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Abstract

Small and Medium Sized Enterprises (SMEs) have to be supported by appropriate programs especially in developing countries. Small and Medium Enterprises Development Organization (KOSGEB) is the institution that supports SMEs in Turkey to survive in the domestic and global markets by taking the responsibility of support programs. In this sense, effective and efficient management of support programs by considering sectoral requirements are crucial for the success and survival of SMEs. Hierarchical clustering analysis is a multivariate technique to build a binary tree of data and visualize a summary. The aim of this study is to investigate the success of general support programs of KOSGEB in Turkey, to determine SMEs which are supported by these programs, to lend assistance to SMEs in Turkey for involving in appropriate programs with respect to their sectors and so, for playing more important roles on domestic and global markets by the agency of hierarchical clustering analysis. In this study, general support programs for SMEs in Turkey were summarized with respect to sectors by hierarchical clustering analysis of the years 2010 and 2011. Ward's hiearchical analysis was preferred to analyze the data, which is mostly used method for social sciences. Results of the analyses have suggested that sectors of SMEs in Turkey were generally agglomerated in two or three clusters for both years. KOSGEB can consider the similarities of sectors to take advantage of general support programs and look for improved support opportunities to encourage these sectors for providing these support programs efficiently.

Keywords: SME, Support Programs, Hierarchical Clustering Analysis

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Introduction

Nowadays, Small and Medium Sized Enterprises (SMEs) play a crucial role with their contribution to all economies worldwide. Especially developing countries recognize the importance of SMEs in globally competitive world, where SMEs account for nearly all of enterprises and undertake more than two thirds of total employment. However, for sure, success and survival of SMEs would not be easy. The challenges of SMEs must be taken into consideration in all aspects, moreover financial supports and strategical guidance should be initially interpreted. These tasks are generally arranged by governments and they commonly delegate their authorities to more professional organizations or institutions. Small and Medium Enterprises Organization (KOSGEB) is the authorized institution in Turkey that supports SMEs by integrating them to the competitive market, increasing their efficiencies and competitive power both domestically and globally. General support programs are the most utilized supports of KOSGEB and sectoral investigation of these programs in terms of SMEs can be instructive to achieve their goals for both SMEs and the institution.

Concentration of SMEs in the same sector is no longer be considered as a competitive advantage, and as the competitive advantage of SMEs has become important for the global economies, clustering policies have taken their places in most of development plans. In fact, numerous institutions and strategic alliances were formed by the governments to accomplish global and economical success. Because the popularity of clustering increases, the researchers turn their attention to this phenomenon. Hiearchical clustering analysis is one of the most frequently used methods in the literature for social sciences. It is a multivariate statistical technique to build a binary tree and visualize a summary. The analysis is useful for agglomerating groups or cases to sub-clusters, when natural number of clusters are unpredictable. These sub-clusters were determined with respect to similarity and dissimilarity measures. As a result, forming new clusters with similarities and monitoring dissimilarities of groups or cases will illustrate the existing position of the research area.

In this study, a sectoral hierarchical clustering analysis of SMEs in Turkey was performed with respect to general support programs for the years of 2010 and 2011. This analysis could be a guidance for both SMEs and authorized institution to be more competitive in the domestic and global market.

The Concept of Cluster and Clusturing

According to Michael E. Porter, clusters are geographic concentrations of interconnected companies and institutions in a particular field and they encompass an array of linked industries and other entities important to competition (Porter, 1990). Clusters are a part of a broader conceptual framework to understand the drivers of regional and national competetiveness.

This framework, grounded in Michael E. Porter's "The Competitive Advantage of Nations", provides a connection between firm-level behaviour and economic policy at the micro-as well as-the macroeconomic level (Ketels & Sölvell, 2006). Starting a cluster involves, first, building the economical fundamentals for an industry or technology, and, second, finding the spark of entrepreneurship to get it going. Both of these are supported by a number of common elements in the regions that we examined (Bresnahan et al., 2005). The manner in which clusters emerge and evolve is important for public policy and corporate strategy. Understanding how and why clusters emerge and develop provides insights into agglomeration phenomena, innovation capacity, location advantages, and may influence local governments' investments (Ferreira et al., 2006).

