

*Full Length Research Paper*

# Study of unsupported types of innovation in Iran and some suggestions

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**This research study focuses on the effective formulation and implementation of a national innovation system. It emphasizes that a concept of regional innovation system is a good tool to generate an effective national innovation system, as it can effectively create different regional innovation systems in different regions. Based on this theoretical review, this research will analyze the Iranian sectoral innovation systems in terms of mapping of innovation actors. We will provide modifying recommendations with relying on the experiences of some selected and successful countries. The recommendations will include creating a new institution or modifying the existing institutional mapping of Iran. Finally the macro strategic modifications will be recommended.**

**Key words:** Innovation, product, process, marketing, organizational, organization for economic cooperation and development (OECD).

## INTRODUCTION

Innovation is a powerful force for sustainable economic growth. Innovation is closely linked with economic growth and productivity gains. Strengthening the conceptual and empirical links between innovation and economic performance is a primary objective of the Innovation Strategy. In recent years National Innovation System (NIS) is accepted as a conceptual framework and analytical instrument for countries' innovation activities by international organizations such as OECD (Organization for Economic Cooperation and Development), UNCTAD and Euro stat (Haghi et al., 2011).

The national innovation system (NIS) is the flow of technology and information among people, enterprises and institutions which is the key to the innovative process on the national level. According to the innovation system theory, innovation and technology development are results of a complex set of relationships among actors in the system, which includes enterprises, universities and

government research institutes.

Four types of innovations are distinguished: product innovations, process innovations, marketing innovations and organizational innovations" (OECD, 2005).

### Product innovation

A product innovation is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in the technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.

### Process innovation

A process innovation is the implementation of a new significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software. Process innovations can be intended to

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decrease unit costs of production or delivery, to increase quality, to produce or to deliver new significantly improved products.

Production methods involve the techniques, equipments and software used to produce goods or services. Examples of new production methods are the implementation of new automation equipment on a production line or the implementation of computer-assisted design for product development.

### **Marketing innovation**

A marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing. Marketing innovations are aimed at better addressing customer needs, opening up new markets, or newly positioning a firm's product on the market, with the objective of increasing its sales.

### **Organizational innovation**

An organizational innovation is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations. Organizational innovations can be intended to increase a firm's performance by reducing administrative costs or transactions costs, improving workplace satisfaction (and thus labor productivity), gaining access to non-tradable assets (such as non-codified external knowledge) or reducing costs of supplies.

In recent years the national innovation system (NIS) has been accepted as a conceptual framework and an analytical instrument for countries' innovation activities by the international organizations such as OECD (Organization for Economic Cooperation and Development). The OECD is a unique forum where the governments of the 30 democracies work together to address the economic, social and environmental challenges of globalization. The organization provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies. The Commission of the European Communities takes part in the work of the OECD.

The system components of a technological innovation system are called structures. These represent the static aspect of the system, as they are relatively stable over time. Three basic categories are distinguished:

#### **Actors**

Actors involve organizations contributing to a technology, as a developer or adopter, or indirectly as a regulator,

financer, etc. It is the actors of a technological innovation system that, through choices and actions, actually generate, diffuse and utilize technologies. The potential variety of relevant actors is enormous, ranging from private actors to public actors and from technology developers to technology adopters. The development of a Technological Innovation System will depend on the interrelations between all these actors. For example, entrepreneurs are unlikely to start investing in their businesses if governments are unwilling to support them financially. Vice versa, governments have no clue where financial support is necessary if entrepreneurs do not provide them with the information and the arguments they need to legitimate policy support.

### **Institutions**

Most authors agree that institutional structures are at the core of the innovation system concept, like Edquist, Johnson and North. It is common to consider institutions as 'the rules of the game in a society. A distinction can be made between formal institutions and informal institutions, with formal institutions being the rules that are codified and enforced by some authority, and informal institutions being more tacit and organically shaped by the collective interaction of actors. Informal institutions can be normative or cognitive. "The normative rules are social norms and values with moral significance, whereas cognitive rules can be regarded as collective mind frames, or social paradigms" (Scott, 2001). Examples of formal institutions are government laws and policy decisions; firm directives or contracts also belong to this category. An example of a normative rule is the responsibility felt by a company to prevent or clean up waste. Examples of cognitive rules are search heuristics or problem-solving routines. They also involve dominant visions and expectations held by the actors (Edquist and Johnson, 1997; North, 1990; Van Lente, 1993, 1998).

