58dcc1a52837435cbd8d4d8bf08c1041ef347fe8.docx
Jan 5, 2021
23798 words / 129493 characters

1.docx

Sources Overview

20%

OVERALL SIMILARITY

1	www.rri.wvu.edu INTERNET	6%
2	www.oecd.org INTERNET	3%
3	edoc.pub INTERNET	2%
4	users.tkk.fi INTERNET	1%
5	members.shaw.ca INTERNET	1%
6	www.planning.unc.edu INTERNET	<1%
7	jnco.gov.jo INTERNET	<1%
8	www.hsr.umn.edu INTERNET	<1%
9	www.partner-thematic-network.org INTERNET	<1%
10	rd.fsa.ulaval.ca INTERNET	<1%
11	msmetfc.in INTERNET	<1%
12	fr.scribd.com INTERNET	<1%
13	www.bvsde.paho.org INTERNET	<1%
14	hosting.competitiveness.org INTERNET	<1%
15	socio.ens-lsh.fr INTERNET	<1%
16	www.fiu.edu INTERNET	<1%
17	www.regionalstudies.org INTERNET	<1%
18	repository.lib.cuhk.edu.hk INTERNET	<1%

19	www.reims-ms.fr INTERNET	<1%
20	www.changingcommerce.com INTERNET	<1%
21	www.redalyc.org INTERNET	<1%
22	yudoanggoro.com INTERNET	<1%
23	www.maxwellsci.com INTERNET	<1%
24	en.wikipedia.org INTERNET	<1%
25	repository-tnmgrmu.ac.in INTERNET	<1%

Excluded search repositories:

- None

Excluded from Similarity Report:

- Small Matches (less than 9 words).

Excluded sources:

- www.urak.org, internet, 8%
- epdf.tips, internet, 7%
- mafiadoc.com, internet, 7%
- www.scribd.com, internet, 7%
- rri.wvu.edu, internet, 6%
- docplayer.net, internet, 5%
- docshare.tips, internet, 4%
- es.scribd.com, internet, 4%
- pt.scribd.com, internet, 3%
- www.tandfonline.com, internet, 3%
- hdl.handle.net, internet, 3%
- ar.scribd.com, internet, 3%
- link.springer.com, internet, 3%
- repub.eur.nl, internet, 2%
- citeseerx.ist.psu.edu, internet, 2%
- manualzz.com, internet, 2%
- centrim.bus.brighton.ac.uk, internet, 2%
- www.researchgate.net, internet, 2%
- hbr.org, internet, 2%
- zombiedoc.com, internet, 1%
- www.sistems.org, internet, 1%
- www.ranjaygulati.com, internet, 1%
- localgov.fsu.edu, internet, 1%
- scholar.csom.umn.edu, internet, 1%
- epdf.pub, internet, 1%
- mylektsii.ru, internet, 1%
- slidelegend.com, internet, 1%
- www.unescap.org, internet, 1%
- repository.tudelft.nl, internet, 1%
- www.slideshare.net, internet, 1%
- www.abslib.com, internet, 1%
- doi.org, internet, 1%
- www.clusterturkey.com, internet, 1%
- www.tumenprogramme.org, internet, 1%
- eachway.com.cn, internet, 1%
- www.alanausterman.com, internet, 1%
- instruction.bus.wisc.edu, internet, 1%
- businesstodays.wordpress.com, internet, 1%
- www.apdcg.net, internet, 1%
- home.furb.br, internet, 1%
- baadalsg.inflibnet.ac.in, internet, 0%
- www.iby.it, internet, 0%

- irp-cdn.multiscreensite.com, internet, 0%
- repository.up.ac.za, internet, 0%
- moam.info, internet, 0%
- journals.sagepub.com, internet, 0%
- ro.ecu.edu.au, internet, 0%
- etheses.whiterose.ac.uk, internet, 0%
- lrd.yahooapis.com, internet, 0%
- www.training.sa.gov.au, internet, 0%
- www.emeraldinsight.com, internet, 0%
- repository.nwu.ac.za, internet, 0%
- scholar.sun.ac.za, internet, 0%
- www.kas.de, internet, 0%
- www.inderscienceonline.com, internet, 0%
- www.isae.it, internet, 0%
- www.fafo.no, internet, 0%
- journals.euser.org, internet, 0%
- 1pdf.net, internet, 0%
- www.alessandrobacci.com, internet, 0%
- www.cmm.qc.ca, internet, 0%
- cmm.qc.ca, internet, 0%
- www.parcogeneticasalute.it, internet, 0%
- www.inderscience.com, internet, 0%
- www.ebms.it, internet, 0%
- www.nordregio.se, internet, 0%
- ec.europa.eu, internet, 0%
- stec.univ-ovidius.ro, internet, 0%
- etd.lib.metu.edu.tr, internet, 0%
- dspace.knust.edu.gh:8080, internet, 0%
- researchrepository.napier.ac.uk, internet, 0%
- viriya.net, internet, 0%
- wesamuels.org, internet, 0%
- documents.mx, internet, 0%
- www.studijoms.lt, internet, 0%
- mediapro.lt, internet, 0%
- www.mathcs.emory.edu, internet, 0%
- mathcs.emory.edu, internet, 0%
- etd.utk.edu, internet, 0%
- inba.info, internet, 0%
- www.coursehero.com, internet, 0%
- repositorio-aberto.up.pt, internet, 0%
- www.albany.edu, internet, 0%
- r-cube.ritsumei.ac.jp, internet, 0%
- journal-archieves5.webs.com, internet, 0%
- arno.uvt.nl, internet, 0%
- www.cip.unze.ba, internet, 0%
- perpus.univpancasila.ac.id, internet, 0%
- eprints.worc.ac.uk, internet, 0%
- researchonline.jcu.edu.au, internet, 0%
- www.ripublication.com, internet, 0%
- www.teiath.gr, internet, 0%
- www.jotr.eu, internet, 0%
- jotr.eu, internet, 0%
- propertibazar.com, internet, 0%
- ir.nuk.edu.tw:8080, internet, 0%
- etd.lib.nsysu.edu.tw, internet, 0%
- etd.lib.ttu.edu, internet, 0%
- docplayer.info, internet, 0%
- adoc.pub, internet, 0%
- www.osir.hihm.no, internet, 0%
- documentop.com, internet, 0%
- doctorat.snspa.ro, internet, 0%
- shura.shu.ac.uk, internet, 0%
- doku.pub, internet, 0%
- mro.massey.ac.nz, internet, 0%
- onlinelibrary.wiley.com, internet, 0%
- archive.org, internet, 0%
- www.ukessays.com, internet, 0%
- repositorio.unican.es, internet, 0%
- www.iioa.org, internet, 0%

- uav.ro, internet, 0%
- run.unl.pt, internet, 0%
- dspace.mit.edu, internet, 0%
- de.scribd.com, internet, 0%
- bradleywilsononline.net, internet, 0%
- thekeep.eiu.edu, internet, 0%
- www.t2f.nu, internet, 0%
- www.repository.cam.ac.uk, internet, 0%
- scholarship.shu.edu, internet, 0%
- issuu.com, internet, 0%
- digitalcommons.unomaha.edu, internet, 0%
- etheses.dur.ac.uk, internet, 0%
- www.wb.home.by, internet, 0%
- www.thefreelibrary.com, internet, 0%
- web.worldbank.org, internet, 0%
- wb.home.by, internet, 0%
- resolve.sustainablelifestyles.ac.uk, internet, 0%
- irjbm.org, internet, 0%
- digitalcommons.wayne.edu, internet, 0%
- aut.researchgateway.ac.nz, internet, 0%
- www.pekerjadata.com, internet, 0%
- www.idrimjournal.com, internet, 0%
- www.dodstarbase.org, internet, 0%
- www.mdpi.com, internet, 0%
- papers.ssrn.com, internet, 0%
- studijoms.sportas.lt, internet, 0%
- scholar.dominican.edu, internet, 0%
- luminarycommunications.org, internet, 0%
- library.iugaza.edu.ps, internet, 0%
- kobra.uni-kassel.de, internet, 0%
- etd.vcu.edu, internet, 0%
- eprints.brighton.ac.uk, internet, 0%
- blog.binadarma.ac.id, internet, 0%
- 123dok.com, internet, 0%
- ir.uitm.edu.my, internet, 0%
- digitalcommons.unl.edu, internet, 0%
- libra.acadiau.ca, internet, 0%
- www.citeulike.org, internet, 0%
- www.power-cluster.net, internet, 0%
- ses.library.usyd.edu.au, internet, 0%
- nukg.pw, internet, 0%
- bg.hbr.org, internet, 0%
- www.theseus.fi, internet, 0%
- academicarchive.snhu.edu, internet, 0%
- www.wcfcg.net, internet, 0%
- www.scirp.org, internet, 0%
- library.wur.nl, internet, 0%
- edepot.wur.nl, internet, 0%
- www.ea2000.it, internet, 0%
- www.academypublication.com, internet, 0%
- www.hrpub.org, internet, 0%
- www.allbusiness.com, internet, 0%
- www.springerprofessional.de, internet, 0%
- www.irbnet.de, internet, 0%
- www.nmmu.ac.za, internet, 0%
- avekon.org, internet, 0%
- www.schoolengagement.org, internet, 0%
- libjournals.mtsu.edu, internet, 0%
- radar.brookes.ac.uk, internet, 0%
- collections.unu.edu, internet, 0%
- www.stps.metu.edu.tr, internet, 0%
- files.eric.ed.gov, internet, 0%
- adriandeleon.cucea.udg.mx, internet, 0%
- opus.bath.ac.uk, internet, 0%
- arabjournalpsychiatry.com, internet, 0%
- www.asianonlinejournals.com, internet, 0%
- www.aimresearch.org, internet, 0%
- www.yumpu.com, internet, 0%
- www.scholink.org, internet, 0%

- studylib.net, internet, 0%
- digital.maag.ysu.edu, internet, 0%
- dergipark.org.tr, internet, 0%
- www.qucosa.de, internet, 0%
- www.cs.rhul.ac.uk, internet, 0%
- archtrauma.com, internet, 0%
- silo.pub, internet, 0%
- pure.iiasa.ac.at, internet, 0%
- iiasa.ac.at, internet, 0%
- webdezign.dk, internet, 0%
- centrim.mis.brighton.ac.uk, internet, 0%
- pisrt.org, internet, 0%
- www.environment.fhwa.dot.gov, internet, 0%
- environment.fhwa.dot.gov, internet, 0%
- www.springerlink.com, internet, 0%
- ebooks.arabou.edu.kw, internet, 0%
- www.econstor.eu, internet, 0%
- eprints.luiss.it, internet, 0%
- www.iimmblr.org, internet, 0%
- www.ecsocman.edu.ru, internet, 0%
- www-sre.wu.ac.at, internet, 0%
- ecsocman.hse.ru, internet, 0%
- www.lsbu.ac.uk, internet, 0%
- www.iimm.org, internet, 0%
- www.ie.boun.edu.tr, internet, 0%
- iimm.org, internet, 0%
- www.rug.nl, internet, 0%
- www.metalsanctuary.org, internet, 0%
- irs.ub.rug.nl, internet, 0%
- dissertations.ub.rug.nl, internet, 0%
- www.creative-technology.lt, internet, 0%
- theses.gla.ac.uk, internet, 0%
- ntrs.nasa.gov, internet, 0%
- uir.unisa.ac.za, internet, 0%
- www.curriculumproject.com, internet, 0%
- eprints.mdx.ac.uk, internet, 0%
- engagedscholarship.csuohio.edu, internet, 0%
- e-journal.uajy.ac.id, internet, 0%
- digital.library.unt.edu, internet, 0%
- arena.slu.edu, internet, 0%
- communalsocieties.hamilton.edu, internet, 0%
- www.crim.umontreal.ca, internet, 0%
- hermes.iacm.forth.gr, internet, 0%
- citation.allacademic.com, internet, 0%
- vibdoc.com, internet, 0%
- www.ssoar.info, internet, 0%
- wesscholar.wesleyan.edu, internet, 0%
- helda.helsinki.fi, internet, 0%
- etkunnskapsbasertnorge.files.wordpress.com, internet, 0%
- s3.amazonaws.com, internet, 0%
- worldwidescience.org, internet, 0%
- repository.out.ac.tz, internet, 0%
- lib.dr.iastate.edu, internet, 0%
- www.clarku.edu, internet, 0%
- www.vlerick.be, internet, 0%
- ipc.mit.edu, internet, 0%
- icaictsee.unwe.bg, internet, 0%
- www.gamtostyrimai.lt, internet, 0%
- openarchive.cbs.dk, internet, 0%
- vlbr.net, internet, 0%
- www2.law.columbia.edu, internet, 0%
- www.itu.dk, internet, 0%
- www.cambridge.org, internet, 0%
- works.bepress.com, internet, 0%
- proceedings.aom.org, internet, 0%
- openaccess.city.ac.uk, internet, 0%
- drum.lib.umd.edu, internet, 0%
- discovery.ucl.ac.uk, internet, 0%
- calhoun.nps.edu, internet, 0%

- scholarworks.gsu.edu, internet, 0%
- dbgroup.ncsu.edu, internet, 0%
- www.workinnet.org, internet, 0%
- www.marketingpower.com, internet, 0%
- seoplannow.com, internet, 0%
- ethesis.helsinki.fi, internet, 0%
- vlerick.be, internet, 0%
- www.rcmewhu.com, internet, 0%
- scholarpublishing.org, internet, 0%
- espace.library.uq.edu.au, internet, 0%
- www.science.gov, internet, 0%
- www.deepdyve.com, internet, 0%
- scholar.google.com, internet, 0%
- ijrcar.com, internet, 0%
- www.questia.com, internet, 0%
- www.heritage.org, internet, 0%
- etd.ohiolink.edu, internet, 0%
- bura.brunel.ac.uk, internet, 0%
- www.nstda.or.th, internet, 0%
- starbase.jpl.nasa.gov, internet, 0%
- technodocbox.com, internet, 0%
- www.internionline.com, internet, 0%
- www.astro.ucla.edu, internet, 0%
- www.cs.washington.edu, internet, 0%
- archives.cerium.ca, internet, 0%
- tutorsonspot.com, internet, 0%
- www.tdx.cat, internet, 0%
- www.keshet-s.info, internet, 0%
- www.markedbyteachers.com, internet, 0%
- researchspace.ukzn.ac.za, internet, 0%
- tel.archives-ouvertes.fr, internet, 0%
- www.estkonsult.com, internet, 0%
- www.cows.org, internet, 0%
- www.accc.gov.au, internet, 0%
- bai2009.org, internet, 0%
- www.research.manchester.ac.uk, internet, 0%
- s3-eu-west-1.amazonaws.com, internet, 0%
- etd.uum.edu.my, internet, 0%
- core.ac.uk, internet, 0%
- hal.upmc.fr, internet, 0%
- hal.sorbonne-universite.fr, internet, 0%
- getteingtoday.info, internet, 0%
- www.parlementairemonitor.nl, internet, 0%
- amsdottorato.unibo.it, internet, 0%
- www.gotocycle.com, internet, 0%
- open.library.ubc.ca, internet, 0%
- bibliotecavirtualdefensa.es, internet, 0%

1. Introduction

Clusters can be characterised as being network of production of strongly interdependent firms (including specialized suppliers), knowledge producing agents (universities, research institutes, engineering companies), bridging institutions (brokers, consultants) and customers, linked to each other in a value adding production chain (Roelandt and Hertog, 1998). Clusters are geographic concentrations of interconnected companies and institutions in a particular field (Porter, 1998).

Roelandt, Hertog, Sinderen and Vollard (1997) define clusters in three groups. These are national level (macro), branch or industry level (meso) and firm level (micro) which is the subject of this study.

Today cluster approach became one of the main agenda of governments for increasing competitiveness of their nations. Therefore, number of cluster approach studies are increasing in today's competitive world: Harvard University has a center for mapping all clusters in the USA; UK has 15 regional development agencies in the country managed by central government; In Sweden Competitiveness Institute is an independent center working for this country's clusters; Italy has various cluster centers in industrial districts initiated by local governments together with industry members; OECD supported cluster approach and sponsored researchers. Because of this support two books consisting of experiences in cluster studies and theory development attempts are issued.

After Porter's book "*Competitive Advantage ofNations*" (1990b), clusters were started to be used in different countries as a part of regional and national development attempts. Porter summarized the outcomes of these studies, made in different clusters, in his *Harvard Business Review* (1998) article. In his article, he

defined **clusters as the derivers of new economics of competition.** After the 1998 article, many countries such as UK, Netherland, Ireland, Sweden, Israel, El Salvador started to use cluster approach in order to increase their countries' competitiveness. Moreover, academic research related to cluster studies in all over the world boomed. Andersen and Teubal (1999) worked on High Tech Cluster Creation and Cluster Reconfiguration. Bergman (2001), and Hertog (2001) studied innovative clusters; Best (1999) made a case study on Singapore/Johar Electronics cluster; Kleinhenz (2000) on Northeast Ohio Clusters Project; Oyeyinka (2001) on networks and linkages in African manufacturing cluster in Nigeria; Peteers and Tiri (1995) on the identification of techno-economic clusters in Flanders by using I/O method. Meeuwsen and Dumont (1998) examined the network ofR&D cooperation between Belgian and foreign firms. Minguzzi and Passaro (2000) found positive relationship between firm's competitiveness and its relations with environment for small firms. Roelandt and Hertog(1 999) led cluster analysis in a cluster based policy study with the support of OECD and they issued the book titled "*An Introduction to the Theme, Boosting Innovation: The Cluster Approach*". Viitamo (2001) analyzed clusters in Forest Sector in Austria and Vock (2001) made his study on Swiss construction cluster. Webster and Muller (2000) worked on urban competitiveness assessment in a developing country by the support of World Bank.

Studies using clustering approach are also made in Turkey for the last few years. Oz (1999, 2001, 2002) mainly applied Porter's framework for National Competitive Advantage on Turkey. Kumral, Akgi.ingor and Lenger (2001) examined the national industry clusters of Turkey. Eraydm (2002) studied relation between economic growth and the clusters. Akgi.ingor (2003) made an Input-Output (I/0) analysis in order to define Turkey's meso level clusters.

Cluster approach has also been used by *Competitive Advantage of Turkey* (CAT), established as a non-governmental organization (NGO) by private sector leaders of Turkey together with the cooperation of Porter's intellectual support in 1999, as a tool for increasing competitiveness of the Turkish economy in global arena. By using the Porter's methodology (see Appendix15), CAT defined the sectors which Turkey may have competitive advantage in global market. These sectors were **textile, tourism, construction, food and ceramics.** Then these sectors started to be analyzed by using cluster approach.

When starting a cluster study, first step is obviously to define the cluster that will be worked on. Although there are neither official guidelines nor standardized approaches to cluster identification, there are some accepted procedures; case study approach , a qualitative method, which is mainly based on researchers experience are being used widely in all levels. There is also quantitative techniques such as I/O analysis, which are being used for meso and macro level; however, there is no analysis tool for micro level. There is a gap and thus there is a necessity of filling this gap. Therefore, especially quantitative approaches for identification of the clusters needs to be further researched in micro level. **This dissertation aims to fill this gap and introduces a new quantitative approach to identify a cluster.**

We decided to start this study from the necessity that we see during our studies in CAT. While developing the model, **we mainly used Porter's value system model** (see Figure 3.5); we developed this model in order to meet requirements of cluster analysis (see section 4.1). We believe that this study will be useful for the researchers who intend to use cluster approach for the analysis of a specific region or a nation. Moreover, by using the approach, we introduced in this study, main players in economy such as banks, entrepreneurs, and governments will have benefits.

Obviously, researchers will have benefits as well. These benefits can be seen as the importance of this study for the practical daily life. As a result of our attempt, a **quantitative tool is developed for the first time for identification of micro clusters. We can summarize the importance of the study as follows:**

a. Needfor a tool in order to identify a microcluster:

Today, researchers use case study approach in order to identify microclusters. They interview industry experts, analyze companies which they think are the members of the cluster. At the end of the analysis, they map the microcluster with respect to their view subjectively. There is no quantitative tool to be used. By this study, researchers might benefit from the microcluster-mapping tool that is developed in the study. **Such a quantitative model will be introduced for the first time and will be used for the researchers as one of the main outputs of the study.**

b. Needfor quantitative techniquesfor clustering approach:

Cluster approach became popular with Porter since 1998. This approach gets major criticism from various academicians for the deficiency in its quantitative side (Oz, 1999). Therefore, this study will be a contribution to cluster approach in order to fullfill the need for quantitative techniques.

c. Establishing a basefor comparison of themicroclusters:

Today, researchers use case study approach mainly in order to define a microcluster. This approach is far from standardization. Two researchers may map the same microcluster differently. Because of this, comparison of microclusters became impossible if different researchers made the studies. The technique that we define in this study will provide a tool that researchers can produce standardized outputs. Thus a country's or a region's analyzed clusters can easily become

comparable. Comparison possibility will open a new horizon to everybody that is interested in a region or a country's clusters; even different countries' clusters might become comparable.

d. Pointing potential investment nichesfor the investors:

If there is a gap in value chain, that gap is a potential investment area. The company, after the gap, has to get its inputs from outside of the cluster and this means additional cost, more time and miscommunication. The tool we define in the study shows the gaps in value system. Thus, investors can use the output in order to see potential investment niches in a microcluster.

e. Indicating the potential areas to be supported by the government:

Governments generally prefer to support some specific sectors, companies and/or regions. They may use our technique while making analysis in order to decide which company or which region is to be supported. Our method will provide a solid base for comparison among different microclusters while pointing the critical members of the clusters.

f Showing companies potential cooperation areas with organizations like universities, research firms, etc.:

Companies inside a microcluster are not sure where to contact for their different material, service and knowledge needs. Research outputs that will be prepared with our approach might be used to fulfill this need.

g. Pointing to banks, the firms that credit lines can be opened:

Microcluster maps as the output of studies will also be very belpful for the c;editor banks. If an investor brings an investment project for a niche in a microcluster, bank's credit experts will know whether the investment has profit potential or not.

h. Pointing the tax collectible areas for governments:

Porter sees the clusters as the source of competitive advantage (Porter, 1998). Companies in a cluster are likely make profit because of this competitive advantage. Therefore, tax collectors will know the places to collect taxes.

This study starts with a theoretical framework. Then the methodology is explained in the third section. Model is introduced. Its variables are operationalized and the strong and weak sides of the methodology are discussed. In the fourth section, analysis of the model is made. Sample selection, and field applications are explained. The findings are analyzed by using both mathematical and statistical methods. The study ends with conclusion and implications section.

We believe that **our study has two main contributions:** First contribution will be in academic area. **By our study, microclusters can be identified in a quantitative way for the first time in literature.** This will provide a solid and useful tool to researchers conducting cluster studies. Second contribution will be for Turkish government. **Our cluster analysis can be a starting point for Turkisb Government in its future development policies.** If our study can be applied all over Turkey, we will know all clusters in our country. Because of this, Turkish government will have very valuable knowledge in order to increase these clusters' competitiveness by applying necessary policies so that Turkey's national competitiveness will increase. Within this perspective, we believe that cluster approach can be a new paradigm for the future development attempts of Turkey.