The concept of clusters focuses on the profits that firms accrue because of the connections to other firms or their proximity. These profits result from cooperation, market relations, spillovers, and in some cases the fact that more start-ups occur. Most of these processes, especially those of spillovers and the increased frequency of start-ups, are much more effective locally. Thus, clusters often have a local connotation (Brenner, 2005). The boundaries of a cluster do not generally follow ordinary administrative borders such as municipalities, counties or even countries. Clusters are dynamic with boundaries in constant change, as new companies and new linkages appear and other disappear (Nordin, 2003). The geographic scope of clusters can vary from a single city, state or region to a network of companies across state borders or even country borders. There are various clustering forms that may ensue to optimise competitive advantage (Braun et al., 2005). Although each existing local industrial cluster has its own specific history, clustering is a phenomenon common for many industries and for different times in the history of industrialised production. The definition of local industrial clusters is based on the mechanisms that cause their emergence and existence (Brenner, 2005).

Clustering policy, generally concentrates on Small and Medium-Sized Enterprises (SMEs). One or more big companies dominate various clusters. However, even if a cluster is directed by a big company, SMEs are absolutely structural elements of any cluster (White Paper, 2008). While, successful clusters are monitored in the world, one can realize that these clusters consist of three elements: (a) international active firms dominate the market and lead to technology, (b) suppliers and complementary businesses (mostly SMEs), (c) specialists based upon innovative and dynamic information (Kaplan, 2009). In many developing countries, SME agglomerations are a widespread phenomenon. On the outskirts of many cities, significant numbers of micro- and small-scale enterprises often operate close to one another and produce similar goods. While in metalworking, woodworking and textile clusters of this kind are common, few of them share the virtues of successful cluster models (UNIDO programme, 2001).

Clustering Projects in Turkey

Clustering surveys of Turkey began in 1999 with 'Competitive Advantage of Turkey (CAT)' platform which was formed by the contributions of Middle East Strategy Center (formed by the guidance of Michael Porter) and Turkish private sector. The platform was later tranformed to 'National Competitiveness Research Institute (URAK)' in the course of instutitionalism. After the early analysis and attempts, clustering and development of clusters were accelerated since the funds provided by European Union, have been assigned.

'Development of National Clustering Policy' project, which was one of the most considerable projects about clustering in Turkey, started on March 2007 with a financial support of European Commission. The project purposed to achieve the country to be one of the unique countries in the world which possess national clustering policy and in this context developed national administrative and constitutional capacity and the results of the project were considered as a national strategy. Within the scope of the project, an inter-institutional working group, consisting of 16 stakeholders from govermental, scientific and academic institutions, was constituted for cooperation. (White Book, 2008). Corpare structures associated with clustering before this project in Turkey are summarized on Table 1.

The ongoing attempt, concerning clustering and networking in Turkey is 'SME Coordination and Clustering Project', which was started on February, 2011 and continues until August 2013. The project is going to performed and financed with a collaboration of Ministry of Economy, Ministry of Science, Industry and Technology, ECORYS Turkey and European Union. The aim of the project is to guide target sectors by the agencies of constituted clustering information centers in 5 provinces (Corum, Gaziantep, Kahramanmaras, Samsun and Trabzon). Within the framework of these clustering centers, SMEs in Turkey are planned to achieve the following opportunities:

- acquiring technical information required for exportation
- easier monitoring of global markets
- technical support about differentiation on product and service, innovation and development of staff
- providing information sharing by creating collaboration opportunities with domestic and international companies
- getting into international markets and opportunity of monitoring technology to maintain export volume (SME Networking Project, 2011).