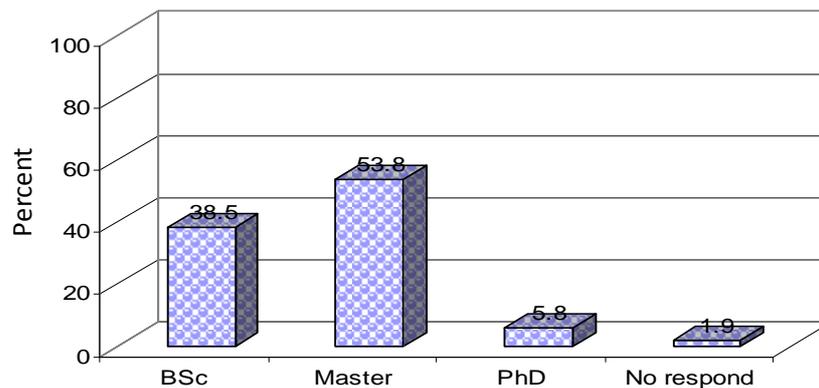
### **Technological factors**

Technological structures consist of artifacts and the technological infrastructures in which they are integrated. They also involve the techno-economic workings of such artifacts, including costs, safety, and reliability. These features are crucial for understanding the feedback mechanisms between technological change and institutional change.

For example, if R and D subsidy schemes supporting technology development should result in improvements with regard to the safety and reliability of applications, this would pave the way for more elaborate support schemes, including practical demonstrations. These may, in turn, benefit technological improvements even more. It should, however, be noted here that the importance of

**Table 1.** Coding questions type 1 on a Likert scale of five options.

Very Good	Good	Average	weak	Very weak
Opportunity	weak opportunity	Average	Weak threat	Threat
5	4	3	2	1

**Figure 1.** Educational distribution of respondents.

technological features has often been neglected by scholars (Suurs, 2009).

The structural factors are merely the elements that make up the system. In an actual system, these factors are all linked to each other. If they form dense configurations they are called networks. An example would be a coalition of firms jointly working on the application of a fuel cell, guided by a set of problem-solving routines and supported by a subsidy programmer. Likewise, industry associations, research communities, policy networks, user-supplier relations, etc. are all examples of networks.

## METHODOLOGY OF RESEARCH

This research study is placed in the category of the survey studies. The researcher tries to use a questionnaire to measure the effectiveness of the implementation of the National Innovation System of Iran. Therefore, in terms of data collection, the research is a field study, and the results are generalized, so it is an applicable study.

The statistical society are the experts in the fields of legislature, policy making, technology and innovation policy coordinators such as the state experts, parliament experts, employees in the ministries of sciences, researches and technologies, industries and mines, research and innovation facilitators, research and development centers, innovation developers such as consultancy firms and incubator centers in the universities and parks of technology and innovation users such as organizations, the state and the private corporations.

Various instruments are implemented for data collection that can both collect and record the required data; some are questionnaires, interviews, observations and library studies. The researcher used the appropriate instruments to obtain the required data in the research. The hypotheses are tested by analyzing and processing

the data and converting it to the information. Major instruments for data collection in this research study are:

1. The primary resources: questionnaires
2. The secondary resources: A) Library research, study of documents, books, articles and letters, thesis and the use of Internet resources. B) Organized documents.

Questionnaires include set of questions that interviewees had to choose the best options. After numerous studies and interviews with both individuals and experts, two questionnaires were designed by the researcher. Each question was based on a scale of five options that was encoded with the Table 1 (Likert, 1932). The main components of the questionnaire are: (a) the attached letter that explains the purpose of collecting data through the questionnaire and willing to cooperate and respond to them in order to ensure confidentiality of the personal information. (b) Instructions: at the beginning of every questionnaire there is an instruction to answer them. (c) Questions: For all the questions there are a few options to be responded quickly and easily, therefore extracting the data would be easy too.

In order to introduce the public face of samples in this field study, as part of the general profile of respondents to obtain demographic characteristics of subjects are allocated in questionnaire. So in Figure 1 the education of sample members is shown. It is clearly that the results of this part in addition to provide an overview of personal characteristics of respondents, it can use in the future researches for investigation, the effect on the personal characteristics of respondents view on the used variables.

