TR 41 Bursa Bilecik Eskisehir, 2 in regions TR 52 Konya, Karaman and TR 72 Kayseri, Sivas, Yozgat, and 1 each TRB1 Malatya, Elazig, Bingol, Tunceli and TRC1 Gaziantep, Adiyaman, Kilis regions. None of the other remaining sites have incubation centers or accelerators.

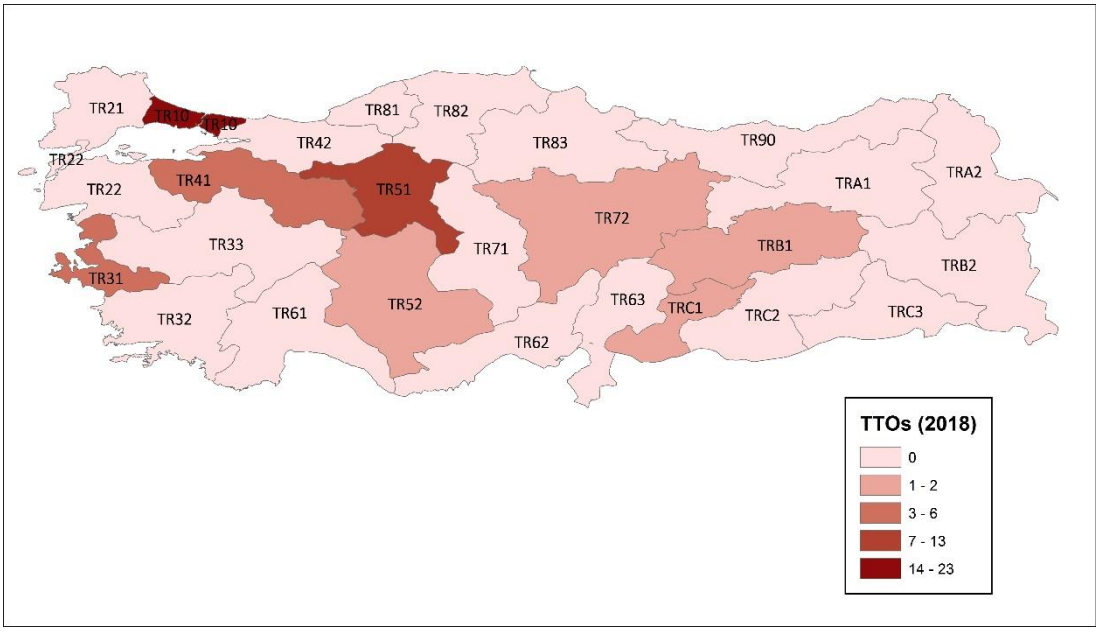


Figure 4.15. Incubation Centers and Accelerators in NUTS 2 Regions (2018)

Source: Map created by author

4.2.3. Innovation Outputs of Regions

Under this title, patent data have been used as the main indicator of innovation and knowledge creation, similar to many studies in the literature. In addition to patent data, useful model inventions, unique design creations, and trademark registrations were also discussed in order to analyze the innovation capacity of the regions in more detail.

4.2.3.1. Patent Applications and Registries

Turkey's NUTS 2 regions, when analyzed according to the number of patent applications in every 100 thousand people, values ranged from 2 to 50 applications. TR 10 Istanbul, TR 51 Ankara, and TR 41 Bursa, Bilecik and Eskisehir regions are the areas where patent applications are higher than the average. TR33 Manisa, Afyon, Kutahya, Usak; TR42 Kocaeli, Sakarya, Düzce, Bolu, Yalova and TR52 Konya and Karaman regions are other regions that attract attention with their high performance in patent applications.

Table 4.25. *Grouping of regions according to descriptive statistics of Patent Applications per 100 thousand people*

Descriptive Statistics						
2018	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Patent	26	2	50	358	13,77	12,317
Regions	Group 1		Group 2		Group 3	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
		TR63	TR21	TR31	TR33	TR10
		TR71	TR22	TRC1	TR42	TR51
		TR82	TR32		TR52	TR41
		TR83	TR61			
		TR90	TR62			
		TRA2	TR72			
		TRB1	TR81			
		TRB2	TRA1			
		TRC2				
		TRC3				

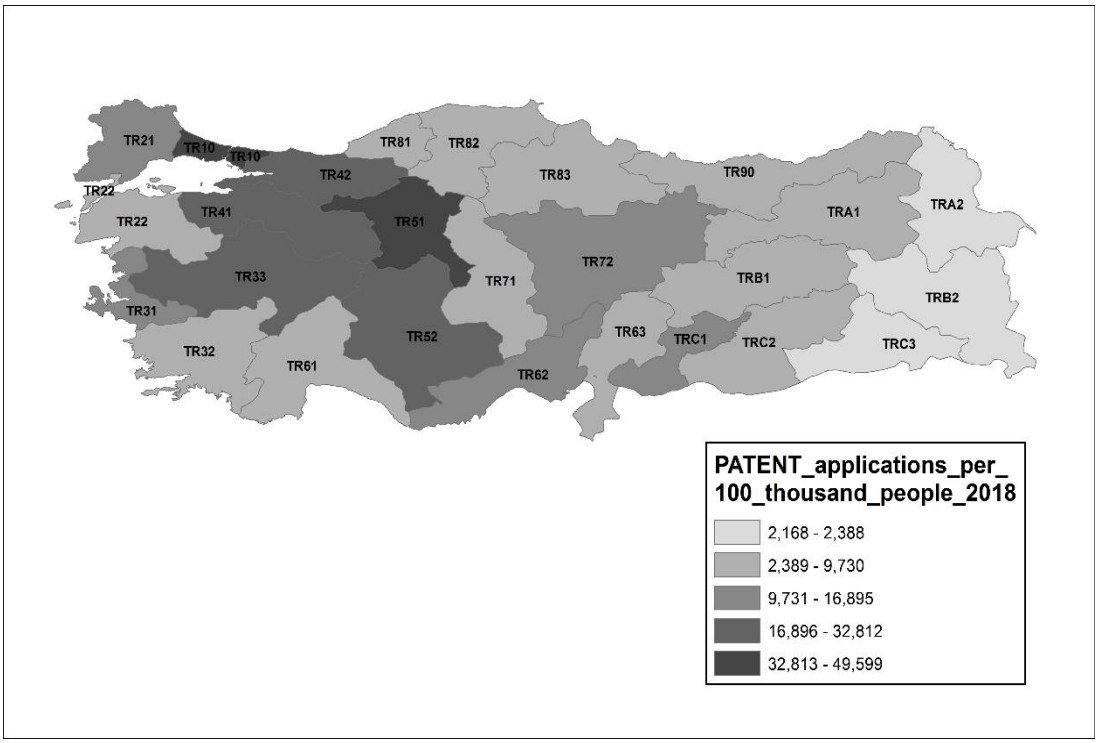


Figure 4.16. Patent applications per 100 thosuand people

Source: Map created by author

Patent applications and patent registrations of the regions vary slightly. When we look at the number of patents per million people throughout the country, we see that TR 10 Istanbul region has achieved a significant advantage over other regions with 219 patents.

As you can see on the map, all of the south-eastern regions, except TRC1, are performing poorly. In the western part of the country, the TR 81 region is well below the average.

Table 4.26. *Grouping of regions according to descriptive statistics of Patent Registries per million people*

Descriptive Statistics						
2018	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Patent REG	26	0	219	1218	46,85	53,296
Regions	Group 1		Group 2		Group 3	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
		TR22	TR33	TR31	TR21	TR10
		TR32	TR61	TRC1	TR42	TR51
		TR62	TR71		TR52	TR41
		TR63	TR72			
		TR81	TR82			
		TR83				
		TR90				
		TRA1				
		TRA2				
		TRB1				
		TRB2				
		TRC2				
		TRC3				

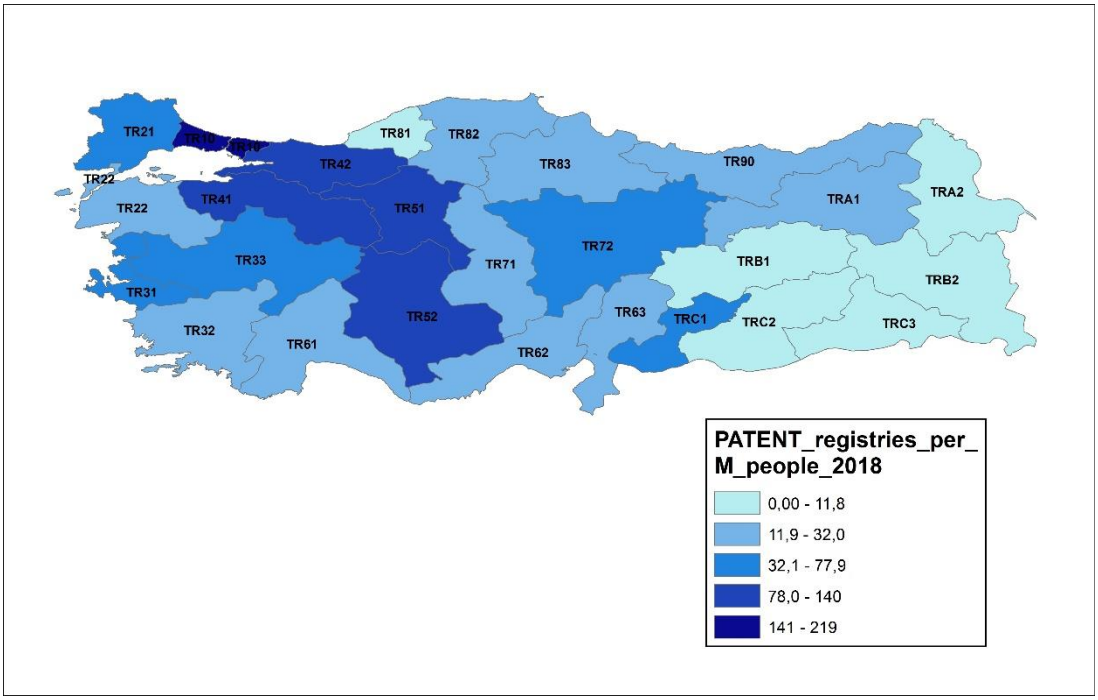


Figure 4.17. Patent Registries per million people

Source: Map created by author

4.2.3.2. Utility Model Applications and Registries

The utility model can be defined as a new form, structuring or repositioning of products, mechanisms, or a part or operation of these products, which offers the use, advantage or technical effect that they did not have before (Suthersanen, 2006).

Utility models provide a separate type of patent right that has a shorter allowable protection period. They also need lower requirements for granting in compare to invention patents. To provide an easier, cheaper, and faster alternative/type of patent protection makes utility models more attractive to users. Especially for developing countries, utility models can be beneficial in technological development and catching-up process (Juma, 1989; Janis, 1999; Suthersanen; 2006; Brack, 2009 as cited in Prud'homme, 2016). From this point of view, the utility model registries in NUTS2 level regions of Turkey are analyzed below as an important innovation indicator.

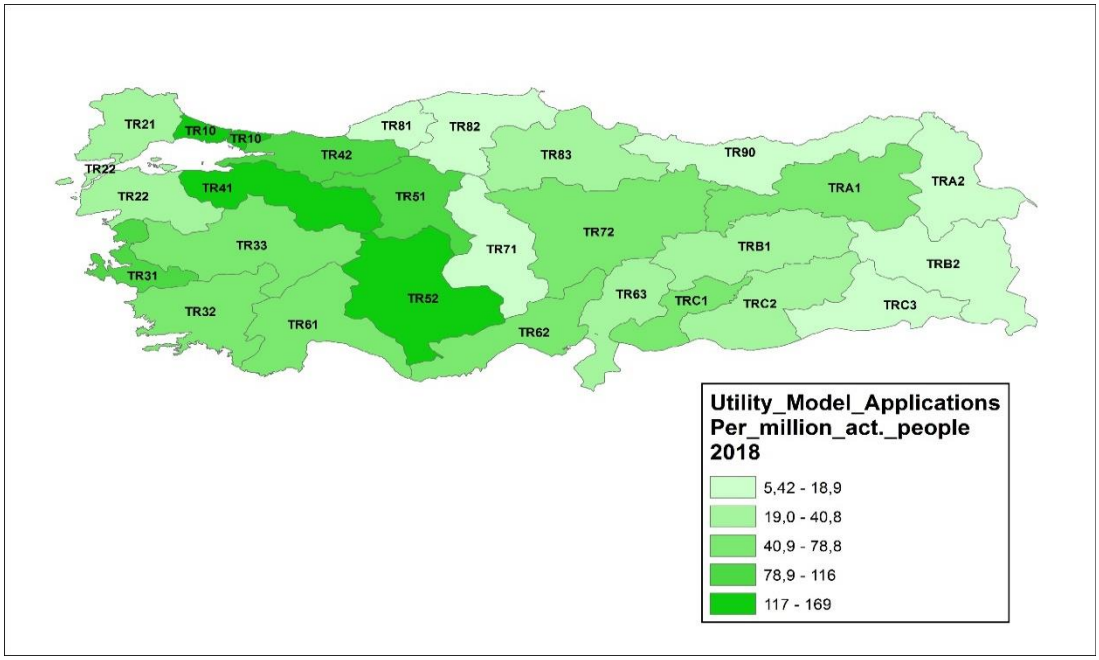


Figure 4.18. Utility Model Applications per million active people

Source: Map created by author

Table 4.27. *Grouping of regions according to descriptive statistics of Utility Model Registries per million people*

Descriptive Statistics						
2018	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Utility_M	26		22	170	6,54	5,995
Regions	Group 1		Group 2		Group 3	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
	TRA1	TR61	TRC1	TR31	TR21	TR10
	TRA2	TR63		TR32	TR22	TR51
	TRB2	TR71		TR33	TR41	TR52
	TRC3	TR82		TR62	TR42	
		TR83		TR81	TR72	
		TR90				
		TRB1				
		TRC2				

When the utility model records are examined, very low performance is observed throughout the country. Except for the TR 72 region, the number of model registrations per million inhabitants throughout the eastern part of the country is negligible. Regions TR 10, TR 51 and TR 52 perform well in this respect.

