Institutions' And Initiatives' Role In Turkey's National Innovation System

A.Orçun Sakarya, Çankaya University, Turkey

ABSTRACT

In Turkey, increasing focus to the concept of innovation underlined the importance of the related institutions' role in the economic agenda. Hence, a clear understanding of the functions of the actors that makes up the country's innovation system is important in policy formulation stages. Accordingly, the goal of this literature review is to analyze institutions' duties that are active in the National System of Innovation and to assess recent developments' contribution to the innovation policy targets. It has been observed that Turkey has a strong institutional infrastructure, but also has some problems concerning firm-based innovation, university-industry cooperation and development of innovation inputs.

Keywords: national innovation system; institutions; Turkey; innovation policies; duties; innovation

INTRODUCTION: INNOVATION AND SYSTEMATIZATION

The need for innovation policies' institutionalization arises due to high and strict competitive markets to which the firms and countries are exposed. Importance of the institutionalized approach to innovation conceived the concept of NIS which is defined in various ways[1]. NIS can be an institutional network which leads, imports or implements new technologies. Alternatively, NIS can be the relations that are used for production and diffusion of new useful economic information or "institutions cluster[2]" which defines innovative performances of the related firms. Lastly, NIS can also be defined as a dynamic system that defines information, regulation and finance flow between the institutions or firms. Typical indicators to assess the structure of the NIS are research and development (R&D) efforts, the quality of educational systems, collaborations between universities and industry, and the availability of venture capital[3] (Negro & Hekkert, 2008). Accordingly, such an institutionalized approach for discovering Turkey's NIS may give a holistic idea about the current status of innovation in the country.

The main goal of this study is to identify the role of the institutions in Turkish NIS and the contributions of the stakeholders on the prior policies. To clarify these issues, a snapshot of the current innovation policies and targets has been taken in this exploratory study [4]. Then the duties and roles of the institutions in the system have been overviewed and top-down innovation policy initiatives have also been analyzed in the same section. Lastly, roles of the system actors toward target achievement have been analyzed by assuming the system as an "innovation environment".

TURKEY'S INNOVATION POLICY OBJECTIVES: STRATEGIES FOR INCREASING INNOVATION SCOREBOARD PERFORMANCE

Since the year 2001, Turkey is one of the countries assessed in the European Innovation Scoreboard (EIS). In order to diminish some of the problems stated in the Scoreboard, the following strategic objectives were defined in the implementation plan of the science and technology strategies (2005-2010) approved by the Supreme Science Council of Science and Technology (BTYK) in March 2005. The role of BTYK will be scrutinized later. Related strategic innovation input objectives are as follows:

1. Increasing the gross domestic expenditure of R&D (GERD) as a percentage of GDP (%)
2. Increasing the GERD per capita (US$, PPS)

3. Increasing the number of total researchers (fulltime equivalent)
4. Increasing the number of researchers per thousand employed
5. Increasing the business expenditure on R&D (BERD) as a percentage of GERD (%)
6. Increasing the public expenditure on R&D as a percentage of GERD (%)
7. Increasing the SMEs innovating in-house (% of all SMEs)
8. Increasing the SMEs involved in innovation co-operation (% of all SMEs)

Whereas the strategic output objectives can be listed as follows:

1. Increasing the number of triadic patents
2. Increasing the number of scientific publication per million population
3. Increasing the number of science citation per million population
4. Increasing the sales of 'new to market' products (% of total turnover)
5. Increasing the share of manufacturing value-added in high-tech sectors (EU, 2007)

At a glance, 2010 targets may be categorized in two ways - Improvement of the firm-based innovativeness and science-based innovation outputs, whereas funding of innovation seems like the prior goal to be achieved by the policy-maker. It should also be added that each of the objectives requires actions of different policy-makers, as well as the involvement of different stakeholders. When we compare input and output objectives, we can see that the latter objectives involve more participation by the private sector than government. That is, increases in the allocated portion of the budget for R&D expenses are controlled by the government, whereas patents, products and added value are mostly governed by the real sector. In other words, regarding the presence of exogenous variables, we can also claim that outputs are indirectly attached to the efforts made by the government.

CAN THE TARGETS BE ACHIEVED WITH CURRENT INFRASTRUCTURE?

In this section, in order to analyze the contribution of the NIS to innovation policy targets, present actors of NIS that are involved in innovation policy implementations will be analyzed. Then, possible contributions of the system components on target achievement will be discussed.