Along with these attempts, there are many references on macroeconomic documents of Turkish government about supporting the clustering and clustering projects. For instance, under the topic "Increasing Competitive Power" of 9th Development Planning, declared by Prime Ministry, State Planning Organization, the statement such as "Physical infrastructure requirements of businesses will be satisfied and their networking and clustering attempts will be supported” and similar statements about clustering under the topic “Establishing Regional Development” (Kaplan, 2009), strongly demonstrate the governmental support of clustering policies.

Clustering Analysis

Cluster analysis is the generic name for a wide variety of procedures that can be used to create a classification. These procedures empirically form ‘clusters’ or groups of highly similar entities. More specifically, a clustering method is a multivariate statistical procedure that starts with a data set containing information about a sample of entities and attemps to reorganize these entities into relatively homogeneous groups (Aldenderfer & Blashfield, 1984). General purpose of clustering analysis is to clasify ungrouped data regarding to their similarities (Tatlıdil, 2002). The groups or clusters should be as homogeneous as possible and the differences among the various groups as large as possible (Härdle & Simar, 2007). In addition, clustering analysis are used for further purposes, such as determination of actual types, forecasting of groups, hypothesis testing, asssesment of clusters instead of data and establishing outliers (Kalaycı, 2006).

Aldenderfer and Blashfield (1984) concluded the goals of all clustering analysis methods in five basic steps:

(1) selection of a sample to be clustered
(2) definition of a set of variables on which to measure the entities in the sample
(3) computation of the similarities among the entities
(4) use of a cluster analysis method to create groups of similar entities
(5) validation of the resulting cluster solution.

Clustering algorithms partition data objects (patterns, entities, instances, observances, units) into a certain number of clusters (groups, subsets, or categories) (Xu & Wunsch II, 2009). There are essentially two types of clustering methods: hierarchical algorithms and partioning algorithms. The hierarchical algorithms can be divided into agglomerative and splitting procedures. Agglomerative hierarchical clustering starts from the finest partition possible (each observation forms a cluster) and groups them (Härdle & Simar, 2003). These are a class of clustering techniques that proceed by a series of steps in which progressively larger groups are formed by joining together groups formed earlier in the process. The initial step involves combining the two individuals who are closest (according to whatever distance measure is being used). The process goes from individuals to a final stage in which all individuals are combined, with the closest two groups being combined at each stage. The series of steps in this type of clustering can be conveniently summarized in a tree-like diagram known as a dendogram

(Landau & Everitt, 2004). The observations are listed on the horizontal axis and the vertical axis represents the Euclidean distance between clusters. In order to determine the cluster composition for a given number of clusters the dendogram can be cut at the appropriate place. Different criteria can be used for determining the best number of clusters (Sharma, 1996).

Various distance measures can be used to form hiearchical clusters such as Euclidean distances, squared Euclidean distances, Manhattan distance (city-block metric), Chebychev distance measure (Yaylalı, et al., 2006). In this study, squared Euclidean distances were used.

Euclidean Distance

The most common distance measure method is the Euclidean distance given by

$$d_{ij} = \left[\sum_{l=1}^{q}\left(x_{il} - x_{jl}\right)^2\right]^{\frac{1}{2}}$$

where d_{ij} is the Euclidean distance for two individuals *i* and *j*, each measured on *q* variables, x_{il}, x_{jl}, $l = 1,..., q$. (Landau & Everitt, 2004). Unlike the correlation-based distance functions, the Euclidean distance takes the magnitude of the expression data into account. It therefore preserves more information about the data and may be preferable (de Hoon, et al. 2010). By using Euclidean distance as a measure of similarity, hyperspherical-shaped clusters of equal size are usually detected (Su & Chou, 2001). In an *n* dimensional population, the sum of squares between two points are computed by the following formula:

$$d_{ij}{}^2 = \sum_{k=1}^{n}\left(X_{ij} - X_{jk}\right)^2$$

X_{ij} and X_{jk} denote the values on *i* and *j* coordinates of *k* variable. If the objects will be clustered according to different measurement units, variables must firstly be transformed to standard values and later squared Euclidean distances must be computed (Yaylalı, 2006).