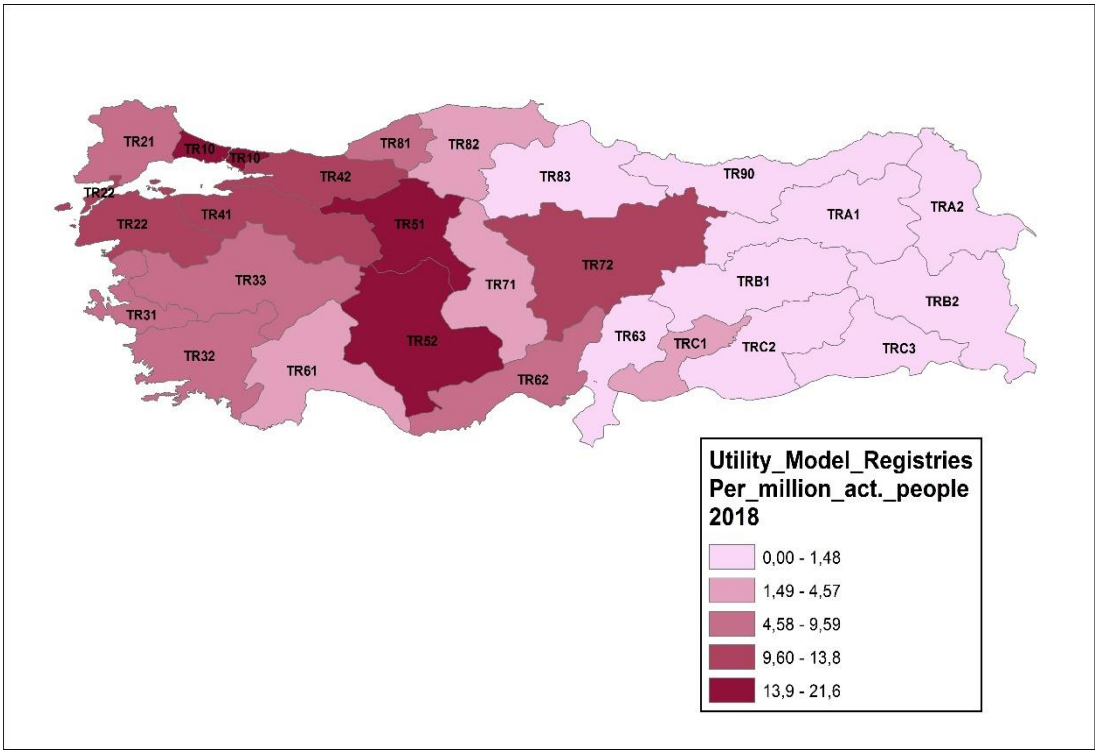


Figure 4.19. Utility Model Registries per million active people

Source: Map created by author

4.2.3.3. Unique Designs Applications and Registries

Original design records differ from other indicators. Regions of TR C1 and TR 72 performed unexpectedly as the leading regions in this field. On the other hand, similar to the other indicators, the east-west of the country again varies greatly.

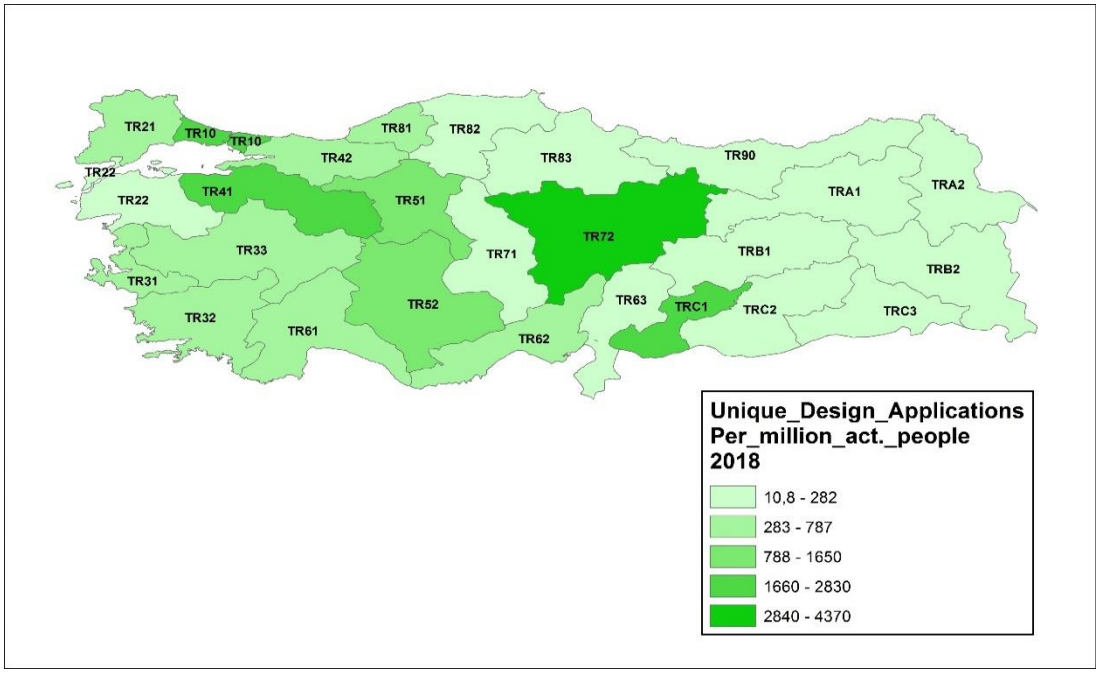


Figure 4.20. Unique Design Applications per million active people
Source: Map created by author

Table 4.28. *Grouping of regions according to descriptive statistics of Unique Design Registries*

Descriptive Statistics						
2018	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Unique_Des	26	13	3853	19124	735,55	1005,350
Regions	Group 1		Group 2		Group 3	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
		TR22	TR21	TR31	TR10	TR72
		TR71	TR32	TR51	TR41	TRC1
		TR82	TR33		TR52	
		TR83	TR42			
		TR90	TR61			
		TRA1	TR62			
		TRA2	TR63			
		TRB1	TR81			
		TRB2				
		TRC2				
		TRC3				

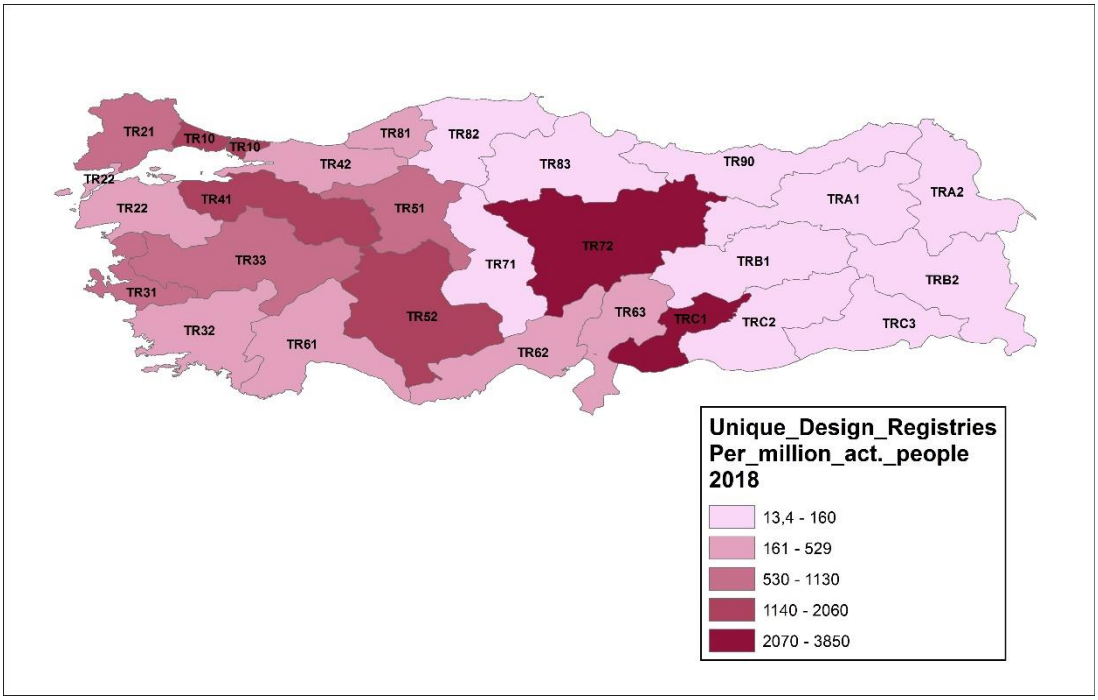


Figure 4.21. Unique Design Registries per million active people

Source: Map created by author

4.2.3.4. Trademark Registries Applications and Registries

Trademarks with their differentiated and perceptible symbols and designations play a significant role in the marketing process of goods and services. They also reflect the identity of firms. These types of characteristics make trademarks an important indicator of innovation. Moreover, together with the increasing use of digital databases and international regulations on trademarks provides a convenient environment to use trademark statistics for innovation studies (Mendonça et al., 2004; Millot, 2009).

Besides the number of registries of patents and utility models, the trademark registries and unique design counts are significant indicators in terms of the creativity levels and entrepreneurship capabilities of regions. In this manner, trademark and unique design registries of the regions are analyzed below.

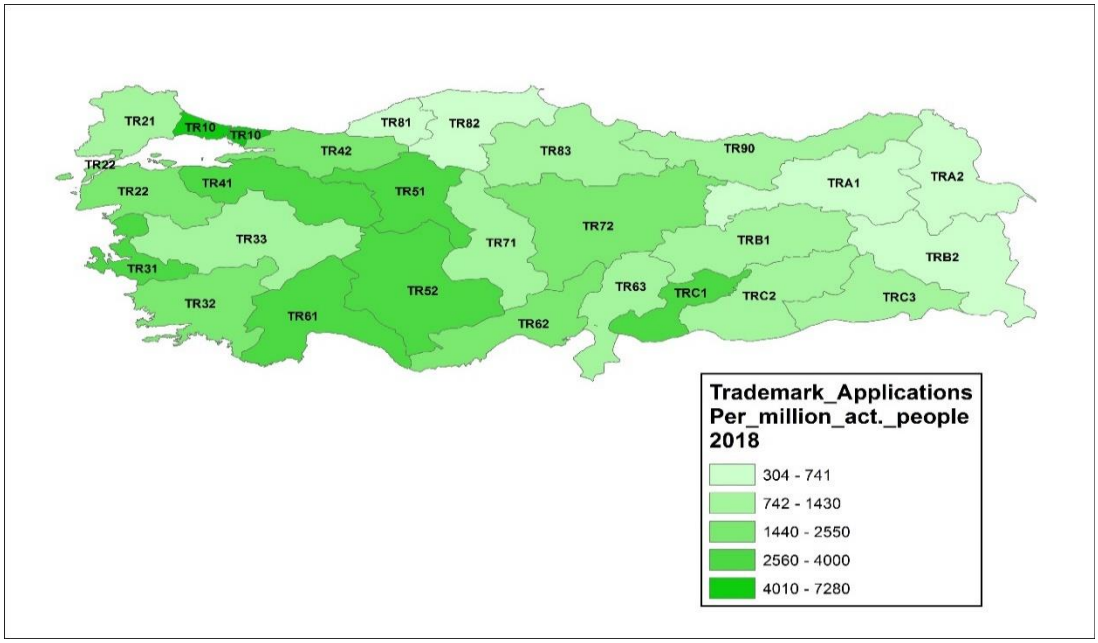


Figure 4.22. Trademark Applications per million active people
Source: Map created by author

Table 4.29. *Grouping of regions according to descriptive statistics of Trademark Registries per million active people*

Descriptive Statistics						
2018	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Trademark	26	220	5688	40745	1567,13	1234,741
Regions	Group 1		Group 2		Group 3	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
		TR33	TR21	TR32	TR31	TR10
		TR71	TR22	TR42	TR41	
		TR81	TR63	TR62	TR51	
		TR82	TR72		TR52	
		TR83			TR61	
		TR90			TRC1	
		TRA1				
		TRA2				
		TRB1				
		TRB2				
		TRC2				
		TRC3				

When the trademark registrations per million people in the regions are examined, Istanbul is the leading region in the country with more than twice the trademark registrations of the nearest region. On the other hand, TR 31, TR 41, TR 51, TR 52, TR 61 and TR C1 regions are other regions with high trademark registration in the country.

