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EXAMINATION OF INNOVATION SOURCES AND COOPERATION ALTERNATIVES FOR TURKISH FIRMS

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Abstract

Within organizations, the management of innovation can require the consideration of different patterns of financial issues, human resource skills and cooperation activities with outside stakeholders. The main goal of this study is to identify potential innovation alternatives in order to reach the target of increasing the number of innovative firms in Turkey. To do this, different innovation criteria were examined by evaluating the results of the 2010 Community Innovation Survey Results of Turkish Firms as an indicator. The Analytic Hierarchy Process method was applied to investigate these priorities. Following the introduction and an outline of the rationale behind criteria selection, the analysis section focuses upon two levels of criteria. The first level includes the knowledge sources of innovation, cooperation among the stakeholders, required skills and capabilities, funding sources and lastly monetary allocations. A number of different knowledge sources and factors related to the firm's networking capabilities were reinvestigated at the second "sub-criteria" level. It was deduced that to reach the goal of improving innovative capability in general terms, firms might concentrate on non-technical innovation activities as the first priority, and then; product and process innovation activities. Additional research guidelines and future strategy measures are also provided in the study.

Keywords: Innovation, Criteria, Priority, Source

1. Introduction: Innovation and Knowledge

To realise process, product and nontechnical innovations, firms should also be capable of exploring the right knowledge resources. These include in-house[1] resources as well as those found in the firm's external environment. Firms may then convert the knowledge acquired from these resources to value added in order to improve their innovation-related capabilities. However bearing in mind the relation between knowledge creation and innovation[2], this process may not always be that simple particularly due to the specific characteristics of innovation.

In the context of a firm, we might begin by considering that innovation generally takes off from the conceptual stage, in which searching through resources for idea generation and relevant skill contribution are critical. We might then infer that knowledge acquisition serving for ideas and skills can also play a role in firm innovativeness. Hence, knowledge transfer from the outside environment is basically useful for generating ideas and that some of the actors act as main providers for useful knowledge that significantly affects innovation.

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[1] See Holsapple and Joshi (2001) for further research on the effects of alternative knowledge resources
[2] See Popadiuk and Choo (2006) for further research on the relationship between innovation and knowledge creation

There is a vast literature on the different dimensions of the knowledge, knowledge resources, knowledge transfer, knowledge network structures and their links with firm innovation, and the way how different knowledge and remote knowledge management (KM) applications affect innovativeness. For example, Lopez-Nicolas and Meroño-Cerdan (2011) have deduced that different KM strategies end up increasing in firm innovation and that Wang and Wang (2012) have mentioned that different knowledge aspects whether tacitly or explicitly contribute to firm innovation. Additionally, knowledge can also be transferred using domestic or international resources, or through a network[3]. In particular the effects of networks on the transfer of knowledge for innovation has been deemed as a dynamic issue by researchers who have highlighted the network structure on knowledge gain (Andersson *et al.* 2007),of network structure and knowledge accumulation on firm innovation, and network closure (Chai *et al.* 2011) on knowledge transfer. It is not only the network[4] characteristics that serve for innovation; leadership can also be considered a moderating catalyst in knowledge transfer as underlined by (Girdauskienė and Savanevičienė, 2012)

All these significant findings have prompted us to define the scope of our study along the dimensions that can be considered in terms of the knowledge transfer and related innovation issues. Our study focuses on the pre-production stage in a research and development (R&D) context, considering the conditions that stimulate innovation, and for defining conventional guidelines in strategic decision-making. Accordingly, we concentrate on knowledge resources and network environment in a relatively limited way in the following sections.

Our departure point is the fact that presence of knowledge sources can either directly or indirectly trigger in-house innovation. For a firm to generate creative conceptualisations, different actors in the firm environment can serve as repositories for knowledge transfer as mentioned before. These include the ones within the specific environment such as suppliers and customers whose theoretical locations can be assumed to be as closer with a basic approach to the firm environment's components. Deployed knowledge might then be used at the product transformation stage before the innovative product is introduced onto the market to create value for the customer.

