Power Plays: The Tale of a Develoing Country Failed in Innovation

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Abstract

Recent two decades, has certainly observed soaring of science and technology policy-making in Iran: the prevalence of discourse of science and technology in various levels of the ruling system; devotion of an important exclusive section to science and technology in three recent National Development Plans; founding of numerous new structures and institutions in direct supervision of president to support science and technology; legislation of important laws in Parliament to encourage national R&D; a big fund has begun to work to support new technology-based start-ups; number of science and technology parks and incubators has experienced a stunning growth; the growth rate of articles published by Iranian scientists and researchers have been the fastest in the world; and Iran has been in first five countries which have had most graduates in science and engineering. But there is a strange paradox: Iran has had a weak performance in innovation and economy output.

What is the cause of the the paradox? This study, at its first level of analysis, and based on National Innovation Systems studies, will show that the cause is rooted in two following factors: 1. Iran's industrial policies has been almost unsuccessful in encouraging or forcing domestics firms to export, and exposing them to international competition. As the result, there has not been any meaningful incentives for them to approach technological frontiers, by exploiting home science and technology infrastructures. 2. In spite of the fact that universities and research centers have had an important role in the catch-up process of new developed countries, albeit by stepping down from the Ivory Tower and solving problems in the face of the society, but most universities and research centers in Iran has been transformed into a set of article-publishing machines. This study, then, at its second level of analysis, will show that the cause of the two above factors, is rooted in another important latent factor: "the power of incumbents and their efforts to maintain the status quo" and "governance of a particular rule of game on science and technology field's actors which has directed them to show ineffective behaviors".

The contribution of this study is utilizing the strategic action field literature and emphasizing the role of incumbents and rules of game in inhibiting an economy to be innovator.

Keywords: Science and technology, Innovation, National innovation system, Industrial policy, Ivory tower, Field theory, Incumbent, Challenger, Rule of game

1. Introduction: An important paradox

Recent two decades, has certainly observed soaring of science and technology policy-making in Iran: the prevalence of discourse of science and technology is well visible in various levels of the ruling system; in three recent National Development Plans, there is always an important exclusive section devoted to science and technology; numerous new structures and institutions are founded in direct supervision of president to support science and technology; important laws are legislated in Parliament to encourage national R&D; a big fund has begun to work to support new technology-based start-ups; number of science and technology parks and incubators has experienced a stunning growth; the growth rate of articles published by Iranian scientists and researchers have been the fastest in the world; and Iran has been in first five countries which have had most graduates in science and engineering.

But there is *a strange paradox*: in spite of all mentioned achievements, Iran has had a weak performance in innovation and economy output. Iran has a very low rank in patent applications and grants in famous international databases; Iran's exports, after eliminating the oil, is not significant; and Iran's high-tech export is also not in a good condition. Even, Iran's rank in quality of publications is not comparable with Iran's high rank in quantity of publications.

What is the cause of the the paradox? This study, at its first level of analysis, and based on *National Innovation Systems* studies, will show that the cause is rooted in two following factors:

1. Iran's *industrial policies*, in spite of very strong protection of domestic industries against foreign competition, has been almost unsuccessful in encouraging or forcing domestics firms to export, and exposing them to international competition. As the result, there has not been any *noticeable pressure* on domestic industries to do more innovation and hence, there has not been any meaningful incentives for them to approach technological frontiers, by exploiting home science and technology infrastructures.

2. In spite of the fact that universities and research centers have had an important role in the catch-up process of new developed countries, albeit by stepping down from the *Ivory Tower* and solving problems in the face of the society, but most universities and research centers in Iran has been transformed into a set of article-publishing machines, and making connections with society is much lesser their concerns.

This study, then, at its second level of analysis, will show that the cause of the two above factors, is rooted in another important latent factor: "the power of incumbents and their efforts to maintain the status quo" and "governance of a particular rule of game on science and technology field's actors which has directed them to show ineffective behaviors". The contribution of this study is utilizing the *Strategic Action Field* literature (Fligstein & McAdam, 2012) and emphasizing the role of incumbents and rules of game in inhibiting an economy to be innovator.

2. Literature review

2. 1. Innovation paradox in extant literature

Some studies have pointed to a similar paradox, called *Swedish Paradox* (Braunerhjelm, 1998; Edquist and McKelvey, 1998; Bitard et al., 2008). These studies have showed that despite the fact that Sweden is a well-known country in investing significant resources in innovation input, Sweden's innovation output is not compatible with other countries which have invested very much less resources in innovation input. Other studies have pointed to a similar paradox for Europe, in more general terms (Tijssen & Van Wijk, 1999; Dosi et al., 2006; Cunningham, 2009): While Europe has a pioneer role in scientific research, and in science and technology graduates, but have not had a significant success in transforming these inputs into valuable innovation for the society. In these studies, the cause of the paradox has been shown to be ones such as "the weakness of firms" especially large firms in exploiting innovation inputs (Edquist & McKelvey, 1998; Bitard et al, 2008; Cunningham, 2009) and some socio-cultural factors especially "the weakness of these countries in entrepreneurial ability" (Audretsch & Keilbach, 2008; Acs et al., 2010).