National System of Innovation Infrastructure and an Overview Duties of the Actors - Top-down Policy Implementations

To begin with, we should mention "direction" of the innovation governance[5]. When central and independent (some of them are regional) innovation policy initiatives are compared in Turkey, efforts can be characterized as mostly central, while the number of regional initiatives is comparably low. This means that government plays a relatively important role and the policy-making institutions undertake all the initiatives on the move. We called central policy formations "top-down" and independent ones "bottom-up" (Howells, 2005) in the study. Therefore, it is possible to argue that the role of the public institutions is important and thus "top down policy formations" dominate the Turkish case.

Redefining the National Innovation System: An Overview of the Institutions and their Roles

The flow of cooperation between public institutions underlines the performance of a NIS[6]. According to an alternative definition, NIS is a set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies. Here, mainly the governments form and implement policies to influence the innovation process. As such, it is also a system of interconnected institutions to create, store and transfer the knowledge, skills and artifacts which define new technologies. In this point, institutions and their networks produce, extend and store technological information**.** Hence, the actors in NIS can be classified under six groups:

1. A network formed by innovative firms (both public and private) which plays an interlocking role in the commercial implementation of the innovations. We will break this network into "layers" in order to clarify the situation.

2. Research institutions: They are non-profit public or semi-private institutions that are active in the production and extension of technological innovations.
3. Scientific system: Universities and research institutes are the most important components of this actor. Primary duties of such institutions are training of the researchers and production of the inventions, as well as scientific knowledge.
4. Supporting and bridge institutions: They deal with disseminating, providing laboratory services, setting of the standards, etc. Supporting institutions also offer infrastructure services for innovative firms.
5. Financing Institutions: Financing of the technological innovative activities requires different tools than the regular investments. Accordingly, such innovations are supported via using the means such as R&D grants, credits, tax exemptions for institutions, such as venture capital firms.
6. Policy-making, implementing and assessing institutions: Lastly, in order to establish a NIS, its coordination and legitimacy are also vital for adequate operations. For this reason, policy-making, implementing and assessing institutions constitute an important part of the system.

Figure 1 displays the complicated relationship of Turkey's NIS. Layers can also be formulated as levels of hierarchy in which Layer 4 stands at the top and 1 at the bottom, respectively.

At the bottom of the hierarchy; it can be observed that education acts as a stimulating factor in initiating innovation. In Layer 2, a complicated network is shared by different participants among which we can basically mention universities, financing and support institutions and mechanisms, clusters[7] (Eraydın & Armatlı-Köroğlu, 2005) consulting bodies and university/industry partnerships, research institutions[8] as the main actors. In fact, most of the operational role is handled by Layer 2 in Turkey's NIS. It should also be noted that innovative firms is of great significance in this layer. Such firms are also connected to many other actors in the system as the innovation infrastructure of business firms depend partly on the support of other institutions. Flows of human capital, financial capital, regulations and knowledge into business firms are of critical importance for the innovative performance of businesses and industries (Oerlemans, 2005) linked together on collaborative networks (Puente et al., 2009). One level above stand the institutions that mostly deal with "legalization" of the Layer 2 outputs - accreditation, standardization and assessment institutions. They also serve as "transmission actors" between policy-making and the operational level. In Layer 4, public and local institutions stand as innovation policy-makers (public institutions-simply the government hierarchy) and representatives (local institutions).