## Significance of the study

In the late 1980s, a new conceptual framework appeared in science, technology, and innovation studies that are the National Innovation System. The framework suggests that the ultimate goal of the research system is innovation, and that the system is part of

a larger system composed of sectors such as government, university, industry and their environment. The framework also emphasized the relationships between the components or sectors, as the "cause" that explains the performance of the innovation systems. Most authors agree that the framework came from researchers like Freeman, Nelson, and Lundvall. In this study, the author wants to go further back in time to show what the "system approach" owes to the Organization for Economic Co-operation and Development (OECD) and also to demonstrate its very early works from the 1960s. This research study develops the idea that the system approach was fundamental to OECD work.

### **Existed function-institutions of national innovation system of Iran**

In this study on the basis of the results of a series of interviews and completing the designed questionnaires (more than 100 sessions) with the major stakeholders in the innovation system of Iran, that 64% of them were Ph.D and masters degree holders, the strengths, weaknesses, opportunities and threats against the NIS of Iran have been listed.

1. According to the law of supporting the knowledge-based companies and commercializing innovations and inventions in August 2010 that has been passed by the Parliament of Iran, it specifies the role of law in innovative companies like the High Council of Science and Technology, Ministry of Science, Research Technology, innovation and development banks and funds, which will be established in the year 2013, but the law does not cover other private and public enterprises and firms (Parliament of Iran, 2010A).
2. According to the patent and innovation law, the recording of new products or production processes in the law can be registered and recorded (Parliament of Iran, 2007).
3. After 2013, 0.5% of GDP will be assigned to innovation and development fund (Maslehat High council of Iran, 2009).
4. Industrial property office registers and records the innovative new products and the new process, but it does not cover two innovation functions (organizational innovation and marketing innovation).
5. Supporting the innovation by local institutions and municipalities such as the local state is evaluated in an average level.
6. Any banks or investment funds do not support investment with financial risk right now, but on the basis of the Parliament law, after 2013, innovation Fund with initial capital of 3 billion dollars will be established to support this investment for innovation and researches (Parliament of Iran, 2010B)
7. Official and legal institutions for registration and marketing of research ideas and achievements do not exist.
8. Offering the graduate studies scholarship by industries is evaluated weak.
9. Centers for technology transfer and technology forecasting by university and industry collaboration are evaluated very poorly.
10. The potential for Iranian companies to enter the production and trade on a global scale is a fairly good evaluation.
11. Rapid transfer of new technology into the country is suffering from challenges.
12. High-speed and secure networks infrastructure and IT applications are evaluated poor.
13. The social capacity to learn from the successful and unsuccessful international experiences is evaluated in average level.
14. The centers for technology development and localization in small and medium industries such as RTO (research technology organization) are evaluated very poor.
15. Approach of women to enter to the colleges and graduate studies have been increased the potential of laboratories and research centers.

16. Globalization as an opportunity to develop innovative technology is suffering from challenges.

17. Young age average for the next ten years is a dynamic opportunity for innovation functions.

18. Purchasing the modern and technical equipments because of sanctions is suffering from challenges.

19. Methods and processes to access researchers and industry are evaluated in average level.

20. Academic research projects in the universities have a good ability for innovative solutions if the industry sector offers its problems.

21. The potential of universities to support research and innovation is an opportunity.

22. The culture of teamwork between different scientific and industrial research groups is good.

## **RESULTS**

### **Hypothesis**

No comprehensive law for the national system of innovation is adopted to determine the responsibility for policymaking, preparing and formulating policies, providing intellectual and financial facilities for four types of innovation, its applications, and the role of key actors of innovation. Since the number of questionnaires about the existence of a comprehensive law for the national system of innovation were adopted in five questions, and each question has studied such a part of the legal debate. At first the differences between five items of options in each question are determined by  $\chi^2$  test (Table 2) and then the existence of the intended law is determined by ratio test.

In the noted table, there are significant differences between items in response to the questions. So the question is whether the comprehensive law for national system of innovation exists or not.

If P: is the real ratio of people who believe that there is a comprehensive law for national system of innovation.

When

$$\begin{cases} H_0 : P \geq 0.05 \\ H_1 : P < 0.05 \end{cases}$$

$H_0$  means that there is a comprehensive law for the national system of innovation, and  $H_1$  means that there is not (Table 3).