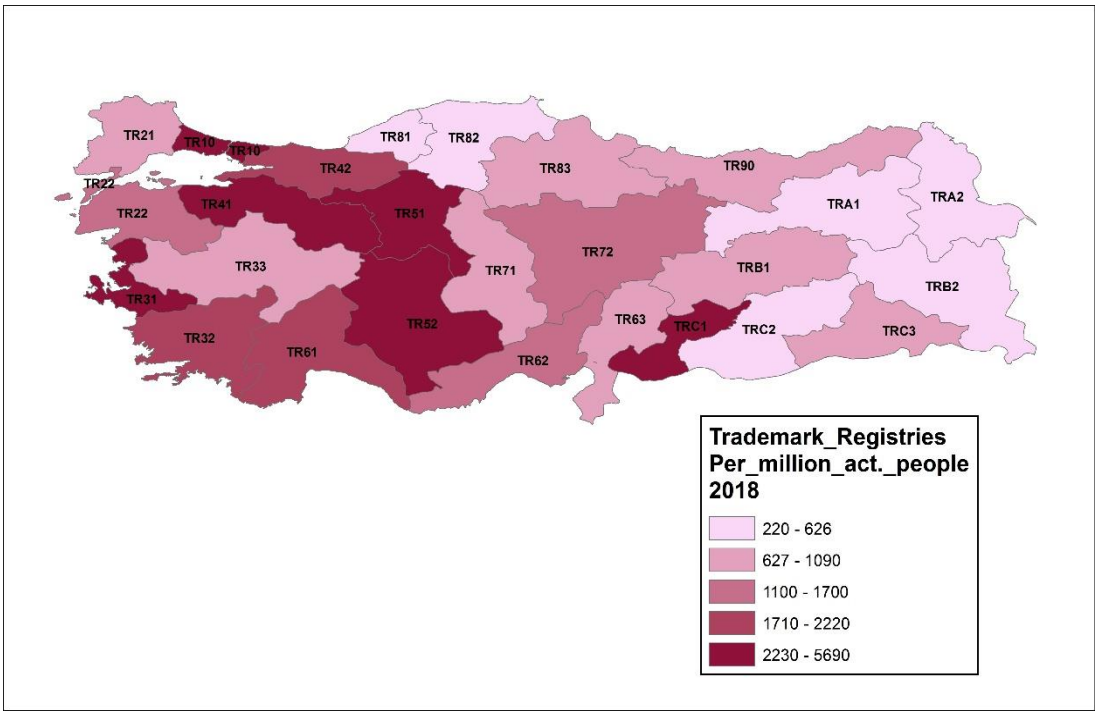


Figure 4.23. Trademark Registries per million active people

Source: Map created by author

4.3. Openness of Turkish Regions

4.3.1. Export Capacities

The statistical analysis of regional export figures per capita is shown in the table below. The average export per capita in the regions is around 2800 dollars. While the

Istanbul region is the leader with 12358 dollars, per capita exports in Erzurum, Erzincan and Bayburt region is only 74 dollars according to 2017 data.

Table 4.30. *Grouping of regions according to descriptive statistics of Exports per active population*

Descriptive Statistics						
2017	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Export_p_act	26	74,01	12358,91	73047,08	2809,5030	3063,61254
Regions	Group 1		Group 2		Group 3	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
		TR22	TR21	TR32	TR31	TR10
		TR61	TR33	TR51		TR41
		TR71	TR52	TR63		TR42
		TR82	TR62			TRC1
		TR83	TR72			
		TRA1	TR81			
		TRA2	TR90			
		TRB1	TRC3			
		TRB2				
		TRC2				

Export figures per capita vary across the country. When the per capita exports in the regions are analyzed, TR 10, TR 31, TR 41 TR 42 and TR C1 regions play a leading role for the country. The TR 32, TR 51 and TR 63 regions are other regions with export performance above the national average.

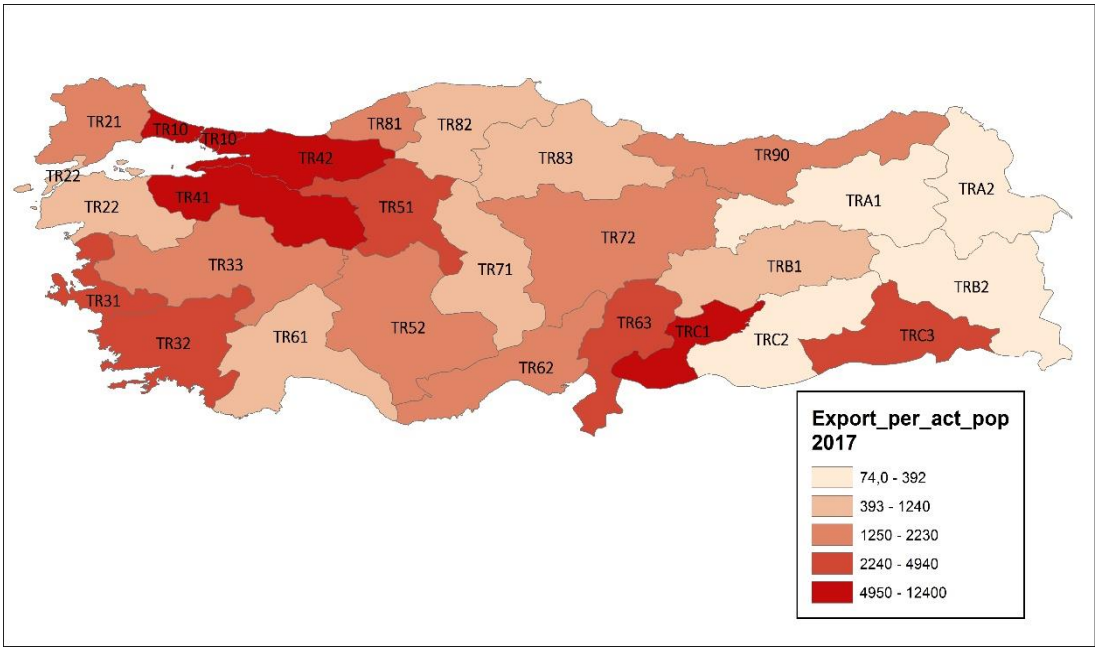


Figure 4.24. Exports per active population

Source: Map created by author

4.3.2. Foreign-Owned Companies

In this section, as another indicator of openness, the foreign-owned companies in regions are analyzed. The number of firms owned by foreigners in the regions is one of the criteria showing the internationality of the region. Open economy and high value-added foreign direct investments trigger productivity and innovation. Therefore, foreign-owned company counts can be used as an indicator of the openness of regions.

According to data from the year 2017, there are 1260 foreign-owned companies in the regions in total. Van, Muş, Bitlis, Hakkari region has no foreign-owned company. On the other hand, Kocaeli, Sakarya, Düzce, Bolu, Yalova region has the most foreign-owned companies with 255 firms. In addition, when we look at the number of firms per 1 million active populations, the number of companies which are over 50, TR 21 Tekirdağ, Edirne, Kırıklareli; TR 31 İzmir and TR 41 Bursa, Bilecik and Eskişehir regions are other regions with high performance.

Table 4.31. *Grouping of regions according to descriptive statistics of foreign-owned companies per million active people*

Descriptive Statistics						
2017	**N**	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Foreign_owned_c	26	0,00	164,09	836,79	32,1844	41,95227
Regions	Group 1		Group 2		Group 3	
Std. Dev.	< -1,5 Std. Dev.	-1,5 - -0,5 Std. Dev.	-0,5 - +0,5 Std. Dev.		0,5 - +1,5 Std. Dev.	> +1,5 Std. Dev.
	TRB2	TR63	TR10	TR22	TR41	TR21
		TR72	TR32	TR33		TR31
		TR81	TR52	TR51		TR42
		TR82	TR62	TR61		
		TRA1	TR83	TR71		
		TRA2	TR90			
		TRB1				
		TRC1				
		TRC2				
		TRC3				

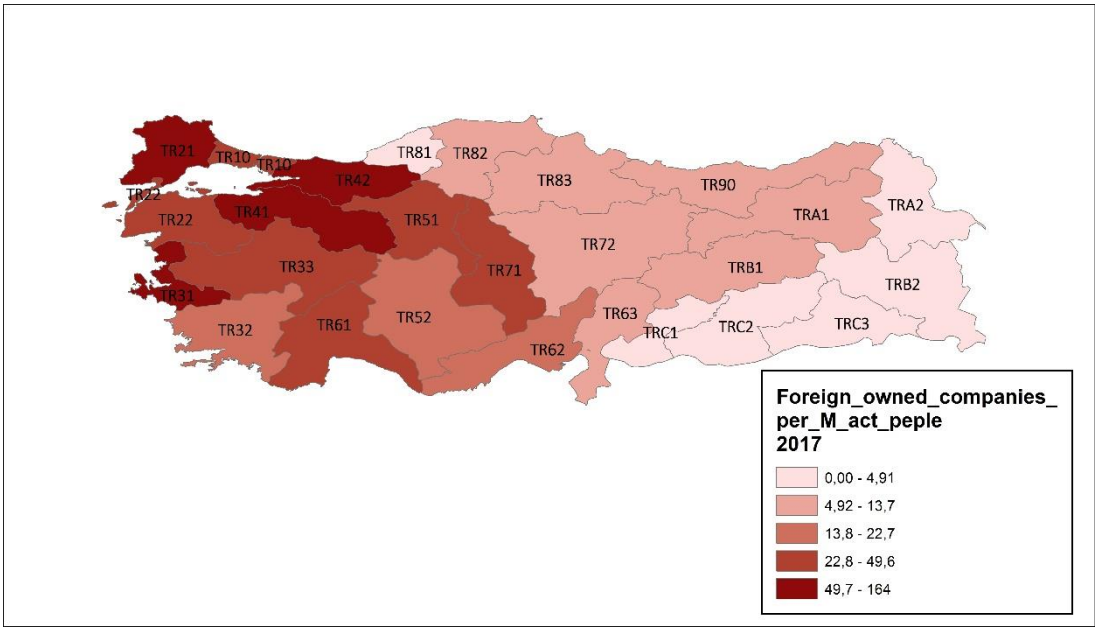


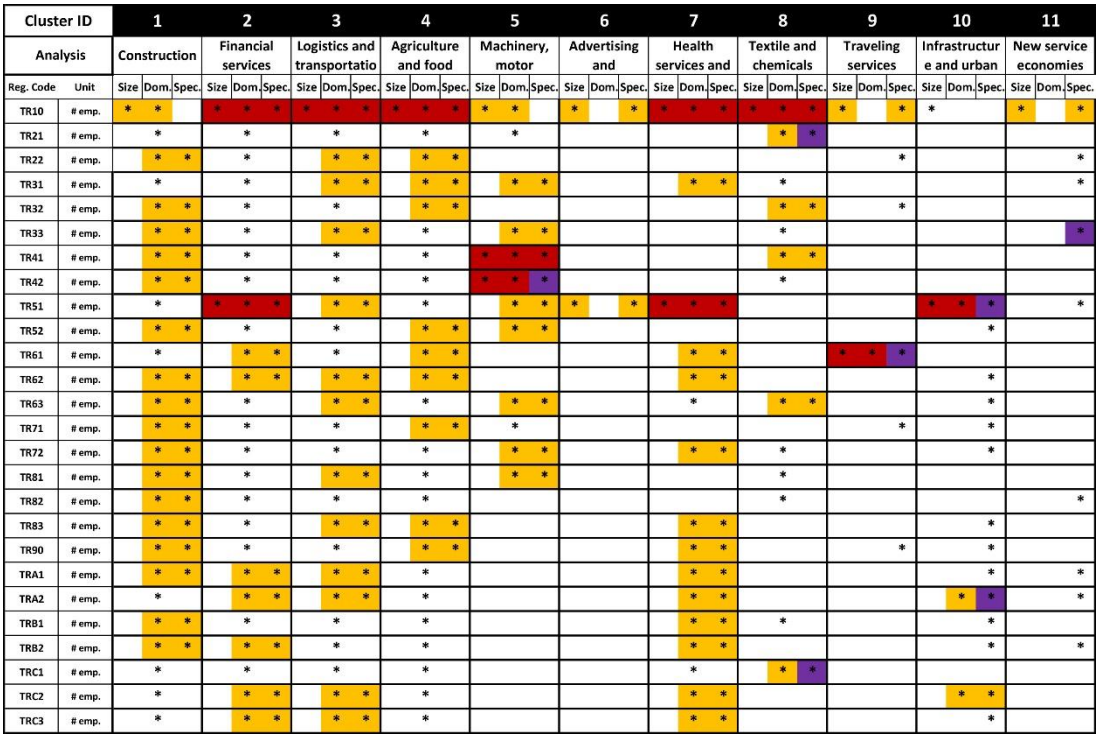
Figure 4.25. Foreign-owned companies per million active people

Source: Map created by author

4.4. General Evaluation of Regional Analysis

4.4.1. Clusters in NUTS 2 Regions of Turkey: There Star Analysis

When we analyze the clusters in regions over three ways; size, dominance, specialization together, which we have mentioned striking features above, we see the figure summarizing the situation of the regions like the one below.



Cluster ID		1			2			3			4			5			6			7			8			9			10			11		
Analysis		Construction			Financial services			Logistics and transportatio			Agriculture and food			Machinery, motor			Advertising and			Health services and			Textile and chemicals			Traveling services			Infrastructur e and urban			New service economies		
Reg. Code	Unit	Size	Dom.	Spec.	Size	Dom.	Spec.	Size	Dom.	Spec.	Size	Dom.	Spec.	Size	Dom.	Spec.	Size	Dom.	Spec.	Size	Dom.	Spec.	Size	Dom.	Spec.	Size	Dom.	Spec.	Size	Dom.	Spec.	Size	Dom.	Spec.
TR10	# emp.	*	*		*	*	*	*	*	*	*	*	*	*	*		*		*	*	*	*	*	*	*	*		*	*		*		*		*
TR21	# emp.		*			*			*			*			*									*	*									
TR22	# emp.		*	*		*			*	*		*	*														*							*
TR31	# emp.		*			*			*	*		*	*		*	*					*	*		*										*
TR32	# emp.		*	*		*			*			*	*											*	*			*							
TR33	# emp.		*	*		*			*	*		*			*	*								*										*
TR41	# emp.		*	*		*			*			*		*	*	*								*	*									
TR42	# emp.		*	*		*			*			*		*	*	*								*										
TR51	# emp.		*		*	*	*		*	*		*			*	*	*		*	*	*	*								*	*	*			*
TR52	# emp.		*	*		*			*			*	*		*	*															*			
TR61	# emp.		*			*	*		*			*	*								*	*						*	*	*					
TR62	# emp.		*	*		*	*		*	*		*	*								*	*								*				
TR63	# emp.		*	*		*			*	*		*			*	*					*			*	*						*				
TR71	# emp.		*	*		*			*			*	*		*												*			*				
TR72	# emp.		*	*		*			*			*			*	*					*	*		*							*				
TR81	# emp.		*	*		*			*	*		*			*	*								*										
TR82	# emp.		*	*		*			*			*												*										*
TR83	# emp.		*	*		*			*	*		*	*								*	*									*			
TR90	# emp.		*	*		*			*			*	*								*	*						*			*			
TRA1	# emp.		*	*		*	*		*	*		*									*	*									*			*
TRA2	# emp.		*			*	*		*	*		*									*	*								*	*	*		*
TRB1	# emp.		*	*		*			*			*									*	*		*							*			
TRB2	# emp.		*	*		*	*		*			*									*	*									*			*
TRC1	# emp.		*			*			*			*									*			*	*									
TRC2	# emp.		*			*	*		*	*		*									*	*								*	*			
TRC3	# emp.		*			*	*		*	*		*									*	*									*			

Figure 4.26. Three Star Analysis on Clusters in NUTS 2 Regions of Turkey

For each region above, the size, dominance and level of specialization of 11 previously identified clusters, respectively, were analyzed. The details of this analysis are detailed in methodology chapter (Chapter 3). Each star represents the adequacy of the region for the specified cluster and analysis. The red boxes show the regions and clusters that can receive three stars in all 3 analysis titles. The yellow boxes show the regions that can receive 2 stars from the 3 analyzes indicated. The purple stars in some columns of the specialization analysis show that the location quotient (LQ) is above 2.0. Therefore, the regions of this star represent a different level of specialization higher than normal values. It points to the existence of definite and great specialization in the clusters mentioned in these regions.