In transferring useful knowledge, firms may engage in different types of contact. Besides interacting with some supply chain actors (which we generalise as "suppliers" for simplicity purposes in our study) customers can also be consulted as alternative idea sources at different stages of the innovation process, depending on the type of product or the service to be commercialised. In the same context, universities can contribute to the process in various aspects. For example, knowledge transfer offices can be useful for open innovation paradigms (Alexander and Martin, 2013), or when radical innovations Janeiro *et al.* 2013) are at stake, a firm's cooperation with universities as important actors of the triple helix[5] or knowledge transfer networks (Bond III *et al.* 2008) is understood to be beneficial to the firm[6] for the firm's R&D strategy. R&D strategy (Bercovitz and Feldman, 2007) or investments (Laursenand Salter, 2004); can be considered as a significant factor affecting relationships with universities,for the firms which concentrate on innovation as the priority universities may also act as providers of the potential qualified human capital for domain-specific knowledge, necessary skills and spin-offs[7] all of which can be assumed to be important facilitators for innovation. One final issue here is knowledge repositories in a broader context-where-trade fairs can be understood as a significant resource. Especially when the producer firms in certain sectors (e.g. construction,

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[3] For example, Pérez-Nortvedt*et al.* (2010)'s research underlines the importance of networks when knowledge is considered as a resource

[4] One step further, knowledge networks serve not only knowledge transfer but also transfer of value as proposed by Büchel and Raub(2002)

[5] In Nwagwu's (2008) research, functions of triple helix actors can be clearly be visualized in Nigerian context

[6] In his research, Motohashi (2005) deduced that firms smaller in scale reach higher productivities by collaborating with universities

[7] In his study, Debroux (2008) analyses the state of the University spin-offs and their characteristics in Japan

machinery, automotive, ship-building etc.) are taken into account, trade fairs can be viewed as a favourable environment for domain-concentrated knowledge exchange, social network building, and an area of inspiration for creative ideas and skills to be utilised in the conceptualisation stage.

Another condition that can leverage firm innovation is the cooperation between the firms at different levels[8] where various inter-firm ties and networks can be perceived as enabling factors[9]. When innovation is in question, besides the in-house R&D implementations, firms may scan for knowledge in their external environment and redefine cooperation activities accordingly (Gallego *et al.* 2013, p.2040).Cooperation with other firms may induce a number of enabling factors for innovation including different types of spillover in certain conditions[10][11][12], mutual learning capabilities, and technology transfer opportunities which might enable the firms to transform valuable knowledge into finished goods and services. Studies also reveal that the type of stakeholder (e.g. university or business services) interacted may determine the degree of innovation undertaken (Tödtling *et al.* 2009).Besides this, access to finance can be considered as a leveraging factor for accomplishments (Goedhuys and Weugelers, 2012). Here the access to and utilisation of different fund resources, whether they are private or public[13],can be a significant factor in fostering innovation of which different examples are provided in the literature[14]. Within the same framework, the allocation of financial resources has sway over all stages of all different types of innovation. Finally, in some cases, the acquisition of certain skills from firm's external environment may also serve to improve different competencies (which are approached mainly as "skill development" in our study) along with knowledge that empowers the "innovation capabilities[15]" of the firm. In our study, we take into account some of the similar dynamics mentioned previously for the case of Turkey whose innovation situation is overviewed next.

To give an overview of Turkey's innovation situation, one of the most important sets of findings comes from the European Union's (EU) Innovation Union Scoreboard (IUS). We refer to the IUS findings for consistency purposes, due to the fact that we use the EU's 2010 Community Innovation Survey as the main data resource in the next section. For example, for the years 2013 and 2014 (European Commission, 2013; 2014), the IUS evaluation briefly describes the current strengths and weaknesses that might affect innovation in Turkey, by using a multidimensional approach. Among the strengths and weaknesses, we have only selected the indicators that are most relevant to our study[16]. We begin by stressing the weaknesses: in 2013, the first group of relative weaknesses appeared in business sector investments such as firm R&D expenditures in the business sector and human resource potential (e.g. new doctorate graduates and the population with tertiary education). The second group of weaknesses comprise the lack of cooperation between the small and medium innovative enterprises (SMEs), and between innovative enterprises and academia. Third group of relative weaknesses is related to the production of intellectual assets, such as patents and trademarks which, in a way, can also be understood as outputs of innovation. On the other hand, the motivation of the SMEs towards non-technical innovation can be observed as very promising and strong, compared to product and process innovations. We can observe a similar picture for 2014 with almost the same level of weaknesses in investments, human resource potential, and the preference given

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[8] Blasco and Carod's (2008) research provides significant results on the characteristics shaping the R&D cooperation activities between different types of partners

[9] According to Ritter and Gemünden, (2004) network competence has also significant effect on innovation

[10] In a "spatial" dimension, trade-based regional proximity is also a convenient factor for innovation spillovers according to Cabrer-Borras and Serrano-Domingo (2007).