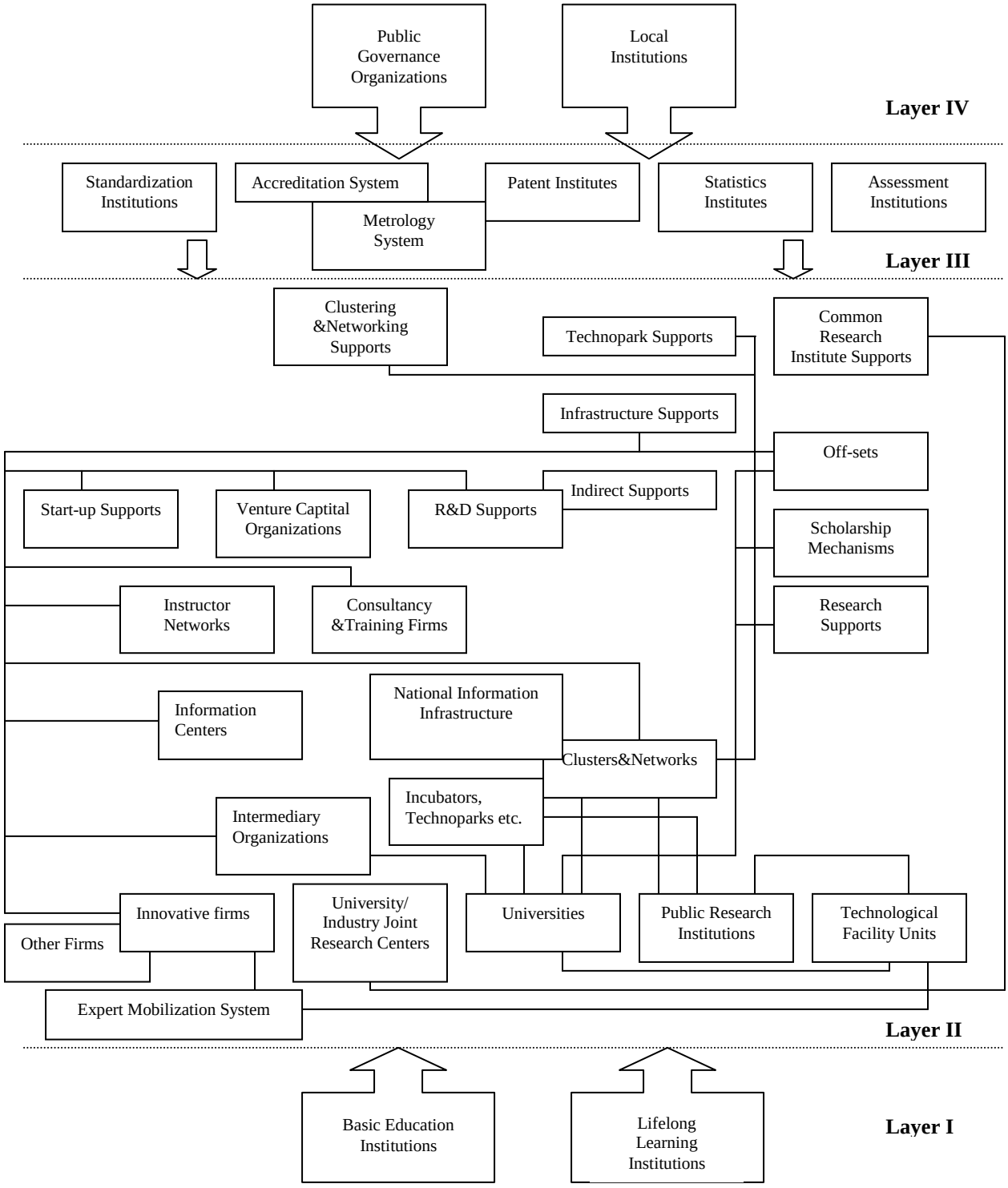
Regarding the position of Layer 4, it is seen that public governance's role is important in five aspects. First of all, the direction of countrywide innovation policy formulation processes (such as design of the technology roadmaps and so on) is mostly top-down in Turkey. Secondly, technological infrastructure for accessing the knowledge and abilities is partly initiated by the government at the national scope, such as the IT architecture for broadband penetration. Thirdly, the commercialization of the innovation, creation of the market rules is also one of the missions of the government. Fourthly, government may also act as an active partner in university/industry cooperation initiatives. Lastly, partial financing of the innovation belongs to the government. Hence, the government operates as an infrastructural policy-maker (Rolfo & Calabrese, 2003).

However, the government is not the only actor in providing effective outputs of Turkey's NIS. Similarly, private sector is also in charge of the undertaking of activities, such as:

- Funding of up-to-date technologies for production purposes
- Undertaking R&D activities
- Development of the human resources within the workforce
- Establishing networks with national and international firms

Keeping Figure 1 in mind, it is possible to analyze the current situation of NIS through reviewing Layer 4. In this layer, Supreme Council of Science and Technology (BTYK) acts as the highest authority. Its primary duties are providing technical support for the government during the formulation of long-term science and technology policies, setting R&D goals in science and technology areas, and finally, mobilizing public institutions within R&D plans/programs. Another duty of BTYK is preparing legal framework and regulations in order to provide the effectiveness of the science and technology system. Hence, it can be said that BTYK manages the system in a policy-making sense.

Figure 1: Institutions in the National Innovation System (TUSIAD, 2003)



Regarding the relationship between innovation/technology policies (Teubal 2002; Rush et al, 2004; Pelkonen 2006; Motohashi, 2008) and recent developments, since the beginning of the year 2000, there is an extensive effort by the BTYK to improve the science, technology and innovation governance system in Turkey. In this respect, the first achievement is the "Vision 2023 Project", which was formulated between 2002 and 2004 (TUBITAK, 2004). Its output, "Vision 2023 document", can be defined as a nationwide technology foresight study for Turkey, prepared by the actors at the supreme level. The document basically covers a detailed study of technology priority areas and activities to be undertaken for reaching the technology policy goals, including a brand new technology vision and related socio-economic targets. Strategic technology areas are also analyzed in the Vision 2023 study. In this way, Vision 2023 defines a new national science and technology strategy and is considered as the most important reference for future science and technology policies.