At other hand, some development literature researchers argue that the developing countries' weakness in innovation interrelates with firms' weakness. For example, Rodrik (2008) argues that in developing countries, innovation is not restricted by factors such as the lack of educated scientists and engineers or lack of R&D laboratories, but is restricted by lack of innovation demand from its potential users, i.e. pioneer entrepreneurs who are the main players in rerouting a developing country from "traditional low productivity activities" to "modern high productivity activities" (Hausmann & Rodrik, 2003; Rodrik, 2008). Chaminade et al. (2009) also emphasize the main role of firms in developing countries' innovation output. They argue that lack of *design and engineering capabilities* (Lall, 1992; Bell and Pavitt, 1995) in developing countries' firms is the main barrier to innovation in these countries.

Some important studies also point to the fact that at last, these are the firms who can combine two main sources of innovation (i.e. technology push and demand pull) and introducing proper innovations to society (Arora and Gambardella, 1994; Kogut and Zander, 1996; Teece et al., 1997; Afuah, 2000; Adner & Levinthal, 2001; Danneels, 2002; Gatignon et al., 2002; Di Stefano et al., 2012).

Some studies, however, do not believe in such paradoxes. For example, Dosi et al (2006) argue that the Europe's weakness in innovation is rooted in both sides: in academic research's weakness as well as in industries' weakness. In other words, they argue that there is not such a thing as Sweddish or European Paradox.

2.2. National Innovation System Studies and the explanation of high innovation

In *National Innovation System* studies, a particular set of factors is enumerated for high innovation output. For example, in the "National innovation systems: a comparative study" with the editorial of well-known scientist Richard Nelson, which is one of the most important books published till now in science, technology and innovation policy[\], there is shown that in national innovation system of the countries with high innovation performance, or the countries which have recently reached such performance, we can observe three important basic characteristics. Nelson argues that the importance of these three basic characteristics is such that in national innovation system of the countries with low innovation performance, we can well observe the lack of one or some of them:

1. The first important characteristic for high innovation performance of a country, is the excellence of its firms in *important general capabilities*: from *design and production* capability, to *management* capability, to the capability of *customers' needs understanding*, to the capability of *connecting to upper and lower hand industries*, etc. These general capabilities, enable a country's firms to master their needed technologies and even become pioneer in developing them. In fact, importance of these capabilities, emphasize again the famous theory that most bulk of activities which result in innovation, must be performed by firms themselves. A short look at historical studies made on the catch-up process of Japan, Germany, Italy, Korea, and Taiwan, and the writers' descriptions about ceaseless efforts of these countries' firms in achieving innovation, approves well this theory. At other hand, the close correlation of low innovation performance of countries such as England, France, Australia, and Israel with their firms' weakness in above general capabilities, in spite of having strong university and research system, would not be too much surprising. Albeit, as historical cases show again, developing such general capabilities is never possible without exposing firms to an intense international competition.

2. The second important characteristic for high innovation performance of a country, is the existence of *a strong education system*, which can provide a continuous supply of knowledgeable and skillful labor for firms. The cases of *Asian Tigers* show well that the ability of these countries' firms in rapid transition from production of simple goods in 1950s and 1960s to production of more complex and technological goods in 1980s, has been possible by availability of young labor force with required trainings in new jobs. Albeit, the unsuccessful cases like Argentina and Israel show again that just availability of trained labor force is not enough, because as expressed in the previous paragraph, the existence of firms with strong general capabilities working in a

[\] The most important and well-known researchers in science, technology, and innovation studies have contributed to this book, such as Nathan Rosenberg, David Mowery, Franco Malerba, Charles Edquist, Bengt-Åke Lundvall, Linsu Kim, and Richard Nelson himself. This book is consisted of 14 historical case studies on 14 countries in three categories of "high-income", "medium-income", and "low-income".

competitive conditions is necessary to force firms to exploit knowledgeable and skillful labor in the country.

3. The third important characteristic for high innovation performance of a country, is the separation of the country's universities and research centers from the *Ivory Tower*, and their continuous efforts to solve the society's problems. In fact, in all historical cases of catch-up, university research programs are always defined in close collaboration with firms -user community- and defined in such a way that can help firms solve their problems, and consequently, advance technology.

