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10 Innovation Ability of Small Firms in Turkish Industrial Clusters: Ankara-Ivedik Industrial Region Case

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Abstract

Research and development activities (R&D) of small firms forming innovation have to be improved because of the insufficiency of financial, technical, and human resources. Innovation ability, which would actually support firm activity, is uncommon by small firms. This fact evidently causes a disadvantage for the small firms to compete in comparison with middle and large-scale firms. However, the disadvantaged situation of small firms arising from their economies of scale can be converted to an advantageous situation by forming a network of organizations in clusters. According to the literature reviewed, small firms within clusters improve in the field of innovation by intensity of communication and interaction, relative ease of information flow, ability of creating collective learning effects, and mutual budget for R&D studies. This study examines the existence of this interaction among firms, as in the case of Ankara-Ivedik Organized Industrial District by a survey depending upon questionnaire information.

10.1 Introduction

Today, competition has become much more dynamic. Global procurement business activities can compensate the disadvantages brought by the costs of factors of production, whereby the age-old idea of competitive capacity loses its importance (Arndt and Sternberg 2000).

During the last decades, regional concentration and competitiveness of small firms became important topics of discussion on how to develop the competitive ability of small firms, whereby large firms

enjoy economies of scale and scope. In order to overcome difficulties resulting from economies of scale, small firms require the benefit arising from the effects of network interaction. Hence, small firms operating under network interaction within industrial clusters would have greater competitive ability, which cannot be attained by the small firms individually. In a study conducted by Hoen (2001), it was found that industrial clusters were, in general, inclined to use more innovations, knowledge spillovers, and experience faster diffusion of technologies and knowledge, which result in an increase in their competitive advantages.

By developed countries or by countries where the economic policies rely upon industrialization as an indispensable factor to achieve growth, R&D, innovative activities, gaining ability generating diversity, and competitiveness, proximity and allied concepts became crucial issues of the economic research and debate. Consequently, innovation has increasingly been viewed as the deciding factor on whether a company, business sector, region, or country will be able to retain and improve its competitive position in the world economy (OECD 2000).

Comparing Turkey with the developed countries, it will be observed that the R&D activities are rather lower than usual (Taymaz 2001). R&D's share in GNP is about 2 percent in developed countries, whereas about 40 personnel among every 10,000 economically active populations are employed in the R&D activities. On the other hand, in Turkey, total R&D expenditures reaches 0.8 percent of the GNP, and only about 10 personnel are engaged in R&D activities among every 10,000 economically active populations (KOSGEB 2007). In this respect, it is noteworthy that the small-scale firms of Turkey are usually not capable of forming a program and an appropriate budget for an R&D unit for reasons related to market position, organizational peculiarities, and certain social effects, although there is no lack of intention to set up such a unit (Akgemici 2001).

This chapter will focus on an empirical study of industrial clusters and innovation capability of small firms in the Ankara-Ivedik industrial region. The methodology and findings of the case study will be explained after a short discussion on the subject and research problems within a theoretical framework on industrial clusters and innovative capability.

10.2 Theoretical Framework

10.2.1 Industrial Clusters and Small-Sized Firms

The literature cluster and industrial district are frequently used interchangeably. However, the term "cluster" will rather be used for a more extensive perspective with respect to the term "industrial districts." Isaksen (2001) explains that every industrial district is a cluster, whilst a cluster is not necessarily an industrial district. Actually, both clusters and industrial districts generate external economies. In this context, the cluster concept relates to the achievement of increased efficiency through extensive external division of labor within the networks of specialized firms (Isaksen 2001). Regional cluster and regional innovation systems have started to take a critical place in the world economy for both the traditional (e.g. in the industrial districts in Turkey) and high technology products (e.g. in the Silicon Valley).

The industrial-district environment places each district company within a web of relationships, which deeply influence its activities and performance. Within this context, the business idea embodies, ever since the company's start-up, certain specific interfirm relationships as an essential feature of its survival and performance potential. Access to the market, marketing, and R&D activities would then start to execute with the help of joint initiatives among many firms (Ritter and Gemünden 2003). That strategic cooperation will in turn increase interaction among firms.

According to conventional classification, industrial clusters in terms of important linkages, complementary and technological abilities, knowledge, marketing, and customer demands determine the spillovers in some broader sense. Such linkages for firms and industries are essential bases for competition and efficiency, and especially for direct new business areas and innovation (Porter 1998).