In relation to Vision 2023 results, BTYK has also defined "Turkish Research Area" (TARAL). TARAL is a platform in which cooperation of the public and private research institutions is aimed via undertaking of joint projects. One of the important goals of TARAL is integration with the European Research Area (ERA).

Economic Policy Motivators

Besides strategy documents that are mentioned below, innovation can also be observed in different areas of economic policy implementations in Turkey. In a globalization context[9], "value creation" efforts sped up innovation in the Turkish economic agenda, especially in the field of sustainable economic growth. Accordingly, traces of innovation can increasingly be noted in the following macroeconomic priorities, such as:

Increase in the Competitiveness of the Sectors[10]

It can be assumed that this title endogenously involves usage of new production methods, increase in innovative start-ups (via development of regional activities), improvement of firm-based innovativeness, etc. Management of these parameters requires a systematic approach in which the government aims to play a leading role.

Shift to a more "Value-added" Type of a Production Strategy

Structural change, leading to a higher share of more competitive and higher valued-added industries, is nearly impossible without an innovative business sector (Kaufmann & Wagner, 2005). While such a shift is basically related with product and process innovations, "supporting projects" that contribute to R&D and innovation activities, as well as technology infrastructure improvements in different sectors, are also aimed.

Since 1963, "a planned economy" strategy has been applied in Turkey for achieving economic development. Every year a document called as "investment program" is prepared in order to identify the areas to which the national budget will be allocated. In the area of innovation, a recent investment plan contains the following:

1. Implementation of the National Innovation Strategy (National Innovation Strategy will be mentioned in the following section)
2. Continuum of the regional innovation policy[11] implementations
3. Improvement of R&D funds allocated for the private sector
4. Securing supports for R&D unit formations in the industry, as well as R&D staff's employment
5. Formulation of the required financing models which support R&D-based entrepreneurship
6. Creation of new technology zones and new technology cooperation networks
7. Increasing cooperation with international networks and countries that are experienced in R&D
8. Raising innovation awareness throughout the country

During the implementation of the investment programs, basically three tools are used for fostering innovation on a firm basis:

1. Research Support Programs: Enhancement of financial supports via TARAL and some other ministries within a "Public Innovation Policy"
2. Research Infrastructures: Creation of excellence centers that offer favorable working conditions for the researchers and disseminate research results, both in basic and applied sciences
3. Training of the Researchers: Academician training programs, researcher training programs and industry PhD programs

Another important document concerning top-down policy implementations is the 2008-2010 National Innovation Strategy. This document, in fact, provides a reference for Turkey's short-term innovation strategies and principally includes tips for increasing innovation-based competitiveness of the country by stressing on focal innovation strategies, such as:

- Promotion of entrepreneurship, innovation and productivity
- Encouragement and creation of sustainable, strong and competitive markets throughout the country
- Establishment of infrastructures convenient for innovation in all fields
- Development of international cooperation
- Development of the innovation system's management and coordination across stakeholders

Discussion: What should be the Political Contributions of NIS beyond Target Achievement?

For achieving ultimate innovation targets, the academia stands on the first extent. Universities (among which decision-making initiative is equally distributed via commissions) play a significant role in the system because they act as a consultant body for policy-makers at the supreme level. To the other extent, TUBITAK's innovation policy decisions are also important because of the fact that it is directly integrated in BTYK, which is the supreme policy-maker itself. At the remaining extent, there are other institutions with various duties.

Keeping this decision-making flow in mind, the first issue is about engine of the system. This issue is a hard one to address as the related institutions are not only dealing with innovation, but also a number of different duties. In order to operate the research execution system, support and infrastructure mechanisms, the "engine" can be assumed as the funds provided by industrial and public research budgets. One of the funds is the one dedicated for "innovation projects". Accordingly, the number of project applications (various disciplines and programs) dramatically increased, especially in the last four years in Turkey[12]. Such an increase also enhanced the cooperation among the actors of the system and most important of all, the one between academia and industry[13]. Here, development of the information-sharing activities between these two parties also acts as a lubricant for the system.

In relation to the fund acquisition, percentage of the budget afforded for R&D activities is another important factor for innovativeness, both at government and firm levels. Table 1 provides insights.

Table 1: Trends in R&D Budget Distribution (TUBITAK, 2009)

Year	2005	2006	2007
GERD of R&D as a percentage of GDP (%)	0,79	0,76	0,93
GERD per capita	60,7	72,6	93,2
BERD as a percentage of GERD (%)	33,8	35,6	41,3
Public expenditure on R&D as a percentage of GERD (%)	54,6	53,2	48,2

As of 2007, increasing GERD of R&D as a percentage of GDP is 0,93% on its way to the ultimate goal of reaching the psychological 2% level by the year 2023. Although technological outputs are still in the medium level, we have to note that the increase in firm-based R&D expenses looks promising. The pickle is the transformation ratio of this input to the science-based outputs, which we discuss in following paragraphs.