As a result, in our study, we aimed to develop an integrating model that will be practically used in daily life as Alpay said *"In 21st Century, interdependent models are not sufficient, we need integrating models"*

2. Scope of the Study

Roelandt, Hertog, Sinderen and Vollard (1997) defined clusters in three groups. These are national level (macro), branch or industry level (meso) and firm level (micro). At the micro level of analysis, clusters can be described as networks of various suppliers around a core enterprise (Hagendoorn and Schakenraad, 1990). This kind of analysis can be used to make a strategic analysis of the firm and to identify missing links or strategic partners when innovation projects encompass the whole production chain. It is also used to analyze the different stages in the production chain when analyzing environmental innovations (waste management, energy use, emissions, materials management). In this case, cluster analysis is often used in combination with case study material (Roelandt, Hertog, Sinderen, Vollaard, 1997). Meso level concentrates on mostly branch or industry scope. Mesoclusters can be defined if there is inter and intra industry linkages in the different stages of the production chain of similar end products in a cluster formation area. Most of the Porter studies carried out in different countries (Finland, Sweden, USA, Denmark, Netherlands) use this level of analysis. In macro level, some countries' contributions focus on linkages between industry groups (mega-clusters, like Finland and Netherlands), and mapping specialization patterns of a country or region economy-wide (Roelandt, Gilsing, Sinderen, 2000). The scope of this study is microcluster. We are dealing with clusters at firm level. As it can be seen from Table 3.3, microclusters are small-scale clusters and studies deal with firm level in microcluster level.

Our main aim in this study is to develop a quantitative model for identification of microclusters. Therefore, we limit our study on microclusters and do not go in detail for the clusters other than microclusters such as meso or macro level clusters

and related studies.

Today, various studies are being made on clusters and their effect on innovation. We did not include studies about innovation side of cluster which is developing fastly in our study. We think that innovation in clusters can be a subject of another study and out of the scope of this study; therefore we defined our scope without caring innovative side of clusters.

3. Theoretical Framework

Although cluster approach is a quite new in academic area, it finds applications in daily life largely. Therefore, academic material about it is not reach a saturation level. In this section, our aim is to find roots of cluster approach in different part of the management discipline and link them to cluster approach so that we believe that we will make a contribution for the creation of a theorectical base for cluster apprach.

3.1. Background for the Study

The notion of industrial complexes and the regional concentration of networks of specialized suppliers, producers and users is by no means new in economic theory. It goes back to Marshall's analysis of industrial districts in 1890. However, Porter(1990b) popularized the concept of industry clusters in his book titled "*The Competitive Advantage of Nations*".

The incentives for cluster formation differ quite considerably. The principle incentives for cluster formation are: (i) to gain access to new and complementary technology; (ii) to capture economics of synergy or economics of interdependent activities; (iii) to spread risks; (iv) to promote joint R&D efforts with suppliers and users; (v) as a defensive strategy to reduce competition; (vi) to obtain reciprocal benefits from the combined use of complementary assets and knowledge; (vii) to speed up the learning process; (viii) to lower transaction costs; and, (ix) to overcome (or create) entry barriers in markets (Roelandt, Gilsing, and Sinderen,2000).

After the Porter's book titled "Competitive Advantage of Nations", case study method was used mainly for cluster analyses all over the world. In the mean time, different studies on clusters have been made without considering Marshall's and Porter's studies. For example, Srinivasan and Moon (1999) worked on supply chain

networks for inventory control. Minguzzi and Passaro (2000) worked on the network of relationships between the economic environment and the entrepreneurial culture in small firms. They concluded that network of relationships between firm and market is the main factor external to the firm. Another researcher Powell (1999) explained necessity of firm networks by stating "many firms are no longer structured like medieval kingdoms, walled off and protected from hostile outside forces. Instead, we find companies involved in an intricate latticework of collaborative ventures with other firms, most of whom are ostensibly competitors" (Powell, 1990:300). Powell (1990) gives the examples of auto and biotechnology industries for network formation of firms. Network form also offers advantages specific to entrepreneurial firms. The use of a network exchange structure represents a critical leveraging opportunity whereby resources can be gained and competitive advantages realized without incurring the capital investments of vertical integration (Larson, 1992).

There are basically three approaches to competitive strategy formulation of the firms in literature: resource-based strategy, strategy based on the economic theory (namely transaction cost theory) and activity-based strategy (Lakhal, Martel, Oral, and Montreuil, 1999). Competitiveness of regions and nations based on cluster approach has roots in three important area of the management discipline; therefore, we will use these three approaches in this study in our analysis of the issue. These are: resource, transaction cost and activity based competitiveness. In the following sections, we examined the relation of cluster approach with these important areas of management.

3.1.1. Resource Based Competitiveness

The success of companies is attributed to many factors, but mostiy to the process of creating core competencies that are difficult to imitate or duplicate (Prahaled and

Hamel, 1990). Resource based theory emphasizes how a firm's unique resource may allow the organization to develop a sustained competitive advantage. This powerful paradigm offers unique insights into competitive situations that go beyond such traditional approaches as SWOT analysis and the industry forces model (Porter, 1980) attributed to Michael Porter (Pringle and Kroll, 1997).

According to Barney (1991), a firm can create sustained competitive advantage if it has resource(s) with the following conditions:

- The resource must be valuable
- The resource must be rare
- There must be no substitute for the resource
- The resource must be imperfectly imitable of unique historical conditions or casual ambiguity or social complexity

Resource based theory to strategic management focuses on costly-to copy attributes of the firms as sources of economic rents and, therefore as the fundamental drivers of performance and competitive advantage (Conner, 1991). According to Gulati, Nohria and Zaheer (2000), the image of quarantined actors competing for profits against each other in an impersonal marketplace is inadequate in a world in which firms are embedded in networks of social, professional and exchange relationships with other organizational actors. Such networks encompass a firm's set of relationships, both horizontal and vertical with other organizations-be their suppliers, customers, competitors, or other entities-including relationships across industries and countries. These networks are composed of interorganizational ties that are enduring, are of strategic significance for the firms entering them and include strategic alliances, joint ventures, long term buyer-supplier partnership and a host of similar ties. Powell discriminates networks by saying "network can be complex: they

involve neither the explicit criteria of the market, nor the familiar paternalism of hierarchy. Basic assumption of network relationships is that one party is dependent on resources controlled by another, and that there are gains to be had by the pooling of resources" (Powell, 1990: 302).

A network perspective can provide new insights for strategy scholars whom frame their ideas around resource-based view of the firm. A comprehensive view of a firm's rent generating resources would not only include elements such as brands, technological capabilities, management talent and so forth, but would also include the network resources or social capital of the firms. **The relationships a firm have are a unique and inimitable asset.** Both the specific network to which a firm belongs and its relative location in that network are likely to be important. Firms whose relationships allow them to occupy a more central place in the strategic networks are a part of superior returns because of access to better information and opportunities than those firms that are more peripheral (Gulati, Nohria and Zaheer, 2000).

3.1.2. Transaction Cost Based Competitiveness

Transaction cost approach considers the efficiency implications of adopting alternative governance mechanisms (Heide, 1994). The network is viewed as a strategic mechanism to improve a firm's competitive advantage through cost minimization while maintaining flexibility. The change in orientation of competition to cooperation in interfirm relationships is rationalized according to the transaction-cost economics perspective (Park, 1996).

Economic approaches to the study of organization, transaction cost analysis included, generally focus on efficiency (Williamson, 1981). According to transaction cost approach, the goal of the organization is to minimize the costs of exchanging

resources in the environment. **Transaction costs arise when organizations exchange resource or information.** Organizations interact with other organizations to get the resources they require, and they have to control those symbiotic and competitive interdependencies (Jones, 2001).

Network perspective is useful to scholars who focus on contracting and governance issues and how the choices influence firm performance. Network perspective suggests that both contracting and coordinating costs can be influenced by viewing each transaction as simply an event in an evolving network of relationships. A new transaction with someone with whom one has a history of prior relationships or who has ties with others to whom one is also connected poses far lower transaction and coordination costs than might be expected within a more traditional analysis (Gulati, Nohria and Zaheer, 2000).

3.1.3. Activity Based Competitiveness

The teaming up of companies to form business networks seems to be a promising competitive strategy since it permits the partner companies to concentrate on those activities of the value chain they perform best and thus every company forming the network maximizes its own added values. The conventional concept of competition that one company competes against the other companies is no longer valid in the world village of globalization. Instead, network against network is the name of the game and therefore the competitive advantage of a company is largely determined by the competitive advantage of the network the company belongs to (Lakhal, Martel, Oral, and Montreuil, 1999).

If for Porter's competitive strategy framework, a firm is viewed as a bundle of activities, for the resource-based scholars, firm is viewed as a bundle of unique resources (Spanos and Lioukas, 2001). Porter (1990b) has suggested that

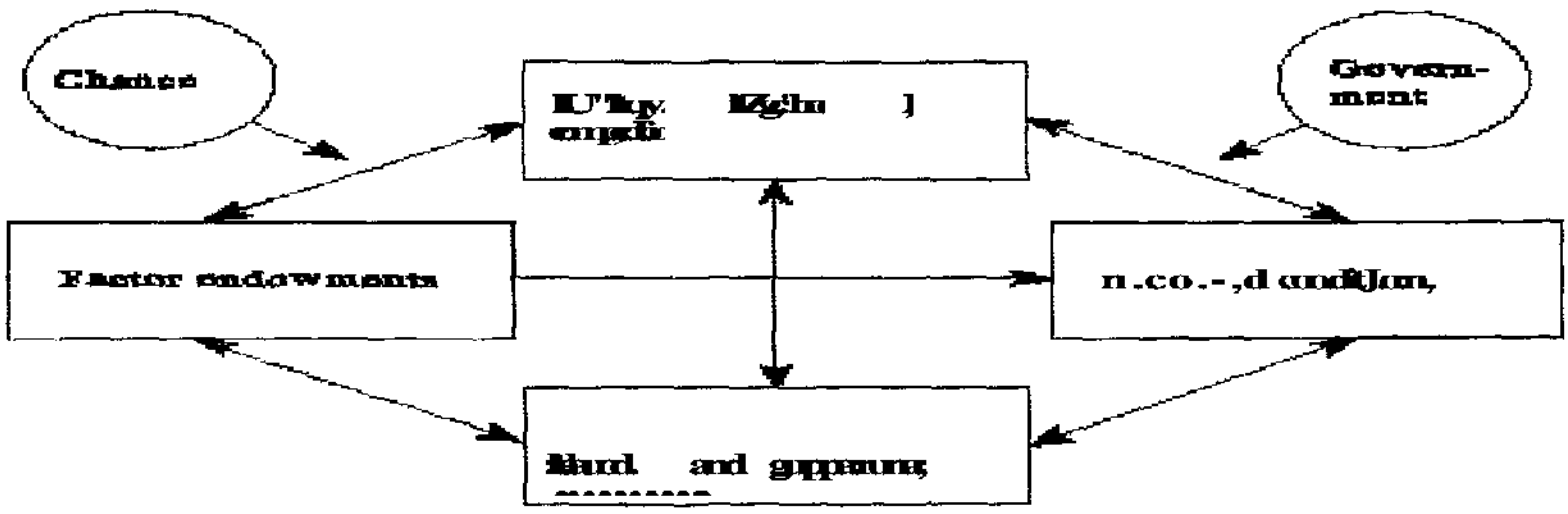
agglomeration should be viewed from competitive perspective in which increased interfirm rivalry is viewed as the principle mechanism through which the benefits of geographic agglomeration are realized. Geographic proximity is so integral to the process through which competitive advantage forged and he states " agglomeration raises interesting questions about whether a city or region instead of a nation is the proper unit of analysis" when considering the creation of national advantage (1990b:790).

Although Porter's assertions regarding the eompetitive benefits of agglomeration have not been rigorously tested, they are grounded in exhaustive case study research. This research was part of a 4-year study on national advantage that involved in-depth analysis of over 100 successful country-based industries from 10 different important trading nations, including the U.S., Japan, Korea, and Germany. Case studies of each industry included a historical assessment of competitive patterns that was designed to provide an insight about how these countries achieve to reach such a competitiveness level.

Porter (1990b) states, "Among the strongest empirical findings from our research is the association between vigorous domestic rivalry and the creation and persistence of competitive advantage in an industry". In his opinion, relative geographic position within an industry plays an integral role in the development of competitive advantage because geographic proximity magnifies the beneficial effects of rivalry. Agglomeration, he notes, is surprisingly common in successful industries around the world (e.g. cutlery in Solingen, West Germany and Seki, Japan; pharmaceuticals in Basel, Switzerland; motorcycles and musical instruments in Hamamatsu, Japan; minicomputers along Route 128 in Boston; advertising on Madison Avenue in New York, etc.). Agglomeration creates an ideal environment

for the creation and maintenance of competitive advantage by fostering healthy rivalry and helping firms avoid some of the pitfalls that often befall firms that are more isolated.

Figure 3.1: Diamond Model



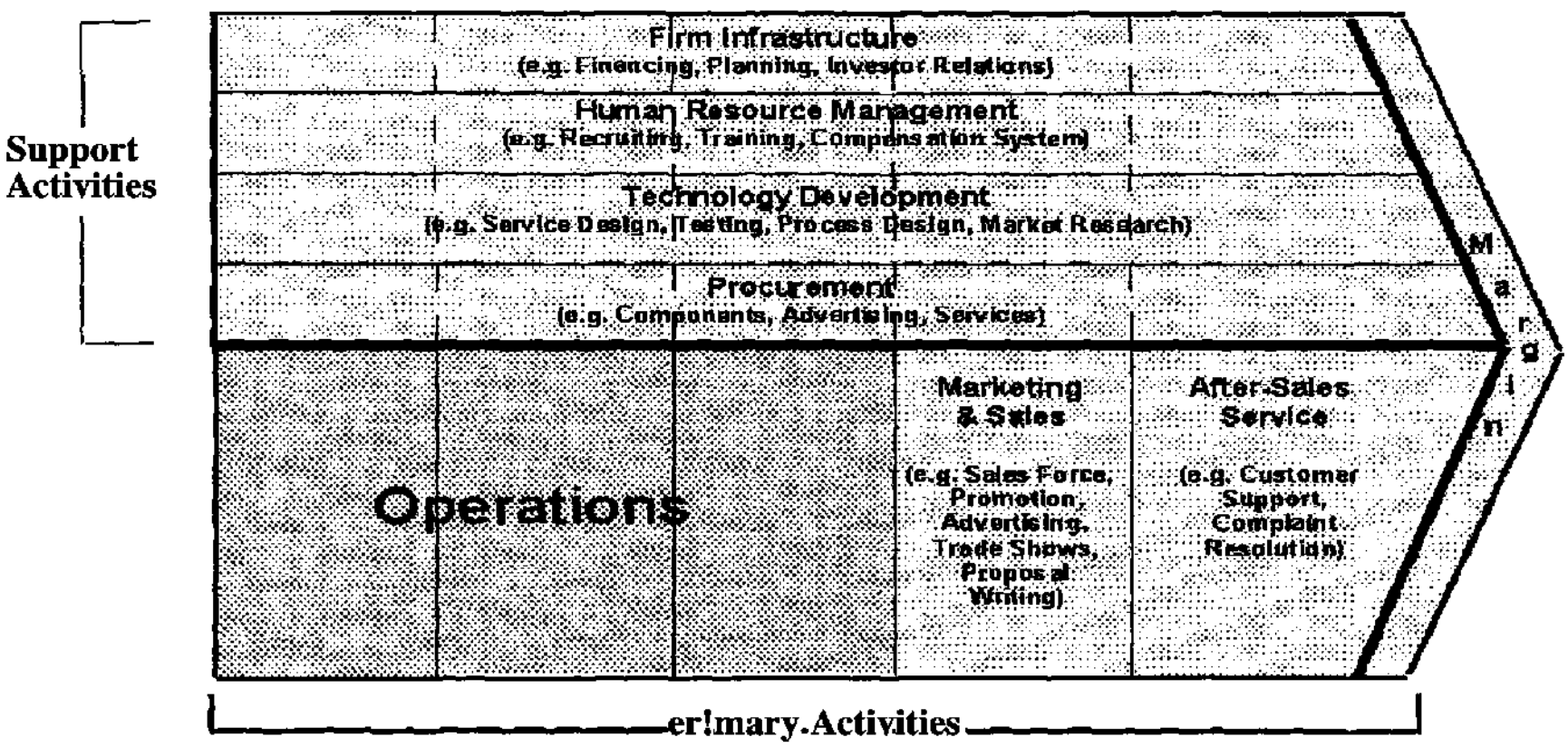
Source: Porter (1990b: 72)

Porter developed the "Diamond of Advantage," which is the four factors determined to create a competitive advantage for firms (Figure 3.1). The four corners of the diamond include factor conditions, demand conditions, industry strategy/rivalry, and related and supporting industries. Porter used this diamond to determine which firms and industries had competitive advantages, and his emphasis of the importance of related and supporting industries encouraged interest in clusters. While his original thesis was applied to nations as a whole, Porter recognized that the majority of economic activity takes place at the regional level. Thus, his ideas are commonly applied to cities and regions.

According to Porter, a firm is more than the sum of its activities. A firm's value chain is an interdependent system or network of activities, connected by linkages. Linkages occur when the way in which one activity is performed affects the cost or effectiveness of other activities. Linkages often create trade-offs in performing different activities that must be optimized (Figure 3.2).

Gaining competitive advantage requires that a firm's value chain is managed as a system rather than a collection of separate parts. Reconfiguring the value chain, by relocating, reordering, regrouping, or even eliminating activities is often at the root of a major improvement in competitive position. A good example is in appliances, where Italian firms transformed manufacturing and exploited an entirely new channel of distribution to become world export leaders in the 1960s and 1970s. In cameras, Japanese firms became world leaders by simultaneously commercializing single lens reflex technology, transforming manufacturing into automated mass production, and pioneering mass marketing (Porter 1990b).

Figure 3.2:Value Chain



Source: Porter (1990b: 41)

Perhaps one reason the story of clustering in Porter's "*Competitive Advantage ofNations*" resonates so strongly with policymakers even as it echoes much of the literature that preceded it is that it is couched in the more accessible verbal language of business strategy rather than in the mathematically refined vernacular of urban and regional economics. But that is hardly a satisfactory explanation given the many compelling verbal treatments of the theories of agglomeration economics,

externalities, industrial districts and innovative millieu (Feser and Luger, 2002).

Recently, Porter (1998) revised and developed the cluster. He redefined the cluster as the geographic concentrations of interconnected companies and institutions in a particular field. He explained the cluster concept in detail as " clusters encompass an array of linked industries and other entities important to competition. They include, for example, suppliers of specialized inputs such as components, machinery, and services, and providers of specialized infrastructure. Clusters also often extend downstream to channels and customers and laterally to manufacturers of complementary products and to companies in industry related by skills, technologies, or common inputs. Finally, many clusters include governmental and other institutions-such as universities, standards-setting agencies, think tanks, vocational training providers, and trade associations-that provide specialized training, education, information, research and technical support"(Porter 1998).

In his 1998 article, **Porter opens a new agenda in competitiveness with cluster approach.** He states this idea by saying "clusters affect competitiveness within countries as across national borders. Therefore, they lead to new agendas for all business executives not just those who compete globally. More broadly clusters represent a new way of the conventional wisdom about how companies should be configured, how institutions such as universities can contribute to eompetitive success, and how government can promote economic development and prosperity".

After Porter's 1998 article, cluster studies in all over the world boomed. Andersen and Teubal (1999) worked on high-tech cluster creation and cluster reconfiguration. Bergman (2001), Hertog (2001) studied about innovative clusters; Best (1999) conducted a case study on Singapore/Johor Electronics cluster; Kleinhenz (2000) on Northeast Ohio Clusters Project; Oyeyinka (2001) on networks

and linkages in African manufacturing cluster in Nigeria, Peteers and Tiri (1995) on the identification of techno-economic clusters in Flanders by using I/O method. Meeuwsen and Dumont (1998) examined the network ofR&D cooperation between Belgian and Foreign Firms. Minguzzi and Passaro (2000) find positive relationship between firm's competitiveness and its relations with its environment for small firms. Roelandt and Hertog (1999) leded a cluster analysis for a cluster based policy study with the support of OECD and they issued the book titled "*An Introduction to the Theme, Boosting Innovation: The Cluster Approach*". Viitamo (2001) analyzed clusters in Forest Sector in Austria, and Vock (2001) made his study on Swiss construction cluster. Webster and Muller (2000) worked on urban competitiveness assessment in developing country by the support of World Bank. However, there are studies that find negative relation between agglomeration and competitiveness (Beal and Gimeno, 2001). Beal and Gimeno analyzed the PC industry in U.S. and found that agglomeration reduces firm-level incentive to engage in private innovative activity and localized knowledge spillovers, although beneficial in the short run, deteriorate over time and therefore fail to provide long-term competitive advantage to agglomerated firms. However, most of the studies positively increased the interest to cluster approach until now.

Cluster studies are also made in Turkey for the last few years. Oz (1999, 2001, 2002) mainly applied Porter[1]s Framework for National Advantage into Turkey. Kumral, Akgi.ingor and Lenger (2001) examined the national Industry Clusters of Turkey. Eraydm (2002) studied on the relation between growth and the clusters. Akgtingor (2003) made an I/O analysis in order to define Turkey's meso level clusters.

3.1.4. Globalization versus Localization

The proportion of traded goods in world output has been rising steadily over the past several decades. When we look at specific products exported by the advanced industrial nations, increasing export specialization is evident. According to Storper (1992) such specialization cannot be explained by conventional notions of comparative advantage, nor entirely by the trade theory based on economies of scale. Rather a significant proportion must be due to technological or "absolute" advantages on the part of the specialized exporter and significant dimension of technological advantage is product-based and renewed through learning, giving rise to dynamic economies of variety as a source of export specialization. Industries characterized by such product based learning and absolute advantage tend to have important development effects on their host economies. Such industries also tend to be organized into production networks combining the advantages of specialization and flexibility, which are key to technological learning. These export oriented absolute advantage industries tend to be found in one or a few subnational regions of their host countries.

With respect to Storper (1992) we can say that a country is successfully specialized in today's world economy when its share of world exports of a specific product is greater than its share of world trade as a whole (Appendix.15). This criterion is emprically more restrictive than a comparative advantage perspective in that it tends to reveal fewer, but more intense areas of strength. Research by Porter (1990), using a similar definition of specialization, reveals that the specialization of Italy, Germany, U.S., Switzerland, Japan and Sweden are suprizingly different from one another, even though the sectoral distribution of activties in these economies would look relatively similar and increasingly convergent if viewed side by side and

in terms of more aggregated sectoral definitions (such as 2 or 3 digt SIC sectors).

3.2.Clusters

3.2.1.Definition of Cluster

Mangiameli, Chen and West (1996) formulate the cluster problem as follows:

$$\min Z = \sum_i \sum_j d_{ij} X_{ij} \qquad (1)$$

subject to

$$\sum_j x_{ij} = 1 \quad \forall i \qquad (2)$$

$$\sum_j x_{jj} = m \quad \forall j \qquad (3)$$

$$X_{ij} \leq X_{jj} \quad V i, j \qquad (4)$$

$$X_{ij} \text{ is a member of } \{0,1\} \quad V i, j \qquad (5)$$

where m is the desired number of clusters; d_{ij} measures the distance or dissimilarity between object i and object j; X_{ij} is a binary variable indicating whether object i is assigned to cluster j; I is the set of n objects; and J is the set of eligible medians. Conceptually the cluster problem can be stated as follows: select m points from the set J, constraint (3), and assign all objects in set I to one and only one median, constraints (2) and (4), so that the sum of the distances from all points to their respective cluster median is minimized. There is not an efficient optimal solution methodology for the cluster definition problem. Therefore, many heuristic and suboptimal methods are used for cluster definition.