Hierachical Clustering Methods

Some of the popular hieraching clustering methods are: nearest neighbor or single-linkage method, farthest-neighbor or complete linkage method, centroid method, average-linkage method and Ward's method. The first step is the same for all the methods, but after the first step the various methods differ with respect to the procedure used to compute the distances between clusters (Sharma, 1996).

Single Linkage Method

This method, described by Sneath (1957), forms clusters by the following rule: Cases will be joined to existing clusters if at least one of the members of the existing cluster is of the same level of similarity as the case under consideration for inclusion. The distance between two clusters is represented by the minimum of the distance between all possible pairs of subjects in the two clusters (Sharma, 1996). Single linkage begins the clustering process by searching for the two most similar entities in the matrix. The major advantage of this method is that it is invariant to monotonic transformations of the similarity matrix, and is unaffected by ties in the data. This means that single linkage is one of the few methods that will not affected by any data transformation that retains the same relative ordering of values in the similarity matrix (Aldenderfer & Blashfield, 1984). If the clusters are separated far from each other, the single linkage method works well (Xu & Wunsch II, 2009).

Complete Linkage Method

Complete linkage method was suggested by several researchers studying independently and different time periods. Horn (1943), used this method to cluster test variables. Sorensen (1948), developed the method for ecological studies. McQuitty (1961), recommended the species analysis by this method (Yaylalı et al., 2006). This method is the logical opposite of single linkage clustering in that the linkage rule states that any candidate for inclusion into an existing cluster must be within a certain level of similarity to all members of that cluster. (Aldenderfer & Blashfield, 1984). The distance between two clusters is defined as the maximum of the distances between all possible pairs of observations in the two clusters (Sharma, 1996). Complete linkage method has a more rigorous rule than single linkage, and, therefore, complete linkage has a tendency to find relatively compact, hyperspherical clusters composed of highly similar cases (Aldenderfer & Blashfield, 1984).

Average Linkage Method

Average linkage method was proposed by Sokal and Michener (1958) and average linkage clustering was developed as an antidote to the extremes of both single and complete linkage. Although there are a number of variants of the method, each essentially computes an average of the similarity of a case under consideration with all cases in the existing cluster (Aldenderfer & Blashfield, 1984). In the average linkage method the distance between two clusters is obtained by taking the average distance between all pairs of subjects in the two clusters (Sharma, 1996). For average linkage, the distance between two clusters is found by computing the average dissimilarity of each item in the first cluster to each item in the second cluster (Izenman, 2008).

Centroid Method

In the centroid method each group is replaced by an average subject which is the centroid of that group. In other words, centroids are changed when a new candidate is involved in a cluster. This method is less affected by outliers with respect to other hierarchical clustering method (Çokluk et al., 2010). The distance between two clusters *A* and *B* is defined as the Euclidean distance between the mean vectors (often called centroids) of the two clusters

$$D\ (A,B) = d\ (\bar{y}_A\ ,\bar{y}_B),$$

where $\bar{y}_A$ and $\bar{y}_B$ are the mean vectors for the observation vectors in *A* and the observation vectors in *B*, respectively (Rencher, 2002).