There are 11 clusters in only 5 regions that can receive three stars from the dominant clusters in the country. TR 10 The Istanbul region re-demonstrated its dominance by receiving 3 stars in 5 of the clusters in the country. Three-star clusters of Istanbul;

Clusters 2, 3, 4, 7, and 8, respectively; financial services; logistics and transportation; agriculture and food; health services and pharmaceuticals, and finally textile and chemistry clusters.

Similar to Istanbul, the Ankara region received 3 stars for financial services and healthcare and pharmaceutical clusters. In addition, Ankara is the only region that can receive all the stars of size, dominance, and specialization in the infrastructure and urban services cluster.

On the other hand, there are only 3 regions that can receive three stars in any sectoral cluster except for Istanbul and Ankara. These include TR 41 Bursa, Eskisehir, Bilecik and TR 42 Kocaeli, Sakarya, Duzce, Bolu, Yalova regions in the same cluster which is machinery, motor vehicles, and equipment. Also, TR 61 Antalya, Isparta and Burdur region is the only region having three stars in traveling services cluster.

As for the more general interpretations after the three-star clusters, the cluster 1,2,3 and 4, the largest four clusters in the country, and dominate other clusters within the region in all 26 regions. TR 10 Istanbul region was able to obtain the size star in all clusters.

In the No. 6 cluster, advertising and publishing, only Istanbul and Ankara were able to receive the stars of specialization and size. A similar situation applies to Istanbul and Antalya in the no. 9 cluster, traveling services. In addition, the only region that dominates the travel services cluster is the Antalya region.

Regions with purple boxed stars, as mentioned earlier, represent specializations that need further attention. These clusters are important at the country level and are proof that the level of specialization along with the sub-sectors of the clusters is at the highest level in the region. TR 42 Kocaeli, Sakarya, Duzce, Bolu, Yalova region number 5 for the machine and motor vehicles cluster was able to receive this star. In the clusters of textile and chemicals numbered 8, the two regions that can receive this star are TR 21 Tekirdağ, Edirne, Kırklareli and TR C1 Gaziantep, Adıyaman and Kilis.

TR 61 Antalya, Isparta, Burdur region is another remarkable region that can receive this star with the cluster of Travelling Services.

4.4.2. Evaluation of Innovation Capacities of NUTS 2 Regions of Turkey

The fourteen indicators in the table below were examined according to 26 NUTS 2 regions above. A composite index was established based on the normalized values of the regions for these indicators. The total values of the fourteen indicators were analyzed on this composite index to determine whether the regions had sufficient innovation capacity according to the mean value of the total values of all regions.

Table 4.32. *Descriptive Statistics of Indicators of Innovation Capacity Analysis*

Descriptive Statistics						
	N	Minimum	Maximum	Sum	Mean	Std. Deviation
HRST	26	11	39	586	22,52	6,034
Tertiary	26	10	23	375	14,43	3,000
Doctorate	26	1	8	74	2,84	1,375
Labour	26	41	60	1351	51,97	4,231
Pop_Dens	26	27	2900	5503	211,65	553,159
RD_Exp	26	58	1239	7392	284,31	317,541
Venture	26	24	60	1089	41,90	10,224
ICT_share	26	5	22	238	9,14	4,211
Self_Emp	26	15	36	601	23,12	4,366
Technop	26	0	7	52	2,00	1,980
TTOs	26	0	17	66	2,54	3,669
Incubation	26	0	23	51	1,96	5,111
Patent	26	0	219	1218	46,85	53,296
Utility_M	26	0	22	170	6,54	5,995
Unique_Des	26	13	3853	19124	735,55	1005,350
Trademark	26	220	5688	40745	1567,13	1234,741
Valid N (listwise)	26					

These indicators are categorized under three headings based on Capello and Lenzi's (2012) approach to territorial patterns of innovation. For each category, the composite index created based on the normalized values of the regions for these indicators. Then, the qualifications of the regions were examined for each category.

Table 4.33. *Categorizations of Innovation Capacity Indicators according to Innovation Phases*

Territorial Preconditions of Knowledge Creation	**Territorial Preconditions of Innovation**	**Innovation Outputs**
Human Resources in Science and Technology	Venture Records	Patent Applications and Registries
Tertiary Education Level	ICT Share in Ventures	Utility Model Applications and Registries
Doctorate Degree Graduates	Self Employed and Employer	Unique Design Applications and Registries
Labour Power	Technopark	Trademark Applications and Registries
Population Density	Technology Transfer Offices	
R & D Expenditure	Incubation Centers and Accelerators	

As a result of these, regional innovation patterns are determined as below figure according to normalized values of regions.

NUTS_ID	REG_NAME	Territorial Preconditions of Knowledge Creation	Territorial Preconditions of Innovation	Innovation Outputs	Regional Innovation Pattern
TR10	Istanbul	4,256415	4,988908	3,276613	*Endogenous*
TR21	Tekirdag, Edirne, Kirklareli	2,109335	1,902720	1,125599	*Endogenous*
TR22	Balikesir, Çanakkale	1,812607	1,500735	0,796975	*Lagging Regions*
TR31	Izmir	2,929254	2,516895	1,399780	*Endogenous*
TR32	Aydin, Denizli, Mugla	2,179594	1,753772	0,908913	*Non-Innovative with potential*
TR33	Manisa, Afyon, Kütahya, Usak	1,552368	1,270574	0,933772	*Lagging Regions*
TR41	Bursa, Eskisehir, Bilecik	2,529718	1,538560	2,288915	*Nearly endogenous*
TR42	Kocaeli, Sakarya, Düzce, Bolu, Yalova	2,486589	2,284177	1,479316	*Endogenous*
TR51	Ankara	4,689622	3,640434	2,365311	*Endogenous*
TR52	Konya, Karaman	2,465318	1,495371	2,053372	*Nearly endogenous*
TR61	Antalya, Isparta, Burdur	2,373678	1,928221	0,719637	*Non-Innovative with potential*
TR62	Adana, Mersin	1,529787	1,397502	0,800691	*Lagging Regions*
TR63	Hatay, Kahramanmaras, Osmaniye	1,241584	1,193185	0,325963	*Lagging Regions*
TR71	Kirikkale, Aksaray, Nigde, Nevsehir,	1,383603	1,290489	0,403357	*Lagging Regions*
TR72	Kayseri, Sivas, Yozgat	1,424892	1,558882	1,897504	*Imitative*
TR81	Zonguldak, Karabük, Bartin	1,333481	1,021709	0,539671	*Lagging Regions*
TR82	Kastamonu, Çankiri,Sinop	1,428420	1,023093	0,353426	*Lagging Regions*
TR83	Samsun, Tokat, Çorum, Amasya	1,641621	1,623933	0,242133	*Lagging Regions*
TR90	Trabzon, Ordu, Giresun, Rize, Artvin	1,800526	1,862212	0,260810	*Entrpreneurial*
TRA1	Erzurum, Erzincan, Bayburt	1,555483	1,170490	0,142227	*Lagging Regions*
TRA2	Agri, Kars, Igdir, Ardahan	0,770513	0,924478	0,000031	*Lagging Regions*
TRB1	Malatya, Elazig, Bingöl, Tunceli	1,889397	1,364979	0,231983	*Educated*
TRB2	Van, Mus, Bitlis, Hakkari	0,603505	0,948537	0,032948	*Lagging Regions*
TRC1	Gaziantep, Adiyaman, Kilis	1,100907	1,208344	1,819779	*Imitative*
TRC2	Sanliurfa, Diyarbakir	0,629752	1,072225	0,163189	*Lagging Regions*
TRC3	Mardin, Batman, Sirnak, Siirt	0,508104	0,819813	0,164416	*Lagging Regions*
	AVERAGE VALUE OF REGIONS	**1,854849**	**1,665394**	**0,981955**	

Figure 4.27. Regional Innovation Patterns of Turkish NUTS 2 Regions

According to Capello and Lenzi's (2012) framework, the endogenous innovation pattern is the most straightforward pattern. In this pattern regions are endowed with endogenous conditions for knowledge creation. This provides the primary condition for transforming knowledge into innovation. With the innovation infrastructure, knowledge can be easily transformed into innovation and regional development is possible. Secondly, Capello and Lenzi mentioned creative application pattern. Despite the lack of prerequisites for generating information, some regions can achieve innovative success. This is possible as the region absorbs information from the outside

and combines it with its own entrepreneurial capabilities. Thirdly, the imitative pattern is mentioned. In this pattern, both the prerequisites of knowledge production and the prerequisites of innovation can be absorbed from the outside and a success can be achieved.

Although this framework Capello and Lenzi's draw as much guidance, the situation looks a little different for NUTS 2 regions of Turkey. According to the results of the analysis, five regions meet the definition of endogenous innovation model. These are the regions that stand out with their intense metropolitan characteristics and industrial performances, which lead the country in knowledge production, innovation infrastructure and innovation performance. TR 41 Bursa, Bilecik, Eskişehir and TR 52 Konya, Karaman regions show an innovation capacity performance following these regions. For this reason, these regions are called as nearly endogenous innovation models.

TR 32 Aydın, Denizli, Muğla and TR 61 Antalya, Isparta Burdur region shows a different model characteristic than that defined by Capello and Lenzi. Although these regions possess qualified manpower, the conditions for the production of information and sufficient level of innovation infrastructure, these regions are not able to achieve innovative success. Therefore, these two regions are called non-innovative with potential regions.

TR 72 Kayseri, Sivas, Yozgat and TR C1 Gaziantep, Adıyaman, Kilis regions conform to the definition of Capello and Lenzi's imitative innovation model.

Apart from these, the two regions stand out with their different characteristics. The first of these TR 90 Trabzon, Ordu, Giresun, Rize, Artvin, Gumushane region. Although this region is insufficient for the production of information, it has an entrepreneurial culture. On the other hand, it does not seem to have achieved innovative success. As such, it is similar to the creative innovation model of Capello and Lenzi, but is not the exact equivalent. With these characteristics, it was named as the entrepreneurial region. Another region that attracts attention is TR B1 Malatya,

Elazığ, Bingöl and Tunceli. This region comes to the forefront with trained manpower. However, the prerequisites for innovation are insufficient. In addition, its innovative performance is low compared to other regions. For this reason, it was named only educated.

The remaining thirteen regions lagged behind the other regions in the three titles analyzed. This analysis is vibrant because it evaluates the regions from three different angles. Regions are named according to their innovation characteristics as endogenous, nearly endogenous, non-innovative with potential, educated, imitative and lagging.

4.4.3. Openness Evaluation of NUTS 2 Regions of Turkey

To determine the openness of regions, for both openness indicators, it is examined the values of the individual regions were below or above the average value of all regions. As a result, regions with values above average in both indicators or in one of the indicators were considered to have openness.

NUTS_ID	REG_NAME	Exp_per_act_pop	FOC_per_M	O= Open C=Close
TR10	Istanbul	12358,906	30,100	O
TR21	Tekirdag, Edirne, Kirklareli	1619,463	122,525	O
TR22	Balikesir, Çanakkale	980,064	32,593	O
TR31	Izmir	4938,083	100,320	O
TR32	Aydin, Denizli, Mugla	3033,692	20,062	O
TR33	Manisa, Afyon, Kütahya, Usak	2189,879	49,645	O
TR41	Bursa, Eskisehir, Bilecik	7164,601	93,789	O
TR42	Kocaeli, Sakarya, Düzce, Bolu, Yalova	9050,157	164,093	O
TR51	Ankara	3050,628	34,842	O
TR52	Konya, Karaman	2127,323	15,927	C
TR61	Antalya, Isparta, Burdur	1244,089	39,364	O
TR62	Adana, Mersin	2226,394	22,742	C
TR63	Hatay, Kahramanmaras, Osmaniye	3178,045	7,366	O
TR71	Kirikkale, Aksaray, Nigde, Nevsehir,	721,285	32,590	O
TR72	Kayseri, Sivas, Yozgat	1994,315	9,132	C
TR81	Zonguldak, Karabük, Bartin	1645,310	4,914	C
TR82	Kastamonu, Çankiri,Sinop	753,769	8,671	C
TR83	Samsun, Tokat, Çorum, Amasya	677,968	13,661	C
TR90	Trabzon, Ordu, Giresun, Rize, Artvin,	1655,622	12,590	C
TRA1	Erzurum, Erzincan, Bayburt	74,013	8,000	C
TRA2	Agri, Kars, Igdir, Ardahan	392,068	2,625	C
TRB1	Malatya, Elazig, Bingöl, Tunceli	862,087	6,135	C
TRB2	Van, Mus, Bitlis, Hakkari	194,856	0,000	C
TRC1	Gaziantep, Adiyaman, Kilis	7878,717	2,323	O
TRC2	Sanliurfa, Diyarbakir	315,657	0,898	C
TRC3	Mardin, Batman, Sirnak, Siirt	2720,087	1,887	C
	MEAN VALUE	2809,503	32,184	

Figure 4.28. Openness Evaluation of Regions

CHAPTER 5

A TAXONOMY OF TURKISH NUTS 2 REGIONS

In order to identifying different regional pathways for smart specialization, the findings of the three axes; which are regions' distinctive industries, regional innovation capacities, and openness of regions, have been examined and presented in detail in the previous chapter.