The second question to be answered is, "What is the role of the policies and actors in order to promote innovation?" Innovation's role in the economic policies is, in fact, an important indicator of the activities to be

undertaken by the actors in the system. To reach an effective innovation-based competitiveness level in economic terms, two more secondary "engines" are required. The first is related to science-based outputs (in which mainly universities and research institutions are involved) and the second one is industry-based.

Table 2: Trend in Turkish Scientific Publications (TUBITAK, 2009)

Years	2004	2005	2006	2007
Number of Scientific Publications	16713	18917	21943	22738
Number of SSCI publications	577	705	911	1213
World Ranking in scientific publications	21	19	19	18

Increase in scientific publications underline the emerging role of the education institutions as important actors of the NIS. Their contribution to industry also looks like one of the most critical ones because one of the usual inputs of innovation is intellectual capital for fostering industry's R&D ability**.** However, the output of the intellectual capital in the industry level is still not attractive yet. Regarding the patent applications[14] and the ratio of the innovative firms, [15]it seems that the innovation awareness needs be refined. In order to reach that, one of the solutions is to improve university/industry partnerships[16] for leveraging firm-based innovations. On the academia side, another solution appears as the sustainability of the implemented education policies and integration of the innovation concept to the university education curricula. These solutions may speed up more qualified "business brains" production[17] and its supply for the industry. Hence, training institutions play a significant role within the system. Ultimate targets related to intellectual capital improvement are vital, but not prior ones.

In fact, prior targets can be assumed as the ones that are related to sectoral development. For the firms, government investment programs and national innovation strategy can be used as effective tools for fostering firm-based innovations. When these two are considered in a nutshell, two potential outputs can be mentioned. The first one is the creation of more innovative markets (including both process and product innovations as outputs in relatively stronger sectors, such as textile, automotive and agribusiness). The second output is the improvement of innovative market management mechanisms in a way that yields an increased sector and export competitiveness level. In order to achieve this, additional economic policy implications may be required in parallel to sophistication of the required innovative inputs, such as R&D activities, intellectual capital and scientific infrastructure (e.g. laboratories).

It should also be noted here that more powerful policies can be followed in order to create a favorable "cooperation milieu" between the organizations, keeping in mind that knowledge spillovers[18] are vital for innovation. Increased partnerships may also be needed in order to create an effective entrepreneurship environment supported by the policy-maker via technoparks, Innovation Relay Centers (IRCs), incubators, etc. Especially contribution of "technology centres" (TEKMER), which might serve as knowledge networks, should not be forgotten[19]. In this way, it can also be contemplated that such institutions are also providing an important element of the innovation support[20] structure (Doloreux & Dionne, 2008) on a regional basis. Additionally, in conjunction with the sector-based development and infrastructural improvement, it may also be possible to create "innovation centres" regarding the high number of firms in certain geographical zones (different than current technology centres) which are charged of firm-needed innovative activities' undertaking. Such a setting may also provide a basis for dissemination of the suitable clustering[21] activities throughout the country in the future. Here, both academic and firm-level international cooperation[22] may also contribute to the process. It should be noted that the absorption capacity of the firms (Notebloom, 2006) is also important for generating new knowledge during cooperation activities.

Finally, capability of the NIS should itself be assessed. When the number and characteristics of institutions are taken into account, it can be seen that NIS infrastructure is strong in Turkey. However, although the targets and the required roles are properly defined, operation mechanism still has some problems, such as relatively weak coordination between the institutions, weak mutual management, (ignorance of the actors' interdependence by themselves during decision-making), and consequently, weak integration between the actors in the process, ending up with political slowdowns. It should also be noted that different conditions,[23] especially on a regional basis, may also create pressure on the operating system. In order to optimize the potential outcomes stated above, improvement

of the coordination and communication between actors is also vital during activities. For this reason, studies involving allocation of the actors' duties, governance[24] and innovation policy impacts, especially at the regional level, are also needed in order to measure the effectiveness of the NIS.

CONCLUSION AND FINAL REMARKS

In this study, Turkey's current status concerning innovation has been investigated in the framework of the NIS and possible contributions of the system participants have been investigated notably on policy design. The first point that should be underlined is that Turkey has a well designed NIS structure with properly-defined roles and responsibility areas.