Ward's Method

Ward's method was proposed to optimize the minimum variance in a cluster (Ward, 1963). This method is also known as sum of in group squares or sum of squared errors. Wishart (1969), indicated how Ward's method was used by using Euclidean matrices in between centroid clusters (Yaylali, 2006). The object of Ward's method is to minimize the increase of the within - class sum of the squared errors,

$$E = \sum_{k=1}^{K} \sum_{x_j \in C_k} \|x_t - m_k\|^2$$

where, where *K* is the number of clusters and m_k is the centroid cluster C_k, caused by the merge of two clusters. This change is only computed on the formed cluster and the two clusters to be merged, and can be represented as,

$$\Delta E_{ij} = \frac{n_i n_j}{n_i + n_j} \left\|m_i - m_j\right\|^2,$$

where n_i is the number of data points belonging to the cluster (Xu & Wunsch II, 2009). As the formula represents, minimum increase of the sum of squared errors is directly proportional with Euclidean distance in between the centers of merged clusters (Yaylalı et al., 2006).

The splitting procedure starts with the coarsest partition possible: one cluster contains all of the observations. It proceeds by splitting the single cluster up into smaller sized clusters. The partioning algorithms start from a given group definition and proceed by exchanging elements between groups until a certain score is optimized. The main difference between the two clustering techniques is that in hierarchical clustering once groups are found and elements are assigned to the groups, this assignment cannot be changed. In partitioning techniques, on the other hand, the assignment of objects into groups may change during the algorithm application (Härdle & Simar, 2003).

Hierarchical agglomerative methods have been dominant among the families of methods in terms of frequency of their applied use (Aldenderfer & Blashfield, 1984). In contrast to other types of cluster analysis in which a single set of mutually exclusive and exhaustive clusters is formed, hierarchical clustering analysis technique proceeds sequentially from tighter, less inclusive clusters through larger more inclusive clusters and is continued until all variables are clustered in a single group (Bridges, Jr, 1966).

Methodology and Data Set

In this study, sectoral hierarchical clustering of SMEs in Turkey with respect to general support programs of KOSGEB in 2010 and 2011, was investigated. The data set was obtained from the database of KOSGEB Headquarters in Ankara. Although all of the hierarchical methods have pros and cons in the literature, it was strived to take the picture of the sectors with respect to general programs by the agency of Ward's hierarchical clustering method which was more frequently used. Since, hierarchical clustering analysis is more appropriate, when sample size is typically smaller than 250 (Çokluk et al., 2010) and number of cluster is unpredictable, as the concerning data in this study, it was considered that this clustering method would have reached the researcher to optimal result. Agglomerative hierarchical algorithm and squared Euclidean distance measure were used for Ward's hierarchical method in this study because of its efficiency and frequent usage for social sciences. When the differences among means and variances of variables on data matrices are erratic, overvalued variables effect the roles of other variables dramatically. In addition, extreme values of variables have negatively effect on clusters. The data should be standardized or transformed in such circumstances (Özdamar, 1999). In this study, the data were standardized by the agency of Z-score transformation to eliminate concerning negative effects of extreme values (outliers). A normally distributed experimental result *X*, is standardised by using the following formula,

$$Z = \frac{X - \bar{X}}{S}$$

where $\bar{X}$ denotes the mean and S denotes standard deviation. Normal distribution assumption was tested for the data by using one-sample Kolmogorov-Smirnov test and it was determined that the data satisfied the normal distribution requirement at the 0,05 significance level (p-values were greater than 0,05).

Results

In this section of the study, sectoral hiearchical clustering of SMEs in Turkey with respect to general supports was performed for the years 2010 and 2011 and the results of Ward's method were represented. As Ward's method dendogram indicated on Figure 1, the sectors of SMEs were clearly agglomerated in two main clusters for the year 2010. First cluster comprises Sector 3, 9, 2, 6, 13 and 11; second cluster comprises Sector 4, 10, 1, 5, 7, 12 and 8.

Agglomerative schedule involves a summarized information about clusters for applied method as shown on Table 2. The left-hand side of the table demonstrates the researcher, all clustered cases for the concerning method. Coefficients indicate the squared Euclidean distance between two cases and as the coefficients increase, in contrast, the similarity between these two cases decreases. This means that two cases do not involve in a cluster. The right-hand side of the table exhibits on which stage the clusters resume until all of the cases agglomerate in one main cluster. The clustering process has began at Stage 1, where Sector 3 and 9 were clustered. Later, these sectors were clustered with Sector 2 at Stage 6. This stage guides us that the sectors would be clustered with Sector 11 at Stage 8. The process has ended at Stage 12 were all of the sectors for this cluster were agglomerated with Sector 1. This producedure was repeated for all stages since all sectors were clustered in a single cluster.