Churchill examines clustering methods and concentrates on most popular of them (Churchill and Iacubbi, 2002). These are linkage, nodal and factor procedures.

a. Linkage procedures: Single, complete and average linkage procedures are used under this title. In single linkage procedure, potential members of the cluster are linked with respect to their similarity. Objects with the highest similarity coefficients

are clustered together. The union of two objects, the admission of an object into cluster, or the union of two clusters is by the criterion of single linkage. In complete linkage method, an object joining a cluster at a certain similarity coefficient must have relations at that level or above with every member of the cluster. Thus, single bonds with just one member of the cluster would not be sufficient to affect the juncture. In practice, this fierce condition, with larger groups forming only when the criterion level is lowered considerably. Complete linkage has a tendency to produce very tight, compact clusters. The average linkage method is an attempt to walk a middle ground between the single and complete linkage methods. As the name implies, the average of all similarities between an object and a class of objects or between the members of two classes has to be above the given level for linkage to occur.

b. Nodal procedures: Nodal-clustering method involves selecting an object that will serve as focal objects or nodes for clusters. The remaining objects are then allocated to each cluster based on their similarity to the focal objects.

An alternative nodal clustering method employs a "prime" node. The prime node is the most "typical" object-that is, the object that has characteristics closest to the average characteristics for all the objects. Than other nodes similar to prime node is added to the cluster until a big jump homogeneity value.

c. Factor procedures: This procedure approaches to the clustering problem through the factor analysis.

14 When we think of clusters and networks, we are basically thinking of groups of firms linked together by being oriented towards similar end products or services, such as clothing products, or packaging machinery, or furniture, and drawing on similar production and service inputs in a value chain. Typically, a notion of

geographical proximity is included (Pyke, 2000).

Clusters can be characterised as being network of production of strongly interdependent firms (including specialized suppliers), knowledge producing agents (i.e. universities, research institutes, engineering companies), bridging institutions(i.e. brokers, consultants) and customers, linked to each other in a value adding production chain (Roelandt and Hertog, 1998).

Clusters are geographic concentrations of interconnected companies and institutions in a particular field. They encompass an array oflinked industries and other entities important to competition. They include, for example, suppliers of specialized inputs such as components, machinery, and services, and providers of specialized infrasturcture. Clusters also often extend downstream to channels and customers and laterally to manufacturers of complementary products and to companies in industries related by skills, technologies, or common inputs. Finally, many clusters include governmental and other institutions-such as universities, standards-setting agencies, think thanks, vocational training providers, and trade assocations-that provide specialized tarining, education, information, research and technical support (Porter, 1998).

3.2.2. Clustering Approaches

In 1890, Marshall defines industrial district for the first time in his book titled *"Principles of Economics"*. According to Markusen (1996), three more types of industrial districts beside the one that Marshall defined are possible. These are (1)Hub-and-Spoke district, where regional structure revolves around one or several major corporations in one or few industries, (2) Satellite Industrial Platform, comprised chiefly of branch plants of absent multinational corporations - this type of district either be comprised of high - tech branch plants or consists chiefly of

Table 3.1 Hypothesized Features of Industrial District Types

M.1n· h.alliati irnimtruil di,!rid:.

- ll:1>:n.% strnetue d.mll1t;(;,,e:dby :>lll,Ili, bc/i;y l'J',1;;1'1;'!rcfir,:r,
- Se;i.1 of;L'()ltulcil 'S re Hvd ¡· k,w
- 11 b t,u1tinl iitt1'tdi l:htt ii.we 1llll(mp, li11ye ;it.<l 1.;l:itillt.i.
- Ke'! imre bu d <leci l<l-f! 1,t.::.i k1c:.1ll\v
- .L@g·tfl'm0".lt1tt·11d 1'tnd c(;tmnitmc::nts bet!.!itrn fo;-:;Nbuye.r,;,md suwlicn
- 1,);',' degre;--l! of etJt;l)Btatilm tsr hnb1 e with firms .:tem,1.! to the <l.u,tt'i.d
- J...l):- matj;l'c.ti1•J.ei:t)olto th1:..-0i,trid., hi11J1\:flexible Wt)L\1:t·st'-OllhaiUedtr,dbtitt. rafoerthan to fo·tu
- H\gh .-Me- ,A l bm- m•m:igrot(m, bwei: l vek ,}f(;Ut-lU.i;{ltJciot•;
- F.wifo.ti(in ,/ unique !.oc:ult::'!llbnil identity, hand
- Spci.iz:eti !i'i.ll!J.rcesoffowctice, t«:hn(c.:.11i,;l',per,t,e, bifl.e::if. er\;"k JvJJHable iu district t}iJ.tti.deof }rms
- F.:xi;tt,I.Ct.'.(,i' ·\;; l:knt t pit !" wi.thin di b"ict
- T :lm,;.;il, ti').l (J<Jd j,Jt,g·teur: pnJo etct for grnw h Jttd im·,µ1<J}'l:eat

fi.al.i.atl-ilte vari.:mt {fnadtlitii:m to ahol'I!.)

- ltgt inddtnct.\t}fu,d,n.tg,.:, of !165oni1e/h<:rtwMn tu5t<:::iH."..niand !JpVl'.ers
- Hj_;h de r ,it C<Jllper::itiof,G-l:t!JIII\t:iJ!.ti))dllw fmm to hi.re ri!ik, st1bihz,e n,oclet, share um,ivatmn
- Di;;pmpmticrmre slu,.'eti 1,Jfworl;iJrs en.12Al:'tdin de:si n, i1m-0wmm
- Stron;i; trnd .J.isoel,.tti.on tl.w.t prQ',ide h;:ired lufra,b.. htr - lt u; m nt, trninitlg, rno.rkefag, tec::huiea[or fo·:a\nr.ia.lkdµ, i.t:., 1.1\tth,1n,.!lw,.for ri k. ,il,llT::ng, -,,ri. ::-nh1lt;,:Mfo11
- Stmnil: [0,(;algnvemuHint ::<ik ;n n'g]l ti.rg and p m1ott11i e-,t<'lhidt,,,ld.-;

Hub·1lhd• o :c di trkh

- .l:hi,HM m1i1:tL1.re(:.\.mt'lr:nrtdby(,1,;m ;:;i;ei·i1.l;ti;te, vertiNIIly ifltl·otrd fbw, 1i'lm}un•kd.b)'mpplitL
- C:,neftnus .en1beddedu-0nioca!ly,with suht;inh.ti h,1b to upp!ren tmd<.:01utii:ors 'Ji1ti.de'•fth d-i.1tcid
- Sr.Rlr. f.t:tm,Jmit>1 rf.htively htgh
- i.r,.-,wrate :/ h_,WQ,te:1·u(°;<_,..:abuiues excejt i1 bird lie:1
- Suh;:tm1tial l:.Ht'f,di.trlctt·ade IMtlfl d.omm;;:nt&i-r:.\srmd 111µplic1·:
- Key ir.vestment <ledsbn m <le locally, but Sk)te:W.outr;kblly

- lmili:·t-r.11r, ,:mti,;ir.-t :md ::imP11n1wnti behvei:1.l d,},1:in.:1ntfo'll1 and 5tJppli.en
- Eh;!: <lew·eei of t<)<J}iem[im,litwi.ge, \.,ithe:.\terunl Hnm k11h loc:a[l ami.ed1.:nu1111·
- Mdet,1te. i;iqd 1 e of P. d llgP.. ;;f per c)tl el b.::twerm (.1;11t)lll!tS nd rnppl(eu
- Imv Mr-;re <)t.t:,ll,ptn.\tkmm \ong krge (<:!f:l})l'Jittwnmit: 1<)hr:re. rHk, Stanib.ec Ul-'l)'kf.J.,skrr. l11n,wath1tl
- LDJJ<Jr l,LMh:t i d e n d b lhe di trid, le :fleo1ble
- DL prnpornc.nott 1\txes ,Jf bke.-t--jlliir wtirkn-:s
- Wo(kel committed. tr1 kirlia fim1 :fL-st, tlien to dis i.:::t, then tu iimall finnt
- f·fi:;;r, !"Mt'. tif !lhJr b-1 \i, rMitnl, but le.s <Jd-1\\grnti:1.)11
- Evnl.uHon (if ur;(r111eh!c-il1 t ilturul (df,\ntity, !xnid\
- SpecialiU¼l :ssiu.ro:::;,,f finaitte, tf:ldrniml e1.t'.)t.!'foe, bu ir1e ser\'ic d(itll.ir:ute,l Ly la1\J,- !:inn
- L,.tl\(i . 'li!.!'.k:.mcapi:tr:.l" W\lhl.t, district {)Utsk!.•}o r J:.'gf. fii' s
- Absenr:;,:oftr de l!Socilttbns th.1t.f,.;;:,vi<l.e,bred i,1&;i,str11-:::nur-e-11lana[!:\elt1entf.rilining:,n,arkeh\<1g,leo:hmc::.l rJt finaoci:it 6:dp, i.e., mt:,c.hani;;:nisfor r!jk shaJiug and sP1.hi'!lE:ntfo,t
- Stro11.gfowl g,Nent,l':t1.t rde il, re.g,1\.Jthg,md.prnm ting ;:oreind·:1,t:-i€5in bea] :md prnvlndat <1mirra.tki:nd 1,,1"<':rl\lllf.'.r:t
- HH, h .Je, ree if publit: i 1,·llh 11ted in p.-ovi.ding t·£1;tt-1J.dure.
- L,;1lte1·t\prospect forw1wth dep,1ul.c11t1:por,\.)PJ£f>i':ctfor tr.-tnd,t1tq,ar;d !tn:;tc_.'! rl domln.:1.nrfirms

SMelHt h1dumwl. tfor®J

- B,1 111e:. trncittre /()lnir:nt.d hy h rg {':,extf.m,i!ly liwi.tl'!<l r..ntl hN.dqua1tt,ce".i1ftt'ms
- Sc..k; eer,rh.iEiiet nv.,tler11t:c:.tn high
- •• L,}:.t: ro tmidet' te 1·.i.tes ,.if tu.·novcr d' platform t,n:.u,.lts
- Mi11imal int,adistrfd tmde runoog bJycn and lipplkr
- R-ev ir;\• sh\t<:::nt deci I,)1., tis,,d.e e temally
- Ah.serH.:iJ ()f lmtY:-tii(l'.:i.mmmttni.6tit tu Htpp)iers kc.illy
- High J.g r,:c <J(0;-Y)v. rali,m, hi,kagei; \villt exl>:nial frm,, spe:-..:/:i.!iywi.th l)Jfe Jl r;;c,mp,my
- High foci,\r::-;.c ,,fr:;:chm1gf!sd. p'?.:;,:,1nndb1m,11fa::l1Bm:1P.,· ni. -i:f'lp:.ieu . nt rnnt\y but nor 1,ir.-illl'I
- L,y,,, d.e, r 0i S::ll◊i_]{lmti.onarnmg comµetJh):r firuu lil 8hare risk, :.tabHilt nm!'ltet, harf.! ltmovatl,;u
- L;;b',Jr l!\(l.fkt ;:rtr:mal t0 rho?: c.l,Md, internal tc v-ertle.tilly ii1.tq,;r11ted fim1

Source: Markusen (1996: p.298)

low-wage, low tax, publicly subsidized establishments and (3) State-centered district is a more eclectic category, where a major government tenant anchor the regional economy (a capital city, key military or research facility, public corporation). Markusen describes the hypothesized features of these four types of industrial districts in Table 3.1.

According to Hoen (1998), the variety of clusters can be classified along two dimensions (See Table 3,2,):

"Firstly clusters can be distinguished according to the scope or level of analysis: the micro level refers to clusters of firms, the meso level and the macro

level refer to clusters of sectors. Secondly, the relation between the entities in a cluster may refer to innovative efforts or to production linkages. Clusters based on innovative efforts relate to firms or sectors that co-operate in the process of diffusing innovations such as new technologies or products; cluster based on production linkages relate to firms or sectors that form a production or value added chain" (Hoen, 1998).

Table 3.2. Six types of cluster

	l11tirw1:-itivrdforts	Pwd1ic:tion linkages
ivikro	Diffa,ion of tcch11dogk:8 and. kn(P,vk:dgc between firm tq:;1.:ard1\1s1:itm:ion .dX, ;	Suonliern and buvt:r:. in Y:aluc-added or ori:1(.bt:tic):tld11titi. of fim1-,
Meso	Diffrndon of tt chnologv and kmnwlrdi.t_1': b{: kn -c n :\t1. t1n:s ,.,	B:ld.\vanl :md fot\v:ml linbigp; httw1:tn s1:i:tnt$; pardil analyst:$
lvfatto	A split up of thl': tcon<;nrlc sp,tern it1 ,ertots th:tt difbst: kno1,vkdge or ti:d11)1:'1log\i:t,	A :,plir np of the etm,omk sr,tnn in stctt)rs that form1 vilue added (1!: pl:tia:.hlc1.i{mrhain

Source: Hoen (1998:p.1)

Despite all this attention, there seems to be no consensus about the definition of an approach towards clusters. The analysis of linkages and interdependence between actors in a value chain can be carried out at different levels of aggregation and geographical scale and with different techniques, depending on the needs and questions to be answered. Roelandt, Hertog, Sinderen, Vollard (1997) define three cluster groups which is very similar to Jacobs and De Man (1995) (Table 3.3).

At the micro level of analysis clusters can be described as networks of various suppliers around a core enterprise (Hagendoorn and Schakenraad, 1990). This kind of analysis can be used to make strategic analysis of the firm and to identify missing links or strategic partners when innovation projects encompass the whole production chain. It is also used to analyze the different stages in the production chain when

analyzing environmental innovations (waste management, energy use, emissions, and materials management). In this case, cluster analysis is often used in combination with case study material (Roelandt, Hertog, Sinderen, Vollaard, 1997). Mesa-level analysis concentrates on mostly branch or industry level. Mesoclusters can be defined if there is inter and intra industry linkages in the different stages of the production chain of similar end products in a cluster formation area. Most of the Porter studies carried out in different countries (Finland, Sweden, USA, Denmark, and Netherlands) use this level of analysis. Finally some countries' contributions focus on linkages between industry groups (mega-clusters, like Finland and Netherlands), mapping specialization patterns of a country or region economy-wide (Roelandt, Gilsing, and Sinderen, 2000).

Table 3.3. Cluster analysis at different levels of analysis

Level of analysis	Cluster concept	Focus of analysis
National level (macro)	Industry groups linkages in the conomic structure	-specialization patterns of a 111ational/regional economy -need for innovation and [Upgrading products and process n megaclusters
Branch or industry level (meso)	Inter and intra industry linkages fo the different stages of the [production chain of similar end tproduct(s)	-SWOT and benchmark analysis of industries -exploring innovation needs
!Firm level (micro)	Specialized suppliers around one K)ra few core enterprises (inter-lfirmlinkages)	strategic business evelopment -chain analysis and chain management -development of collaborative nnovation projects

Source:Roelandt,Hertog,Sinderen,Vollard (1997:p.5)

Porter looks the clusters in broader view. He considers service clusters beside production clusters. Porter provides a simple definition of two types of clusters: **vertical clusters,** and **horizontal clusters.** Vertical clusters are made up of industries that are linked through buyer-seller relationships. Horizontal clusters

include industries which might share a common market for the end products, use a common technology or labor force skills, or require similar natural resources Porter (1990b).

According to Jacobs and De Man roughly three groups of cluster notions can be distinguished (Jacobs and De Man, 1995):

a. Regional clusters

The similarity-based regional cluster approach is an old one, in his *Principles of Economics*, Marshall already mentioned 'industrial districts' (Marshall, 1890). He says, "The development of regional clusters went way back in time, because of the existence of competitive advantages".

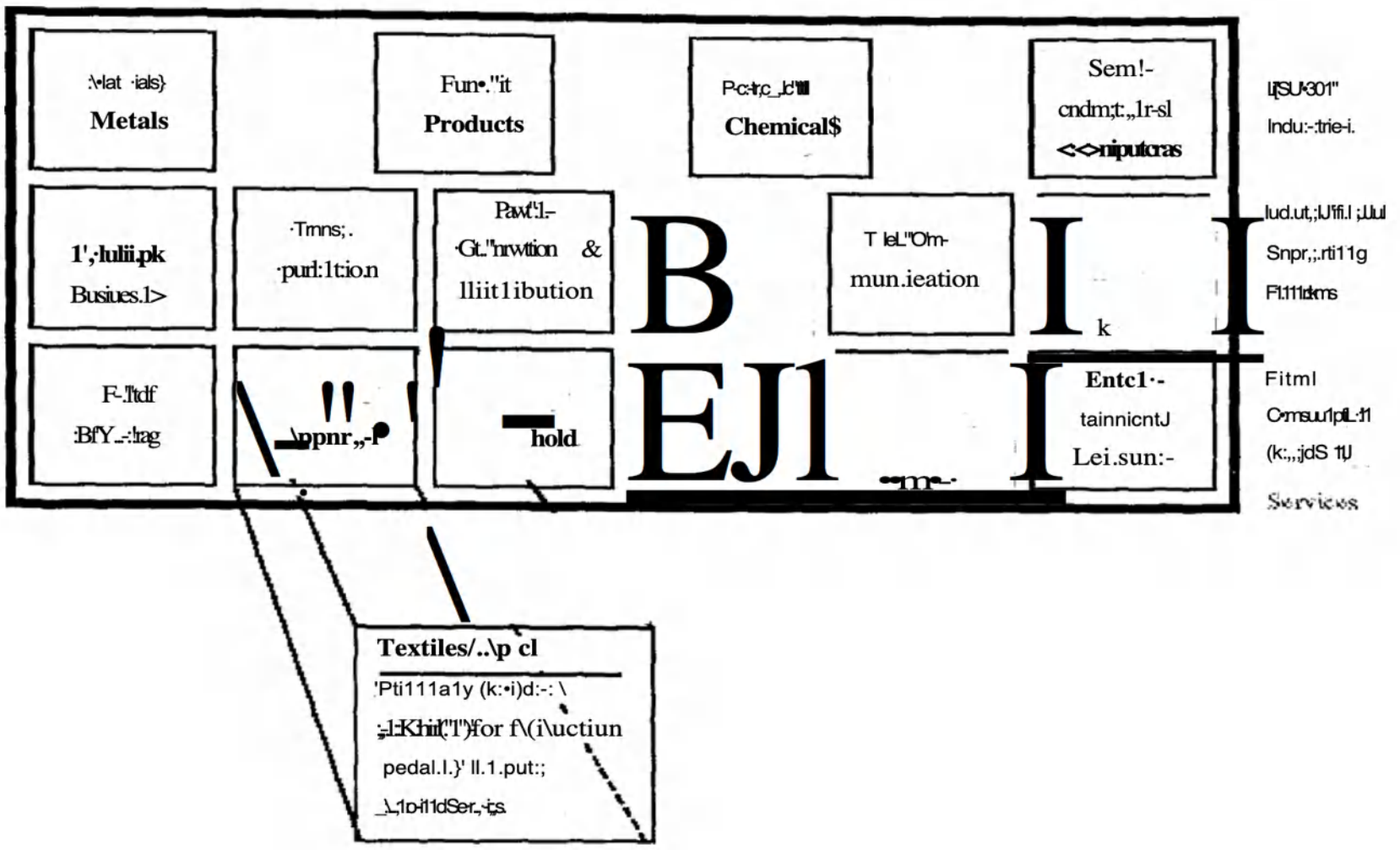
According to Marshall, the main advantages of localized industries are innovative interactions between people, specialized supplies and a skilled labor pool. In other words, localized industries have similar needs with regard to framework conditions.

b. Sectorial megaclusters

Porter's book (1990b) is the driving force behind the sectorial approach, which links sectors in megaclusters (Figure 3.3).

The similarity-based Porter approach is a standardized one, incorporating sixteen possible clusters, sub-divided in three industry groups (upstream, support, consumption) at four different levels (goods, machinery, input, services), per group and level dependent on similar framework conditions. Porter clusters based on competitive advantages within industries. Each nation's cluster chart is constructed by identifying the industries that are successful in international trade, the measurement for success being significant exports or foreign direct investment.

Figure 3.3: Porter's Cluster Chart



Source: Porter (1990b:p.288)

Porter's cluster approach was a breakthrough, because it is standardized, ready-to-use and goes beyond traditional boundaries dividing sectors in primary, secondary and terni$_{ary}$ sectors. The critique on this method focuses on the fact that it indicates what the specialization patterns in a country are, but not what the networks are or what they look like. The approach has been adapted worldwide in 35 countries until 2000.

c. Production Chains

Firms are part of a larger entity of users, suppliers, competitors and other economic actors with network relations representing knowledge and production flows (Verbeek, 1999). Networks develop as a consequence of interaction between firms: such as customers, customer's customers, competitors, supplementary suppliers, suppliers, distributors, agents, consultants, as well as regulatory and other public agencies who are all different business actors (Ghoshal and Barlett, 1990).

Similarly, industries can be seen as networks of business relationships. In a specific country, different industrial networks can be distinguished. Therefore, the entire economy may be viewed as a network of organizations (Thorelli, 1986).

3.2.3. Cluster Analysis Approaches

Choosing the 'right' cluster approach is quite difficult. There is no unique approach. There are however appropriate approaches, depending on your intentions. Besides the basic distinction between similarity and interdependency-based approaches, there are of course still other dimensions. Each approach incorporates certain dimensions, blended to get a resulting mixture suitable for a certain purpose.

Jacobs and DeMan (1995) defines the following dimensions for the different cluster approaches:

Geographical *(similarity/interdependency):* spatial clustering in a production network or in a composite of production networks;

Horizontal *(similarity):* classical sector classification at a specific level of aggregation;

Vertical *(interdependency):* composite of production chains (supply networks and outsourcing networks), the strategically important question being: who within the network is the main cause of innovation?

Lateral *(similarity):* 'related' sectors with shared capabilities and the possibility of synergy;

Technological *(similarity):* (overlap with the lateral dimension) related technologies and technological characteristics that could link sectors;

Focal *(interdependency):* clustering around a central actor; and

Network quality *(interdependency):* nature and quality of co-operation between companies.