In this chapter, first of all, factor analysis findings about which indicators for these axes will be used for regional classification are presented. Secondly, the results of regional taxonomy were displayed and mapped at three different levels.

5.1. Findings of Factor Analysis

Factor analysis was applied to understand which indicators of the three criteria mentioned in the previous sections are the determining factor.

In the factor analysis, the case studies in the literature were examined and the following points were taken into consideration. For the Kaiser-Meyer-Olkin sample suitability test, a value of 0.6 was considered a threshold. Promax rotation with Kappa 4 value was used. Those with an eigenvalue value of 1 or higher were accepted. In the sieving of variables, variables with reverse-image values below 0.5 were sieved. In addition, loading of variables with loading value close to multiple patterns is eliminated. In total variance adequacy, 70 percent and above were considered sufficient.

5.1.1. Determinant Factors of Regions' Distinctive Industries

Firstly, factor analysis was conducted to determine which regional clusters were the determining factor. In the previous chapter, the three-star method used to determine the presence of clusters operating in the country in NUTS 2 regions based on input-output tables is mentioned. From the size, dominance and specialization data that

emerged while applying this method, 11 cluster based specialization values of the regions were used in the regional taxonomy study. Size and dominance data were not used because they were not comparable. Factor analysis was performed on the specialization (LQ) values of the regions belonging to 11 clusters.

Table 5.1. *KMO and Bartlett's Test for Factor Analysis 1*

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,608
Bartlett's Test of Sphericity	Approx. Chi-Square	116,478
	df	28
	Sig.	,000

As a result of this analysis, 1 (construction), 6 (advertising and publishing), 11 (new service economies) variables were extracted from LQ data of 11 clusters. 8 variables remained significant.

Table 5.2. *Total Variance Explained for Factor Analysis 1*

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	3,581	44,765	44,765	3,581	44,765	44,765	3,575
2	2,101	26,268	71,033	2,101	26,268	71,033	2,123
3	,882	11,025	82,058				
4	,622	7,773	89,830				
5	,269	3,366	93,196				
6	,268	3,351	96,547				
7	,203	2,535	99,082				
8	,073	,918	100,000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Two basic factors have emerged. Factor 1 was named services-sector-oriented and Factor 2 was named agriculture-and-tourism-oriented and recorded as variable.

Table 5.3. *Pattern Matrix 1*

Pattern Matrix[a]

	Component	
	1	2
LQ2	,900	
LQ10	,844	-,320
LQ7	,842	
LQ8	-,716	-,383
LQ3	,657	
LQ5	-,624	
LQ4		,943
LQ9		,926

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

5.1.2. Determinant Factors of Regional Knowledge Bases and Innovation Capacities

Secondly, factor analysis was conducted on 16 variables in which we examined regional innovation capacities.

Table 5.4. *KMO and Bartlett's Test 2*

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,779
Bartlett's Test of Sphericity	Approx. Chi-Square	455,196
	df	91
	Sig.	,000

According to the results Unique Design and Lobour power data were extracted. The number of variables has decreased to 14.

Table 5.5. *Total Variance Explained for Factor Analysis 2*

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	8,698	62,127	62,127	8,698	62,127	62,127	7,642
2	1,810	12,926	75,053	1,810	12,926	75,053	7,096
3	1,130	8,071	83,125	1,130	8,071	83,125	2,378
4	,761	5,437	88,562				
5	,648	4,628	93,190				
6	,385	2,749	95,939				
7	,177	1,263	97,202				
8	,112	,800	98,003				
9	,109	,780	98,783				
10	,083	,595	99,378				
11	,042	,299	99,677				
12	,020	,144	99,821				
13	,017	,118	99,939				
14	,009	,061	100,000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Three factors emerged and were named according to the weight of their components. Factor 1 was named as Knowledge-Intensive, Factor 2 was named as Innovation-Centers, and Factor 3 was named as Weak-Entrepreneurship.

Table 5.6. *Pattern Matrix 2*

Pattern Matrix[a]

	Component		
	1	2	3
RD_Exp	1,005	-,369	
Utility_M	,918		
Doctorate	,911		
Tertiary	,859		
HRST	,783		
Technop	,620		
Pop_Dens	-,382	1,185	
Incubation		,791	
TTOs		,761	
Trademark	,313	,672	
Patent	,438	,510	
Self_Emp			-,762
ICT_share		,537	,708
Venture	,544	,390	-,624

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

5.1.3. Determinant Factor of Regional Openness

In this part, factor analysis did not give very meaningful results because it was done on two variables. However, the factor of these two variables was recorded as a single variable. The test results are as follows.

Table 5.7. *KMO and Bartlett's Test 3*

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,500
Bartlett's Test of Sphericity	Approx. Chi-Square	5,382
	df	1
	Sig.	,020

Table 5.8. *Total Variance Explained for Factor Analysis 2*

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1,452	72,620	72,620	1,452	72,620	72,620
2	,548	27,380	100,000			

Extraction Method: Principal Component Analysis.

Table 5.9. *Pattern Matrix 3*

Component Matrix[a]

	Component
	1
Exp_per_act_pop	,852
FOC_per_M	,852

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

5.2. Findings of Hierarchical Cluster Analysis

The hierarchical clustering analysis based on the six factors revealed above was performed by the Ward's method. The result is the following dendogram. Regional clusters can be named with 2 macros, 5 mezzos and 11 micro clusters on this dendogram

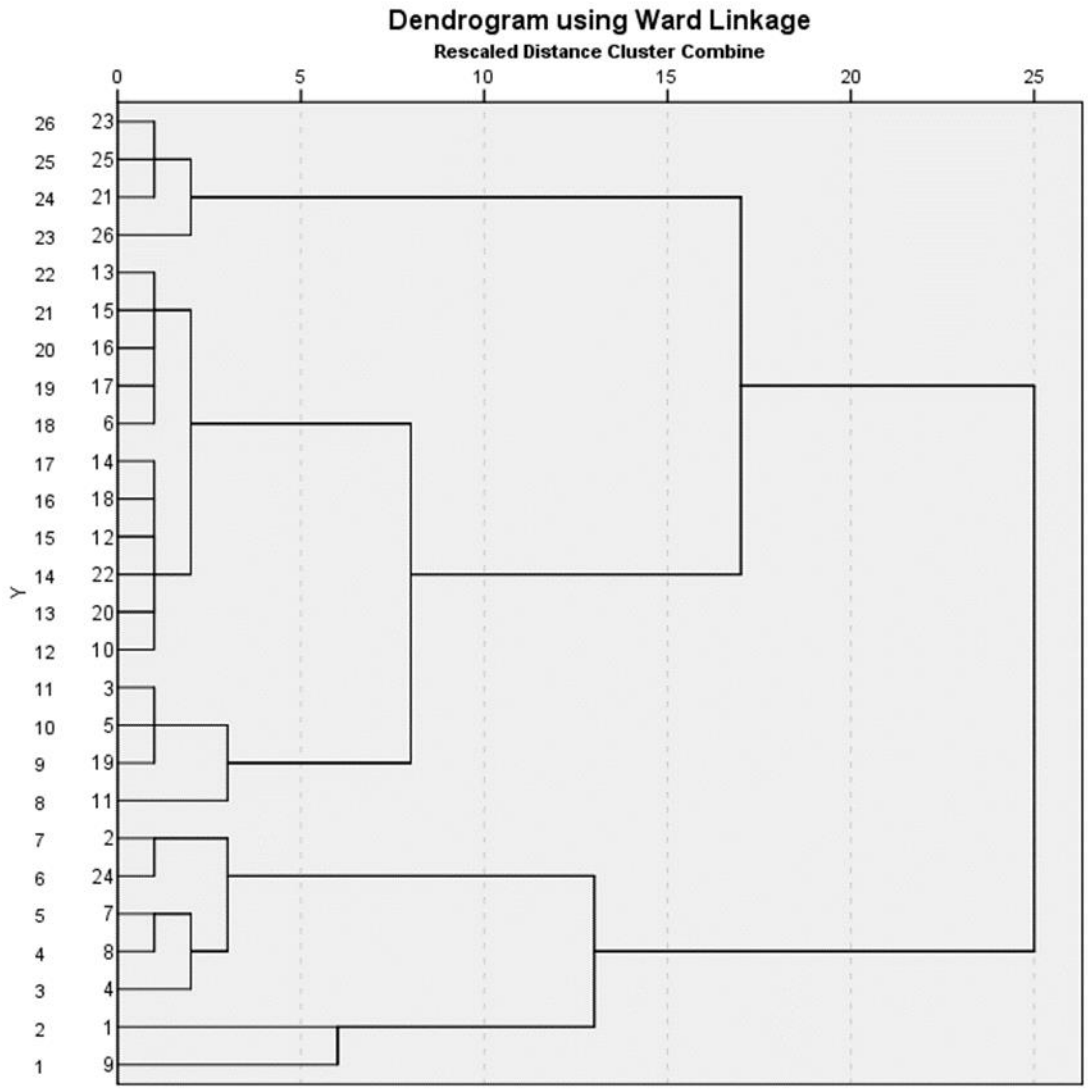


Figure 5.1. Cluster Combination through Cluster Analysis

When the regional cluster combinations were named, the factor scores of the 6 factors used in the analysis on the regional clusters played the main role. However, in order to make meaningful denotation towards micro-level taxonomy, that is, as getting in detail, regional analyzes in chapter-four were also used. As a result, final denotations are shaped as below figure.

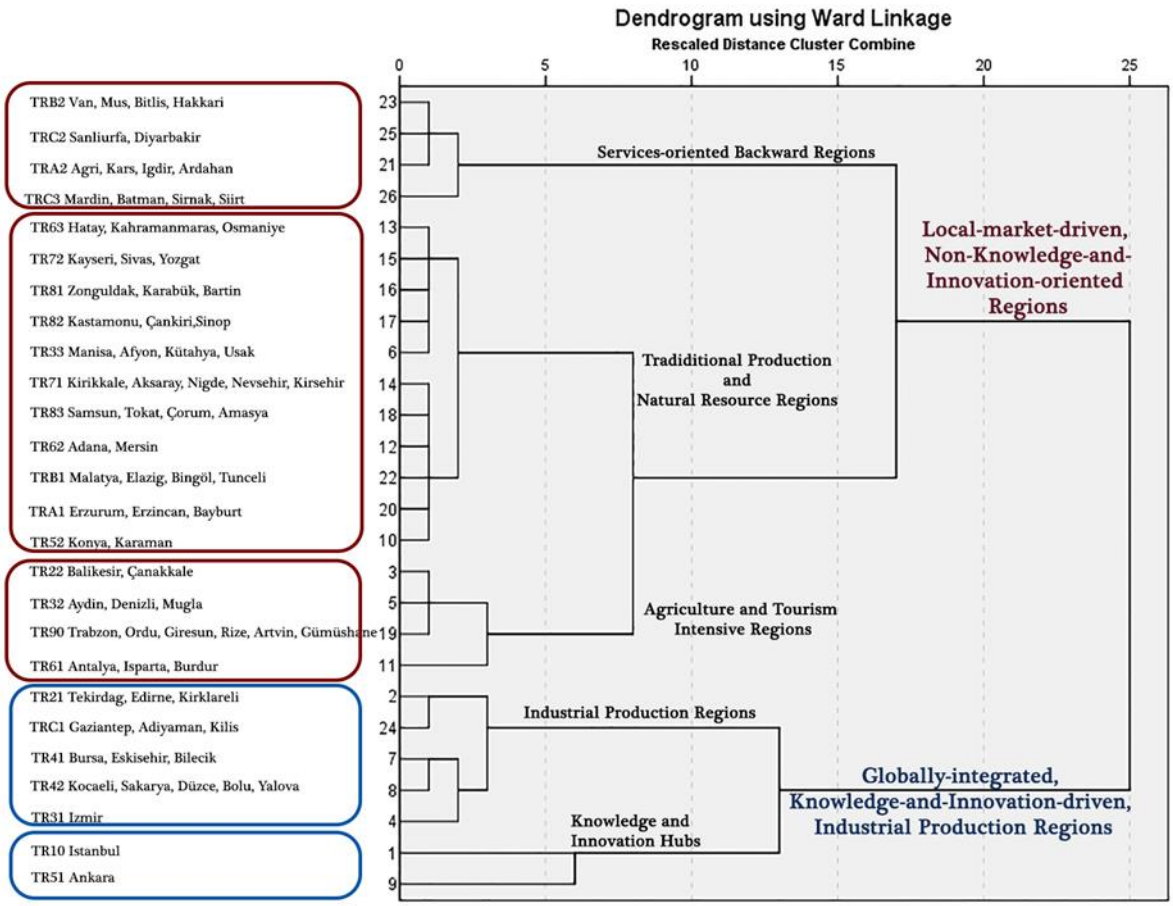


Figure 5.2. Denotation of Macro-level and Mezzo-level Clusters

Together with micro-level clusters, denotations are finalized as below figure.