Next, the researcher should ensure that whether the number of clusters observed on Ward's method dendogram was ideal. This can be guaranteed by increasing the number of clusters to 3 and examining the result in that circumstance. Cluster membership was represented on Table 3. When attempted to increase the number of clusters to 3, we would see that Sector 8 was clustered in Cluster 3. This result was not logical because this sector tended to involve in Cluster 1 on centroid dendogram. As a result, we can suggest that agglomeration of sectors in two clusters for Ward's method was ideal. Sectoral hierarchical clustering of SMEs in Turkey according to Ward's method for the year 2011 was represented on Figure 2. Ward's method agglomerated the sectors in three main clusters. First cluster comprises Sector 1, 4, 10, 8, 11, 3 and 9; second cluster comprises Sector 6, 13 and 7; third cluster comprises Sector 2, 12 and 5.

While, agglomeration schedule for Ward's method was examined on Table 4, we can observe that the clustering process has began at Stage 1, where Sector 1 and Sector 4 were clustered. These sectors were clustered with Sector 10 at Stage 4 and the process has continued at Stage 6. Sector 8 was agglomerated with previously clustered sectors and we are moving to Stage 8. Sector 3 involved in the cluster at Stage 8 and the process has continued at Stage 11. Sector 6 was clustered at this stage before moving to Stage 12. Finally, Sector 2 was agglomerated with all the other sectors in this process to form the first main cluster. The repetition of this process was established until all the sectors were clustered in a single cluster.

Later, we should look for whether the number of clusters was ideal for the method. Cluster membership was indicated on Table 5, by increasing the number of clusters to 3 and decreasing to 2. While the number of clusters was increased to 4, three sectors (Sector 6, 7 and 13) were agglomerated in a distinct cluster. This solution was not logical because these sectors tended to involve in the third cluster when the number of clusters was 3. However, two clusters were not optimal, since one of the main clusters would have been eliminated in this circumstance. As a result, it could have been suggested that a three-cluster solution was ideal.

Discussion & Conclusion

In this study, sectoral hierarchical clustering of SMEs in Turkey with respect to general support programs was investigated for the years 2010 and 2011. Ward's hierarchical clustering method was used to interpret the data set obtained by KOSGEB Headquarters. Ward's method offered a two-main cluster solution for SMEs for the year 2010. With respect to their similarities, sectors of first main cluster were: production and distribution of electricity, gas, vapour, air conditioning; mining and quarrying; other service activities; construction; transportation and storage; water supply; sewage, waste management and amendment activities. Second main cluster included the following sectors: administrative and support service activities; information and communication; manufacturing; accommodation and food service activities; wholesale and retail trade, repair of motor vehicles and motor cycles; culture, art, entertainment, leisure and sport.

When the results of Ward's hierarchical clustering method for the year 2010 were examined, it could be suggested that rescaled distance clusters have differed and introduced the similarities between sectors and their clustering expectations. When these distances were observed in detail and implementations were established with respect to the distances and similarities, more optimal decisions about competitive advantage of SMEs would be made. In addition, because general support programs were initially introduced by KOSGEB in this year, less competitive sectors in Turkish economy could have experienced more challenges than leading sectors and could not have realized the importance of these supports. So, when these sectors have overcome their concerning challanges as well as they were informed about the benefits of the programs, more competitive and more globalized SMEs would have been created.