So according to the results of Table 3, it can be concluded that, despite the law to determine the main actors of innovation systems and the existence of a high council policymaking exists but there is not a registration of intellectual property law (copy right) for all of innovation functions, and there are not formulation of innovation policies in related institutions and matching between innovation plans and 20 years strategy of the country. The role of Ministry of Industries and Mines and Other

**Table 2.**  $\chi^2$  test for the comprehensive law for national system of innovation.

Factors	Items					$\chi^2$ test	
	Very good	Good	Average	Weak	Very weak	Quantity	Significant level differences
Determine the actors of innovation in law	1	27	15	6	0	31.898	0.000
Determine the intellectual properties registration in law	1	6	21	14	4	29	0.000
Determine the policy making high council	3	25	13	5	1	41.191	0.000
Formulation of innovation policies in related institutions	0	11	26	11	1	26.02	0.000
Matching between innovation plans and 20 years strategy of country	2	15	22	10	0	17.367	0.000

**Table 3.** Ratio test for comprehensive law of national system of innovation.

Factors	Statistic t	Mean level (H)
Determine the actors of innovation in law	1.29	0.9
Determine the intellectual properties registration in law	-5.66	0.000
Determine the Policy making high council	1.29	0.9
Formulation of innovation policies in related institutions	-4.11	0.0001
Matching between innovation plans and 20 years strategy of country	-2.91	0.0027

Ministries involved in innovation for the innovation policy formulating are ignored.

As the results of data collection, the strengths, weaknesses, opportunities and treats are:

### Strengths

(a) In the law of supporting the knowledge –based companies and commercializing innovations and inventions has been identified and the role of innovative companies, the High Council of Science and Technology, Ministry of Science, Research and Technology, innovation and development banks and funds are approved.

(b) According to patent and innovation law, recording the new products or production processes in the law (Parliament of IRI, 2007) can be registered and recorded.

(c) High Council of Science and Technology has the responsibility to follow up the law of supporting the knowledge–based companies and commercializing innovations and inventions.

(d) Responsibility for innovation policy and planning based on legislation is the job of High Council of Science and Technology.

(e) After 2013, 0.5 % of GDP will be assigned to innovation and development fund.

(f) Industrial property office registers and records the innovative new products and new process.

(g) Academic research projects in the universities have a good ability for innovative solutions if the industry sector offers its problems.

### Weaknesses

(a) In the law of supporting the knowledge–based companies and commercializing innovations and inventions has not been covered the innovations in all of private and public enterprises.

(b) High Council of Science and Technology does not cover the policy, planning and follow-up two identified functions of innovation (organizational innovation and marketing innovation).

(c) There is no organizational interface between state, university and industry with the mission of coordinating the main pillars of innovation.

(d) The patent law does not cover two innovation functions (organizational innovation and marketing innovation).

**Table 4.** Categories of strengths, weaknesses, opportunities and threats in Iran's national innovation system.

<b>Strengths</b>	<p>S1. Approved law of parliament for supporting the knowledge-based companies and commercializing innovations and inventions.</p> <p>S2. Recording the new products or production processes in the law can be registered and recorded.</p> <p>S3. High Council of Science and Technology has the responsibility to follow-up the law of supporting the knowledge-based companies and commercializing innovations and inventions</p> <p>S4. Responsibility for innovation policy and planning based on legislation is the job of High Council of Science and Technology</p> <p>S5. After 2013, 0.5% of GDP will be assigned to innovation and development fund.</p> <p>S6. Industrial property office registers and records the innovative new products and new process.</p> <p>S7. Academic research projects in the universities have a good ability for innovative solutions.</p>
<b>Weaknesses</b>	<p>W1. In the approved law of parliament, innovations and inventions has not been covered in all of private and public enterprises.</p> <p>W2. High Council of Science and Technology does not cover the policy planning and follow-up organizational innovation and marketing innovation.</p> <p>W3. There is not any organizational interface between state, university and industry with the mission of coordinating the main pillars of innovation.</p> <p>W4. The Patent law does not cover organizational innovation and marketing innovation.</p> <p>W5. Official and legal institutions for registration and marketing of research ideas and achievements do not exist.</p> <p>W6. Offering the graduate studies scholarship by industries is evaluated weak.</p> <p>W7. Centers for technology transfer and technology forecasting by university and industry collaboration are evaluated very poor.</p> <p>W8. High-speed and secure networks infrastructure and IT applications are evaluated poor.</p> <p>W9. The centers for technology development and localization in small and medium industries are evaluated very poor.</p> <p>W10. Data based information network to facilitate access between researchers and applicants is evaluated poor.</p>
<b>Opportunities</b>	<p>O1. The potential for Iranian companies to enter the production and trade on a global scale is a fairly good evaluation.</p> <p>O2. The approach of women to enter to the colleges and graduate studies have increased the potential of laboratories and research centers.</p> <p>O3. Young age average for the next ten years is a dynamic opportunity for innovation functions.</p> <p>O4. Potential of universities to support research and innovation is an opportunity.</p> <p>O5. Culture of teamwork between different scientific and industrial research groups, is evaluated strong.</p>
<b>Threats</b>	<p>T1. Rapid transfer of new technology into the country is suffering from challenges.</p> <p>T2. Globalization as an opportunity to develop innovative technology is suffering from challenges.</p> <p>T3. Purchasing the modern and technical equipments cause of sanctions are suffering from challenges.</p>