Table 3.4 Cluster Analysis Applications

Name	Mdlmd	Foundatlim.	Data	Output
SCHMOOKLER, 1966	C,1mr,l◆li,,mof int,1.11wdia1y kcbnc,k,.1iv fl,:,wmatrix.	Iuterdepeudeucy	-	-
SCHERER. 19&2	Compifotim1 ,:,fintmncdiary tcc b111k◆vfl ov n1.alri x.	"lutistdcp<,ndcfWY	FF4R&JJ-expenditures and I(-ii'6-J(TJ7pat<cnt,bta. ,;_ USA.	Tedmo1ogy lr;,1. mafri:c41 rnws Ltppli,zr,;:,x SJ mlurnrn (m-zm;,
MONTFOIIT& Dt,TAIU.Y, ViS?.	!..inkingsı1ppl'1-i(,ii, mainu,er and n.,◆1,,itsnmin&ippli.t·.	InhHdt1:pendmc:,	1981 I'O-table, 90x90 sectors, France.	19 clusters
ROELANDT, 1986	Linking snpplkr t,,it, main rnle,rand 11,sr/;t◆nmin,1.1pp1ic:.	InJ<cnkpmdmc:,	1977 &'0-i.able, 24;,;24 sectors. the N◆th◆rb.11d,.	6 d11◆ters
HA1"U.• 19ll4	Con1pibtfon ofp,1to:m-w::ight;;d intermr.◆diary r◆chnfJJoiy t◆i;nmir j_;, _	Interdependency	1978-1989 patent data .1ndinpuJ:-,,i1tput labk◆ Cmmda,	Patent-weighted int.:m:,,:,diary 1;◆hn,,ld;•.llt,,v malri,-x%
VM,rnm O.;;AG, H!95	Liuki11g.,uppli,:rfori◆main pmdu0twithprndutts main us,-rmid lit1king n◆afr,r i◆nmin produ0t with pmd1Jt◆mt1in :i11\1!"!]i;:,r.	Interdependency	1991 make&use tables, 230 sectors x 65iJprndudg;r,,,up,, tlle N◆th,,d.md,.	9 clusters
TJeJI.RE:s!IOM ET AL.. LJi\)4	Cmnpi]3\ir,n •A'innr,◆ntiw ll◆,m<,Li,m malTiL	Sim.ilarity	I"181-F)85 ,um,y dat1,, lu1l:	43x66 inuovati ve inter,icti:c,n maw]x
[Jt;BJRF.S:"P.JNET AL. , I 994	C:,rnpHatirn ,;,lria11guJm1.<-d . ;imk<JY3liv;:") acti,,il; nmlri:..	Int<mlq,en dency	1981-1()85 H)-tabk◆ surv,:ydat:a, Italy. c	10b61:-lrbnguhrimr.1 and ,)rne,,lkmqni>:<m-ml rrw.tri◆
Fnm & rlERGMAI-J. 199-::	Linl<ing inJm;t.ris:◆thal haw: ,imilar buying_ ,md ;;ellini!.plutm1s..	Similarity	1987. LU mbkA78x478 ,◆rnm;, USA"	23 clusters
WITTEVEEN, 1997	Uukingsupplkr tbiB main u◆and user h;. it;; main &'lfJJJ' i◆:	Interdepenelency	1983 I'O-table, 213x213 sectors, the Netherlands.	M dmtern
HER(IIIRON ETAL,,. I 99/I	Constmctin◆t,xl111;,l,Jgy-iL1dt.hrj t:1blc, ,linking iudu,tri,,:; ,md tg...:hm;k,◆,,; 1mir,,,,J.by prnr,dmil.'i.	Similarity	1985-1Q90patents by Fr,md, firm:\in USA.	12le..:bno-imlu,tritil du,l-.:1·;;

Source: Verbeek (1999:p.11)

Verbeek (1999) prepared a cluster analysis applications table in his Ph.D. Thesis. According to this table, cluster analysis can be classified with respect to their foundations in either interdependency or similarity approach. As it can be seen from Table 3.4, all these studies are either meso or macro level. Most of them used intersectoral I/0 tables. Scherer, DeBresson and Bergeron did not use I/O tables in

their studies. Scherer and Bergeron used patent data for their cluster analyses and DeBresson uses a survey; however, DeBresson's study is specific for innovative interaction matrix.

Verbeek made his study in the light of these studies and he preferred intersectoral I/O tables for the definition of the clusters. Obviously, he defined meso level clusters with these I/O tables.

Nahm (2001) analyzed the Cheonggyechon region in Seul, South Korea. In this area fashion, clothes and apparels clusters are developed around the two main streets of the city that is very similar to Bayrampa a textile region in Istanbul. He uses case study approach in order to analyze this region and makes a comparison between Cheonggyechon region and Silicon Valley (See Table 3.5).

Table 3.5 Key characteristics of Silicon Valley and Cheonggyechon Cluster

	Cbeontn!:yechon Cluster	Silicon Valley
Main Industries	Fashion/Clothes/Apparels Design/planning/production/sales	IT/Internet/Bio R&D/production/marketing
Knowledge	Know-hows andknow-whereas of existing business owners	High-techs developed in Universities, Institutions and Labs
Labor	Merchants/Small and medium sized businessmen	Technical labor of universities and firms
Capital	Private capital	Angel capital/venture capital
Organization of Firms	Private firms	Venture firms
Networking	Self-contained/international sales	Global networking of R&D/production/marketing

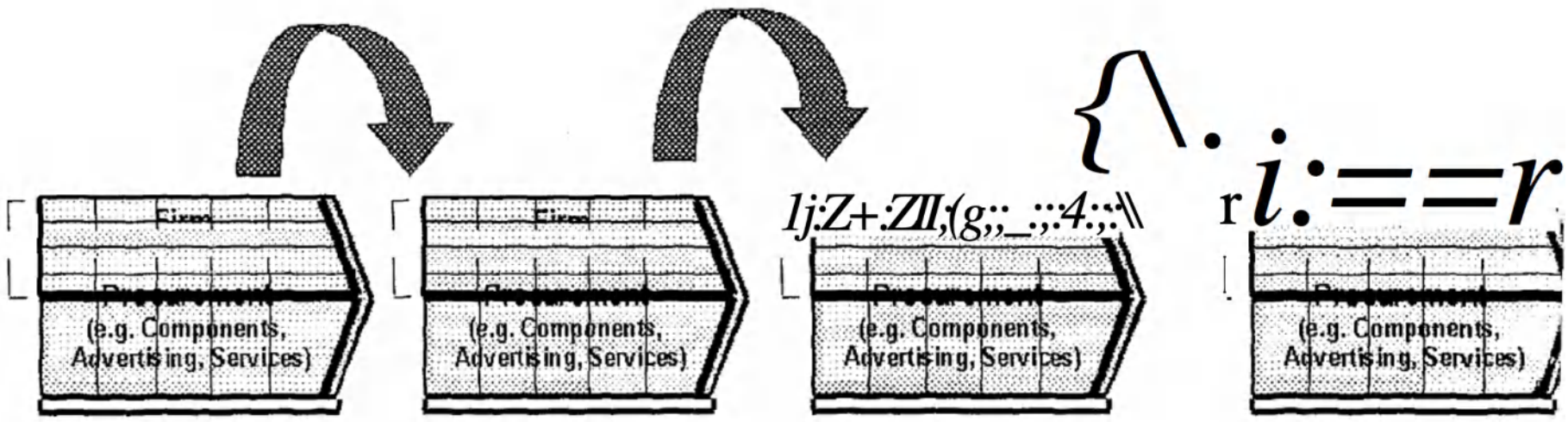
Source: Nahm (2001:p.11)

3.2.4. Linkage in clusters

Porter defines value system as the company's value chain for competing in a particular industry that is embedded in a larger stream of activities (Figure 3.4). The value system includes suppliers, who provide inputs (such as raw materials, components, machinery, and purchased services) to the firm's value chain. Then he focuses on the links among the members of the value system. He states "a company

can create competitive advantage by better optimizing or coordinating these links to the outside. Frequent and timely deliveries by suppliers (a practice now widely termed "kanban" after its Japanese innovators), for example, can lower a firm's handling costs and reduce the required level of inventory. Nevertheless, the opportunities for saving through coordinating with suppliers and channels go far beyond logistics and order processing, and encompass R&D, after-sale service, and many other activities. A company, its suppliers, and its channels can all benefit from better recognition and exploitation of such linkages. The ability of a nation's firms to exploit linkages with home-based suppliers and customers will prove important to explaining the nation's competitive position in an industry."

Figure 3.4: Value System



Source: CAT 1999, Adapted from Porter

The cluster concept focuses the analyses[11] on the linkages and interdependencies among actors in the value chain that produces products and services as well undertaking innovative activity.[11] Clusters differ from other forms of co-operation and networks in that the actors involved in a cluster are linked together in a value chain. Therefore, the cluster concept goes beyond "simple" horizontal network in which firms, operating on the same end-product market and belonging to the same industry group, co-operate on aspects such as R&D, demonstration programs, collective marketing or purchasing policy. Clusters are often cross-sectorial (vertical and/or

lateral) networks, made up of dissimilar and complementary firms around a specific link or knowledge base in the value chain. Interdependency is key to cluster analysis. However, interdependency is multi-faceted and can be based on trade linkages, innovation linkages, and knowledge flow linkages or on a common knowledge base or common factor conditions (Hertog, Leyten, Limpens, and Whalley, 1990).

Dumont and Meeusen (2000) in their study titled "*Knowledge Spillovers Through R&D Cooperation*" did not get the innovation and knowledge flow linkages separately; they use these two terms interchangeably.

The term network refers to two or more organizations involved and connected in long-term exchange relationships (Thorelli 1986; Holm and Johanson, 1997). Relations are the building blocs of network analysis (Knoke and Kuklinski, 1982). Firms in industrial markets establish, develop, and maintain business interactions and relationships with other business actors by means of gaining knowledge and developing trust. Interaction means strong commitment to relationship, which is characterized by continuity, multiplexity and specifity. The actors are, according to network theory, ties to each other by several technical, social, cognitive, administrative, legal, economic bonds or connections which can be understood exactly through experience of interactions inside. These relationships are called as networks (Johanson and Vahlne, 1992). Strategic technology alliances between companies are taken as the measure of ties in a study made on computer industry network in order to decide whether a link is available or not (Hagedoorn and Duysters, 2002).

3.2.5. Cluster Boundary

It is hard to find studies made about defining the cluster boundary in the literature. Researchers should be interested in this area.

Bilgic and Turksen (2002) examined five possible interpretations of the membership. These are likelihood view, random set view, similarity view, utility view and measurement view. Likelihood view looks whether an agent is member or not with respect to a probability conditions of that agent regarding to membership criteria. Random set view gets membership function as a random function. In similarity view, membership function measures the degree of similarity of an element to the set in question. Utility view decides the membership with respect to a pay off function. For example, when one asserts that "John is tall", there exists a pay-off function related to this assertion. This pay-off function offers more if statement is closer to truth. In measurement theory view, researcher tries to answer, "to what degree an agent from A belongs to set F".

3.3.Graph Theory and Networks

There has been considerable growth in the potential that is offered by the relatively new techniques of social network analysis. Unfortunately, this potential has been seen as unachievable for many researchers, who have found it difficult to grips with the highly technical and mathematical language in which much discussion of these techniques has been cast (Scott, 2000).

In order to understand social network analysis, firstly we have to understand the graph theory and networks.

"Graphs are simple diagrams consisting of points (vertices) and lines (edges). These diagrams or graphs are used extensively to represent the form of a system. Graphs are simple abstract of reality. In this sense, graphs are diagrammatical models of systems. Because they are models, graphs are useful in enhancing the understanding of complex systems. As a general rule, any system involving binary relationships can be represented in the form of a graph"(Charchra, Ghare and More,

1979:4).

"Graph theory is a fascinating subject. Its origin is as diverse as its application. The Swiss mathematician Leonard Euler (1707-1783) is clearly the father of graph theory. In the latter part of the eighteenth century, he established an important result for a famous unsolved problem of his day. It involved the seven bridges of Konigsberg, which connected two islands, and the banks of the river Pregel. The problem was to determine the route to walk across the seven bridges of Konigsberg, crossing each bridge only once and returning to the starting point. Euler proved this impossible and in doing so laid the foundations of graph theory" (Charchra, Ghare and More, 1979:1).

Gould (1988) says, "Mathematicians have affected the growth and development of computer science. In the beginning, they helped design computers for the express purpose of simplifying large mathematical computations. However, as the role of computers in our society changed, the needs of computer scientists began affecting the kind of mathematics being done". In addition, he adds, "Graph theory is a prime example of this change in thinking". Mathematicians study graphs because of their natural mathematical beauty, with relations to topology, algebra and matrix theory. Computer scientists also study graphs because of their many application to computing, such as in data representation and network design. These applications have generated considerable interest in algorithms dealing with graphs and graph properties by both mathematicians and computer scientists". Interest to graph theory is increasing for the last decade that it has application to problems originating from such diverse fields as psychology, engineering, business, sociology, economics, anthropology, linguistics and geography (Charchra, Ghare and More, 1979: 1).

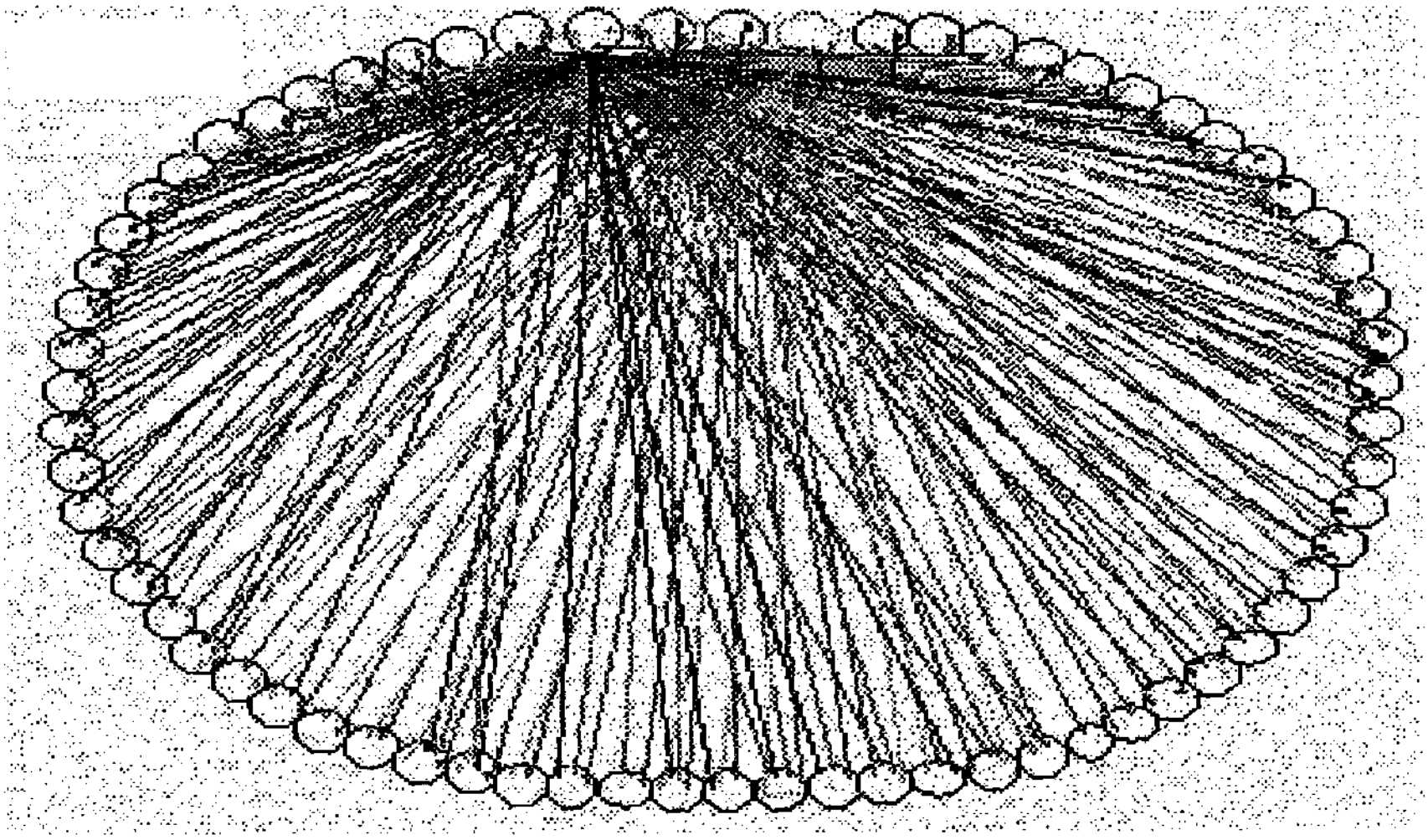
In graph theory, a directional relation is represented by an **arc.** An arc is a line between entities with an arrowhead at the destination. For example, if country A exports manufactured goods to country B, the direction of trade is from A to B, reflecting B's imports from A If the direction is not recorded, the trade flow could be misconstrued to be about exports of B. Graphically, the directed relation of A's international trade exports to B is shown as A -> B. The matrix form for recording this relation would have an entry in the A row and the B column (Kilkenny and Nalbarte, 2000).

Relational data can be presented not only in matrix form but also by graphs. If the relational ties have direction (arcs), the graphs are called directed graphs or **diagraphs.** The entities in digraphs are called **vertex** and the relations are represented by arcs. A directed graph (or just digraph) D consists of a non-empty finite set V(D) of elements called vertices and a finite set A(D) of ordered pairs of distinct vertices called arcs. We call V(D) the vertex set and A(D) the arc set (Jensen and Gutin, 2001).

We say a diagraph D is weakly connected if every two vertices of D are joined by a semipath; unilaterally connected if for every two vertices u and v, there is a directed u-v path or directed v-u path in D; strongly connected if all pairs of vertices u and v are joined by both a u-v a v-u directed path (Gould, 1988, p.52).

The graphic form shows how each agent in a system relates to all other agents in the system. If the number of agents is not too large, a graph is an efficient way to show which agents are connected to which others, and which are isolated; which are senders or receivers. Figure 3.5 is a digraph of 73 agents. It is a good example of the case where the number of agents is too large.

Figure 3.5.Sample diagraph



Source: Kilkenny and Laura Nalbarte (2000:p.10)

Figure 3.5 shows directional ties between nodes. Clearly, the more fruitful form in which to analyze these ties is as a matrix of zeros and ones. **Adjacency is the graph theoretic expression of the fact that two agents, represented by nodes, are directly related, tied, or connected with one another.** Formally, given agents *ni* and nj in a set of agents *N*, and the A ={ a_{IJ}} arcs denoting the existence of relations from agents i to agents j; agents i and j are **adjacent** if there exist either of the two arcs, a_1 or afi. Given the diagraph *D = (N,A)*, its adjacency matrix *A(D)* is defined by *A(D)* = {aij} where aij= 1 if either a_{ll} or a_{li} exists, and Ootherwise.

Looking at Figure 3.5 it seems like there are many interactions among the entities, but in fact, it is far from complete. A **complete** graph is one in which all the actors have two-way ties to all other actors. In fact, in the diagraph in Figure 3.5 only 24% of the entities have ties. The density of a complete graph is 100%. Formally, the **density** of a digraph (D) is the actual number of arcs in proportion to the maximum

possible number of arcs:

$$D = \sum_i \sum_j a_{ij} / N(N-1)$$

Note that the numerator is the count of actual ties:

$$L; \; L_j \; aij \text{ for all } i \neq j$$

In the case of a complete network, all nodes are reciprocally adjacent to one another, and all elements of the adjacency matrix are equal to one (Kilkenny and Nalbarte, 2000).

The nodes at the top of the oval in Figure 3.5 are the sources or sinks for the largest number of ties. The strength of a node as a source or a sink in a system is most easily measured using the adjacency matrix data. The number of arcs beginning at a node is called the **outdegree** of the node. Outdegree is the row sum for the node:

$$\text{Outdegree of actor i} = L_j \; a_{ij}$$

The number of arcs ending at a node is called the **indegree** of the node. The indegree is measured by the column sum for the node in an adjacency matrix:

$$\text{Indegree of actor j} = L; \; a_{ij}$$

A directed graph can be used to distinguish four different kinds of nodes based on the possible ways that arcs can be incident with the node. According to this classification, a node is

Isolate if $d_I(n) = d_o(n) = 0$

Transmitter if $d_I(n) = 0$ and $d_o(n) > 0$

Receiver if $d_I(n) > 0$ and $d_o(n) = 0$

Carrier or ordinary if $d_I(n) > 0$ and $d_o(n) > 0$

The distinction between a carrier and ordinary node is that, although both kinds

have both positive indegree and positive outdegree, a carrier has both indegree and outdegree precisely equal to 1, whereas an ordinary node has indegree and/or outdegree greater than 1(Wasserman and Faust, 1994).

The density of a directed graph is equal to the proportion of arc present in the diagraph. It is calculated as the number of arcs, L, divided by the possible number of arcs. Since an arc is an ordered pair of nodes, there are g(g-1) possible arcs. The density, , is:

$$\Delta = \frac{L}{g(g-1)}$$

The density of a digraph is a fraction that goes from a minimum of 0, if no arcs are present, to a maximum of 1, if all arcs are present. (Wasserman and Faust, 1994).

A **directed walk** is a sequence of altering nodes and arcs so that each arc has its origin at the previous node and its terminus at the subsequent node. Similarly, a directed path or simply a **path** in a diagraph is directed walk in which no node and no arc is included more than once. A semipath joining nodes n and n_1 is a sequence of distinct nodes, where all successive pairs of nodes are connected by an arc from the first to the second, or by an arc from the second to the first for all successive pairs of nodes (Wasserman and Faust, 1994).

Considering paths and semipaths between pairs of nodes, we can define four different ways that two nodes can be connected by a path or semi path. A pair of nodes n and n_1 is:

-Weakly connected if they are joined by a semipath

-Unilaterally connected if they are joined by a path from n to n_f or path from n_j to n

-Strongly connected if there is a path from n to nJ and a path from nJ to n; the path from n to n_1 may contain different nodes and arcs than the path from n_1 to n

-Recursively connected if they are strongly connected, and the path from n to n_f uses the same nodes and arcs as the path from n_1 to n in reverse order

From the above definitions a directed graph is:

-Weakly connected if all pairs of nodes are weakly connected

-Unilaterally connected if all pairs of nodes are unilaterally connected

-Strongly connected if all pairs of nodes are strongly connected

-Recursively connected if all pairs of nodes are recursively connected

(Wasserman and Faust, 1994)

For example, consider the following digraph and adjacency matrix in Figure 3.6 and Figure 3.7 illustrating the relation between four entities A, **B, C,** and **D:**

Figure 3.6 Diagraph

A B C

D

In the above, A is a transmitter, B is a carrier, and C is a receiver; while D is **isolated.** An actor is **isolated** when there is no arc that relates the actor to any other in the network. The adjacency matrix for this digraph can be seen in Figure 3.7. This shows that A relates to B, and B relates to C, while C does not relate OUT (only IN), and D does not relate at all.

Figure 3.7 Adjacency Matrix

	A	B	C	D
A	0	**1**	0	0
B	0	0	**1**	0
C	0	0	0	0
D	0	0	0	0

Formally, a node is a proper source or transmitter if its indegree is zero and its outdegree is non-zero; that is, if the column sum is zero while the row sum is greater than zero (Figure 3.7). A node is a proper sink or receiver if its indegree is non-zero and its outdegree is zero, that is, if the column sum is greater than zero while the row sum is zero. A node is isolated if both indegree and outdegree are zero (Wasserman and Faust, 1994).

The distance between entities in a network is measured by the length of the path between them. Of course, there can be many paths, but the shortest path is the relevant one. The shortest path from ni to ni is called the **geodesic.** When nodes i and j are adjacent or tied in one step, the shortest path is the value of the adjacency matrix element a_{ij}. When nodes i and j are related in a two-step path, the ijth element of A^2 will be non-zero. If the shortest path is in three steps, the ijth elements of A and A^2 will be zero, but the ijth element of A^3 will be non-zero. In general, the pth power of the adjacency matrix shows the existence of all directed p-step paths. Consequently, the geodesic, d(niA), is measured as the first power p for which the ijth element of A^P is non-zero (Wasserman and Faust, 1994).

One of the primary uses of graph theory in social network analysis is the identification of the most important actors in the network. Local centrality reflects the number of direct transmissions, and thus measured simply by the outdegrees (row

sums of adjacency matrix) for each actor. Local prestige reflects the number of direct receipts, and thus measured simply by the indegrees (column sums of adjacency matrix) of each actor. Since these measures are based on the degrees of the nodes, they are also known as degree centrality and degree prestige (Wasserman and Faust, 1994).

If an actor is in the shortest paths between others, the actor is **central.** The shortness of the paths from that actor to others is measured by **closeness.** The proportion of intermediary roles an actor plays measures **betweenness.** Both measures rely on the geodesic measure of distance.