Industrial clusters are defined and referred as key structures for competitive ability of small and medium firms. Porter (1998) points out the rivalry as an explanation for the success of the clusters. Cooperation among firms in clusters has been viewed and deeply studied as a powerful determinant of the competitive advantage of clusters and of the individual firms in such clusters (Boari et al. 2003). Clustering of economic activity seems to enable firms, and especially the SMEs to

grow and upgrade more easily (Altenburg and Meyer-Stamer 1999). Moreover, geographical agglomeration provides capital market, pool of labor, and interfirm relations for SMEs. Capello (1999) claims that if SMEs are located in a cluster, they would be initially influenced by greater capital and higher labor productivity.

Nadvi (1995) mentions that clusters offer unique opportunities for SMEs to engage in the wide array of domestic linkages between users and producers that stimulate learning and innovation (e.g. especially by the knowledge producing sectors). Reaching external knowledge is not quite easy for SMEs. However, cluster can help SMEs to provide external knowledge by its mechanism of information flows among different economic actors. Firms of cluster exchange and create knowledge through face-to-face interactions together with the creation of a common language among institutions and associations.

The emergence of clusters can be explained by several theoretical approaches. In the literature, studies by Krugman (1991) and Porter (1998) are well known as presenting fundamental sources about the emergence of clusters. While Krugman attempts to stress upon the role of interaction between factors that cause localization, Porter points out the positive effects of "agglomeration economies" as the reason for the existence of clusters Hoen (2001). A model designed by Krugman (1991) tries to explain the emergence of clusters on the transportation costs, mobile production factors, and economies of scope and scale.

10.2.2 Innovation and Small Firms in Industrial Cluster

Thompson (1965), who forwarded one of the essential studies about innovation, defines it as diffusion, acceptance, and execution of new ideas concerning process, product, or service. Similarly, Zaltman (1973), Roger (1995), Amabile et al. (1996), Johnson et al. (1997), Moorman and Miner (1998), and Verona (1999) reflect innovation process as acquisition, diffusion, and explosion of new knowledge.

Calantone et al. (2002) associate innovation factor studying the relationship among learning orientation, firm innovativeness, and firm performance with organizational learning, and also adopt learning orientation as a model approach that is a start point or basement for firm innovativeness effecting firm performance.

The importance of knowledge spillover and innovation inputs emphasize that R&D activities do not develop in isolation (Nelson 1993). Several studies in the literature reveal direct linkages between innovation level and the existence of R&D in industrial clusters (Braunerhjelm and Carlsson 1999).

Since the end of the 1960s, industrial economists, sociologists, and local economists have begun to take interest in the constellations of small companies being concentrated in specific areas that have been termed as industrial districts (Brusco and Pezzini 1999). Firms in industrial districts dispose of capabilities to store and develop knowledge through their established rules and routines as well as through specific documentation procedures, as Nelson & Winter (1982) have shown. In recent approaches to the theory of the firm, firms have been considered not only as repositories of knowledge, but also as processors of knowledge (Amin and Cohendet 2000).

Baptista and Swann (1998), in their study stating that firms in clusters have more innovative activities, explain the relationship between clusters and innovations from four different aspects, namely: nature of clustering process, nature of technology, nature of innovation process, and nature of economic growth. One of the main reasons for the existence and success of clusters' technological innovation seemed to be the wider spread of knowledge or spillovers (Baptista and Swann 1998).

10.2.3 Innovation Capability of Small Firms

The largest problem to determine the factors of innovation ability was a lack of appropriate and qualified technology or R&D personnel. The next most important problem was excessive economic risk, since most of an enterprise's main information sources come from customers. The third category arose within the enterprises (Hsien-Ta Wang et al. 2003).

In the early 1990s in particular, increasing criticism was leveled at the exclusive orientation of R&D support toward large enterprises, which were mostly enhancing their competitive advantage by downsizing operations and reducing employment EC (2003). In parallel with the development of the theoretical approach toward the national systems of innovation, practitioners (especially in the EU)

were pointing out the existence of the SME problem. In practice, the innovation-systems approach stimulates policy actions in SMEs, in order to enhance technology diffusion between actors, and to increase the absorptive capacity of these companies.

Relatively smaller scale of firms might also prevent the achievement for specialized and effective internal division of labor that, according to classical economic theory, fosters cumulative improvements in productive capabilities and innovation (Ceglie and Dini 1999).

In particular, although dynamic SMEs have a strong potential to create new ideas, innovations, and employment, they will be, on the other hand, hindered by weak access to knowledge resources and finance due to relatively high fixed costs, and especially high information and administrative costs, if they intend to participate in research programs (Bessant 1999).