(e) Official and legal institutions for registration and marketing of research ideas and achievements do not exist.

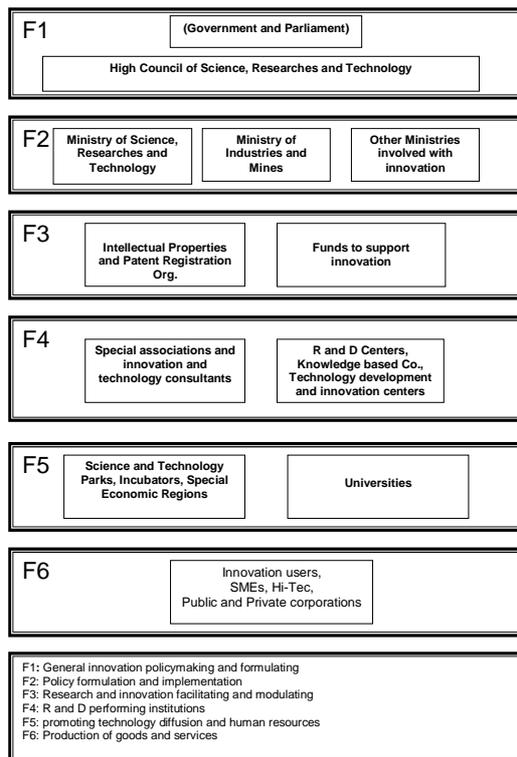
(f) Offering the graduate studies scholarship by industries is evaluated weak.

(g) Centers for technology transfer and technology forecasting by university and industry collaboration are evaluated very poor.

(h) High-speed and secure networks infrastructure and IT applications are evaluated poor.

(i) The centers for technology development and localization in small and medium industries such as RTO (research technology organization) are evaluated very poor.

(j) Data based information network to facilitate



**Figure 2.** Suggested modified institutional mapping for NIS of Iran.

access between researchers and applicants is evaluated poor.

### Opportunities

- The potential for Iranian companies to enter the production and trade on a global scale is a fairly good evaluation.
- The approach of women to enter to the colleges and graduate studies have increased the potential of laboratories and research centers. O3. Young age average for the next ten years is a dynamic opportunity for innovation functions.
- Potential of universities to support research and innovation is an opportunity.
- Culture of teamwork between different scientific and industrial research groups, is evaluated strong.

### Threats

- Rapid transfer of new technology into the country is suffering from challenges.
- Globalization as an opportunity to develop innovative technology is suffering from challenges.
- Purchasing the modern and technical equipments cause of sanctions are suffering from challenges.

So categories of strengths, weaknesses, opportunities and threats in Iran's national innovation system are organized and shown in Table 4.

## CONCLUSION AND SUGGESTIONS

Finally by the analysis of the data collected through a field research via interview with policymakers, officials, executives and various related national innovation system based on questionnaires designed and considering the classification based on OECD (Organization for Economic Cooperation and Development) related to National Innovation System, the following solutions for improving the NIS of Iran are recommended:

- The role of industrial and Intellectual Properties and Patent Registration Organization for covering some types of innovation must be considered (marketing and organizational innovation are not supported by the laws of parliament but the product and process innovation are covered by laws and rules).
- The role of professional associations, innovation, research and technology organizations for promoting the technological entrepreneurship and developing technology and innovation should be considered.
- The High Council of Science and Technology has the responsibility to follow-up the law of supporting the knowledge-based companies and commercializing innovations and inventions, therefore, High Council of Science and Technology should be covered the policy, planning and follow-up two identified functions of innovation (organizational innovation and marketing innovation).
- An organizational interface between state, university and industry with the purpose of coordinating the main pillars of innovation should be established.
- The level of enjoying the industry and universities structure and government support should be improved.
- The institutional mapping for NIS of Iran is suggested in Figure 2.

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