Closeness, C(ni), is the inverse of distance. The shorter the distances between node i and other nodes, the more central node i is. Formally, C(ni) = [L (d(ni,nj)r1 where d(ni,nj) is the geodesic (shortest path) distance between i andj entities in the network, and *N* is the network size.

Betweenness, B(ni) measures the probability that a path from actor j to actor k takes a particular route through agent i. Assume each one-step tie has equal weight, and assume that interactions will occur through the shortest routes. Formally, B(ni) = *Lt* gjk(ni)/gjk where gjk(ni) is the total number of geodesics through i, and 1/gjk is the probability that a particular geodesic is chosen.

All these measures depend on the size of the network. Thus, the measures must be standardized before comparisons are made between networks of different numbers of entities. In degree centrality and closeness measures, the measures are standardized dividing by N-1. For betweenness measures, the standardization factor is (N-1)(N-2), where *N* is the number of agents or network size(Kilkenny and Nalbarte,2000).

Agents in a network that all relate to each other can be classified as a subset of

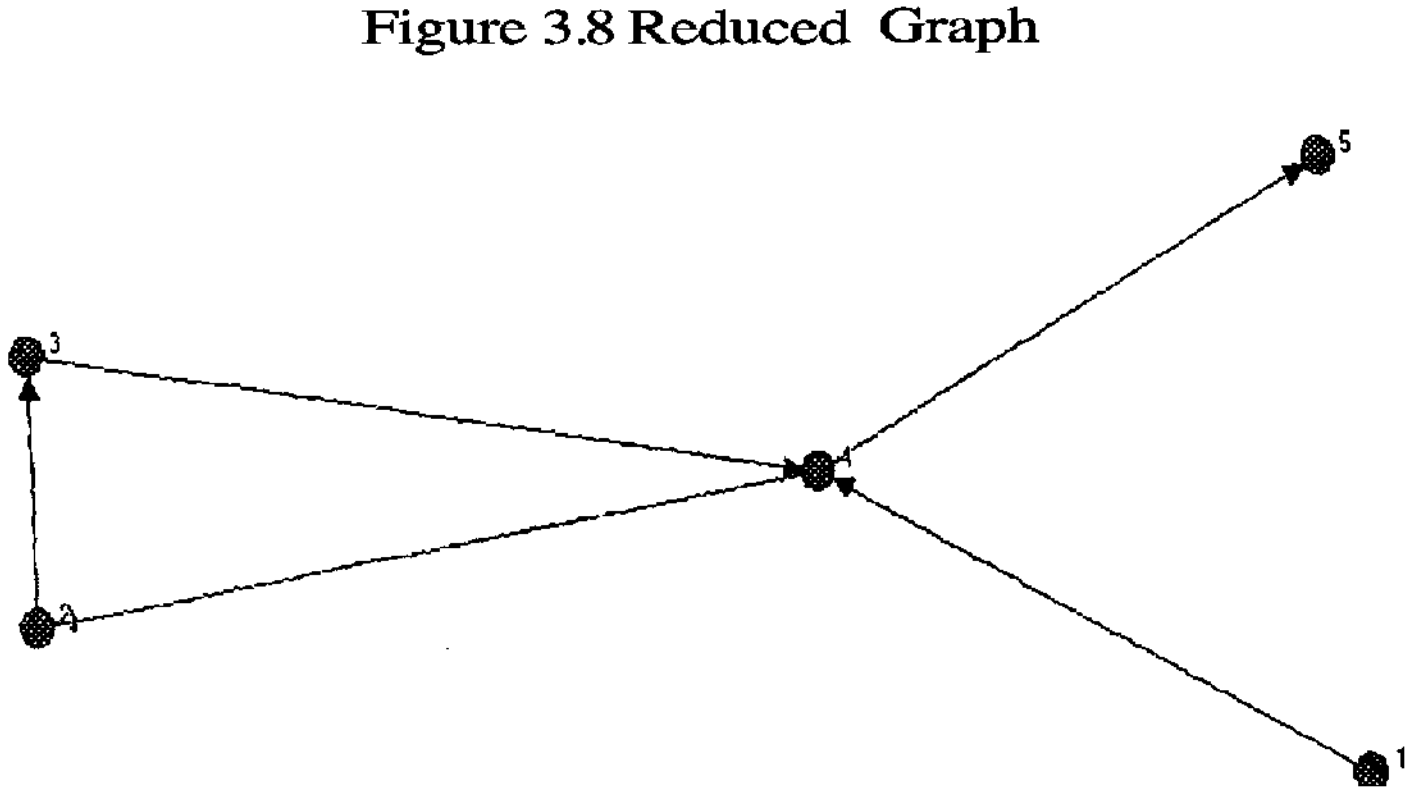
the *N* actors as a *group*, a *sub-graph*, or as we shall say here, as a *component*. A **component** is the largest subset of related actors in a network. In the ABCD example above, three of the actors are linked to one another through one or more step paths. These three, ABC, are thus a sub-graph, group, or component. The whole network has two components, the group ABC and the singleton D (Hanneman, 1998).

A **clique** in a graph is a maximal complete subgraph of three or more nodes. It consists of a subset of nodes, all of which are adjacent to each other and there are no other nodes that are also adjacent to all of the members of the clique (Wasserman and Faust, 1994)

Let **D= (V,A)** be a diagraph. If, for every arc ij EA, U_{ij} is equal to the number of arcs from I to j in D, we call these kind of representation as **directed multigraph** (Jensen and Gutin, 2001:348).

A **cut-point** of a graph is a vertex whose omission increases the number of connected components; an **isthmus** is an edge whose omission has the same effect. The graph in Figure 3.8 has a cut point in vertex 4, and two isthmuses, edges (1,4) and (4,5). (Gondran and Minoux, 1984: 16)

Figure 3.8 Reduced Graph



Source: Adapted from Wasserman and Faust, 1994

Reduced graph is used to describe the graph G divided by the strong connectivity relation (Gondran and Minoux, 1984: 16). By subtracting the connections one by one, we can reduce the graphs. According to Gondran and Minoux, reduced graph are great importance in many situations such as in the structural analysis of a system.

4. Methodology

In this section our aim is to introduce our model and define the hypotheses to be tested. While introducing the model, we will consider the restrictions and how to overcome these restrictions. Besides we will explain how we operationalize the variables in the modelas well.

4.1. Model

The aim of the model is to identify a microcluster. For doing this, model maps the microcluster's members by examining their supplier, customer and competitor linkages. Here, these four concepts, supplier, customer, competitor and linkage are the main bricks of the model. Model will be composed of nodes representing members and the linkages among suppliers and customers of a cluster. The model will decide the members of the cluster and relations among them. Therefore, we will first define node and linkage terms.

4.1.1.Node

We can start to present model by describing the place of supplier, and customer nodes:

S1	**M1**	**C1**
S2	**M2**	**C2**
.	.	.
.	.	.
Si	**Mj**	**Ck**

Where

S is supplier node

C *is customer node*

Mis supplier and/or customer node

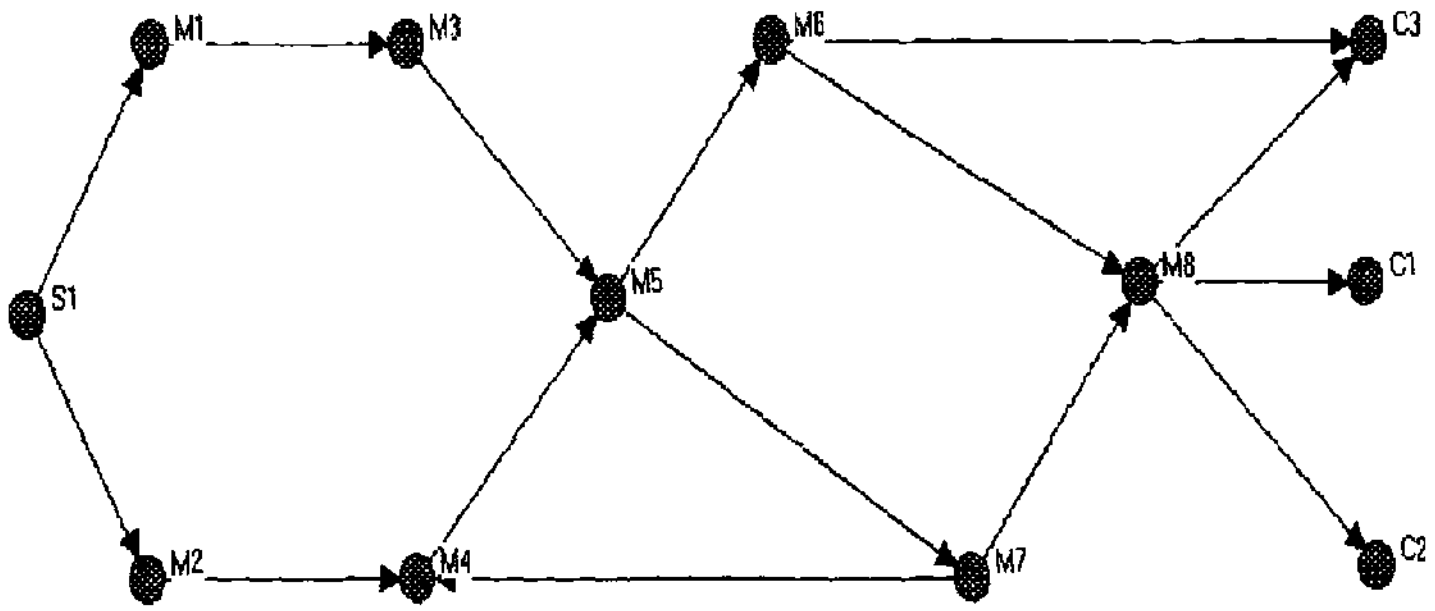
i is maximum number of supplier nodes

k is maximum number of customer nodes

j is maximum number of medium nodes

As it can be seen from notation, we accepted first column nodes as the supplier node only. Similarly, nodes in last column should be customer nodes. The nodes between first and last column can be supplier and/or customer nodes (we call these as medium nodes).

Figure 4.1 Microcluster Model



In Figure 4.1 some members have only incoming links[1] (indegree>O), some members have only outgoing links (outdegree>O) and some members have both incoming and outcoming links (indegree> and out degree>O). We can classify the members with respect to their incoming and outgoing links positions as follows:

A member is:

-Supplier if indegree= Oand outdegree>O

-Medium (Supplier and Customer) if indegree>O and outdegree>O

-Customer if indegree>O and outdegree= O

4.1.2.Linkage

In the second step, relations between supplier and customer nodes will be

defined. These relations are called as linkages. As it can be seen in Figure 4.1 links can be thought as directed arrows. These arrows show the relationships between agents of the cluster.

Another representation of the cluster in Figure 4.1 can be seen in Table 4.1. We called this matrix "Competitor Matrix". In competitor matrix, nodes that have rivalry relation among them are presented with 1. Competitor matrix considers only nodes. It does not give information about linkages. As it can be seen from Table 4.1 and Figure 4.1 C1, C2 and C3 are competitors for each other. This can be seen in last three column or last three rows of competitor matrix.

Table 4.1. Micro Cluster Competitor Matrix

SEQ	0	0	0	0	0	0	0	0	0	0	0
liff	o	a	1	o	o	o	a	a	o	o	o	o
120		1	a	a	o	a	o	0	0	0	0	0
110		0	0	0	1	0	0	0	0	0	0	0
140		0	0	1	0	0	0	0	0	0	0	0
l$o		a	a	a	a	a	a	0	0	0	0	0
is.a	o		o	o	o	o	o	0	0	0	0	0
Ii			0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0
Bio	o		0	0	0	0	0	0	0	0	1	1
b2	oo		0	0	0	0	0	0	0	1	0	1
@3.	oo		0	0	0	0	0	0	0	1	1	0

Data given in Figure 4.1 can be represented as an adjacency matrix as well (Gould, 1988). In adjacency matrix, 1's show linkages from the agent in the left column to the agent in the top row. Adjacency matrix have both node and arrow information; however, competitor relations are not possible to include in this representation. In Table 4.2, it is possible to see adjacency matrix of the graph given in Figure 4.1. In Table 4.2, adjacency matrix is a 12x12 matrix. Rows and columns are assigned for nodes and the cross section cells of the combinations give whether a

[1] For definitions of indegree and outdegree, see section 3.3

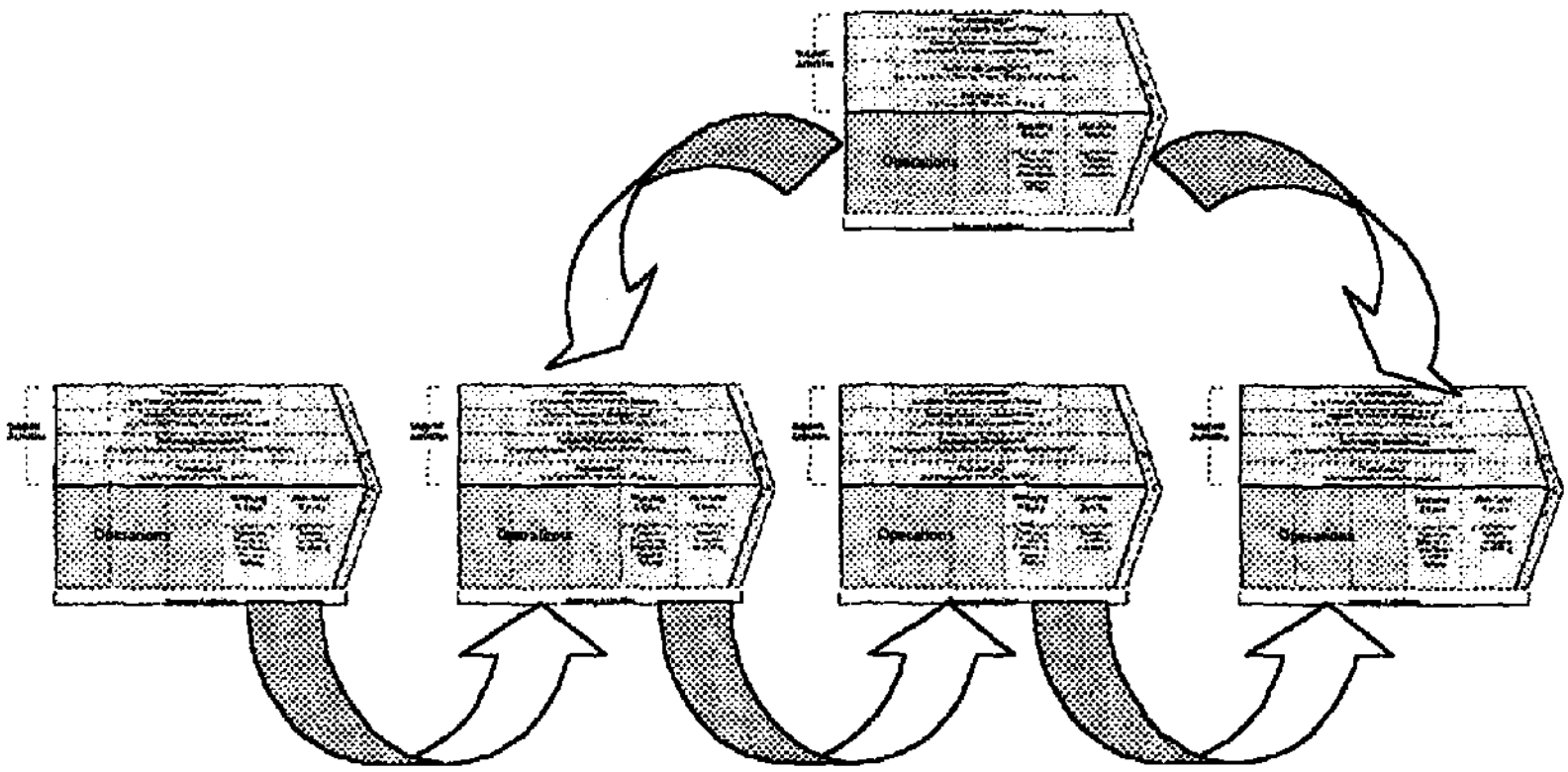
linkage is available or not between nodes.

Table 4.2 Adjacency Matrix

STD	1	1	0	0	0	0	0	0	0	0	0
110	0	0	1	0	0	0	0	0	0	0	0
M[O	0	0	0	1	0	0	0	0	0	0	0
1 0	0	0	0	0	1	0	0	0	0	0	0
MikO	0	0	0	0	1	0	0	0	0	0	0
M$o	0	0	0	0	0	1	1	0	0	0	0
mJo		0	0	0	0	0	0	1	0	0	1
mtz)o	0	0	0	1	0	0	0	1	0	0	0
r&tsOo	0	0	0	0	0	0	0	0	1	1	1
.Clo	o	0	0	0	0	0	0	0	0	0	0
tlno	0	0	0	0	0	0	0	0	0	0	0
!$1 •••	0	0		0	0	0	0	0	0	0	0

Showing the entire cluster related information either with adjacency or competitor matrix is not possible but we have to use both tools together. As a second alternative, graph representation includes all the information related to a cluster; however, if the number of the agents is too much, graphs can be difficult to visualize.

Figure 4.2 Improved Value System Model



As it can be seen from the explanations in theoretical framework and model development sections, **our model is mainly built up on the Porter's model of "value system"** (see Figure 4.2). Our contributions to Porter's model are twofold:

firstly, we add competitors to value system model as the players and secondly we add backlinkages. Backlinkages permit a firm to be a customer and supplier at the same time in any part of the value system. By making these changes Porter's value system model becomes a network model so that researchers can use network analysis techniques that are quite developed in mathematics discipline. As a result, **our model can be tbougbt as a bridge between value system model of Porter to current modern cluster model.**

4.2. Limitations

The set of challenges that we must overcome to meet our goal of developing a rational and quantitative method for defining microclusters are:

-To define whether a node is a member of the cluster or not,

-To operationalize a link,

-To determine where the value chain starts and stops.

Since these are the areas that can be subjective, we can face validity problems. In order to overcome these problems we used following methodology:

In order decide whether a node is a member or not, we used snowball sampling method with a trash value of five. As the nature of snowball sampling, starting members will point the next members. Snowball sampling also is used to decide where the value chain starts and stops. For operationalization of the link, different studies in the literature are examined. Operationalization of a link has serious validity problem; because, defining a link between two firms is quite subjective. Components such as frequency of the relation, type of the relation, volume of the relation should be measured objectively. Since our aim was only to decide whether a link is available or not between two firms/organizations, our work was easier. By asking respondents to sort the organizations from the one that they have relation mostly to lesser, we

attain the objectivity about the link definitions.

Another issue is about the size of the cluster member that will be used in our analyses. In the study, firm size of the cluster members are decided with respect to the part of the member active in the examined cluster region. If that member has branches in other place(s), those parts are not included in the study.

4.3.Hypotheses

Cluster mapping model developed in this study is a new tool in order to define network structure of an industry and service clusters in micro level. Therefore, the main hypothesis here claims that **if there is a microcluster in a specified region, it can be defined as a network composed of nodes and linkages.** Here, nodes are the members of the cluster that can be production and/or information supplier or customer of another member. In this respect, after mapping a cluster, different analyses are possible to make with the base that cluster mapping tool provides. In this section, our aim is to design our research to extract the characteristics of Bayrampa a, Sultanahmet and Taksim clusters in Istanbul. While doing this, outputs from the mathematical analysis section will be used. Therefore, we will show that our model's outputs are inputs for the probabilistic analysis as well.

We can analyze a cluster with respect to its own characteristics and/or we can design our analysis based on comparing different clusters. With respect to this frame, we formalized various hypotheses for Sultanahmet, Taksim and Bayrampa a clusters and we classified our hypotheses into three section. These sections are:

- Intra cluster hypotheses
- Cluster comparison hypotheses
- Hypotheses applied for all clusters

In order to analyze microclusters individually and compare them with respect

to different characteristics, we defined fourtyone different hypotheses for Bayrampa a, Sultanahmet and Taksim clusters. **Our aim with these hypotheses is to test various characteristics of Bayrampa a, Sultanahmet and Taksim clusters that is waited due to their network structure.** Therefore we mainly test relations between a node's characteristics such as labor size, age, revenue and its network related charecteristics such as center/periphery, indegree, outdegree, betweenness, incloseness and outcloseness. Moreover, we test some bi-variate hypotheses among clusters from same sector and different sectors and we applied some hypotheses to all clusters.

4.3.1. Intra cluster hypotheses

The size of the firm represents a kind of "filter" of the relational exchanges between the external environment and the firm. The revenue and number of employees are indicators of the size of the firm. They are identifiers of the firm's capacity to intensely relate with the market by stimulating the learning process evolution. Relative to the "size of the firm" an increase in the size leads to an increase in relationships with the market. Conversely, a smaller size indicates fewer relationships with the market. .(Minguzzi and Passaro, 2000). We will test the hypotheses HI, H2, H4, HS, H7, H8 in this respect for Bayrampa a, Sultanahmet and Taksim clusters.

We will test whether a relation is available between age of a cluster member and its link density with other cluster members in H3, H6 and H9 for Bayrampa a, Sultanahmet and Taksim clusters respectively.

Hl: Cluster members with higher number of employee in Bayrampa$a have more links compared to other cluster members

H2: Cluster members with higher revenue in Bayrampa$a have more links compared to other cluster members

H3: Older cluster members in Bayrampa$a have more links compared to other cluster members

H4: Cluster members with higher number of employees in Sultanahmet have more links compared to other cluster members

H5: Cluster members with higher revenue in Sultanahmet have more links compared to other cluster members

H6: Older cluster members in Sultanahmet have more links compared to other cluster members

H7: Cluster members with higher number of employees in Taksim have more links compared to other cluster members

HB: Cluster members with higher revenue in Taksim have more links compared to other cluster members

H9: Older cluster members in Taksim have more links compared to other cluster members

Above hypotheses we are searching for the relation of link number that a member have and age, the number of employees and the revenue of the firm. We assume that age and size of a firm can be a sign of the competitiveness of a firm. If a firm survives in a cluster long years, this means that the firm has a competitive edge to live in long years. Besides size of the firm also can be assumed to a reflection of competitive power of a firm. We use number of employee and revenue in order to operationalize the size of the firm for the hypotheses.

According to Gulati, Nohria and Zaheer (2000), firms whose relationships allow them to occupy a more central place in the strategic networks are a part of

superior returns because of access to better information and opportunities than those firms that are more peripheral. We will look our clusters Bayrampa a, Sultanahmet and Taksim central and periphery members have similar characteristics or not in hypotheses HlO, H1 1,H12 below.

HlO: Core and periphery members in Bayrampa$a cluster are not similar in revenue, age and labor

Hll: Core and periphery members in Sultanahmet cluster are not similar in revenue, age and labor

H12: Core and periphery members in Taksim cluster are not similar in revenue, age and labor

4.3.2. Hypotheses Comparing Clusters

Hypotheses H13, H14, HlS and H16 are related to same sector clusters, whereas Hl 7, Hl8, H19, H20, H21, H22, H23 and H24 related to test of different sector clusters.

a) Hypotheses on the Same Sector Clusters

Since we have a common base for Sultanahmet and Taksim tourism clusters, we think that we can make some comparisons between these two clusters. Therefore, we will test below hypotheses about age, revenue, number of employee and realton densty of cluster members.