On the other hand, it is important to note that Turkey has still more to achieve for innovation where three alternatives can be assumed. The first one is the stimulation of innovation as subsystems of "regional innovation", which requires participation of local stakeholders, brokers and Institutes for Collaboration (IFCs)[25]. The second alternative is the fostering of innovation on a firm basis. A third alternative can be the formation of innovation clusters[26]. Policy-maker dominated NIS still plays the leader role in both of them.

In the first alternative, establishment of regional innovation initiatives requires involvement of local institutions (which of them are mostly public) as one of the stakeholders. Then, connection of such initiatives should be made by a moderator in the framework of a legal constitution. Design of such constitution depends on the performance of the NIS actors, that is, the policy-maker itself should be active on such a process.

In the second alternative, firm basis innovative activities may depend on the policy-maker, especially in the area of funding. In case of new firm establishments, venture capital (being still in a vulnerable level) mechanisms may contribute to the process. This requires active participation of the related institutions in NIS, most of which are public. Control of the funding use is again made by the IFCs, which work in coordination with the policy-maker on a local basis. IFCs themselves are also monitored by the Ministry of Industry and Trade.

Establishment of innovative clusters[27] may be initiated by a broker, mostly a university or a research institution regarding the fact that most of current independent clustering projects are still bottom-up ones. In this case, universities, being important actors in NIS, may also provide the know-how during the process. It should be noted that most of the universities are public[28] in Turkey and that required funding is provided via projects held by the financing mechanism of NIS.

On the other hand, independent projects serve for optimal dissemination of innovation throughout the country. In other words, they act as a leverage mechanism within NIS. Being mostly cooperation projects, such initiatives also test the innovation capability of the related stakeholders, as well as regions, meaning that the activities of NIS differ among sectors and regions. This can also be assumed as one of the reasons for the starting of policy implementations as "pilot projects" in certain regions due to the differences of required conditions, such as the number of entrepreneurships, technical and scientific infrastructures. As a result, increase in such bottom-up projects yields the effectiveness of policy implementations in the long run. However, the potential contribution of such projects remains as a subject of further research.

Remaining factors mentioned in the study, in fact, indicate the readiness level of the country for the integration of innovation, as well as the potential duties that should be undertaken by NIS.

AUTHOR INFORMATION

Dr. A. Orçun Sakarya is instructor at Çankaya University, Faculty of Economics and Administrative Sciences, Department of Management. His research interests include competition, technology policies, clustering and innovation policies.

REFERENCES

1. Bosco, M.G. (2006). Innovation, R&D and technology transfer: Policies towards a regional innovation system: The case of Lombardy. *European Planning Studies,* 15(8), 1085-1111.
2. Brett, V., & Roe, M. *The impact of Irish Maritime Cluster.* Project document 2006 (Grant-aid Agreement No. PHD/IMDO/04)
3. Coccia, M., & Rolfo, S. (2007). How research policy changes can affect the organization and productivity of public research institutes: An analysis within the Italian national system of innovation. *Journal of Comparative Policy Analysis: Research and Practice,* 9, 215-233.
4. Doloreux, D., & Dionne, S. (2008). Is regional innovation system development possible in peripheral regions? Some evidence from the case of La Pocatière, Canada. *Entrepreneurship and Regional Development,* 20, 259-83.
5. Edgington D.W. (2008). The Japanese innovation system: University-industry linkages, small firms and regional technology clusters. *Prometheus,* 26(1), 1-19.
6. Engelbrecht, H. J., & Darrogh, J. A. (1999). Comparative macro-level assessment of New Zealand's ' national innovation system. *Prometheus,* 17, 283-298
7. Eraydın, A., & Armatlı-Köroğlu, B. (2005). Innovation, networking and the new industrial clusters: the characteristics of networks and local innovation capabilities in the Turkish industrial clusters. *Entrepreneurship and Regional Development,* 17, 237-266.
8. European Union. (2007). *INNO-Policy TrendChart Policy Trends and Appraisal Report: Turkey*. European Commission Enterprise Directorate-General. Retrieved from http://www.proinno-europe.eu/index.cfm
9. Howells, J. (2005). Innovation and regional economic development: A matter of perspective?. *Research Policy,* 34, 1220-1234.
10. Ibrahim, S., & Fallah M. H. (2005). Drivers of innovation and influence of technological clusters. *Engineering Management Journal,* 17(3), 33-41
11. Kaufmann, A., & Wagner, P. (2005). EU Regional policy and the stimulation of innovation: The role of the European Regional Development Fund in the objective 1 region Burgenland. *European Planning Studies,* 13, 581-599.
12. Karllson, C.. (2007). Introduction. In C.Karllson (Ed,). *The Handbook on Research and Innovation and Clusters: Cases and Policies* (pp.1-19). Northampton: Edward Elgar Publishing,
13. Kuah, A. T. H. (2002). Cluster theory and practice: Advantages for the small business locating in a Vibrant Cluster. *Journal of Research in Marketing and Entrepreneurship,* 4(3), 206-228.
14. Kuhlmann, S., & Edler, J. (2003). Scenarios of technology and innovation policies in Europe: Investigating future governance. *Technological Forecasting and Social Change,* 70, 619-637.
15. Lee, S. H., &Yoo, T. (2007). Government policy and trajectories of radical innovation in dirigiste states: A comparative analysis of national innovation systems in France and Korea. *Technology Analysis and Strategic Management,* 19, 451-470.
16. Lundwall, B. A. (1998). Why study national systems and national styles of innovation?. *Technology Analysis and Strategic Management,* 10, 407-421.
17. Motohashi, K. (2008). Growing R&D collaboration of Japanese firms and policy implications for reforming the national innovation system. *Asia Pacific Business Review,* 14, 339-361.
18. Negro, S. O., & Hekkert, M. P. (2008). Explaining the success of emerging technologies by innovation system functioning: The case of biomass digestion in Germany. *Technology Analysis and Strategic Management,* 20, 465-482.
19. Nischalke, T., & Schöllmann, A. (2005). Regional development and regional innovation policy in New Zealand: Issues and Tensions in a Small Remote Country. *European Planning Studies,* 13(4), 559-579.
20. Notebloom, B.. (2006). Innovation, Learning and Cluster Dynamics. In B. Asheim, P.Cooke, R.Martin (Ed.), *Clusters and Regional Development Crucial Reflections and Explorations* (pp.137-163). New York: Routledge,
21. OECD. (1997). *National Innovation Systems.* Organization for Economic Co-operation and Development, Paris.
22. OECD. (2005). *Business Clusters, Promoting Enterprise in Central and Eastern Europe*. Organization for Economic Co-operation and Development, Paris.