Denotation of Clusters				
Macro-level	**Mezzolevel**	**Microlevel**	**Region ID**	**Region No.**
Local-market-driven, Non-Knowledge-and-Innovation-oriented Regions	Services-oriented Backward Regions	Service-oriented, Inertia Regions	TRB2	**23**
			TRC2	**25**
			TRA2	**21**
		Non-entrpreneur Backward Region with Certain ICT Investment	TRC3	**26**
	Traditional Production and Natural Resource Regions	Medium-tech Manfacturing Regions	TR63	**13**
			TR72	**15**
			TR81	**16**
			TR82	**17**
			TR33	**6**
		Agricultural Production Regions with Certain Services Sector	TR71	**14**
			TR83	**18**
			TR62	**12**
			TRB1	**22**
			TRA1	**20**
			TR52	**10**
	Agriculture and Tourism Intensive Regions	Agriculture and Tourism Regions with Entrepreneurial Potential	TR22	**3**
			TR32	**5**
			TR90	**19**
		Highly-specialized Region in Agriculture and Tourism	TR61	**11**
Globally-integrated, Knowledge-and-Innovation-driven, Industrial Production Regions	Industrial Production Centers	Export-oriented Regions Specialized in Traditional Sector	TR21	**2**
			TRC1	**24**
		Export-oriented Production Regions	TR41	**7**
			TR42	**8**
		Globally-integrated, Highly-innovative Region	TR31	**4**
	Knowledge and Innovation Hubs	Globaly-integrated, National Innovation Hub	TR10	**1**
		Service-oriented, Knowledge-intensive Capital Region	TR51	**9**

Figure 5.3. Denotation of Clusters

5.2.1. Macro-level Clusters

Considering the all NUTS 2 levels regions, in the context of smart specialization, the sharpest distinction was made as above, in the light of indicators for industrial activities, innovation capacities and openness of the regions.

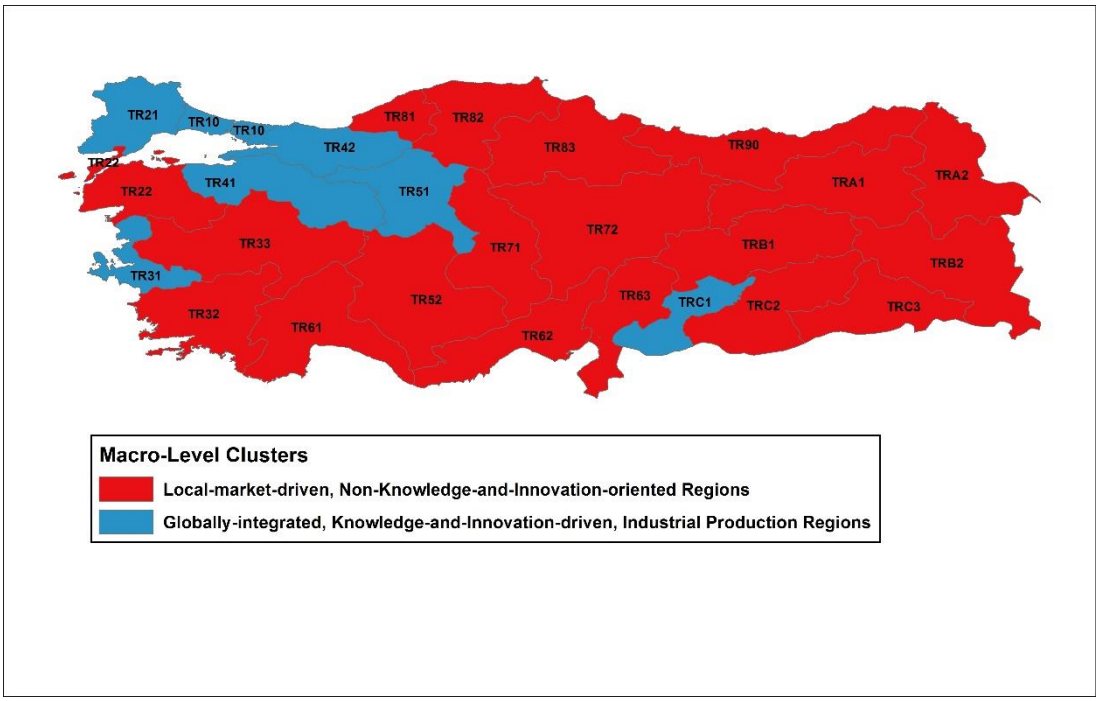


Figure 5.4. Macro-level Clusters

5.2.1.1. Globally-integrated, Knowledge-and-Innovation-driven, Industrial Production Regions

The seven regions of the country have differentiated from the other 19 regions in terms of their integration into the global world, their openness to the foreign market, their intensity of science and technology and their innovation activities. According to 2017 TURKSTAT data, these 7 regions produce 62.72 percent of the national GVA.

The three major cities of the country, İstanbul, Ankara and İzmir, naturally belong to this class, as well as the industrial infrastructures of other cities and their access to the global market are the distinguishing features of these regions.

5.2.1.2. Local-market-driven, Non-Knowledge-and-Innovation-oriented Regions

The 19 regions in this group are mainly separated from the other 7 regions, especially in terms of export performances and innovation activities. It is observed in these regions that industrial activities are directed towards the internal market. The weakness of the manpower with a high level of education, except for a few regions, is also observed in these regions. In terms of innovation indicators, all 19 regions are below the national average. These 19 regions produce remaining 37.28 percent of the national GVA.

5.2.2. Mezzo-level Clusters

The macro-level divided into two regional classes, the first of which is divided into two, the second is divided into three, forming middle-level regional clusters with five classes. This 5-class distinction means more about the characteristics of the regions. These are explained in detail below.

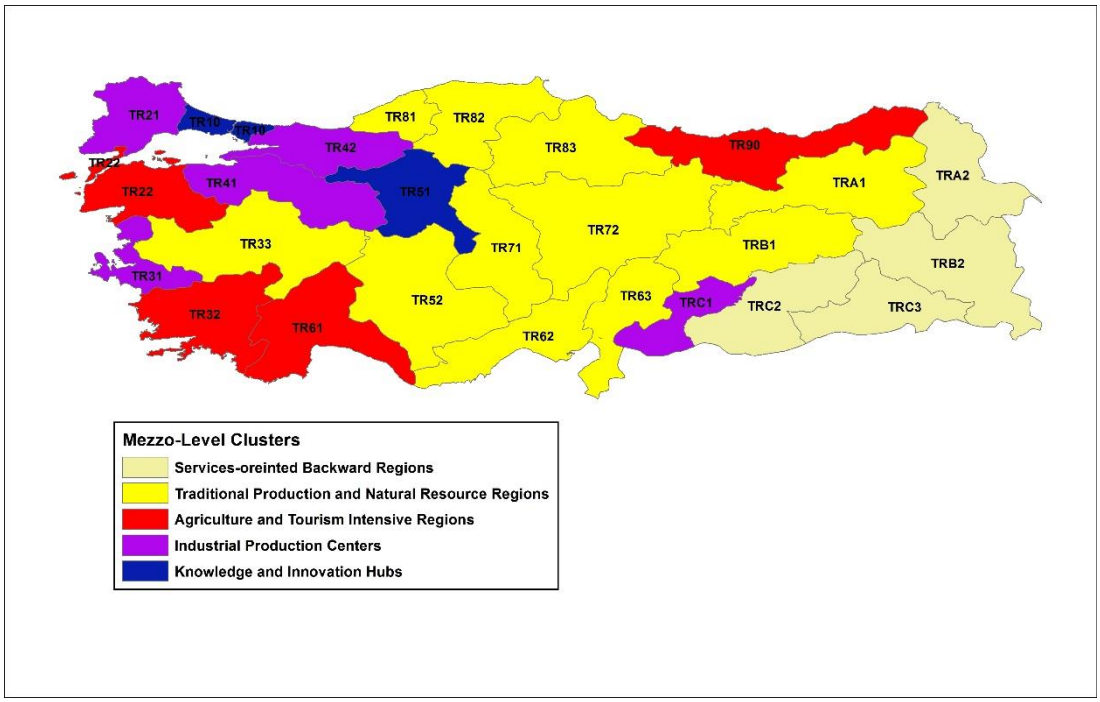


Figure 5.5. Mezzo-level Clusters

5.2.2.1. Knowledge and Innovation Hubs

The two largest cities of the country, Istanbul and Ankara, are both NUTS 2 regions in their own right and the two regions together form the first class of this mezzo-level taxonomy work.

Forty percent of the nationally generated value added is produced only by these two regions. While Ankara exhibits a significant performance in terms of its trained manpower, average education level and similar subjects, Istanbul plays role of the country's innovation center. In addition to the population densities of these regions, the diversity in industrial activities is higher than in other regions as they are the administrative and commercial centers of the country.

5.2.2.2. Industrial Production Centers

The five regions that undertake the industrial production load of the country are grouped in this class. Although it does not have as much metropolitan features as Istanbul and Ankara, it has high population, urban opportunities, trained manpower, strong production infrastructure and export capacity. Together, these five regions account for 22.45 percent of the value added generated in the country. Of the five regional clusters in the mezzo-level classification, the most outward-oriented regions in terms of export figures and the number of foreign-owned firms were also collected in this class.

5.2.2.3. Agriculture and Tourism Intensive Region

The regions most identified with the agriculture and tourism sectors in the mezzo-level classification are grouped in this class, and with these characteristics they are sharply distinguished from the other 4 classes. Agriculture and tourism activities are

the main sources of the 4 regions of this class. In fact, the intensity of activity in the agricultural and tourism sectors suppressed the industrial activities in the regions. However, the regions where the average unemployment rate is the lowest in this country are gathered in this class.

In addition, there are considerable entrepreneurial activities in these regions. Regions in this class have high levels of education and manpower, but innovation infrastructure and activities are insufficient.

5.2.2.4. Traditional Production and Natural Resource Regions

Regarding the factors that are decisive in this classification study, the regions that cannot be separated from other regions with certain characteristics are collected in this class. So much so that 11 of the 26 regions of Turkey has created this class. There are productive activities that do not stand out in these regions which have average values in 6 factors used. The performance of these regions in terms of openness and integration into the global market cannot be mentioned.

These regions are also insufficient in terms of innovation infrastructure and activities, educated manpower and entrepreneurship activities.

5.2.2.5. Services-oriented Backward Regions

These four regions clustered in the south-eastern anatolian region of the country show lagging characteristics compared to other regions in all aspects used in this study. To put it a little bit, the activities in these regions consist of existing urban service activities. Knowledge-oriented manpower is minimal. Innovation activities are almost non-existent. In parallel, these regions are also far from all kinds of entrepreneurial activities. The observation of the highest unemployment rates in these regions also supports this conclusion.

5.2.3. Micro-level Clusters

The 11-cluster taxonomy obtained from micro-level classification is as follows.

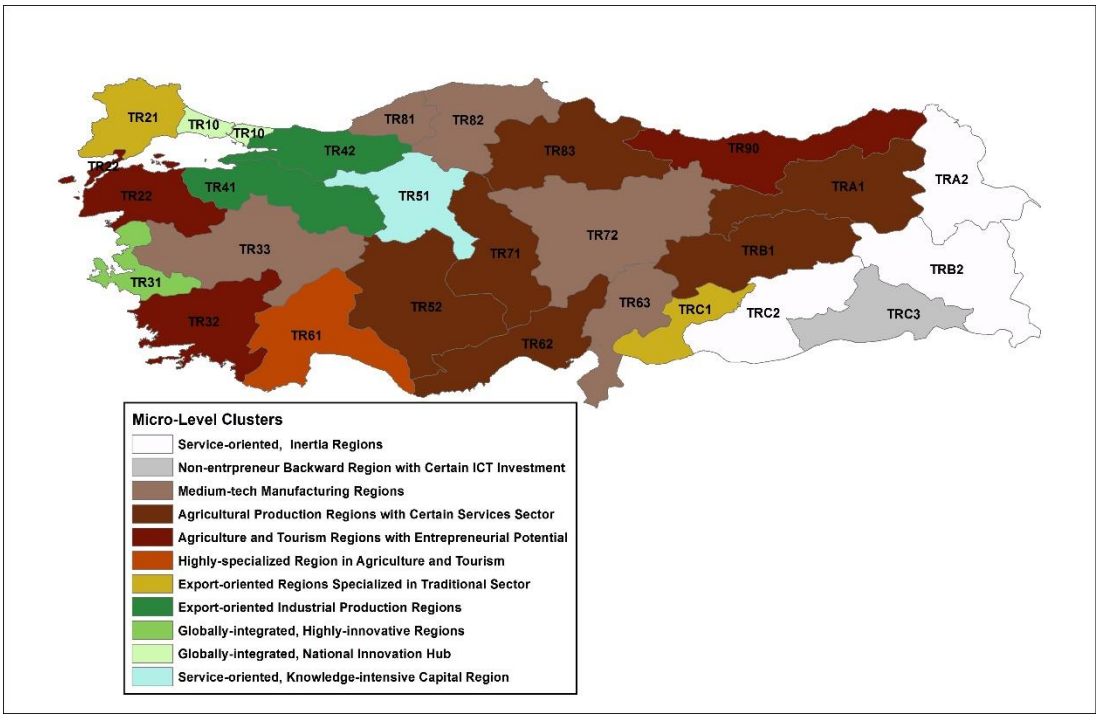


Figure 5.6. Micro-level Clusters

5.2.3.1. Service-oriented Knowledge-intensive Capital Region

There are reasons for Ankara to be a separate region in this classification. In detail, Ankara is the region with the highest density of urban services. In addition, the region with the highest share of knowledge-oriented human capital with a high level of education is again the Ankara region. However, despite the high level of innovation infrastructure and outputs, the rate of entrepreneurship activities remains low.