[11] Cappelli *et al.* (2014)'s research reveal that input from customers and research institutions rather than spillovers from rivals results in more original innovations

[12] In certain cases collaboration with extra-regional agents rather than local partners may result with more innovation as deduced by Fitjar and Pose (2013).

[13] In her research, Paunov (2012) deduced that access to public funds affects innovation investments

[14] See, Cumming (2007) for the effect of the funding on innovation in Australia

[15] Urgal *et al.* (2013)'s research results display that knowledge is also an indirect affecting factor for improving firm's innovation capability

[16] Among the 25 EIS indicators we mainly focus on the ones that converge to our criteria selection

to non-technical innovations over than product and process innovations. For both years it can also be estimated that firms innovate in-house rather than collaborating with each other; and yet also display relatively low levels of academia-firm collaboration. These snapshots can guide us in selecting the factors to discuss in order to reach the ultimate goal defined in the following paragraph.

In the following sections, we concentrate on four basic dynamics that might leverage innovation. These are contact with different sources, cooperation among the different actors involved, the effect of financing (including fund-raising and allocation) and the required skills for innovativeness. Then we survey idea sources and levels of cooperation and examine these two dynamics for different actors, to determine the type of innovation to be implemented. Hence our research question involves determining the type of innovation strategy path to be implemented, given the effect of the resources we have considered above, with our ultimate goal being to increase the number of innovative firms according to the innovation type selected. Thus, the departure point of our study is how firms react to the conditions that we have discussed, and how they might act in the future. We also provide related recommendations in the final section of the study.

2. Analysis: The Case of Turkish Firms

2.1. Material and Methodology

To assess the reactions of the selected Turkish firms, the 2010 Community Innovation Survey (EUROSTAT, 2013) was used as a data source acknowledging the fact that it is one of the most recent studies to compile the reactions of firms in Turkey and shed light to the escalation of criteria selection.

In our study, we use a simplified version of the Analytic Hierarchy Process (AHP) approach. With the AHP technique, we do deconstruct decisions through the steps of problem definition and we determine the decision hierarchy along with the goal from the first to inferior levels (Saaty, 2008). We then use the priorities obtained via the pairwise comparison matrices to explore the escalation of priorities.

2.2. Criteria Hierarchy

Figure 1 shows the criteria hierarchy we formulated in which it is important to note the connotation meanings. Relative notations have been assigned according to the grouping of the firms' various responses to innovation we took from Community Innovation Survey. Under the "funding" group, we have shown the number of the firms receiving different funding types, such as public, Union and local authorities. A second group that we have called "money allocated" mainly involves the relative distribution of funds for in-house and external R&D activities, whereas the "sourcing and cooperation" section indicates the contribution of different idea sources and selected areas of cooperation between the firm and its stakeholders. Stakeholders cooperated are the ones that are assumed to inspire firm innovativeness, which, we focus on in more detail as an "inferior level" criterion in the next section. Finally, "competencies required" includes results on various types of external skills[17] such as design and engineering, web design, software development and market research. We can observe the assigned weights in Table 1 of the next section.