23. Oerlemans, L., & Rooks, G. (2005). South Africa: A rising star? Assessing the X-effectiveness of South Africa's national system of innovation. *European Planning Studies,* 13, 1205-1226.
24. Pekkarinen, S., & Harmaakorpi, V. (2006). Building regional innovation networks: The definition of an age business core process in a regional innovation system. *Regional Studies,* 40(4), 401-413.
25. Pelkonen, A. (2006). The problem of integrated innovation policy: Analyzing the governing role of the science and technology policy council of Finland. *Science and Public Policy,* 33, 669-680.
26. Preissl, B., & Solimene, L. (2003). *Innovation clusters: virtual links and globalization.* Proceedings of the Conference on Clusters, Industrial Districts and Firms, The Challenge of Globalization held at University of Modena and Reggio Emilia.
27. Puente, J. M. D., Cazorla, A.,& De Los Rios, I. (2009). Policy support for the diffusion of innovation among SMEs: An evaluation study in the Spanish region of Madrid. *European Planning Studies,* 17, 365-387.
28. Rolfo, S., & Calabrese, G. (2003). Traditional SMEs and innovation: the role of the industrial policy in Italy. *Entrepreneurship and Regional Development,* 15, 253-271.
29. Rush H., Bessant J., & Lees, S. (2004). Assessing the effectiveness of technology policy—A long-term view. *Technology Analysis & Strategic Management,* 16, 327-442.
30. Singh. L. (2004). Globalization, national innovation systems and response of public policy. *International Journal of Technology Management and Sustainable Development,* 3, 215-231.
31. Simmie, J. (2006). The contribution of clustering to innovation: From Porter I Agglomeration to Porter II Export Base Theories. In C.Karllson (Ed.), *The Handbook on Research and Innovation and Clusters: Cases and Policies* (pp.19-32). Northampton: Edward Elgar Publishing,
32. Solleiro, J. L., & Castañòn, R. (2005). Competitiveness and innovation systems: the challenges for Mexico's insertion in the global context. *Technovation,* 25, 1059-1070.
33. Teubal, M. (2002). What is the systems perspective to innovation and technology policy (ITP) and how can we apply it to developing and newly industrialized economies?. *Journal of Evolutionary Economics,* 12, 233-257.
34. Tödtling, F., & Trippl, M. (2005). One size fits all? Towards a differentiated regional innovation policy approach, *Research Policy* 34, 1203-1219.
35. TPI. (2010) .Turkish Patent Institute. *Yearly Statistics.* Retrieved from http://www.tpe.gov.tr/portal/default_en.jsp?sayfa=124.
36. TUBITAK. (2004). National science and technology policies 2003-2023 strategy document. Version 19, Ankara
37. TUBITAK. (2009). Turkish Scientific and Technological Council. *National Technology and Innovation Statistics*. Retrieved from http://www.tubitak.org.tr.
38. TUIK. (2010). Turkish Statistical Institute. *Technology Statistics*, Retrieved from http://www.tuik.gov.tr TUSIAD. (2003). *National Innovation System*. Turkish Industrialists and Businessman Association. Publication No: TUSİAD-T/2003/10/362, İstanbul.
39. Uyarra, E. (2007). Key dilemmas of regional innovation policies. *Innovation: The European Journal of Social Science Research* 20(3), 243-261.