Ward's method offered a three-main cluster solution for the year 2011. Sectors of first main cluster were information and communication; administrative and support service activities; professional, academical and technical activities; culture, art, entertainment, leisure and support; water supply, sewage, waste management and amendment activities; production and distribution of electricity, gas, vapour, air conditioning; mining and quarrying. Second main cluster was combined by the following sectors: construction;

transportation and storage; accomodation and food service activities. Sectors of third main cluster were: other service activities; wholesale and retail trade, repair of motor vehicles and motorcycles.

As the results of Ward's hierarchical clustering method were considered for the year 2011, it could be suggested that the number of main clusters have increased to 3. This means that the dissimilarites between the clusters tend to decrease. Rescaled distance cluster should have been taken into account to determine the similarities or dissimilarities of the sectors and to interpret the results as a competitive advantage for SMEs. When compared to previous year, the volume of general supports have significantly increased. In this manner, less supported sectors of the year 2010 were able to involve in a cluster. Furthermore, it would have been put forward that less competitive sectors could have overcome several challenges in the previous year and the gaps between leading sectors could have been decreased.

Success of KOSGEB depends on the success of SMEs in Turkey. Especially, global competitivenesses of the enterprises play a crucial role for KOSGEB's vision. Economic power of SMEs will be the most important component that has to be taken into account for the organization to achive its vision. So, the organization has to monitor the economic conditions of SMEs permanently and go into action when needed. KOSGEB should consider the similarities with respect to rescaled distances and clusters of the sectors to take advantage of general support programs and look for improved support opportunities to encourage these sectors for providing general support programs effectively and efficiently. Results of 2010 and 2011 can land assistance for future years of supports. In addition, These results are able to serve as a model for other support programs because of major share of general supports in all KOSGEB supports.

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APPENDICES

Table 1. Corporate Structures in Turkey Related to Clustering

Corporate Structure	Conceptual Definition	Related Corporate Structures in context of Turkey
Regional Agglomeration	Agglomeration for related firms of the same sector in the same region geographically without neccesity	▪ Organized Industry Regions (OIR) ▪ Specialized OIR Free Trade Regions ▪ Technoparks
Clustering Projects	Clustering and relatedness of actors in a particular profession, region complementarily	▪ Adıyaman Ready-Made Clothing Clustering Project ▪ Şanlıurfa Ready-Made Clustering Project ▪ Fashion and Textile Clustering Project ▪ Bartın Shipping Industry Clustering Project ▪ Cukurova Clustering Project, regional innovation system
Industrial and Tertiary Networks	Assembling of actors in a particular industry area as 'information or production networks' without geographical similarity or complementarity	▪ Textile Industry in Istanbul, Bursa and Denizli ▪ Furniture Industry in Ankara, Kayseri and Bursa ▪ Automotive Industry in Bursa and Kocaeli ▪ Wine production in Nevşehir and Tekirdağ ▪ Service Sector Networks (medical, tourism and logistic)

Source: White Book Development of a Clustering Policy for Turkey (2008).

Table 2. Agglomeration Schedule for Ward's Method (2010)

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	3	9	,186	0	0	6
2	2	6	,482	0	0	5
3	1	5	,946	0	0	7
4	4	10	1,776	0	0	10
5	2	13	2,921	2	0	6
6	2	3	5,056	5	1	8
7	1	7	7,517	3	0	9
8	2	11	10,535	6	0	12
9	1	12	14,129	7	0	10
10	1	4	18,782	9	4	11

11	1	8	23,925	10	0	12
12	1	2	40,766	11	8	0

Table 3. Clustering Membership for Ward's Method (2010)

Case	3 Clusters	2 Clusters
1:J-Information and Communication	1	1
2:S-Other Service Activities	2	2
3:D-Production and distribution of electricity, gas, vapour, air conditioning	2	2
4:N-Administrative and support service activities	1	1
5:C-Manufacturing	1	1
6:F-Construction	2	2
7:I-Accomodation and Food Service Activities	1	1
8:R-Culture, art, entertainment, leisure and sport	3	1
9:B- Mining and quarrying	2	2
10:M-Professional, academical and technical activities	1	1
11:E-Water supply; sewage, waste management and amendment activitie	2	2
12:G-Wholesale and retail trade; repair of motor vehicles and motorcycles	1	1
13:H-Trasportation and storage	2	2