Hl3: Taksim and Sultanahmet cluster members have different life spans

H14: Taksim and Sultanahmet cluster members have different revenue

Hl5: Taksim and Sultanahmet cluster members have different number of employees

H16: Members of Taksim cluster have more relation with

other cluster members than Sultanahmet cluster members have

b) Hypotheses on Different Sector Clusters

Bayrampa a is a textile cluster whereas Sultanahmet and Taksim are tourism clusters. We have common base due to our model outputs that permit different cluster comparisons. Therefore, we planned to make comparisons between different sector clusters about their member's age, revenne, number of employee and relation density.

H17: Bayrampa$a cluster has older members than Sultanahmet cluster

H18: Bayrampa$a cluster members have more revenue than Sultanahmet cluster members

H19: Number of employees in Bayrampa$a cluster members are more than Sultanahmet cluster members

H20: Members of Bayrampa$a cluster have more relations with other members compared to Sultanahmet cluster members

H21: Bayrampa$a cluster has older members than Taksim cluster

H22: Bayrampa$a cluster members have more revenue than Taksim cluster members

H23: Number of employees in Bayrampa$a cluster members are more than Taksim cluster members

H24: Members of Bayrampa$a cluster have more relations with other members compared to Taksim cluster members

4.3.3. Hypotheses Applied for all Clusters

According to Minguzzi and Passaro (2000), an increase in the size of a firm leads to an increase in relationships with the market. Conversely, a smaller size indicates fewer relationships with the market. We will test the hypotheses H25 and H26 in this respect for all Bayrampa a, Sultanahmet and Taksim clusters.

H25: Members of the clusters that higher number of employees have more links with other cluster members

H26: Members of the clusters that have higher revenue have more links with other cluster members

We will test whether a relation is available between age of a cluster member and its link density with other cluster members in H27 for all three cluster members together.

H27: Old members of the clusters have more links with other cluster members

Firms whose relationships allow them to occupy a more central place in the strategic networks are a part of superior returns because of access to better information and opportunities than those firms that are more peripheral (Gulati, Nohria and Zaheer, 2000). Therefore core and periphery firms will be tested around this claim. Do firms in the core of cluster have different characteristics from the firms in the periphery in the cluster? In order to answer this question we will test H28, H29, H30, H31, H32, H33, H34, H35, H36, H37 and H38.

H28 and H31 are related to labor size, H29 and H32 to revenue, H30 and H33 to age, and H34 is concerned with the relation with other members (degree) for core firms in clusters.

H28: Core and periphery members of Bayrampa9a, Taksim and

Sultanahmet clusters are not similar number of employees

H29: Core and periphery members of Bayrampa9a, Taksim and Sultanahmet clusters are not similar in revenue

H30: Core and periphery members of Bayrampa9a, Taksim and Sultanahmet clusters are not similar life spans

H31: Core firms in Bayrampa9a, Taksim and Sultanahmet cluster firms are similar in number of employees

H32: Core firms in Bayrampa9a, Taksim and Sultanahmet cluster firms are similar in revenue

H33: Core firms in Bayrampa9a, Taksim and Sultanahmet cluster firms are similar life span

H34: Core firms in Bayrampa9a, Taksim and Sultanahmet cluster firms are similar relation density

In H35, H36, H37 and H38 periphery nodes will be analyzed about labor size, revenue, age and relation density (degree) for all three clusters of Bayrampa a, Sultanahmet and Taksim.

H35: Periphery firms in Bayrampa9a, Taksim and Sultanahmet cluster firms are similar in number of employee

H36: Periphery firms in Bayrampa$a, Taksim and Sultanahmet cluster firms are similar in revenue

H37: Periphery firms in Bayrampa9a, Taksim and Sultanahmet cluster firms are similar life span

H33: Periphery firms in Bayrampa9a, Taksim and Sultanahmet cluster firms are similar relation density

Betweenness is a term used in social network analysis and states that a member

has middle of at least two other cluster members' relation. Closeness is again another term used in social network analysis and means the step size in order to reach another cluster member. In H39, H40 and H41, we will search whether higher betweenness and closeness values are positively correlated with relation number in cluster members.

H39: Cluster members with higher betweenness values have more links with other firms

H40: Cluster members with higher incloseness values have more links with other firms

H41: Cluster members with higher outcloseness values have more links with other firms

In conclusion it can be seen that the hypotheses that we formulate serves to two main goal. First is about the profiling of the clusters we searched for. For this purpose, we formulate the hypotheses comparing the clusters mainly(In mathematical section, we have already realized a deep profiling study). Secondly, as the outputs of our hypotheses, our goal is to make contribution to theory. For this purpose, we search for positive relation between centrality and the competitive advantage of cluster members.

4A.Operationalization of Variables

In the model defined in section 4.1, dependent variable is cluster itself and independent variables are node and linkage. We discuss how to operationalize these variables below.

4.4.1.Node

In section 4.1 we defined members of a cluster as nodes. These nodes can be supplier, customer and/or competitor. We will use these terms in broader meaning

compared to daily usage. For example, a university can be a member of a cluster and it supplies information for a production company. This means that university becomes information supplier in the cluster. Firms, NGOs, sectoral organizations, schools can be a member of a cluster. In this study, the firm size of the cluster members are decided with respect to the part of the member active in the examined cluster. If that member has branches in other place(s), those parts are not included in the study.

A competitor node can be defined if two nodes have the potential of selling its outputs to a customer node. From this statement, two supplier nodes becomes competitor if they have potential of selling their outputs to the same customer node. Nevertheless, if these customer nodes do not have the potential to sell their outputs to the same customer node, they will not be competitor.

It is possible to find at least a relation between two nodes (company, university, NGO, etc.) in a cluster (even in the world). Therefore, we need a selection criterion in order to select appropriate nodes useful for our purposes as a member of the cluster. If a selection criterion is easy for being member, the map of the cluster will be too big. In such a case, mapping process will need more resource and time. If the selection criterion becomes difficult, map will be too small so that cluster map cannot be used for the purpose that was considered in the significance of the subject section. Moreover some important details can be skipped.

Our proposition here is to develop a threshold level for linkage definition and to check whether that threshold level is available or not between nodes. Besides, beginning and end of the value chain will help us to define the boundary of the cluster as well.

Another need for operationalization is necessary for the size of the firms for

hypothesis testing purposes in the following sections. Minguzzi and Passaro (2000) use total revenue and number of employees for the operationalization of the firm size that is appropriate for our study as well.

4.4.2.Linkage

The basic feature of network analysis, as distinct from the more usual data, is the use of relational information to study or test hypotheses. A relation is the collection of ties of a specific kind among a set of entities or actors. Relational data can include, for example, data on family ties, interactions between people, or individuals' attitudes about other individuals in a group. The relational link between a pair of actors is called tie. A tie is a property of the pair, therefore a tie cannot be thought of pertaining simply to an individual actor (Kilkenny and Nalbarte, 2000).

Since ties exist only between pairs of actors, the relevant unit of analysis is the dyad. A dyad consists of a pair of actors and the possible ties between them (Wasserman, and Faust, 1994). For example, a father and son are a dyad, and their familial relation is implied by their labels. Two cities connected by a commuter's travel pattern between them, and a retail store and customer, are also dyads.

For social network analysis, relational data are collected by observing or interviewing individuals about their interactions with the others in the set or network. The unit of observation is an individual from whom we obtain information about their ties with other actors. For economic analyses, relational data may include data on the values of purchases or sales between firms, the existence (or lack) of contractual agreements or information flows between agents, or the value, volume, or frequency of international trade flows among countries (Kilkenny and Nalbarte 2000).

There are two main types of ties or relations: i) *dichotomous* or *valued*, and/or

ii) *directional* or *non-directional*. A dichotomous relation is recorded as either the presence or absence of a tie between two entities in the set. Meanwhile, a valued relation records not only the existence of a relation but also the intensity or frequency of the relation (Wasserman and Faust, 1994). An example of a dichotomous relation is public safety agency A's provision of services enjoyed by business B. Since a public good is by definition non-rival, use or non-use is the relevant measure (rather than quantity used.) An example of a valued directional relation is the dollar value of exports recorded as being shipped from country A to country B.

Hertog, Leyten, Limpens and Whalley (1999) define three components for linkages between nodes. These are supplier linkages, customer linkages and knowledge producing agents linkages.

Kilkenny and Nabarate (2000) use money, information and support components while defining linkage in a study that was made in the social network analysis of a town in US.

Alex Hoen (2001) defines relations in two parts as production and innovative efforts linkages. Hagedoornand and Duysters (2002) defined the strategic technology alliances between companies as the measure of ties in a study made on computer industry network in order to decide whether a link is available or not.

In this study, we prefer to use a linkage definition similar to Hoen's (2001). Linkage definition ofHertog, Leyten, Limpens and Whalley (1999) is very similar to Hoen' s. Only difference is Hertog, Leyten, Limpens and Whalley define supplier and customer relations instead of production linkages.

Kilkenny and Nabarate's (2000) classification has one more component, which is "support". Since they give importance to social side of the network, they consider the "support" as a main component of the linkage; however, we will not use

"support" as a linkage component in our study since we are not dealing with the support side of the members such as church in detail. We examined the organizational support component in the innovative effort component of the linkage construct.

In the survey, questions 1 through 13 and 19 are related to define the production linkages, wheras questions 9, 15, 16, 17, 18,20,21 and 22 are related to innovative efforts (See Appendices 1 and 2).

4.5.Sample

4.5.1.Sampling method

While applying the survey, snowball sampling method is used. The snowball sample is a judgment sample.[18] Judgment samples are often called purposive samples; the sample elements are handpicked because it is expected that they can serve the research purpose. Most typically, the sample elements are selected because it is believed that they are representative of population of interest (Churchill and Iacubbi, 2002).

Snowball method begins[8] with a focal actor or set of actors. Each of these actors is asked to name some or all of their ties to other actors. Then, all the actors named (who were not part of the original list) are tracked down and asked for some or all of their ties. The process continues until no new actors are identified, or until we decide to stop (usually for reasons of time and resources, or because the new actors being named are very marginal to the group we are trying to study) (Hanneman, 1998).

In snowball sampling, sample relies on the researcher's ability to locate an initial set of respondents with the desired characteristics. These individuals are then used as informants to identify others with the desired characteristics. Those initially asked to participate would also be asked for names of others whose cooperation

would be solicited. Thus, the sample "snowballs" by getting larger as participants identify still other possible respondents (Churchill and Iacubbi, 2002).

There are two major potential limitations and weaknesses of snowball sampling methods. First, actors who are not connected (i.e. "isolates") are not located by this method. The presence and numbers of isolates can be a very important feature of populations for some analytic purposes. The snowball method may tend to overstate the "connectedness" and "solidarity" of populations of actors. Second, there is no guaranteed way of finding all of the connected individuals in the population. Where does one start the snowball rolling? Ifwe start in the wrong place or places, we may miss whole sub-sets of actors who are connected – but not attached to our starting points (Hanneman, 1998).

Hanneman (1998) describes the first problem as nodes with no connections to cluster members are not our concern so that it is not a problem for our analysis.

Our proposition to overcome second problem is to start with potential candidate nodes that are competitor to each other. 1f we choose main competitors in the cluster for the starting points, they will direct us to other players as well.

4.5.2.Boundry Definition

While deciding about the boundary of a cluster we are analyzing whether a member will be decided to be included into cluster or not. For doing this, two criteria will be used. These are geographical and methodological boundaries.

Geographical boundary decision of the cluster is not so difficult in our cases. Expert opinion is used for deciding geographical boundary of a cluster. Some experts from the related sectors were invited to define the geographical boundary of the cluster. Generally, in the second round, they agreed on geographical boundaries.

Since we used snowball sampling method while selecting the nodes of the

cluster, we asked top five nodes for each linkage question. Therefore, we set threshold level as five for each different type linkage among nodes of the cluster. Five is selected because it is not difficult for cluster members to tell top five contacts easily without looking company documents. Also our pretest showed five links are sufficient to map a network in a specified region.

4.6. Assumptions

While desining and applying our model, we have some assumptions. These assumptions were made in order to make our study applicable. Besides due to resource constraints, these assumptions provided us shortcuts in our study. By making assumptions, obviously we became a little bit far from the truth; however, in order to conclude n the study we have to make these assuptions.

First assumption we made is about linkages among the cluster members. We assumed that linkages due to production and knowledge flow relations have same effect while a mapping a cluster. Besides we assume that the components of production linkage such as raw material supplier firms, energy supplier firms, etc.have same weight in the mapping process.

Second assumption we made is regarding to measuring the size of the firm. We assume that number of employee and revenue is the variables in order to measure size of a firm.

Third assumption we use is about the measurement of the competitive advantage of the firm. We assume that size and age of a firm can be a sign of the competitive power of a firm. If a firm has competitive advantage it should live long so that it has to be older . Similarly a firm size can be larger if it has the potentialof using more resources which is a trust to that firm; again it can be tought a sign of competitive power.

5. Analyses and Results on Application of Model

As the output of the model, it identifies a network. It has nodes and links. Therefore, it is natural that we applied networking methodology while we were designing our research. According to Knoke and Kuklinski (1982) four elements of a research design shape the measurement and analysis strategies available to a researcher in network analysis: the choice of sampling units, the form of relations, the relational content, and the level of data analysis. We decided on sampling sectors with respect to trade data analysis (Porter, 1990b). Then clusters were selected considering resource constraints to make a survey study. Form of relations is decided with the help of our linkage construct. The relational content will be the outcome of the application of the survey. Finally, we will use network analysis in order to analyze the findings.

5.1. Application of Model

5.1.1. Sample Selection

For the application of the model, unfortunately we had resource constraint. Therefore, we tried to find samples that represent microclusters and permit our mathematical and statistical analysis for the model that we developed at the same time by using minimum resource level. Besides, we aimed to analyze the microclusters that are important for Turkey so that the outputs of our analysis can be used for related sides (managers, entrepreneurs, government officials, credit departments of banks, etc.).

We had to select sample from two different sectors at least. This was necessary to make cluster comparisons of different sectors. Moreover, for making the same sector cluster comparison we need at least two same sector clusters samples. As a result, we need at least three cluster samples from two same and one from different

sectors. By selecting, these three cluster samples, we have the chance of utilizing our resources efficiently while giving opportunity to test all opportunities of the model.

After deciding on the sample clusters number, we decided about the sectors that we choose. For doing this, we thought that we could choose top two foreign exchange earning sectors of Turkey (due to resource constraint, we could not afford to work in different country from Turkey). According to Porter, we should see cluster(s) if a sector has the power of earning foreign exchange (Porter, 1998). These two sectors are textile and tourism obviously for Turkey. By the way, Turkey has the highest foreign export earning ratios in the related global market as well.

Next step was finding possible places of textile and tourism microclusters in Turkey. We prefer to find these clusters from Istanbul in order to benefit from loactional advanatage. After this stage, we asked experts from textile and tourism sectors for the possible microcluster locations. From the possible alternatives, we decided that Sultanahmet and Taksim tourism clusters and Bayrampa a flat knitting cluster are the most appropriate clusters that we can work on them. Information from sector experts show that sample sizes of these clusters are around:

Bayrampa a: 1000 members

Sultanahmet: 700 members

Taksim: 1500 members

While thinking these cluster sizes all members of the cluster considers that means members in the valus system considered. For example, restaurants, hotels, travel agencies, transportation companies, tourism schools, etc. are included for tourism cluster.

5.1.2.Application

A survey was applied to three different micro clusters. These are Sultanahmet

tourism, Taksim tourism and Bayrampa§a flat knitting clusters. The reason for these applications is to show the comparability of two similar clusters. Thus, we are planning to show that our model will provide a base for cluster comparisons. We are planning to compare Sultanahmet tourism cluster map that was developed by using case study method by CAT and our output in order to test the validity of the model. Besides, outputs of Sultanahmet and Taksim were compared with Bayrampa§a as well. This will be the first attempt in the world to compare two different sector clusters.

By using snowball sampling method, survey was applied to potential nodes of the cluster firstly; then analysis of the first contacts addressed next few members to be surveyed. This recursive process continued until the cluster boundary nodes were reached. We understood whether we reach the boundary if we reach the first or last unit of the value chain or ifwe get the same nodes compared with the previous steps.

5.2.Analysis

We used two kinds of analysis in order to analyze the data collected. These are mathematical and statistical approaches. We used mathematical analysis tools for the deterministic sides of the clusters. Mainly UCINET and PAJEK software programs developed for social network analysis were used. UCINET and PAJEK are developed for social network analysis. We generally use PAJEK for graphical outputs and UCINET for statistical outputs. For the stochastic side of the analysis, we used statistical analysis methods using SPSS software.

5.2.1. Mathematical Analysis

5.2.1.1.Data Revision

Some nodes have no linkages with other firms in clusters. These are isolated ones. We omitted these nodes for the rest of our analysis because of the snowball

sampling methodology. These firms have been surveyed because of $rival_{ry}$ input from other cluster firms. There are only three firms omitted due to this reason from Bayrampa a cluster. Moreover one firm from Taksim cluster omitted for the same reason.

5.2.1.2.0verall Structures of Clusters

5.2.1.2.1.Cluster Size

We used snowball sampling method and used "5" as threshold level. As a result, following cluster sizes occurred in the study:

Bayrampa a: 72

Sultanahmet: 44

Taksim: 63

These members can be seen in appendix. 3

5.2.1.2.2. Cluster Adjacency Matrices

Cluster adjacency matrices are designed from the outputs of surveys. In these matrices, iflinkage between two nodes are available, "1" is assigned to related cell otherwise "O" is assigned. Adjacency matrices can be seen in Appendix.4.

5.2.1.2.3. Cluster Densities

The density of a directed graph is calculated as the number of arcs, L, divided by the possible number of arcs. The density, , is:

$$= \frac{L}{g(g-1)}$$

Where g is the number of nodes in the graph. We calculated densities of clusters by using UCINET software. The outputs of calculations are in Appendix.5.

As it can be seen from Table 5.1, densities of the clusters are too low. This shows that all three clusters' members do not have dense linkages among others. According to Porter, this is a sign of undeveloped cluster. Among these three

clusters, Bayrampa a is the densest one. Taksim and Sultanahmet tourism cluster densities are 0 .07 32 and 0.0 449 respectively. Density of Taksim cluster is much more higher than Sultanahmet tourism cluster. Therefore, according to Porter we can say that Taksim tourism cluster has a sign of more developed cluster compared to Sultanahmet tourism cluster according to network density analysis.

Table 5.1 Cluster Densities

Clusters	**Density**
Bayrampa a:	0 .07 97
Taksim	0 .0 732
Sultanahmet	0.0 449

5.2.1.2.4. Reachability and Connectivity Analysis

Table 5.2.Distribution of ties for the Bayrampa9a, Sultanahmet and Taksim Cluster Members

Bayrampa a
Distribution of Ties

	Freq	Pet (%)
1 Absent	4318.000	92.029
2 Weak	374.000	7.971
3 Strong	0.000	0.000

Sultanahmet
Distribution of Ties

	Freq	Pet (%)
1 Absent	1807.000	95.507
2 Weak	85.000	4.493
3 Strong	0.000	0.000

Taksim
Distribution of Ties

	Freq	Pet (%)
1 Absent	3505.000	92.676
2 Weak	277.000	7.324
3 Strong	0.000	0.000

In a diagraph, ifthere is a directed path from n to nj , then node nj is reachable from node n .In Appendix. 6,reachability analysis of cluster members calculated by UCINET can be seen. Since we omitted isolated nodes, all members of the clusters are reachable.

In Appendix 7,connectedness analysis of cluster members were made by using UCINET. Results shows that all three clusters are mainly connected with weak ties.

5.2.1.2.5.Geodesic Distances of Cluster Members

The geodesic distance between a pair of nodes in a graph is the length of a shortest path between the two nodes, and the basis for defining the diameter of the graph. The diameter of a graph is the largest geodesic distance in the (connected) network between any pair of nodes. Number of geodesic paths between pairs of points was calculated by UClNET (see Appendix 9). The outputs of these calculations will be used for centrality calculations of the cluster members.

Diameters of the three clusters are calculated by PAJEK software. With respect to PAJEK outputs (Appendix 10), diameters can be seen in Table 5.3.

Table 5.3 Cluster diameters

Clusters	**Longest Path**	Diameter
Bayrampa a	From AKAL IPLIK (4) to RETKO (54)	5
Sultanahmet	From ADVENTURE TOURS (2) to IBRAHIM PASA OTELl (21).	9
Taksim	From ASYA TUR (1)b GOLDENAGE HOTEL 1(18).	6

5.2.1.2.6. Cluster Maps

Visual maps ofBayrampa a (Figure 5.1), Sultanahmet (Figure 5.2) and Taksim (Figure 5.3) clusters are obtained by PAJEK software. The placement of nodes was made randomly by PAJEK. Then we organized the members in such a way that

center members are placed at the center of the map. In theses maps, numbers correspon to the cluster members listed in Appendix 3.

PAJEK software provides another algorithm, which is circular, for drawing networks. We also draw three cluster maps by using circular algorithm. These drawings can be seen in Appendix. 1 8.