FOOTNOTES

1. See Lee et al. 2007 for alternative definitions of NIS
2. See Ibrahim & Fallah, 2005 and Karllson, 2008 for examples of different cluster knowledge production and diffusion mechanisms
3. See Engelbrecht & Darrough, 1999 for alternative aspects of NIS
4. See Lundvall, 1998 for the rationale behind for analyzing the innovation and economic integration in the national level as the situation is similar to Turkey's.
5. In their studies, Kuhlmann &Edler, 2003 provide an example of governance patterns in the area of innovation policy-making in European Union.
6. An "institutionalized" definition provided by OECD, 1997 underlines the flow of cooperation's importance between the public institutions plays an in the establishment and sustainability of NIS.
7. Preissl & Solimene, 2003 define a cluster as a set of interdependent organizations that contribute to the realization of innovations in an economic sector or industry

8. See Coccia& Rolfo, 2007 for the importance of research institutes in a NIS
9. See Singh, 2004 for the relation between globalization, NIS and economic growth
10. While focusing innovation based competitiveness, distinction made by Solleiro & Castanon, 2005 provides clear insights.
11. Tödtling & Trippl, 2005 propose an efficient regional innovation policy model in their studies.
12. The number of project applications is 711, 1498, 2285, 2001 for 2006, 2007, 2008 and 2009 respectively
13. These actors are in fact two of the triple helix ones. See Bosco, 2006 and Edgington, 2008 for a definition of the triple helix.
14. Total patent applications between years 14806 whereas only 4,2% of the application sources are national firms (TPI, 2010)
15. Between 2006 and 2008 the ratio of the innovative firms is 29% (TUIK, 2010)
16. University/Industry Cooperation Platform (USAMP) is the best example of such partnerships in the country. USAMP involves participation of the universities and firms on project basis in order to develop cooperation between actors involved, assessment of R&D system as well as enhancement of technical know-how for the firms such as project management. It operates in nine centers operating as contact points throughout the country. USAMP acts according to certain yearly themes which have been selected as clustering for 2009, currently, a very popular subject.
17. Regarding the link between qualification, creativity and population; young university graduates provide a potential for innovativeness. As a basic indicator 2008 demographics denote that 26.5% of the population (about 19,5 million) is between the ages of 15-29.
18. For explanation see Brett &Roe, 2006 and Kuah, 2002 in an agglomeration framework
19. In Turkey**,** TEKMERs are incorporated under universities' constitution, generally with government's financial support. They aim the establishment of firms which use technology efficiently within structure. TEKMERs also enhance financial support for SMEs' R&D projects and they also catalyze university/industry partnership. As of 2007, total numbers of TEKMERs in different cities is 28, including 667 organizations.
20. See also Nischalke & Schöllmann, 2005 for the elements of regional support structure.
21. Industrial clustering is a recently focused policy in Turkey. As of 2009, there are 10 different clusters including software, construction machinery, ceramics, yachting, automotive spare parts, textile and electronics.
22. TARAL that has been mentioned in 3.1.1 can also be used as an efficient tool for international cooperation
23. The source of innovation is often the interaction of different actor-networks comprising users, producers and related development organizations (Pekkarinen & Harmaakorpi, 2006). Such conditions may vary according to region
24. Regional governance structures emerge from a dual process of top-down institutional change, and bottom-up regional political and economic mobilization (Uyarra, 2007)
25. IFCs are acting as formal and informal actors (e.g. chamber of commerce, industry associations and so on) who are interested in the cluster initiative formations
26. Clusters were classified as innovative if their companies showed a high level of mutual co-operation, both at the customer-supplier level, as well as at the level of developmental activities, and co-operated intensively with universities, development institutions, and with other education and training organization (Adopted from OECD, 2005)
27. In this context, we should not forget the innovation clusters that stay within the scope of RIS. Innovativeness is a key aspect of localized clusters and a policy concern (see Simmie, 2006 for reasons)
28. As of 2010, total number of universities is 141 in Turkey. Almost, 69% of them are public, remaining are private ones.

NOTES