Table 4. Agglomeration Schedule for Ward's Method (2011)

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	1	4	,095	0	0	4
2	3	9	,214	0	0	8
3	8	11	,418	0	0	6
4	1	10	,654	1	0	6
5	6	13	1,146	0	0	9
6	1	8	1,761	4	3	8
7	2	12	2,511	0	0	10
8	1	3	3,906	6	2	11
9	6	7	5,669	5	0	11
10	2	5	7,592	7	0	12
11	1	6	12,610	8	9	12
12	1	2	20,263	11	10	0

Table 5. Clustering Membership for Ward's Method (2011)

Case	4 Clusters	3 Clusters	2 Clusters
1:J-Information and Communication	1	1	1
2:S-Other Service Activities	2	2	2
3:D-Production and distribution of electricity, gas, vapour, air conditioning	1	1	1
4:N-Administrative and support service activities	1	1	1
5:C-Manufacturing	3	2	2
6:F-Construction	4	3	1
7:I-Accomodation and Food Service Activities	4	3	1

8:R-Culture, art, entertainment, leisure and sport	1	1	1
9:B- Mining and quarrying	1	1	1
10:M-Professional, academical and technical activities	1	1	1
11:E-Water supply; sewage, waste management and amendment activitie	1	1	1
12:G-Wholesale and retail trade; repair of motor vehicles and motorcycles	2	2	2
13:H-Trasportation and storage	4	3	1

Figure 1. Ward's Method Dendogram (2010)

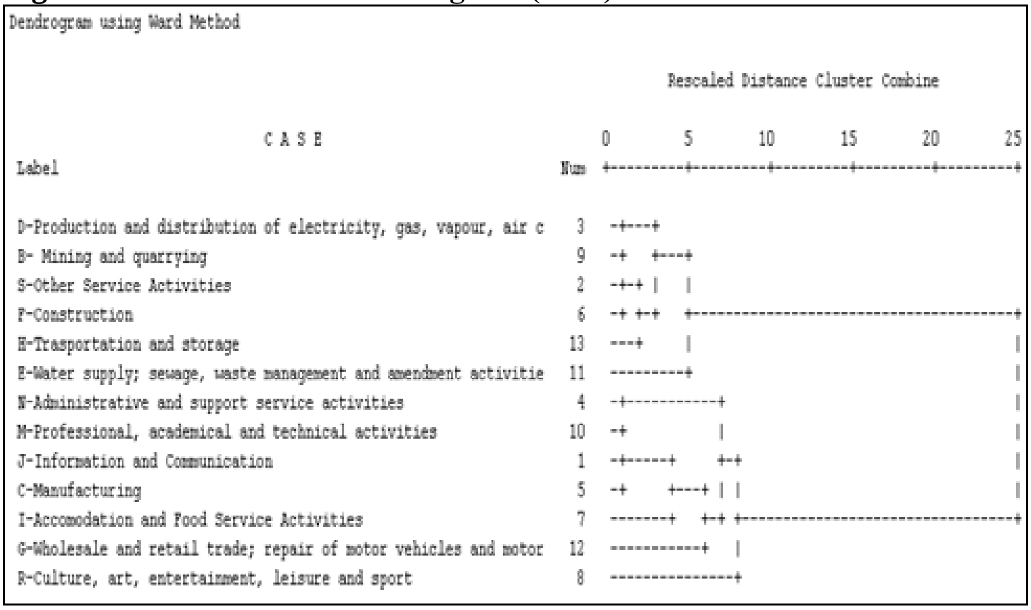

Figure 2. Ward's Method Dendogram (2011)