Figure 5.1 Bayrampa a Cluster Map

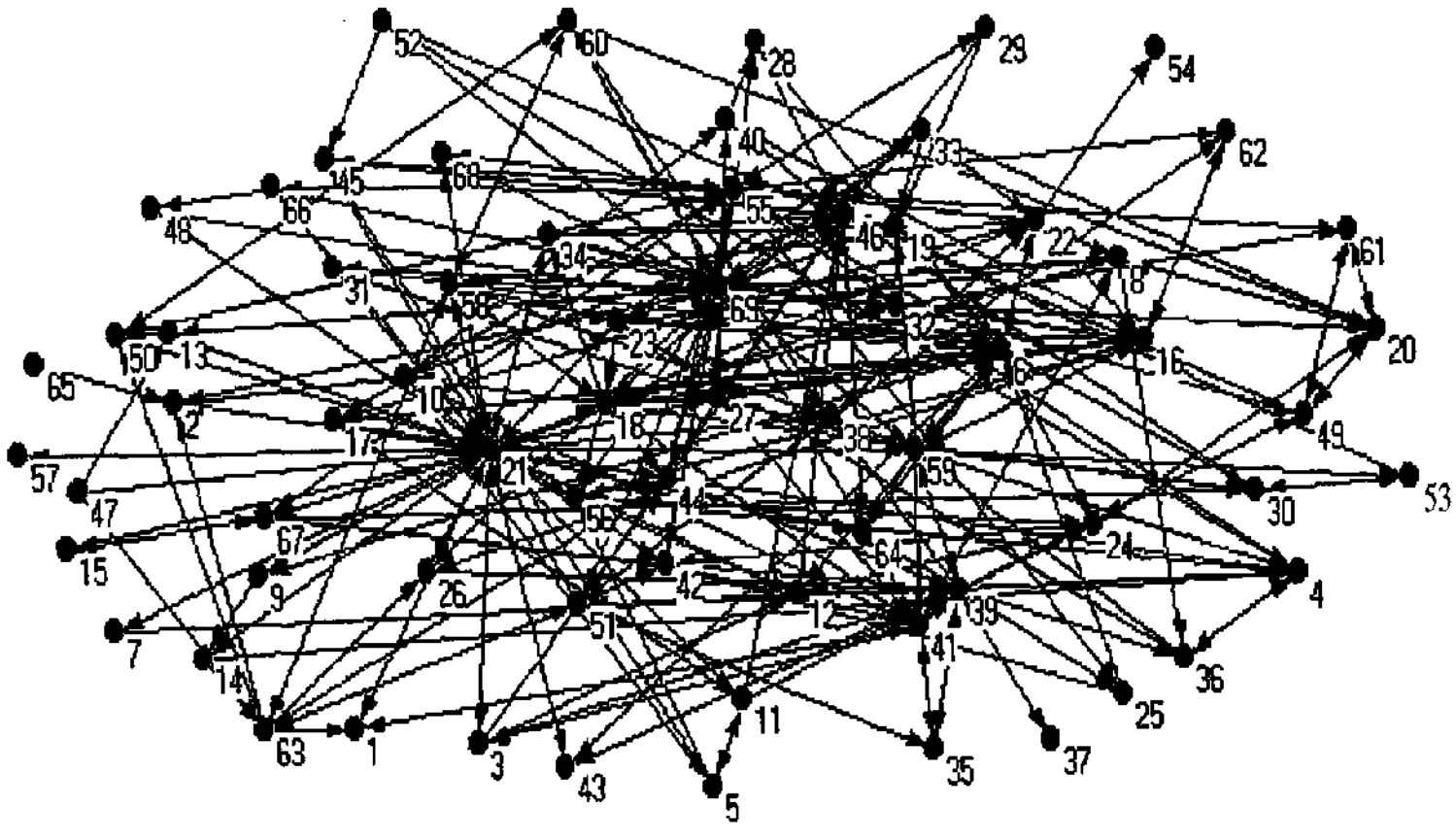


Figure 5.2 Sultanahmet Cluster Map

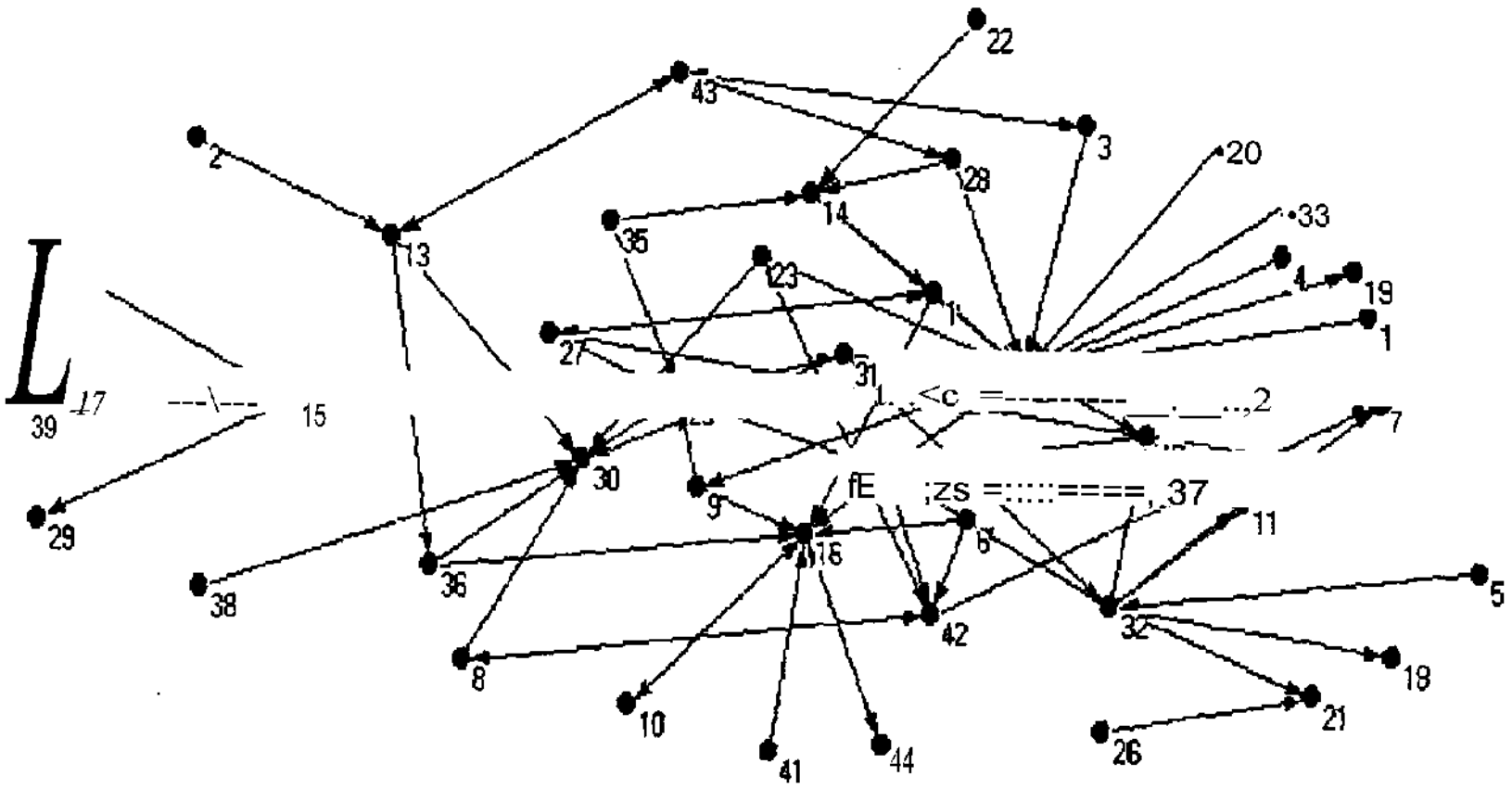
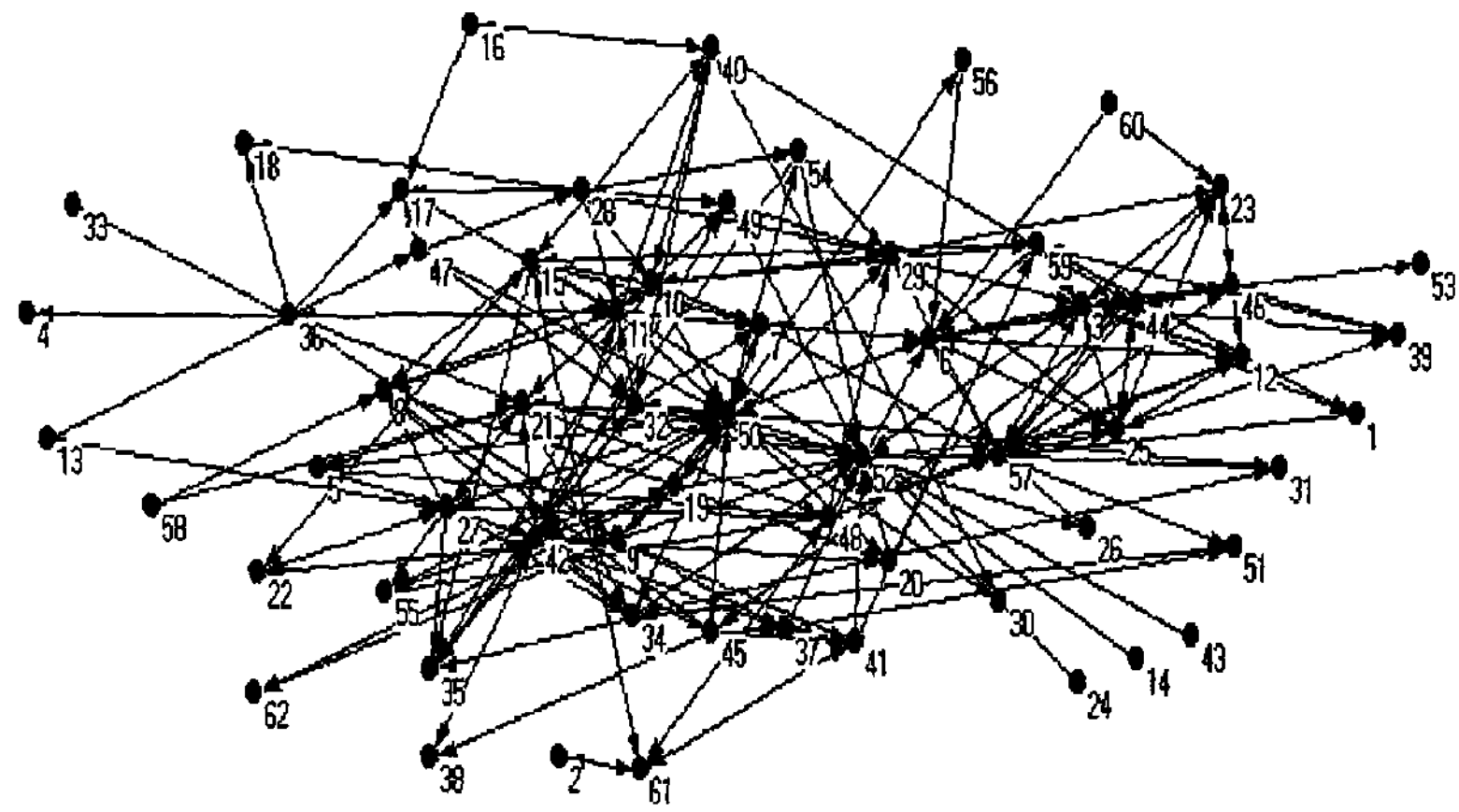


Figure 5.3 Taksim Cluster Map



5.2.1.3. Centrality and Prestige

5.2.1.3.1.Degrees of Cluster Members

By the help ofUCINET, we calculated the indegree and outdegree of cluster members for three clusters we examined (Appendix 8). UCINET output also gives the normalized indegree and outdegree values. Normalized values are very useful for cluster comparisons in statistical analysis.

Table 5.4 Normalized Indegree and Outdegree Values of Bayrampa a, Sultanahmet and Taksim Clusters(Top five members)

Bayrampa9a	NrmOutDeg	NrminDeg
DALTEKS	48.529	51.471
TRISAD	36.765	36.765
MARMARA IPLIK	23.529	13.235
ALMAR	20.588	17.647
SARAC ORME	17.647	19.118
Sultanahmet		
	NrmOutDeg	NrminDeg
RAMI RESTAURANT	13.953	4.651
LESARTSTURCS	13.953	30.233
SARNIC HOTEL	11. 628	11. 628
DOYDOY	9.302	0.000
MAGNIFICIENT	9.302	11. 628
Taksim		
	NrmOutDeg	NrminDeg
SHE TOUR	29.508	32.787
PLAN TOUR	24.590	22.951
CEYLAN INTER.	19.672	18.033
ELITE HOTEL	16.393	4.918
ERESIN TAXIM	16.393	11. 475

As it can be seen from the Table 5.4., Bayrampa a cluster members have the highest indegree and outdegree values compared to Taksim and Sultanahmet clusters for the top five members. Similarly, members of Taksim cluster have higher indegree and outdegree values compared to Sultanahmet tourism cluster.

We defined our model in section 4.1.1. In the model, cluster members are

classified into three types. These are supplier, customer and medium members.

A member is:

Supplier if indegree= Oand outdegree>O

Medium (Supplier and Customer) ifindegree>O and outdegree>O

Customer if indegree>O and outdegree= O

From the above definition, we found supplier, medium and customer type members (See Table 5.5). Medium type members can be seen in Appendix 8 which have positive indegree and outdegree values at the same time.

Table 5.5 Supplier and Customer type members

Clusters	Supplier Type Members	Customer Type Members
Bayrampa9a	ORSUNLER ORME	RETKO
Sultanahmet	DOYDOY,SDC, ISTANBUL HOSTEL, AND OTELI, BAZAAR66, Z&B, ARARAT HOTEL, SAFRAN HALI, ADVENTURE TOURS, MARCO POLO, SULTANAHMET SARAYI, HOTEL PIER LOTI	ORIENT HOSTEL, FOUR SEASON, IBRAHIM PASA OTELI, FEZ TRAVEL, ORIENT HOUSE
Taksim	HOTEL LA VILLA, POLO HOTELS, EZOP TRAVEL, VARDAR HOTEL, VIKING, EXPRESS OTO KIRLM	SOFRA LONDON REST,LION HOTEL, GOLDENAGE HOTEL 1,CRYSTAL HOTEL, ERGUVAN, GOLDENAGE HOTEL 2,TAKSIM GONEN HOTEL, EKIN YAZIM, YENISEHIR PALAS

5.2.1.3.2.Closeness

Closeness is a way of looking at the centrality of the members in a network. Closeness values for each node in three clusters were calculated by UCINET (see Appendix 11). As it can be seen from Table 5.6, standardized closeness figures are much higher in Bayrampa a cluster compared to two tourism clusters for the top five

members. Besides, Sultanahmet and Taksim clusters' top five members have very similar closeness values.

Table 5.6 Closeness Values of Bayrampa a, Sultanahmet and Taksim Clusters (Top five members)

Bayrampaljla	inCloseness	outCloseness
DALTEKS	38.636	37.363
TRI SAD	35.602	34.872
SIVA TRIKO	33.498	33.663
NIT ORME	32.850	27.869
EROL TRIKO	32.536	32.850
Sultanahmet	inCloseness	OutCloseness
FENER	9.954	2.381
AVICENNA HOTEL	9.227	2.380
KUMKAPI DERNEGI	9.227	2.380
ORIENT HOUSE	8.022	2.273
LESARTSTURCS	6.858	4.555
Taksim	inCloseness	outCloseness
SOFRA LONDON	9.652	1.613
ERGUVAN	9.652	1.613
EKIN YAZIM	9.621	1.613
SULTANA'S	9.342	11.317
SHE TOUR	9.327	12.708

5.2.1.3.3. Betweenness

Betweenness values for each node in three clusters were calculated by UCINET (see Appendix 12). Betweenness values show the centrality of a member in a cluster. As it can be seen from Table 5.7, DALTEKS have the higher betweenness measure. SHE TOUR in Taksim and LES ARTS TURCS in Sultanahmet are also having highest betweenness values in their clusters. Therefore, we can see these firms as the center firms of three clusters relatively with respect to betweenness analysis.

Table 5.7 Betweenness Values of Bayrampa a, Sultanahmet and Taksim Clusters(Top five members)

Bayrampal?a	Betweenness	nBetweenness
DALTEKS	1. 661. 294	36.464
TRISAD	938 .111	20.591
SARAC ORME	400.040	8.781
MARtvIARA IPLIK	329.379	7.230
SIVA TRIKO	275.331	6.043
Sultanahmet	Betweenness	nBetweenness
LESARTSTURCS	387.786	21.472
MAGNIFICIENT	226.140	12.522
SARNIC HOTEL	201.498	11.157
ASKIN HOTEL	149.250	8.264
PETROL HOTEL	147.000	8.140
Taksim	Betweenness	nBetweenness
SHE TOUR	970.146	26.507
DIVAN HOTEL	414.260	11. 319
PLAN TOUR	390.774	10.677
SULTANA'S	317.220	8.667
CEYLAN INTER.	315.230	8.613

5.2.1.4. Sub-groups in Clusters

5.2.1.4.1.Cliques

A clique in a graph is a maximal complete subgraph of three or more nodes. It consists of a subset of nodes, all of which are adjacent to each other and there are no other nodes that are also adjacent to all of the members of the clique. By using UCINET, we find all the cliques in three clusters (see Appendix 13).

Bayrampa§a cluster has 92 different cliques. Biggest clique has 4 member.

Sultanahmet cluster has 10 different cliques. Biggest clique has 3 member.

Taksim cluster has 64 different cliques. Biggest clique has 5 member. From these outputs, we can say that Taksim cluster members are working together with 3 to 5 members subgroups. However, it is not the case in Sultanahmet cluster compared to Taksim. This can be seen as the sign of inter cluster study is higher in Taksim cluster.

5.2.1.4.2. Core-Periphery Analysis

Core-Periphery algorithm ofUCINET software seeks to find the minima (maxima) of the cost function. It tries to divide the cluster members into two groups as core and periphery.

Table 5.8.Density Matrices of Core-Periphery Analysis of Bayrampa a, Sultanahmet and Taksirn Clusters

Bayrampa9a Density matrix

	1	2
1	0.194	0.093
2	0.088	0.019

Sultanahmet Density matrix

	1	2
1	0.181	0.049
2	0.084	0.007

Taksim Density matrix

	1	2
1	0.207	0.090
2	0.078	0.020

As the result of this analysis, core and periphery densities are given in Table 5.8. In this table, (1, 1) is the density of core subgroup and (2,2) is the density of periphery subgroup.

Table 5.9.Core Nodes of Bayrampa a, Sultanahmet and Taksim Clusters

Core members of Bayrampa a cluster	Core members of Sultanahmet cluster	**Core members of Taksim cluster**
TRISAD	ACCURA	LAMARTINE HOTEL
BIR-B TRIKO	LESARTSTURCS	ELAN HOTEL
AGUL	MAGNIFICIENT	CEYLAN INTER.
AKAL IPLIK	DOYDOY	GRACE HOTEL
AKTIF	RAMI RESTAURANT	SHE TOUR
ALMAR	ARENA HOTEL	GRAND STAR HOTEL
MERKEZ	SARNIC HOTEL	DORINT PARK PLAZA
EMEK TRIKO	KYBELE	FERONYA HOTEL
EMRE	PETROL HOTEL	KEBAN HOTEL
YON	OZBI	ELITE HOTEL
BO-DE	AYASOFYA PANSIYON.	ERESIN TAXIM
TURKSEVEN IPLIK	SAGID	VASCO
DALTEKS	IBRAHIM PASA OTELI	KERVANSARAY HOTEL
MARMARA IPLIK		RICHMOND HOTEL
GUNAY TEKSTIL		HYATT REGENCY
CETIN		MARBLE HOTEL
OZTUNC		PLAN TOUR
SARAC ORME		NIPPON HOTEL
EROL TRIKO		INKA HOTEL
NARIN TRIKO		
SIVA TRIKO		
SEVILEN TRIKO		
DOGUS ORME		
GUZEL IPEK TRIKO		

5.2.1.5. Rivalry Analysis

Rivalry data is vital where a cluster analysis is being made. Without looking the competitor firms and their position in the cluster it is not healthy to comment on that specific cluster. Competitor matrices, can be seen in Appendix 17, which show the competitors of firms in Bayrampa a, Sultanahmet and Taksim clusters.

When we analyze the competitor structures of three clusters (Table 5.10, 5.11 and 5.12), we see that competitor relation is the highest in Taksim cluster. The ratio of total rivalry pair to total cluster members is 1,25 in Taksim cluster. This ratio is 0,95 in Sultanahmet and 0,78 in Bayrampa a clusters. Sultanahmet firms do not have so much competitor compared to Taksim firms (Table 5.11and Table 5.12).

Table 5.10 Bayrampa a firms and their rivalry data

Members	Number of Competitors
DERYA MAKINA	3
OZTUNC	3
SEVILEN TRIKO	3
SOGUTTRIKO	3
AGUL	2
ALMAR	2
AYGUN TRIKO	2
BIR-B TRIKO	2
COLAKTRIKO	2
DOGUS ORME	2
GUZEL IPEK TRIKO	2
HAZA TRIKO	2
MER-KA	2
OZOKAN	2
SEIR TRIKO	2
SIVA TRIKO	2
YONTRIKO	2
Total	**38**
Cluster Total	56
Coverage Ratio	**%68**
Number of cluster members	72
Total competitor link/number of member	0,78

Table 5.11 Sultanahmet firms and their rivalry data

Members	Number of Competitors
COMMODORE TOUR	**4**
ARENA HOTEL	2
ARTEMIS HOTEL	2
ASKIN HOTEL	2
AVICENNA HOTEL	2
BLUE HOUSE	2
MAGNIFICIENT	2
MASAL	2
MEDUSA	2
ORIENT HOSTEL	2
RAMIRESTAURANT	2
SARNIC HOTEL	2
SENKRON	2
SULTANAHMET SARAYI	2
Z&B	2
Total	32
Cluster Total	**42**
Coverage Ratio	%76
Number of cluster members	**44**
Total competitor link/number of member	0,95

Table 5.12 Taksim firms and their rivalry data

Members	Number of Competitors
ERESIN TAXIM	6
GRAND STAR HOTEL	5
THE MARMARA	5
CEYLAN INTER.	4
DIVAN HOTEL	4
ELITE HOTEL	4
FERO NYA HOTEL	4
HYATT REGENCY	4
KEBAN HOTEL	4
NIPPON HOTEL	4
RITZ CARLTON	4
SAVOY HOTEL	4
DORINT PARK PLAZA	3
ELAN HOTEL	3
HILTON HOTEL	3
PLAN TOUR	3
RIVA HOTEL	3
LAMARTINE HOTEL	2
RICHMOND HOTEL	2
Total	71
Cluster Total	79
Coverage Ratio	%89
Number of cluster members	63
Total competitor link/number of member	1,25

We see that firms in the Taksim cluster have high rivalry numbers compared to other clusters. We can say that rivalry is fierce compared to Sultanahmet and Bayrampa a clusters in Taksim.

5.2.2. Statistical Analysis

For testing hypotheses related to tourism and textile clusters, SPSS computer program was used. The non-metric variables that we used in tests are:

Cluster (1,2,3), CorePerihery (0,1)

and metric variables are:

Revenue, Age, Labor, TotalDegree, Indegree, Outdegree, Betweenness, Incloseness, Outcloseness

As they explained in theoretical framework, totaldegree, indegree, outdegree, betweenness, incloseness and outcloseness are related to centrality level of a member in a cluster. Therefore we use these variables while operationalizing the centrality of a member.

We prefer to use correlation analysis, paired t-test and one way ANOVA with F-test in order to test the hypotheses with the given type of variables (Sharma, 1996). Metric variables could not maintain the normality assumption statistically (Appendix 16); however, we examined the Q-Q plots and decided to continue without any revision of the data. [2]

Hypotheses 1, 2, 3

Hl: Cluster members with higher number of employee in Bayrampa9a have more links compared to other cluster members

H2: Cluster members with higher revenue in Bayrampa9a

---

[2] When we examined the skeweness and kurtosis values of these variables, all the metric variables have positive kurtosis value except revenue. According to Sharma, kurtosis has a bad effect on the power of a test statistic if kurtosis has negative value. We accepted visual examination sufficient while continuing with our data without any transformation. Because statistical tests are not sensitive for small sample numbers such as 40 and 70 observations; however, they are sensitive for large numbers such as 1000 observatons (Hair, Anderson, Tatham and Black, 1998)

have more links compared to other cluster members

H3: Older cluster members in Bayrampa$a have more links compared to other cluster members

For hypotheses 1,2 and 3, we try to test whether positive correlations are available between labor(number of employees), revenue, age and degree(relation density) of the Bayrampa a cluster members.

Table 5.13.Pearson Correlation Coefficients for labor number, revenue, age and degree in Bayrampa a Cluster Members

	Labor Number	Revenue	Age
Degree	-0,047	0,296	0,94
Sig. (2-tailed)	0,715	0,071*	0,477

*Correlation 'ls 'significant at the 0, ! level (2-tailed)
**Correlation is $si_{g\ n}$ ificant at the 0,05 level (2-tailed)
***Correlation is significant at the 0,01 level (2-tailed)

As it can be seen from Table 5.13 revenue and age positively correlated with degree in Bayrampa a cluster; if we accept 90% confidence level we can say that revenue is positively correlated with degree of members in Bayrampa a cluster. For labor and age, we cannot consider statistically acceptable correlations (see Appendix 16). Therefore, we conclude that higher linkage number members in Bayrampa a cluster have higher revenue that is inline with our expectations.

Hypotheses 4, 5, 6

H4: Cluster members with higher number of employees in Sultanahmet have more links compared to other cluster members

H5: Cluster members with higher revenue in Sultanahmet have more links compared to other cluster members

H6: Older cluster members in Sultanahmet have more links

compared to other cluster members

For hypotheses 4, 5 and 6, we try to test whether positive correlations are available between labor, revenue, age and degree of the Sultanahmet cluster members.