5.2.3.2. Globally-integrated, National Innovation Hub

TR 10 The Istanbul region continues to assume the dominant role in the country in many ways. Especially, it is the innovation center of the country with its institutions that will accelerate the innovation, number of patents and registrations, population density and playing an active role globally.

According to TUIK 2017 data, 31.2 percent of GVA of Turkey meets by Istanbul. On the other hand, its industrial structure exhibits multi-sectoral characteristics. It can be said that all sectors and sub-sectors are active in the Istanbul region.

5.2.3.3. Globally-integrated, Highly-innovative Region

Similar to the Istanbul region, the TR 31 Izmir region plays a globally active role. It is a regional center with a high level of educated manpower, knowledge-oriented production and innovation capacity.

5.2.3.4. Export-oriented Industrial Production Regions

TR 41 and TR 42 regions constitute the export-oriented industrial production zone of the country. Together, these two regions cover 11.7 percent of the country's GVA (TURKSTAT, 2017). After three major metropolises in the country, the regions with the highest innovation capacity are grouped in this class.

5.2.3.5. Export-oriented Regions Specialized in Traditional Sector

In this class TR 21 Tekirdağ, Kırıklareli; and TR C1 Gaziantep, Adıyaman, Kilis regions are the important regions in export with their traditional industrial production structures. However, since these production activities are low-tech, the added value produced remains limited.

5.2.3.6. Highly-specialized Region in Agriculture and Tourism

TR 61 Antalya, Isparta, Burdur region is separated from all other regions by its very high level of specialization in agriculture and tourism sectors. In parallel, the intensity of entrepreneurship activities is high.

5.2.3.7. Agriculture and Tourism Regions with Entrepreneurial Potential

This class of TR22, TR32 and TR90 regions has an economy focused on agriculture and tourism. However, they do not specialize in these sectors as much as the TR 61 region. The regions with the highest performance in terms of their entrepreneurial activities are these regions. The regions with the lowest unemployment rates are again these regions according to TURKSTAT 2018 data. However, innovation infrastructure is almost non-existent.

5.2.3.8. Agricultural Production Regions with Certain Services Sector

With the six regions it hosts, the most regions in the micro-level classification are in this class. Regions in this class are separated from other regions due to the intense traditional agricultural production activities. On the other hand, in these regions with limited metropolitan features, service-oriented activities are not less than in backward regions.

5.2.3.9. Medium-tech Manufacturing Regions

This class is composed of TR 33, TR 63, TR 72, TR 81 and TR 82 regions. The common feature of these regions is that they have their own industrial production activities. Although these production activities are not high value added, they are mostly oriented towards the domestic market. Moreover, it does not show knowledge-oriented and innovative features. Existing entrepreneurship activities remain limited.

5.2.3.10. Non-entrepreneur Backward Region with Certain ICT Activity

TR C3 Mardin, Batman, Şırnak, Siirt region, which constitute this class alone, have distinctive characteristics from other regions. The most striking feature of this region is that according to 2016 TURKSTAT data, considering the ratio of initiatives related to information and communication technologies in the initiatives, it is one of the 3 regions with the highest share in the country together with Ankara and Istanbul regions.

In addition, total entrepreneurship activities show the lowest performance in 26 regions. Furthermore, the second highest unemployment rate in the country is observed here after the TR B2 region.

5.2.3.11. Service-oriented, Inertia Regions

The regions with the highest unemployment rates were collected in this class. The regions TR A2, TR B2, and TR C2 show backward characteristics in many respects compared to the other 23 regions. Even production resources for natural resources in these regions are limited. In parallel to the lack of metropolitan characteristics, innovation capacities, average education levels and entrepreneurship activities are again the lowest in the country.

CHAPTER 6

CONCLUSION

6.1. General Evaluation

The research topic of this study is to reveal the regional potentials for smart specialization. For this purpose, the concept of smart specialization as a regional development paradigm has been discussed and examined by considering theoretical arguments. The characteristics of this concept have been introduced and a research design has been developed for Turkish NUTS 2 regions.

The *smart* side of smart specialization is not only that it provides solutions for regions that are successful in economic, technological and innovative aspects. It is *smart* because it claims to offer different road maps with strategic thinking approach for each type of region. On the other hand, the specialization part of the concept refers to the protection, development and adaptation of the specialties of the regions to the driving areas of economic growth (Nano-technology, information and communication technologies, etc.).

Accordingly, the starting point for regional development strategies for smart specialization is the comprehensive analysis of regions. This comprehensive analysis process includes the discovery of the areas of expertise of the regions, the discovery of the activity groups associated with these areas, the innovative infrastructures and capabilities of the regions, the level of trained manpower they possess, and the level of connectivity of the regions to global or local markets. Therefore, in this thesis, these analyzes for the potential intelligent specializations of the regions were made with scientific methods. At the point of the study, 11 different regional clusters emerged at the micro-level, showing distinctive features in the context of smart specialization. These regional clusters are shaped according to the strengths or weaknesses of the

regional distinctive industrial specializations, the openness of the regions, and the innovation capacity of the regions, which can be called the three pillars of smart specialization.

6.2. Future Directions of Study

The study provides a general analysis of smart specialization based on available data. The next stage may be the evaluation of production areas in which the regions are specialized together with the sub-sector links. In addition, for each different micro-cluster, complementary and triggering sectors can be identified, and the status of these sectors in these clusters can be determined and production-oriented road maps can be determined. While doing this, the openings and closures of the regions and their innovation capacities should be taken into consideration. Moreover, by analyzing the anatomy of interventional discovery processes better, detailed studies on smart specialization are among the possible future directions of this study.

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APPENDICES

A. MATCHING TABLES FOR CPA 2008 AND NACE REV.-2 CLASSIFICATIONS

Table A.1. *NACE and CPA Matching*

Faaliyet kodu Activity code	**Faaliyet Grupları (*)** **(NACE Rev.2 Sınıflandırmasına Göre)** Branch of activities according to NACE Rev.2 Classification (*)	**CPA (Ürün kod)**	**No**
01	Bitkisel Ve Hayvansal Üretim	A 01	1
02	Ormancılık Ve Tomrukçuluk	A 02	2
03	Balıkçılık Ve Su Ürünleri Yetiş.	A 03	3
05	Kömür Ve Linyit Çıkartılması	B	4
06	Ham Petrol Ve Doğalgaz Çıkarımı		
07	Metal Cevheri Madenciliği		
08	Diğer Madencilik Ve Taş Ocak.		
09	Madenciliği Destekleyici Hizmet		
10	Gıda Ürünleri İmalatı	C10-C12	5
11	İçecek İmalatı		
12	Tütün Ürünleri İmalatı		
13	Tekstil Ürünleri İmalatı	C13-C15	6
14	Giyim Eşyaları İmalatı		
15	Deri Ve İlgili Ürünler İmalatı		
16	Ağaç,Ağaç Ürünleri Ve Mantar Ür.	C 16	7

Table A.1 (continued)

17	Kağıt Ve Kağıt Ürünleri İmalatı	C 17	8
18	Kayıtlı Medyanın Basılması Ve Çoğ.	C 18	9
19	Kok Kömürü Ve Petrol Ürün. İm.	C 19	10
20	Kimyasal Ürünleri İmalatı	C 20	11
21	Eczacılık Ve Ecz.İlişkin Mal.İm..	C 21	12
22	Kauçuk Ve Plastik Ürünler İm.	C 22	13
23	Metalik Olmayan Ürünler İma.	C 23	14
24	Ana Metal Sanayi	C 24	15
25	Fabrik.Metal Ürün.(Mak.Tec.Har)	C 25	16
26	Bilgisayar, Elekronik Ve Optik Ür.	C 26	17
27	Elektrikli Techizat İmalatı	C 27	18
28	Makine Ve Ekipman İmalatı	C 28	19
29	Motorlu Kara Taşıtı Ve Römork İm.	C 29	20
30	Diğer Ulaşım Araçları İmalatı	C 30	21
31	Mobilya İmalatı	C 31-C32	22
32	Diğer İmalatlar		
33	Makine Ve Ekipman.Kurulumu Ve On.	C 33	23
35	Elk.Gaz,Buhar Ve Hava.Sis.Üret.Da.	D 35	24
36	Suyun Toplanması Arıtılması Ve Dağt.	E 36	25
37	Kanalizasyon	E37-E39	26
38	Atık Maddelerin Değerlendirilmesi		
39	İyileştirme Ve Diğer Atık Yön.Hiz.		

Table A.1 (continued)

41	Bina İnşaatı	F	27
42	Bina Dışı Yapıların İnşaatı		
43	Özel İnşaat Faaliyetleri		
45	Toptan Ve Per.Tic.Ve Mot.Taşıt.On.	G 45	28
46	Toptan Tic.(Mot.Taşıt.Onar.Hariç)	G46	29
47	Perakende Tic.(Mot.Taşıt.Onar.Har)	G 47	30
49	Kara Taşıma.Ve Boru Hattı Taşıma.	H 49	31
50	Su Yolu Taşımacılığı	H 50	32
51	Havayolu Taşımacılığı	H 51	33
52	Taşıma.İçin Depolama Ve Destek.Fa.	H 52	34
53	Posta Ve Kurye Faaliyetleri	H 53	35
55	Konaklama	I	36
56	Yiyecek Ve İçecek Hizmeti Faal.		
58	Yayımcılık Faaliyetleri	J 58	37
59	Sinema Filmi Ve Ses Kaydı Yayımcılı.	J59-J60	38
60	Programcılık Ve Yayıncılık Faal.		
61	Telekominikasyon	J 61	39
62	Bilgisayar Programlama Ve Danış.	J62-J63	40
63	Bilgi Hizmet Faaliyetleri		
64	Finansal Hizmet.(Sig.Ve Emek.Har.)	K 64	41
65	Sigorta Reas.Emek.Fonl(Zor.S.G.Hariç)	K 65	42
66	Finans.Ve Sig.Hiz.İçin Yard.Faal.	K 66	43

Table A.1 (continued)

68	Gayrimenkul Faaliyetleri	L 68B	44
69	Hukuki Ve Muhasebe Faaliyetleri	M69-M70	45
70	İdari Danışmanlık Faaliyetleri		
71	Mimarlık Ve Mühendislik Faaliyeti	M 71	46
72	Bilimsel Araştırma Ve Geliş.Faal.	M 72	47
73	Reklamcılık Ve Pazar Araştırması	M 73	48
74	Diğer Mesleki,Bilim.Ve Tek.Faal.	M74-M75	49
75	Veterinerlik Hizmetleri		
77	Kiralama Ve Leasıng Faaliyetleri	N 77	50
78	İstihdam Faaliyetleri	N 78	51
79	Seyahat Acentesi,Tur Oper.Rez.Hiz	N 79	52
80	Güvenlik Ve Soruşturma Faaliyet.	N80-N82	53
81	Bina Ve Çevre Düzenleme Faaliyet.		
82	Büro Yönetimi,Büro Desteği Faal.		
84	Kamu Yön.Ve Savunma,Zor.Sos.Güv.	O 84	54
85	Eğitim	P 85	55
86	İnsan Sağlığı Hizmetleri	Q 86	56
87	Yatılı Bakım Faaliyetleri	Q87-Q88	57
88	Sosyal Hizmetler		
90	Yaratıcı Sanatlar,Eğlence Faal.	R90-R92	58
91	Kütüphane,Arşiv Ve Müzeler		
92	Kumar Ve Müşterek Bahis Faal		

Table A.1 (continued)

93	Spor, Eğlence Ve Dinlence Faal.	R 93	59
94	Üye Olunan Kuruluş Faaliyetleri	S 94	60
95	Bilgisayar Ve Kişisel Ev Eşya.Onar.	S 95	61
96	Diğer Hizmet Faaliyetleri	S 96	62
97*	Ev İçi Çalışanların Faaliyetleri	T	T
98*	Hanehalkları Tar.Kendi İht.Faal.		
99*	Uluslararası Örgüt Ve Tems.Faal.	U	U
*	***Excluded Activity Groups***		

Table A.2. *Numbering and codes of CPA*

Previous and Correct Numbering		
No	Ürün kod (CPA 2008) Product code (CPA 2008)	Ürün tanım (CPA 2008) Product definition (CPA 2008)
1	A01	Tarım ve avcılık ürünleri ve ilgili hizmetler Products of agriculture, hunting and related services
2	A02	Orman ürünleri ve ilgili hizmetler Products of forestry, logging and related services
3	A03	Balık ve diğer balıkçılık ürünleri; su ürünleri; balıkçılık için destekleyici hizmetler Fish and other fishing products; aquaculture products; support services to fishing
4	B	Madencilik ve Taşocakçılığı Mining and quarrying
5	C10-C12	Gıda, içecekler ve tütün ürünleri Food, beverages and tobacco products
6	C13-C15	Tekstil, giyim eşyası, deri ve ilgili ürünler Textiles, wearing apparel, leather and related products
7	C16	Kereste, ağaç ürünleri ve mantar ürünleri (mobilya hariç); hasır ve örme malzemesinden (saz, saman vb.) ürünler Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials
8	C17	Kağıt ve kağıt ürünleri Paper and paper products
9	C18	Basım ve kayıt hizmetleri Printing and recording services
10	C19	Kok ve rafine petrol ürünleri Coke and refined petroleum products
11	C20	Kimyasallar ve kimyasal ürünler Chemicals and chemical products
12	C21	Temel eczacılık ürünleri ve müstahzarları Basic pharmaceutical products and pharmaceutical preparations
13	C22	Kauçuk ve plastik ürünler Rubber and plastic products

Table A.2 (continued)