10.3 Research Methodology

10.3.1 Research Questions

The present research work depends upon a developed model to determine effects influencing research and development activities of SMEs. After specifying the effects on the availability R&D leading to the creation of a new product, the relationship between the innovation and the availability of R&D activity was investigated. Innovation capability is then evaluated by the degree of introducing the new product. R&D activities here are considered as a process to form a new product, which would locate the firm into a competitively advantageous position in the market. The R&D activity gives rise to knowledge, which is valuable both for directly commercializing a product, and for being the basis for a new and better version of the product (Fosfuri and Ronde 2002).

In this respect, it should be kept in mind that shortage of skilled personnel in small-scale firms prevents these firms from realizing effective technological R&D activities and bringing out technological innovation. Moreover, laboratory activities might be intended to provide testing and certification services, but will eventually be fully engaged in technology development (Cooke 2001). Also to be taken into consideration is that the trade fairs, which provide leading sources of

information within the industrial clusters, will have a core function in improving flows of technical and marketing know-how, in providing quality and fashion feedback, and in enhancing the competitiveness of clustered and networked producers (Nadvi 1995). In that sense, participation in fairs would mean that new potential customers will be contacted, and that results in new interactions that bring in ideas and opportunities for innovation.

Accordingly, the first research question in the study defines the determinants of the R&D activities related to new product development as:

- Skilled personnel,
- Quality improvement initiatives,
- Availability of laboratories,
- Training and development activities,
- Use of computer for production, and
- Participation in fairs.

The question can be set as follows: *Is there a relationship between these determinants and the availability of research and development activities?*

Related to the preceding question, the second level of the investigation concerns the innovation ability of the firms. In order to determine the innovation ability of the firms in the industrial district, the relationship between the degree of new product development and the availability of R&D might be analyzed. R&D activities are defined as one of the main effects for making innovation. Firms with increased degree of R&D availability have strong intentions to realize innovations (Taymaz 2001). From this point of view, the research examines the relationship between the level of innovation ability and the R&D activities.

Hence the related question might be formulated as follows: *Does the level of innovation ability depend on the availability of research and development activities leading to new product innovation?*

As a result, firms being surveyed are (according to the determinants defined in the preceding sentence) classified as "potential innovators" and "noninnovators." Potential innovators are then defined as firms with R&D activities, while noninnovators are found being deprived of R&D activities.

10.3.2 Background Data

The study as such is a theory application. Hence it utilizes a research methodology based on a questionnaire survey. The questionnaire survey was applied on the small-sized manufacturing firms in the "Ankara-Ivedik Organized Industrial District" (Ivedik OID). Ivedik OID, established on an area of 477 hectares, is one of the most important small-sized industry complexes in Turkey. Machinery, chemicals, metal works, wood works, plastics, printing, and construction equipment are the main manufacturing sectors of the district. Ivedik OID is a center, which brings all support units required for quality manufacturing together with manufacturers.

Data were collected from 314 firms. In order to determine the present situation exactly and to reach at accurate results, "face-to-face interview" method was used for collecting data. For that reason, there was no problem of response rate. In accordance with the statistical criterion of the EU for small firms, the small firms were composed of 10–50 employees. The EU definition entails furthermore that SMEs should yearly have achieved less than € 25 million sales. (OECD 2004; TOBBKOSGEB 2002).

Data obtained by applying questionnaire forms were systematically analyzed. The interpreted results came out as shown in the coming section.

10.3.3 Analysis

Concerning the first research question, the analysis was based upon the data as shown in Table 10.1. The relationship between independent variables has been listed in the table, and the availability of R&D activities has been tested. There were 202 firms, for which it was stated that they had research and development activities (i.e. Yes group), and there were 112 firms for which the answer was negative (i.e. No group).

Binomial test has been used to find out whether the variables listed in Table 10.1 have an impact on the availability of R&D activities and, therefore, in terms of the statistical hypotheses.

$$H_0 : p = 0.5$$

$$H_1 : p \neq 0.5$$

Table 10.1 Availability of R&D activities

Independent variables	Availability of R&D activities	
	Yes	No
Skilled personnel	1582	366
Quality improvement initiatives	136	70
The availability of laboratories	66	15
R&D activities	120	29
Use of computer for production	140	40
Participation in fairs	104	41

If a variable has an impact on the availability of research and development, it is expected that the proportion of that variable to the total is higher in the "yes" group—of course at its computed level of significance. On the other hand, if the same proportion is higher in the "no" group, it would result in the opposite (e.g. in case of quality improvement initiatives, it would mean that the majority of firms do not have adequate quality improvement initiatives)—again the result to be accepted at its level of significance. If "yes" and "no" are distributed evenly, this fact would rather imply that, for example the quality improvement initiatives will not be considered as a significant factor.