Recalling our ultimate goal to increase the number of firms involved in innovative activities, we begin by setting two main criteria levels, which can be observed in Figure 1. We do call the first-level as the "first-level criteria" and the second one: "inferior criteria". Here, we suggest that the first-level criteria are the ones that dominate the management process on the way to reaching the ultimate goal. They are: financial resources, idea sources, allocation of the funds acquired, required competencies for innovation purposes and different stakeholders

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[17] The skills that the firm acquires from the external environment

cooperated. In the second stage, we extend two of these components; idea sources and stakeholders cooperated in order to detect different types of alternatives.
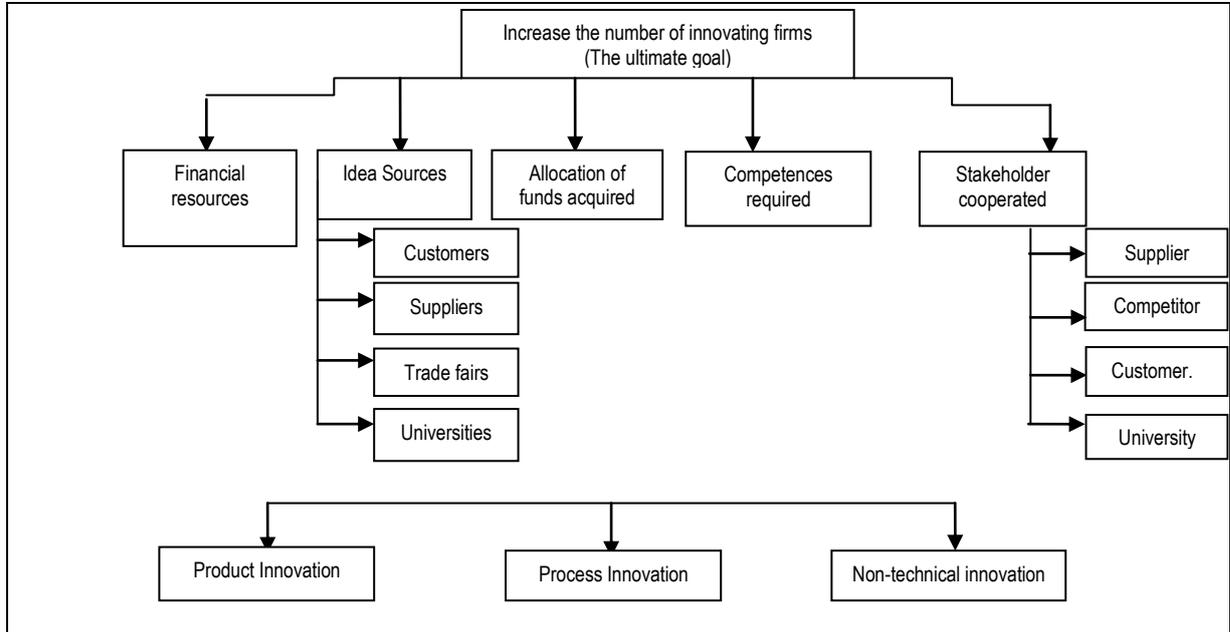

Figure 1. Criteria hierarchy

Different sources and stakeholders mainly constitute the two-dimensional (source and stakeholder) second- level criteria. The logic behind this context is to go further in the inferior levels, to include the significance of cooperation with outside stakeholders who act as principal but diffused sources (and opportunities such as fairs) for the pre-production stages of the basic innovation process. We focus on the different effects of these sources and stakeholders in the discussion section.

To conclude this section, using the priority findings we expect to obtain by considering the first-and inferior- level criteria, we then attempt to explore a priority management path by considering three different types of innovation. These are: product, process and non-technical innovation; we assume that the management path would be different in the implementation of each one. In other words, we try to determine which type of priority innovation-related strategy should be applied when the effects of both levels criteria have been taken into account.

2.3. Results and Discussion

We began by cross-weighing the first-level criteria taking into account the number of firms who responded to the Community Innovation Survey .The weights assigned for the first-level criteria and related pairwise comparisons, resulted in Tables 1 and 2 respectively.

Table 1. Weights for the first level criteria

	Fin.Res.	Fund Alloc.	Idea Source	Cooperation	Ext Skills
Fin.Res.	1	1/7	1/3	3	1/6
Fund Alloc.	7	1	5	9	2
Idea Source	1/5	1/6	1	5	1/5
Cooperation	1/3	1/9	1/5	1	1/8
Ext. Skills	6	1/3	5	8	1