14	C23	Diğer metalik olmayan mineral ürünleri Other non-metallic mineral products
15	C24	Ana metaller Basic metals
16	C25	Fabrikasyon metal ürünler, makine ve ekipmanlar hariç Fabricated metal products, except machinery and equipment
17	C26	Bilgisayarlar ile elektronik ve optik ürünler Computer, electronic and optical products
18	C27	Elektrikli teçhizat Electrical equipment
19	C28	Başka yerde sınıflandırılmamış makine ve ekipmanlar Machinery and equipment n.e.c.
20	C29	Motorlu kara taşıtları, treyler (römork) ve yarı treyler (yarı römork) Motor vehicles, trailers and semi-trailers
21	C30	Diğer ulaşım araçları Other transport equipment
22	C31_C32	Mobilya ve diğer mamul eşyalar Furniture and other manufactured goods
23	C33	Makine ve ekipmanların kurulumu ve onarımı Repair and installation services of machinery and equipment
24	D35	Elektrik, gaz, buhar ve iklimlendirme Electricity, gas, steam and air conditioning
25	E36	Doğal su; suyun arıtılması ve temini hizmetleri Natural water; water treatment and supply services
26	E37-E39	Kanalizasyon hizmetleri, kanalizasyon çamuru; atığın toplanması, işlenmesi ve bertarafı; maddelerin geri kazanımı; iyileştirme hizmetleri ve diğer atık yönetimi hizmetleri Sewerage services; sewage sludge; waste collection, treatment and disposal services; materials recovery services; remediation services and other wa...
27	F	İnşaatlar ve inşaat işleri Constructions and construction works
28	G45	Toptan ve perakende ticaret ile motorlu kara taşıtlarının ve motosikletlerin onarım hizmetleri Wholesale and retail trade and repair services of motor vehicles and motorcycles
29	G46	Toptan ticaret, motorlu kara taşıtları ve motosikletler hariç Wholesale trade services, except of motor vehicles and motorcycles

Table A.2 (continued)

30	G47	Perakende ticaret (motorlu kara taşıtları ve motosikletler hariç) Retail trade services, except of motor vehicles and motorcycles
31	H49	Kara taşımacılığı ve boru hattı taşımacılığı hizmetleri Land transport services and transport services via pipelines
32	H50	Su yolu taşımacılığı hizmetleri Water transport services
33	H51	Hava yolu taşımacılığı hizmetleri Air transport services
34	H52	Depolama ve destek hizmetleri, taşımacılık için Warehousing and support services for transportation
35	H53	Posta ve kurye hizmetleri Postal and courier services
36	I	Konaklama ve yiyecek hizmetleri Accommodation and food services
37	J58	Yayıncılık hizmetleri Publishing services
38	J59_J60	Sinema filmi, video ve televizyon programı yapımcılık hizmetleri, ses kaydı ve müzik yayımlama; programcılık ve yayıncılık hizmetleri Motion picture, video and television programme production services, sound recording and music publishing; programming and broadcasting services
39	J61	Telekomünikasyon hizmetleri Telecommunications services
40	J62_J63	Bilgisayar programlama, danışmanlık ve ilgili hizmetler; bilgi hizmetleri Computer programming, consultancy and related services; Information services
41	K64	Finansal hizmetler (sigorta ve bireysel emeklilik hariç) Financial services, except insurance and pension funding
42	K65	Sigorta, reasürans ve emeklilik fonları hizmetleri, zorunlu sosyal güvenlik hariç Insurance, reinsurance and pension funding services, except compulsory social security
43	K66	Finansal hizmetler ile sigorta hizmetlerine yardımcı hizmetler Services auxiliary to financial services and insurance services
44	L68B	Gayrimenkul hizmetleri Real estate services excluding imputed rents

Table A.2 (continued)

*45**	*L68A**	*Kendi konutunda ikamet edenler için izafi kira* *Imputed rents of owner-occupied dwellings*
46	M69_M70	Hukuk ve muhasebe hizmetleri; idare merkezi hizmetleri; idari danışmanlık hizmetleri Legal and accounting services;Services of head offices; management consulting services
47	M71	Mimarlık ve mühendislik hizmetleri; teknik test ve analiz hizmetleri Architectural and engineering services; technical testing and analysis services
48	M72	Bilimsel araştırma ve geliştirme hizmetleri Scientific research and development services
49	M73	Reklamcılık ve pazar araştırması hizmetleri Advertising and market research services
50	M74_M75	Diğer mesleki, bilimsel ve teknik hizmetler; veterinerlik hizmetleri Other professional, scientific and technical services and veterinary services
51	N77	Kiralama ve leasing hizmetleri Rental and leasing services
52	N78	İstihdam hizmetleri Employment services
53	N79	Seyahat acentesi, tur operatörü, diğer rezervasyon hizmetleri ve ilgili hizmetler Travel agency, tour operator and other reservation services and related services
54	N80-N82	Güvenlik ve soruşturma hizmetleri; bina ve çevre düzenleme (peyzaj) hizmetleri; büro yönetimi, büro destek ve diğer iş destek hizmetleri Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services
55	O84	Kamu yönetimi ve savunma hizmetleri; zorunlu sosyal güvenlik hizmetleri Public administration and defence services; compulsory social security services
56	P85	Eğitim hizmetleri Education services

Table A.2 (continued)

57	Q86	İnsan sağlığı hizmetleri Human health services
58	Q87_Q88	Yatılı bakım hizmetleri; barınacak yer sağlanmaksızın verilen sosyal hizmetler Residential care services; social work services without accommodation
59	R90-R92	Yaratıcı sanatlar, gösteri sanatları ve eğlence hizmetleri; kütüphane, arşiv, müze ve diğer kültürel hizmetler; kumar ve müşterek bahis hizmetleri Creative, arts, entertainment, library, archive, museum, other cultural services; gambling and betting services
60	R93	Spor hizmetleri ile eğlence ve dinlence hizmetleri Sporting services and amusement and recreation services
61	S94	Üye olunan kuruluşlar tarafından verilen hizmetler Services furnished by membership organisations
62	S95	Bilgisayarların, kişisel eşyaların ve ev eşyalarının onarımına ilişkin hizmetler Repair services of computers and personal and household goods
63	S96	Diğer kişisel hizmetler Other personal services
*64**	*T**	*Ev içi çalışan personelin işverenleri olarak hanehalklarının hizmetleri* *Services of households as employers; undifferentiated goods and services produced by households for own use*
*****	*****	***Excluded Activity Groups***

Table A.3. *Numbering for Principal Component Analysis (PCA)*

Numbering for PCA		
No	Ürün kod (CPA 2008) Product code (CPA 2008)	Ürün tanım (CPA 2008) Product definition (CPA 2008)
1	A01	Tarım ve avcılık ürünleri ve ilgili hizmetler Products of agriculture, hunting and related services
2	A02	Orman ürünleri ve ilgili hizmetler Products of forestry, logging and related services
3	A03	Balık ve diğer balıkçılık ürünleri; su ürünleri; balıkçılık için destekleyici hizmetler Fish and other fishing products; aquaculture products; support services to fishing
4	B	Madencilik ve Taşocakçılığı Mining and quarrying
5	C10-C12	Gıda, içecekler ve tütün ürünleri Food, beverages and tobacco products
6	C13-C15	Tekstil, giyim eşyası, deri ve ilgili ürünler Textiles, wearing apparel, leather and related products
7	C16	Kereste, ağaç ürünleri ve mantar ürünleri (mobilya hariç); hasır ve örme malzemesinden (saz, saman vb.) ürünler Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials
8	C17	Kağıt ve kağıt ürünleri Paper and paper products
9	C18	Basım ve kayıt hizmetleri Printing and recording services
10	C19	Kok ve rafine petrol ürünleri Coke and refined petroleum products
11	C20	Kimyasallar ve kimyasal ürünler Chemicals and chemical products
12	C21	Temel eczacılık ürünleri ve müstahzarları Basic pharmaceutical products and pharmaceutical preparations
13	C22	Kauçuk ve plastik ürünler Rubber and plastic products
14	C23	Diğer metalik olmayan mineral ürünleri Other non-metallic mineral products
15	C24	Ana metaller Basic metals

Table A.3 (continued)

16	C25	Fabrikasyon metal ürünler, makine ve ekipmanlar hariç Fabricated metal products, except machinery and equipment
17	C26	Bilgisayarlar ile elektronik ve optik ürünler Computer, electronic and optical products
18	C27	Elektrikli teçhizat Electrical equipment
19	C28	Başka yerde sınıflandırılmamış makine ve ekipmanlar Machinery and equipment n.e.c.
20	C29	Motorlu kara taşıtları, treyler (römork) ve yarı treyler (yarı römork) Motor vehicles, trailers and semi-trailers
21	C30	Diğer ulaşım araçları Other transport equipment
22	C31_C32	Mobilya ve diğer mamul eşyalar Furniture and other manufactured goods
23	C33	Makine ve ekipmanların kurulumu ve onarımı Repair and installation services of machinery and equipment
24	D35	Elektrik, gaz, buhar ve iklimlendirme Electricity, gas, steam and air conditioning
25	E36	Doğal su; suyun arıtılması ve temini hizmetleri Natural water; water treatment and supply services
26	E37-E39	Kanalizasyon hizmetleri, kanalizasyon çamuru; atığın toplanması, işlenmesi ve bertarafı; maddelerin geri kazanımı; iyileştirme hizmetleri ve diğer atık yönetimi hizmetleri Sewerage services; sewage sludge; waste collection, treatment and disposal services; materials recovery services; remediation services and other wa...
27	F	İnşaatlar ve inşaat işleri Constructions and construction works
28	G45	Toptan ve perakende ticaret ile motorlu kara taşıtlarının ve motosikletlerin onarım hizmetleri Wholesale and retail trade and repair services of motor vehicles and motorcycles
29	G46	Toptan ticaret, motorlu kara taşıtları ve motosikletler hariç Wholesale trade services, except of motor vehicles and motorcycles
30	G47	Perakende ticaret (motorlu kara taşıtları ve motosikletler hariç) Retail trade services, except of motor vehicles and motorcycles

Table A.3 (continued)

31	H49	Kara taşımacılığı ve boru hattı taşımacılığı hizmetleri Land transport services and transport services via pipelines
32	H50	Su yolu taşımacılığı hizmetleri Water transport services
33	H51	Hava yolu taşımacılığı hizmetleri Air transport services
34	H52	Depolama ve destek hizmetleri, taşımacılık için Warehousing and support services for transportation
35	H53	Posta ve kurye hizmetleri Postal and courier services
36	I	Konaklama ve yiyecek hizmetleri Accommodation and food services
37	J58	Yayıncılık hizmetleri Publishing services
38	J59_J60	Sinema filmi, video ve televizyon programı yapımcılık hizmetleri, ses kaydı ve müzik yayımlama; programcılık ve yayıncılık hizmetleri Motion picture, video and television programme production services, sound recording and music publishing; programming and broadcasting services
39	J61	Telekomünikasyon hizmetleri Telecommunications services
40	J62_J63	Bilgisayar programlama, danışmanlık ve ilgili hizmetler; bilgi hizmetleri Computer programming, consultancy and related services; Information services
41	K64	Finansal hizmetler (sigorta ve bireysel emeklilik hariç) Financial services, except insurance and pension funding
42	K65	Sigorta, reasürans ve emeklilik fonları hizmetleri, zorunlu sosyal güvenlik hariç Insurance, reinsurance and pension funding services, except compulsory social security
43	K66	Finansal hizmetler ile sigorta hizmetlerine yardımcı hizmetler Services auxiliary to financial services and insurance services
44	L68B	Gayrimenkul hizmetleri Real estate services excluding imputed rents

Table A.3 (continued)

45	M69_M70	Hukuk ve muhasebe hizmetleri; idare merkezi hizmetleri; idari danışmanlık hizmetleri Legal and accounting services;Services of head offices; management consulting services
46	M71	Mimarlık ve mühendislik hizmetleri; teknik test ve analiz hizmetleri Architectural and engineering services; technical testing and analysis services
47	M72	Bilimsel araştırma ve geliştirme hizmetleri Scientific research and development services
48	M73	Reklamcılık ve pazar araştırması hizmetleri Advertising and market research services
49	M74_M75	Diğer mesleki, bilimsel ve teknik hizmetler; veterinerlik hizmetleri Other professional, scientific and technical services and veterinary services
50	N77	Kiralama ve leasing hizmetleri Rental and leasing services
51	N78	İstihdam hizmetleri Employment services
52	N79	Seyahat acentesi, tur operatörü, diğer rezervasyon hizmetleri ve ilgili hizmetler Travel agency, tour operator and other reservation services and related services
53	N80-N82	Güvenlik ve soruşturma hizmetleri; bina ve çevre düzenleme (peyzaj) hizmetleri; büro yönetimi, büro destek ve diğer iş destek hizmetleri Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services
54	O84	Kamu yönetimi ve savunma hizmetleri; zorunlu sosyal güvenlik hizmetleri Public administration and defence services; compulsory social security services
55	P85	Eğitim hizmetleri Education services
56	Q86	İnsan sağlığı hizmetleri Human health services

Table A.3 (continued)

57	Q87_Q88	Yatılı bakım hizmetleri; barınacak yer sağlanmaksızın verilen sosyal hizmetler Residential care services; social work services without accommodation
58	R90-R92	Yaratıcı sanatlar, gösteri sanatları ve eğlence hizmetleri; kütüphane, arşiv, müze ve diğer kültürel hizmetler; kumar ve müşterek bahis hizmetleri Creative, arts, entertainment, library, archive, museum, other cultural services; gambling and betting services
59	R93	Spor hizmetleri ile eğlence ve dinlence hizmetleri Sporting services and amusement and recreation services
60	S94	Üye olunan kuruluşlar tarafından verilen hizmetler Services furnished by membership organisations
61	S95	Bilgisayarların, kişisel eşyaların ve ev eşyalarının onarımına ilişkin hizmetler Repair services of computers and personal and household goods
62	S96	Diğer kişisel hizmetler Other personal services