We started by considering the results of the binomial test for the number of skilled and nonskilled personnel. Note that only in this group the number of persons is taken as a unit of measurement, and by all of the others the data presented are given in number of firms. The criterion for success (denoted by 1) in the "yes" group (X1) is the number of skilled persons, and criterion of success (denoted by 1) for the "no" group (X2) is the number of nonskilled personnel. Skilled persons were composed of university, vocational school, or technical high school graduates. The others were classified as nonskilled personnel.

The results of the significance test are presented in Table 10.2. As can be seen from Table 10.2, the hypothesis $p = 0.5$ is rejected for both possibilities. So the proportion of nonskilled personnel is higher in each group. But this proportion is 0.64 in the "yes" group and 0.22 in the "no" group. In the light of the data, it can be said that the proportion of nonskilled personnel is higher in the "no group".

For the binomial test being used for quality improvement initiatives, the results are presented in Table 10.3 where $p = 0.5$ is again rejected.

Table 10.2 Test results for the existence of skilled persons

	Category	N	Observed prop.	Test prop.	Asymp. sig. (2-tailed)
X1	Group 1	1	1581	0.36	0.000
	Group 2	0	2789	0.64	
	Total		4370	1.00	
X2	Group 1	1	1304	0.78	0.000
	Group 2	0	366	0.22	
	Total		1670	1.00	

Table 10.3 Test results for quality improvement initiatives

	Category	N	Observed prop.	Test prop.	Asymp. sig. (2-tailed)
X1	Group 1	1	136	0.67	0.000
	Group 2	0	66	0.33	
	Total		202	1.00	
X2	Group 1	1	42	0.38	0.011
	Group 2	0	70	0.63	
	Total		112	1.00	

Table 10.4 Test results for the availability of laboratories

	Category	N	Observed prop.	Test prop.	Asymp. sig. (2-tailed)
X1	Group 1	1	66	0.33	0.000
	Group 2	0	136	0.67	
	Total		202	1.00	
X2	Group 1	1	97	0.87	0.000
	Group 2	0	15	0.13	
	Total		112	1.00	

Interestingly enough, the proportion of firm managers saying that they have quality improvement initiatives is approximately the same for both groups.

The results of the test concerning the impact of availability of laboratories on the availability of R&D activities are presented in Table 10.4 where $p = 0.5$ will again be rejected. But the impact of the laboratory possession reveals clearly different proportions between two groups. Although most of the firms do not possess any laboratory

Table 10.5 Test results on the existence of training and development activities

	Category	N	Observed prop.	Test prop.	Asymp. sig. (2-tailed)
X1	Group 1	1	120	0.59	0.009
	Group 2	0	82	0.41	
	Total		202	1.00	
X2	Group 1	1	83	0.74	0.000
	Group 2	0	29	0.26	
	Total		112	1.00	

in two groups, the proportion of the laboratory availability is higher in the "yes" group.

In the variable of "training and development activities," $p = 0.5$ hypothesis at 5 percent significance is rejected for both groups. Most of the firms have training and development activities in the "yes" group (59 percent of them have training and development activities). On the other hand, most of the firms in the "no" group do not have training and development activities (74 percent of the firms do not have training and development activities). The results are presented in Table 10.5. Firms in the "yes" group seem to be more willing to train employees and develop their processes than the firms in the "no" group.

Use of computer in production was also subjected to the binomial test. As can be seen from Table 10.6, $p = 0.5$ is again rejected for both groups. However, the proportion of computer use in production for the "yes" group is substantially higher than that of the "no" group. Whilst 69 percent of firms in the "yes" group use the computer in production process, just 36 percent of the firms in the "no" group make use of computers in production.