From here, we reach to the pairwise comparison matrix as

Table 2. Pairwise comparison results

	Fin.Res.	Fund Alloc.	Idea Source	Cooperation	External Skills	Priorities
Fin.Res.	0.069	0.074	0.029	0.115	0.046	**0.067**
Fund Alloc.	0.482	0.523	0.434	0.346	0.574	**0.472**
Idea Source	0.014	0.084	0.087	0.192	0.057	**0.087**
Cooperation	0.023	0.058	0.017	0.038	0.036	**0.034**
Ext. Skills	0.413	0.262	0.434	0.308	0.287	**0.341**

Table 2 displays the relative preferences of the first-level criteria with respect to the ultimate goal. As a snapshot, we can observe from the table that two prior criteria are related to fund allocations and external skills with weights of 47.2% and 34.1% respectively. According to Table 2, fund allocation seems to be the most significant factor among them all. However, the results obtained from Table 2 will mainly be used to focus on the question of idea source and cooperation as inferior criteria. As previously mentioned, we re-decompose idea sources and stakeholder cooperated into 4 distinctive criteria each by using those five priorities in Table 2 to weigh the inferior criteria.

Before we proceed, it is important to distinguish the roles of the two levels of criteria which have been given in Table 3. In the first line of the table, we can observe the relative priorities with respect to the ultimate goal as mentioned in the previous paragraph. In the following lines of Table 3, we have displayed the priorities of the sub criteria concerning the three types of innovation alternatives' preferences. At the sub-criteria level, we are only going to express the relative preference of the criteria on the selection of the three alternatives. Our final matrix is as follows:

Table 3. Synthesis of the results

	Fin.Res. 0.067	Fund.Alloc. 0.472	Sources 0.087				Skills 0.341	Cooperat. 0.034			
			Customers 0.524	Suppliers 0.271	Trade Fairs 0.147	University 0.058		Supplier 0.496	Customer 0.242	Competitor 0.177	University 0.086
Product	0.620	0.258	0.686	0.282	0.640	0.234	0.106	0.245	0.634	0.609	0.316
Process	0.284	0.138	0.093	0.621	0.273	0.688	0.260	0.688	0.106	0.272	0.582
Nontech	0.097	0.604	0.221	0.097	0.087	0.078	0.634	0.108	0.260	0.120	0.102
										NORMAL	IDEAL
Overalls Product	0.041	0.122	0.031	0.007	0.008	0.001	0.036	0.004	0.005	0.004	0.001	0.260	**0.495**
Process	0.019	0.065	0.031	0.015	0.003	0.003	0.089	0.012	0.001	0.002	0.002	0.241	**0.458**
Nontech	0.006	0.285	0.010	0.002	0.001	0.000	0.216	0.002	0.002	0.001	0.000	0.526	**1.000**

Second series data of Table 3 displays the three first level criteria's preferential effect on the innovation alternatives. It can be observed that the product innovation alternative seems mostly dominated by financial resources (62.0%). However, the situation changes when it comes to fund allocations; depending on the producers' priorities, allocating the funds for non-technical innovation seems more beneficial (60.4%). And to conclude with this section, Table 3 underlines that "skills" are most significant in the area of non-technical innovation (63.4%). Here we express once again that these three factors are main the ones that contributing to the different stages of the innovation process.

At the two sub-level criteria levels, we focus on four different sources as the decision-making criteria, from which the insights for innovative activities emerge. As mentioned in the

previous section, one of the most important features of network organizations is the increased amount of knowledge exchange and, accordingly, the knowledge sources are mainly considered as external stakeholders and environments in our study. It can be observed that customers mainly contribute ideas concerning product innovations (68.6%), whereas suppliers and the universities seem mainly make contributions on process innovation (62.1% and 68.8% respectively), and lastly, trade fairs make them on product innovation (64%).The second sub-level criteria are the levels of cooperation empowering firm-based innovation decisions. Mostly, the results obtained ran parallel to those sub-criteria one. As one might expect, suppliers and universities contribute mostly on process innovation decisions (68.8% and 58.2% respectively) while customers and competitors mostly contribute on product innovation decisions with the ratios of 63.4% and 60.9% respectively.

Finally, we have observed overall priorities from the synthesis Table 3. It can be concluded that, in order to reach the ultimate goal, when both levels of criteria are taken into account, firms should mainly consider the alternatives of non-technical innovation as the first priority (52.6%), then by product and finally process innovation. In idealized conditions, product innovation (49.5%) is closely followed by process innovation (45.8%). It is also important to note the validations of the related criteria selected. We observed that all criteria are consistent except that of market research which is slightly greater than 10% level which we therefore omitted.