Table 5.14.Pearson Correlation Coefficients for labor number, revenue, age and degree in Sultanahmet Cluster Members

	Labor Number	Revenue	Age
Degree	-0,067	-0,172	-0,156
Sig. (2-tailed)	0,680	0,371	0,330

*Correlation is significant at the 0,1 level(2-tailed)
**Correlation is significant at the 0,05 level(2-tailed)
***Correlation is significant at the 0,01 level(2-tailed)

As it can be seen from Table 5.14 labor, revenue and age are all negatively correlated with degree in Sultanahmet cluster; therefore, we reject H4, HS and H6. For labor, revenue and age, we cannot consider statistically acceptable positive correlation (See Appendix 16). Therefore, we could not get positive feedback from H4, HS and H6 hypotheses in accordance with our expectations. This can be due to Sultanahmet cluster structure (ifwe look Sultanahmet cluster map, we see an undeveloped cluster map).

Hypotheses 7, 8, 9

H7: Cluster members with higher number of employees in Taksim have more links compared to other cluster members

H8: Cluster members with higher revenue in Taksim have more links compared to other cluster members

H9: Older cluster members in Taksim have more links compared to other cluster members

For hypotheses 7,8 and 9, we try to test whether there are positive correlations between labor, revenue, age and degree of the Taksim cluster members. As it can be

seen from Table 5.15 labor, revenue and age positively correlated with degree in Taksim cluster; however even in 90% confidence level we have to reject H7, H8 and H9 (See Appendix 16). For labor, revenue and age, we cannot consider statistically acceptable positive correlation with degree. Although all correlation coefficients are positive, we could not find statistically acceptable correlation in Taksim cluster members about labor number, revenue and age characteristics.

Table 5.15.Pearson Correlation Coefficients for labor number, revenue, age and degree in Taksim Cluster Members

	Labor Number	Revenue	Age
Degree	0,169	0,221	0,098
Sig. (2-tailed)	0,231	0,247	0,494

*Correlation'1s siginficant at the 0,1 level (2-tailed)
**Correlation is significant at the 0,05 level (2-tailed)
***Correlation is significant at the 0,01 level (2-tailed)

Hypotheses 10, 11, 12

HI0: Core and periphery members in Bayrampa9a cluster are not similar in revenue, age and labor

HII: Core and periphery members in Sultanahmet cluster are not similar in revenue, age and labor

H12: Core and periphery members in Taksim cluster are not similar in revenue, age and labor

One-way ANOVA can be used in order to test the equality of means of two or more groups. We compared the revenue, age and number of labor means of three clusters for core and periphery firms by using SPSS's one-way ANOVA with F-test function.

Hypothesis 10

For 95% confidence interval, we can not accept revenue, age and labor values

of the cluster members are statistically different for core and periphery firms in Bayrampa a cluster (See Appendix.16). Because ofthis analysis, we can say that there is not statistically acceptable difference for core and periphery firms for revenue, age and labor number that is not inline with our expectations.

Hypothesis 11

For 95% confidence interval, revenue of the cluster members are statistically different for core and periphery firms in Sultanahmet cluster (See Appendix 16). Because of this analysis, we can say that there is a difference for core and periphery firms for revenue. On the other hand, we cannot find statistically acceptable differences for age and labor of core/periphery members that is not inline with our guess.

Hypothesis 12

For 95% confidence interval, revenue, age and labor values of the cluster members are not statistically different for core and periphery firms in Taksim cluster (see appendix.16). This is also not inline with our expectaton. For three clusters, we could not find statistically acceptable values for labor, revenue and age characteristics of core and periphery firms. The reason behind that can be due to our selection methodology. We used snowball sampling and this method gives us nearly core firms ifwe think whole population. Therefore, HlO, Hl 1 and H12 outputs can be rationalized.

Hypotheses 13, 14, 15, 16

Hl3: Taksim and Sultanahmet cluster members have different life spans

H14: Taksim and Sultanahmet cluster members have

different revenue

Hl5: Taksim and Sultanahmet cluster members have different number of employees

H16: Members of Taksim cluster have more relation with other cluster members than Sultanahmet cluster members have

lndependent sample t-test is used from SPSS for these hypotheses. We tested the hypotheses 13, 14, 15 and 16 with independent sample t-test. With 95% confidence interval we accepted all hypotheses (see Appendix 16). This means that labor, age, revenue and totaldegree are statistically different for Taksim and Sultanahmet tourism clusters.

Table 5.16 Sultanahmet(2) and taksim(3) cluster statistics for comparison.

Group Statistics

	CLUSTER	N	Mean	Std. Deviation	Std. Error Mean
REVENUE	2	29	1,83	,759	,141
	3	32	3,09	,734	,130
AGE	2	41	10,22	5,956	,930
	3	51	19,29	20,057	2,809
LABOR	2	40	23,30	35,155	5,559
	3	52	136,04	317,312	44,003
TotalNrmDegree	2	44	8,98550	8,096228	1,220552
	3	63	14,4157	11,8915	1,498187

As it can be seen from Table 5.16, Taksim cluster firms are older than Sultanahmet firms. Average life is 19,29 for Taksim and 10,22 for Sultanahmet clusters. Revenues of Taksim firms are greater than Sultanahmet firms and labor numbers are much more higher in Taksim cluster. From these results, we can conclude that Taksim tourism cluster has firms with larger revenue and labor size and they are older than the firms in Sultanahmet tourism cluster. Because of these,

the connections ofTaksim firms should be denser compared to Sultanahmet firms that are tested for Hypothesis 16.Because of the test, average member ofTaksim cluster have 14 ,4 link where it is 8,9 in Sultanahmet cluster, which is inline with our hypothesis (Table 4 .16).

Hypotheses 17, 18, 19, 20: Bayrampa a versus Sultanahmet Cluster Comparison

H17: Bayrampa$a cluster has older members than Sultanahmet cluster

HlB: Bayrampa$a cluster members have more revenue than Sultanahmet cluster members

Hl9: Number of employees in Bayrampa$a cluster members are more than Sultanahmet cluster members

H20: Members of Bayrampa$a cluster have more relations with other members compared to Sultanahmet cluster members

We could not accepted Hl 7, 18, 19 and accepted H20 . It is very interesting that revenue, age and labor of cluster members in Bayrampa a and Sultanahmet clusters are significantly similar; however totaldegree of cluster members in Bayrampa a is greater than Sultanahmet (see Table 5.17). This shows that Bayrampa a members are much more linked to each other compared to Sultanahmet cluster members. However, the revenue averages of these two clusters are the same. This can be a result of the profit margin di:fferences for textile and tourism clusters.

Table.5.17 Bayrampa a(l) and Sultanahmet(2) clusters revenue, age, labor and degree statistics

Group Statistics

	CLUSTER	N	Mean	Std. Deviation	Std. Error Mean
REVENUE	1	38	.1,87	,963	,156
	2	29	1,83	,759	,141
AGE	1	60	11,93	8,340	1,077
	2	41	10,22	5,956	,930
LABOR	1	63	24,22	50,443	6,355
	2	40	23,30	35,155	5,559
TotalNrmDegree	1	72	14,8081	15,0989	1,779426
	2	44	8,98550	8,096228	1,220552

Hypotheses 21, 22, 23, 24

H21: Bayrampa$a cluster has older members than Taksim cluster

H22: Bayrampa$a cluster members have more revenue than Taksim cluster members

H23: Number of employees in Bayrampa$a cluster members are more than Taksim cluster members

H24: Members of Bayrampa$a cluster have more relations with other members compared to Taksim cluster members

We accepted H21, H22, H23, but rejected H24. Revenue, age and labor of cluster members in Bayrampa a and Taksim clusters are significantly different; bowever degrees of cluster members in Bayrampa a is statistically similar witb Taksim cluster(Table 5.18). This shows that Bayrampa a and Taksim cluster members are linked to each other in a similar way. However, Taksim members have higher revenue and they are older than Bayrampa a members. Taksim firms' revenue are higher than Bayrampa a firms although their links are similar.

Table.5.18. Bayrampa a(1) and Taksim(3) clusters revenue, age, labor and degree statistics

Group Statistics

	CLUSTE	N	Mean	Std. Deviation	Std. Error Mean
REVENU	R	38	1,87	,963	,156
	1	32	3,09	,734	,130
AGE	1	60	11,93	8,340	1,077
	3	51	19,29	20,057	2,809
LABOR	1	63	24,22	50,443	6,355
	3	52	136,04	317,312	44,003
TotalNrmDegree	1	72	14,8081	15,0989	1,779426
	3	63	14,415 7	11,8915	1,498187

Hypotheses 25, 26, 27

H25: Members of the clusters that higher number of employees have more links with other cluster members

H26: Members of the clusters that have higher revenue have more links with other cluster members

H27: Old members of the clusters have more links with other cluster members

As it can be seen in Table 5.19, there is positive correlation between revenue, age, labor and degree. However, only revenue is statistically acceptable with 90% confidence level. Therefore, revenue and linkage level is statistically positively correlated as inline with our hypotheses.

Table 5.19.Correlations of degree Labor Age and Revenue for the whole data:

	Labor Number	Revenue	Age
Degree	0,122	0,178	0,089
Sig. (2-tailed)	0,132	0,078*	0,278

*Correlation is significant at the 0,05 level (2-tailed)
**Correlation is significant at the 0,01 level (2-tailed)
***Correlation is significant at the 0,001 level (2-tailed)

Hypotheses 28, 29, 30

H28: Core and periphery members of Bayrampa9a, Taksim and Sultanahmet clusters are not similar number of employees

H29: Core and periphery members of Bayrampa9a, Taksim and Sultanahmet clusters are not similar in revenue

H30: Core and periphery members of Bayrampa9a, Taksim and Sultanahmet clusters are not similar life spans

For all three hypotheses, with respect to SPSS results we could not accept hypotheses 28, 29 and 30 (Tahle 5.20). Therefore, there is no statistically proven differences hetween core and periphery members with respect to age, labor and revenue with 95 % confidence interval. We could not find differences between core and periphery firm characteristics that are not inline with our hypotheses.

Table.5.20 Revenue, age, labor statistics for all firms with respect to core and periphery factor

Group Statistics

	CorePeriphry	N	Mean	Std. Deviation	Std. Error Mean
REVENUE	I	33	2,21	1,083	,188
	0	66	2,27	,985	, 121
AGE	I	41	11,80	7,672	1,198
	0	11 1	14,73	15,165	1,439
LABOR	1	41	37,44	78,023	12,185
	0	114	70, 15	220,619	20,663

Hypotbeses 31, 32, 33, 34

H31: Core firms in Bayrampa9a, Taksim and Sultanahmet cluster firms are similar in number of employees

H32: Core firms in Bayrampa9a, Taksim and Sultanahmet cluster firms are similar in revenue

H33: Core firms in Bayrampa9a, Taksim and Sultanahmet

cluster firms are similar life span

H34: Core firms in Bayrampa9a, Taksim and Sultanahmet cluster firms are similar relation density

We reject H3 1 and H32 with 95% confidence level with respect to SPSS' Oneway anova with F-test results(Table.4.21). However, we accept H33 and H34 that is core firms are similar in life span and their connections numbers with other firms. This shows that core firms have similar life and linkage characterstics even though they are different in labor sizeand revenue.

Table.5.21 Revenue, age, labor statistics for all core **firms**

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
REVENUE	Between Groups	13,464	2	6,732	8,397	,001
	Within Groups	24,051	30	,802		
	Total	37,515	32			
AGE	Between Groups	159,666	2	79,833	1,382	,263
	Within Groups	2194,77	38	57,757		
	Total	2354,44	40			
LABOR	Between Groups	48518,9	2	24259,459	4,728	,01 5
	Within Groups	194983	38	5131,136		
	Total	243502	40			
TotalNrm Degree	Between Groups	768,408	2	384,204	1,313	,278
	Within Groups	15211,0	52	292,519		
	Total	15979,4	54			

Hypotheses 35,36,37,38

H35: Periphery firms in Bayrampa$a, Taksim and Sultanahmet cluster firms are similar in number of employee

H36: Periphery firms in Bayrampa$a, Taksim and Sultanahmet cluster firms are similar in revenue

H37: Periphery firms in Bayrampa$a, Taksim and

Sultanahmet cluster firms are similar life span

H38: Periphery firms in Bayrampa a, Taksim and Sultanahmet cluster firms are similar relation density

We reject H35,H36,H37 and H38 with 95% confidence level with respect to SPSS Oneway Anova with F-test results(Table.5.22). We can say that there is no equality of periphery firms for revenue, labor, age and degree characters. This shows that we could not find any similarity of member characteristics in different clusters.

Table.5.22 Revenue, age, labor statistics for all periphery firms

ANOVA

		Sum of Squares	df	Mean Square	F	Siq.
AGE	Between Groups	2356,04	2	1178,019	5,546	,005
	Within Groups	22941,9	108	212,425		
	Total	25297,9	110			
LABOR	Between Groups	397911	2	198955,620	4,328	,01 5
	Within Groups	5,E+06	111	45965,128		
	Total	6,E+06	113			
TotalNrmDegree	Between Groups	375,937	2	187,968	3,972	,021
	Within Groups	5725,41	121	47,317		
	Total	6101,35	123			
REVENUE	Between Groups	22,773	2	11,386	17,792	,000
	Within Groups	40,318	63	,640		
	Total	63,091	65			

Hypothesis 39

H39: Cluster members with higher betweenness values have more links with other firms

As it can be seen from Table 5.23, there is statistically acceptable correlation between degree and betwenness of the core cluster members which is inline with our hypothesis. Therefore we conclude that cluster members which have higher centrality(betweenness)value have more linkages with other cluster members for all three clusters we examined.

Table 5.23. Correlation table for betweenness and degree for core firms

Correlations

		nBetweenness	TotalNrmDegree
nBetweenness	Pearson Correlation	1	,863**
	Sig. (2-tailed)	.	,000
	N	179	179
TotalNrmDegree	Pearson Correlation	,863**	1
	Sig. (2-tailed)	,000	.
	N	179	179

**. Correlation is significant at the 0.01 level (2-tailed).

Hypotheses 40, 41

H40: Cluster members with higher incloseness values have more links with other firms

H41: Cluster members with higher outcloseness values have more links with other firms

Incloseness and outcloseness values of core members are positively correlated with degrees of cluster members as it can be seen in Table 4.24 which is inline with our hypotheses. This output shows that members that have more incloseness value have more linkages with other cluster members. Similarly, members with more outcloseness members have more linkages with other cluster members.

Table 5.24 Correlation table for incloseness,outcloseness and degree

Correlations

		TotalNrm Degree	InCloseness	outCloseness
TotalNrmDegree	Pearson Correlation	1	,280'''	,294''
	Sig. (2-tailed) N	'	,000	,000
InCloseness	Pearson Correlation	179	179	179
	Sig. (2-tailed) N	,280'''	1	,909'''
outCloseness	Pearson Correlation	,000	'	,000
	Sig. (2-tailed) N	179	179	179
		,294'''	,909'''	1
		,000	,000	,
		179	179	179

25 ,d,. Correlation is significant at the 0.01 level (2-tailed).

5.3.Summary of Mathematical and Statistical Analyses

In section 5, we used mathematical and statistical analyses methods in order to analyze Bayrampa a, Sultanahmet and Taksim clusters. In mathematical analysis, we draw the picture of these three clusters and then calculated necessary characteristics of these three networks.

We saw that Bayrampa a cluster is the densest one among these clusters. On the other hand, Sultanahmet cluster members have the fewest links. This picture was reflected in the statistical analysis as well: We could not find confirm our hypotheses from Sultanahmet cluster. We think that this is due to Sultanahmet cluster's underdeveloped structure.

Taksim tourism cluster is quite developed compared to Sultanahmet cluster. Therefore, its characteristics are similar to Bayrampa a textile cluster.

Another analysis we focus on was about the core and periphery members of the clusters. Generally, we could not get clear differences for these two group members. We think that the reason behind that is our sample selection method. Because of

snowball sampling procedure, we chose the members in the highest linkage levels; therefore, clear distinction among these members was difficult.

From the overall perspective of these three clusters, we see that there is a developed textile cluster in Bayrampa a and a tourism cluster in Taksim; however, Sultanahmet tourism cluster need to be developed. This can be an opportunity for entrepreneurs. Besides, government can prepare a support program for Sultanahmet cluster, which has big potential in tourism market.

6. Conclusion and Implications

6.1. Conclusions

Cluster approach opened a new and unexplored area for the people who are interested in competitiveness of firms, sectors, regions and nations in the last decade. In this area, various studies should be made in order to explore the new field. Identification of cluster, cluster policies for increasing competitiveness, innovation strategies for clusters, regional development policies with cluster approach are some of the unexplored subfields under cluster title. If we think this new area as building a new wall in management house, this study aims to put a brick in the wall that will be constructed for the management house.

Table 6.1 Comparisons between classical cluster identification methods and Bulu's approach

Characteristics	Case Study Approach	1/0 Approach	Our Approach
Scale	Micro, Meso, Macro	Meso	Micro
Cluster boundary	Expert opinion	With respect to SITC	Regional boundary and threshold point
Application level	Regional application is possible	Regional application is not possible	Regional application is possible
Linkage definition	Expert opinion	Forecasted coefficients	Binary (0/1)
Reproducibility	No	Yes	Yes

In this study, we improved Porter's value system model by adding competitor and backlinkage components to his model. By doing this, improved model became a network composed of nodes and links among these nodes. Thus, we are able to handle such a model with the tools coming from mathematics discipline. We get the graph theory from mathematics discipline and apply it to cluster approach in order to reach our goal. As it can be seen in the study, tools of graph theory fit the

requirements of cluster approach perfectly. By doing this, we aim to show that microclusters can be identified in quantitative way. Table 6.1 summarizes comparison of the approach we introduced and classical approaches used for the cluster identification available in literature.

While starting to this study, our aim was to introduce a quantitative tool in order to define microclusters. We belive that we reached our goal by introducing the cluster model in section 4.1. Besides, we applied our model to three different microclusters in Turkey and showed that the model is working. Moreover, our model makes network and statistical analysis techniques available for cluster analysis. Therefore, we can say that researchers have a useful tool if they use our model while starting microcluster analysis. Softwares such as UCINET and PAJEK prepared for social network analysis will be very beneficial during the analysis stage and **SPSS** will be helpful for the statistical analyses if our model will be used for the identification of microclusters.

Another important conclusion our hypotheses supports that, firms with higher relations with other cluster members have competitive advantage. This conclusion can be tought as a contribution to cluster approach. Moreover our :findings support resource based theory since being in the center of the network provides a sustainable competitive advantage. Also we can say that being in the cluster decreases transaction costs and provides competitive advantage to firms in the cluster.

6.2.Implications

For implications of our study, following possibilities can be considered for governments, researchers, managers, entrepreneurs and banks:

(i)Government:

a) Today cluster approach became one of the main agenda of governments for increasing competitiveness of their nations. Therefore, importance of cluster approach studies is increasing in today's competitive world. Within this perspective, we believe that our study will be a starting point for Turkish government in its future development attempts. If our study can be enlarged throughout Turkey, we will know all clusters in our country. Because of this, Turkish government will have very valuable knowledge in order to increase these clusters competitiveness by applying necessary policies with respect to data coming from cluster analyses so that Turkey's competitiveness can be increase.

b) By defining a cluster we are introducing very important data for the service of different players in economy. One of these players is government. Government can use the information extracted from cluster identification studies for development purposes, tax purposes, etc. If governments planning to give support to some specific areas and some specific firms, cluster and their core firms (see section 5.2 .1.4.2) are ideal candidates.

(ii) Managers: linkages are important for a company manager. If a company has more links with its cluster companies (see center company in section 5.2 .1.3), it will have competitive advantages. Therefore increasing the links with cluster firms should be one of the company managers responsibility.

(iii) Entrepreneurs: to invest in a cluster is an advantageous one; because, cluster firms have competitive advantage compared to non-cluster firms (Porter,

1998). Therefore, it is natural for an entrepreneur to prefer to be in cluster while deciding a new investment. Moreover, entrepreneurs will prefer to enter the part of the value chain where competitiveness level is low. For deciding this, competitiveness matrix (see section 5.2.1.5) will be very useful.

(iv) Researchers: cluster approach is quite new and it has various unexplored areas. Therefore, many studies should be made. Fore example, microcluster map for whole Turkey should be defined (I map only three of them). Cluster development policies should be designed. Studies for increasing cluster innovativeness should be researched.

(v) Banks: One of the main tasks of banks is to give credit to firms. While doing this, banks want to be sure the credit will be paid back in time. Therefore, credit-marketing departments of banks make various kinds of studies. We belive that cluster maps will be very helpful to these people while rating firms credibility. For example, firms in a cluster with no competitor can be ideal candidate for giving credit. Because, these kinds of firms (e.g. Lesartsturcs in Sultanahmet cluster) have the chance of making profits compared to a firm that is not a cluster member.

6.3. Reliability and Validity of the Study

The model that we developed in this study is a quantitative one. Therefore, reproducibility of same results for the same clusters will be obvious if we try to define a cluster several time. Only obstacle for the reproducibility of the same result can be realized if respondents from organizations gave different answers for the same questions. If the respondents have the necessary knowledge about all organization, this problem is overcome. For doing this, during our study, respondents got the help of related departments when answering the questions.

The set of challenges that we must overcome to meet our goal of developing a rational and quantitative method for defining microclusters are to define whether a node is a member of the cluster or not, to operationlize a link, to determine where the value chain starts and stops. Since these are areas that can be subjective, we can face validity problems. In order to overcome these problems we followed the procedure described below:

In order to decide whether a node is a member or not, we used snowball sampling method with a treshold value of five. Snowball sampling also is used to decide where the value chain starts and stops. For operationalization of the links, different studies in the literature are examined, then the experts who have knowledge about cluster studies are communicated. However, operationalization of a link may create serious validity problems; since to define a link betwecn two firms as quite subjective. Components such as frequency of the relation, type of the relation, volume of the relation should be measured objectively. Since our aim was only do decide whether a link is available or not between two firms/organizations, our work was easier. By asking respondents to sort the organizations from the one that they have relation mostly to lesser, we catch a kind of objectivity about the link

definitions. However, for the researchers who want to decide the links more confidently a scale can be developed in order to measure the level of the link. Due to resource restrictions, this kind of study can be the subject of another study.

We compared the results of the study that we made in Sultanahmet cluster with a study that was made in the same cluster by CAT by using case study approach. For the CAT's study a qualitative method, case study, was used. Nearly twohundredfifty members of the cluster were interviewed; then a cluster map was initiated. As the result of the comparison of these two studies, we saw that our study gave the nearly the same map with the previous one. Therefore, we can conclude that our model is quite valid.

6.4.Further Research

In this study, we introduce a new quantitative tool for identification and the analysis of the microclusters. While doing this, we have some limitations. These are about boundary and link definitions. We used expert opinion and defined the regional boundaries together with threshold level while defining the boundary of a microcluster. While analyzing links, we used a binary approach, which is very useful during the research. We think that both of the approaches we used in this study need to be further researched. For boundary definition, new mathematical approaches can be good area for further research.

While using a binary approach, we lost most part of the information related to link; however, we choose this way due to resource constraints. We believe that a more developed scale should be designed while defining the links between members of the cluster and this issue needs to be further researched.

As the second part of this research, we applied our model in three important microclusters of Turkey and showed the usefulness of model. We believe that the outputs of analysis of from these three clusters will be very helpful; however, we believe that all potential microclusters in Turkey should be identified urgently. Besides, we believe that our model will be helpful to whole microclusters researchers who need an identification tool.