Table 10.6 Test results on the Computer use in production

	Category	N	Observed prop.	Test prop.	Asymp. sig. (2-tailed)
X1	Group 1	1	140	0.69	0.000
	Group 2	0	62	0.31	
	Total		202	1.00	
X2	Group 1	1	72	0.64	0.003
	Group 2	0	40	0.36	
	Total		112	1.00	

Table 10.7 Test results on the participation in the fairs

Category	N	Observed prop.	Test prop.	Asymp. sig. (2-tailed)
X1 - Group 1	1	104	0.51	0.725
Group 2	0	98	0.49	
Total	202	1.00		
X2 - Group 1	1	71	0.63	0.006
Group 2	0	41	0.37	
Total	112	1.00		

As a last variable defined for impact on R&D activities, the test results for participation in fairs indicates that the $p = 0.5$ hypothesis is accepted for the "yes" group, meaning that half of the firms in the "yes" group are participating in the fairs. On the other hand, the hypothesis for the "no" group is rejected and, as can be seen from Table 10.7, 63 percent of the firms in the "no" group are not participating in the fairs.

As an overall evaluation, it can be asserted that the proportions of skilled persons, of firms stating that they have quality improvement initiatives, possess laboratory, training and development activities, use computer in their activities, and participate in the fairs are higher for the firms stating that they have R&D activities.

It should be taken into account that all of these firms are SMEs. As can be seen from Table 10.2, although the proportion of skilled personnel is higher in the "yes" group, most of their employees are nonskilled. Table 10.3 shows that the proportion of firms that have quality improvement initiatives is approximately the same for both the "yes" and "no" group of firms. These results indicate that both groups of firms do emphasize quality improvement. The managers attribute greater importance in production than R&D. However, if Table 10.4 is examined, it will be seen that most of the firms in the "yes" and "no" groups do not possess laboratories, which is enough evidence that their main concern is not R&D. These findings confirm that most SMEs are production oriented rather than being interested in creating designs and trademarks.

As for the second research question of the paper, the relationship between the new product development and the availability of R&D was tested. The fundamental data for this test is presented in Table 10.8.

Table 10.8 Availability of R&D activities and new product development

Independent variable	New product development	
	Yes	No
Availability of R&D	Yes	84
	No	50

Table 10.9 Results of the Chi-squared analysis upon the fourfold data in Table 10.8

	Value	Df	Asymp. sig. (2-sided)	Exact sig. (2-sided)	Exact sig. (1-sided)
Pearson Chi-square	0.276	1	0.600		
Continuity correction	0.165	1	0.685		
Likelihood ratio	0.275	1	0.600		
Fisher's Exact test				0.635	0.342
Linear-by-linear association	0.275	1	0.600		
N of valid cases	314				

The analysis was done by means of applying chi-squared test. Here, one of the variables is "availability of R&D" and another variable is "new product development." Chi-squared analysis was performed on the bases of the following hypothesis:

H_0 = There is no relationship between availability of R&D and new product development.

Test results are presented in Table 10.9.

As can be seen from Table 10.9, the hypothesis is not accepted at appropriately high levels of significance. The finding thus reveals that there is no sensible relationship between "availability of R&D" and "new product development."

10.4 Conclusion

The determinants of the R&D activities related to new product development were taken as the number of skilled personnel, quality improvement initiatives, availability of laboratories, training and

development activities, use of computer on production, and participation in the fairs. The relationship between these determinants and the availability of R&D activities were investigated. According to the binomial test results, for most of the SMEs the hypotheses for the determinants (except the hypotheses of "training and development activities" and "participation in fairs") of the R&D activities are rejected. On the other hand, the proportion of independent variables with impact on availability of the R&D activities are found higher in the "yes" group, which indicates the availability of R&D activities in the firms under investigation.

In case the hypotheses are accepted, there is a positive impact of "training and development activities" on the availability of R&D activities. In industrial complexes (such as a cluster, a district, or a network of small-scale firms), training and development activities that were organized by district administration seem to be very important for the R&D performance. The firms attending these training and development activities are considered to increase their competitive advantage, since the output of R&D activities is usually new product development.

"Participation in fairs" is another hypothesis being accepted by means of statistical analysis. It is determined that there is a direct impact of participation in fairs on the availability of R&D activity in firms. Participation in fairs enables the firm managers to meet R&D experts and reach the know-how of new products in the sector.

Furthermore, the relationship between innovation and the availability of the R&D activity was investigated by the chi-square test. Innovation capability was represented by the new product development. In the light of the statistical analysis, it is found that there is no relationship between availability of R&D and new product development in the Ankara-Ivedik Industrial Region case. It is interesting to note that the managers from the firms without R&D activities have stated the availability of new product development. This paradox can be explained with the high participation rate in the fairs. The managers of these firms participating in the fairs may adopt or integrate the new product forms easily into their production processes without intensive R&D activities.

It is evident that the nature of the compiled data restricts the outcomes. Future research providing longitudinal studies might contribute

to theory. This research may then be comprehended as a basis for a further macro study.

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