We can briefly assess the results obtained in conjunction with a profile of current policies. Criteria results indicate that financial resources are mostly used for product innovation whereas funds are allocated to non-technical innovations. This result seems indirectly consistent with the EIS findings which suggest that firms mainly concentrate on non-technical innovations and, relative gaps could be observed with investments and hence related product and process innovations. To solve this funding problem, an increasing number of public programmes that either directly or indirectly support innovation have been activated[18]. Moreover some of the new opportunities for facilitating access to finance for SMEs were set up to enable innovativeness[19]. Here, one of the most important topics on the agenda is the improvement of venture capital opportunities in the country, which still seems to be in initial stages.

Regarding the fact that skills are mostly a priority for non-technical innovation, obstacles to human resource potential indicate towards a hazardous situation despite the intense number of vocational schools in the country[20]. To solve this further development of collaborative projects with universities and industry should be proposed, which also diffuse vocational training activities into compelling sectors in different regions. As can also be inferred from Table 3, similar initiatives may also ameliorate the product innovation issues regarding the weight of the universities as idea sources on the process and, temper the communication weaknesses between academia and business sector[21].Again, according to Table 3, another significant issue for firms which aim to increase product innovation might be pursuing strategies that improve communication with customers, and, for those who want to increase process innovations, collaboration with suppliers. The integration of information and communication technologies can be viewed as a positive step towards accurate communication and the creation of the knowledge communities for facilitating information exchanges. Another positive approach can

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[18] Supports for the industry are provided in different forms including scientific and technologic network platform generation, start-up foundation, patent production, collaboration with universities, innovation capacity improvement, entrepreneurship capital and R&D discounts (TSATRCO, 2014)

[19] Supports for SMEs involve R&D, innovation and industrial support programs, entrepreneurship supports and laboratory services (SMEDO, 2014)

[20] As of 2014, total number of 184 university incorporated vocational schools is 955. (HEC, 2014)

[21] Public supports provided for technology transfer office establishment in different universities can be assumed as the backbones of the technology transfer in Turkey. Moreover, universities are also rated under "entrepreneurship and innovation index" in which "cooperation and interaction" and "economic contribution" and commercialization are two of the components that might affect university rankings (MSIT, 2014)

be envisaged as the advancement of recent industry cluster initiatives[22] that might also serve to potentially increase the collaboration between business sector actors.

3. Conclusion

The usage of different knowledge exchange nodes not only improves firm's innovative capabilities but also contributes to further collaboration opportunities. This collaboration is multidimensional rather than superficial, and also includes academia members. Our results provide a brief picture of different facets of the interaction between various factors that might end up with different types of innovation when taking into account existing funding opportunities. However, the strategies we have discussed in the study not only require the proactive approach of firm managers but also the cooperation of policy makers, who should also formulate strategies to further support the diversification of knowledge sources.

The significance of the results collected indicates three important notions. First, they confirm that current policy mainstreams are aligned with firms' perception of innovation. Second, they exhibit the priority strategies by which firms can select knowledge exchange partners, and third, policy makers formulate the relevant policies in order to empower the innovation. To sum up, by having a superior synopsis of the path to be followed to maximize innovation, the results can also be considered as general guidelines to be embedded within firm strategies.

There are two limitations to our study. The first is related to our usage of the AHP methodology. The results we arrived at can only be used by policy makers to frame future policy guidelines for innovation. The second limitation concerns the scope of the firms examined. We have mainly focused on a mainstream behavior of firms towards innovation, regardless of different domains, geographical concentration, cooperative alliances or funding constraints. This, in a way, also constitutes the main constraint of our study. Accordingly, the assessment of firm-based innovativeness, by scrutinising alternative cases in different regional levels, sectors and under different policy effects, would constitute a further area of research.

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[22] Especially in recent years many cluster formation and improvement initiatives for different sectors, some in collaboration with universities are progressing in Turkey. Formations include medical equipment, construction machinery, home appliances, ceramics, metal molding and winemaking sectors.

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