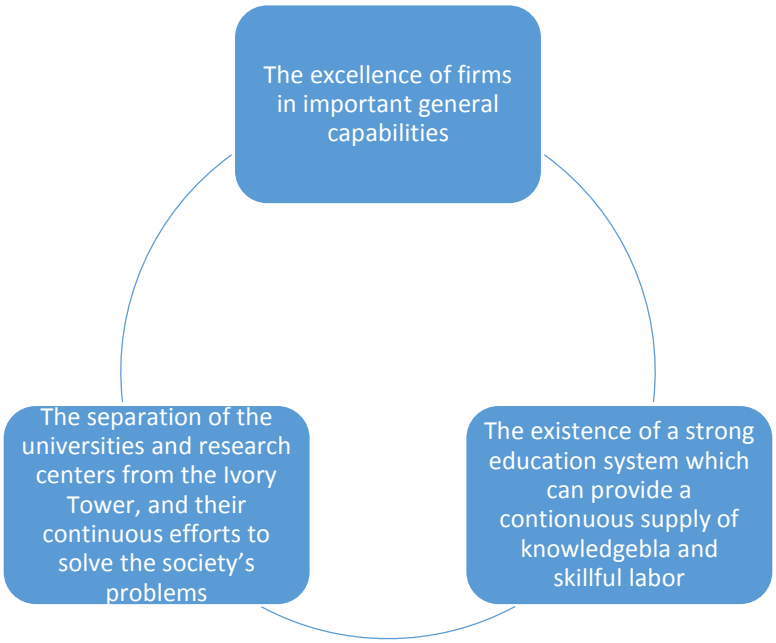


Figure 1. The most important basic characteristics the countries with high innovation performance or the countries which recently have reached such a performance

2.3. Strategic Action Field

Fligstein and McAdam (2012) define *strategic action field* as a meso social order, in which, actors are interacting with each other based on a shared understanding of the aim of the field, and the rules governing the field, which define legitimate actions in the field. Strategic action field is a socially constructed space, in which, different actors owning different resources, vie for more

advantage. Each field is constituted by incumbents, challengers, and rule of the game. Incumbents are who:

> "… [w]ield disproportionate influence within a field and whose interests and views tend to be heavily reflected in the dominant organization of the strategic action field. Thus, the purposes and structure of the field are adapted to their interests, and the positions in the field are defined by their claim on the lion's share of material and status rewards. In addition, the rules of the field tend to favor them, and shared meanings tend to legitimate and support their privileged position within the strategic action field … (Fligstein & McAdam 2012, p. 13)"

On the other hand, the challengers are who:

> "…[o]ccupy less privileged niches within the field and ordinarily wield little influence over its operation. While they recognize the nature of the field and the dominant logic of incumbent actors, they can usually articulate an alternative vision of the field and their position in it … Most of the time challengers can be expected to conform to the prevailing order, although they often do so grudgingly, taking what the system gives them and awaiting new opportunities to challenge the structure and logic of the system… (Fligstein & McAdam, 2012, pp.13-14)"

The contribution of this study is utilizing the Strategic Action Field literature and emphasizing the role of incumbents and rules of game in inhibiting an economy to be innovator. This study will show that the cause of the inefficiency of Iran's industrial policies, and transformation of Iran's universities and research centers into a set of article-publishing machines, is rooted in "the power of incumbents and their efforts to maintain the status quo" and "governance of a particular rule of game on science and technology field's actors which has directed them to show ineffective behaviors".

3. Research Design

This is a *qualitative study* and tries to explore the research question through archival datas and also performing purposefully semi-structured interviews with managers of some research centers. Qualitative data have particular strengths for understanding processes because of their capacity to capture temporally evolving phenomena in rich detail, something that is difficult to do with methodologies based on quantitative surveys that are coarse-grained (Langley & Abdallah, 2011) and tend to 'skim the surface of processes rather than plunging into them directly' (Langley, 1999, p. 705).

4. Science and technology policy-making in Iran

With little doubt, science and technology policy-making is at its historical apex in Iran. Discourse of science and technology has become the dominant discourse at all levels of policy-making: from political leaders to government people to parliament lawmakers. For example, at the ruling level, we can observe a noticeable leap in usage of keywords such as "knowledge-based economy" or "science and technology cycle" in speeches of Iran's *Supreme Leader* in recent years (figure 2 and figure 3). Perhaps, Supreme Leader's quotations such as "the real progress is not possible without the scientific and technological progress[۲]" or "science and research production, makes the nation's future[۳]" show well the importance of science and technology at the ruling level. Formulating the *National General Science and Technology Policies* under the supervision of the Supreme Leader and ordering it to all executive agencies, and also formulating the *National Comprehensive Scientific Map* in *Supreme Council of the Cultural Revolution*[۴] in 2010 and founding a steering committee for implementing, is other evidences of apex of science and technology discourse at the ruling level.

[۲] Speech of Iran's Supreme Leader at a meeting with young elites; 2013; Retrieved from: farsi.khamenei.ir

[۳] Speech of Iran's Supreme Leader at the Research and Technology Fair at the state of Khoarasan Razavi; 2010; Retrieved from: farsi.khamenei.ir

[۴] As the uppermost national policy making agency, in which, most important Iran's decision makers are member of it, including: The President (chairman); Head of the Parliament; Head of the Judiciary Branch; Minister of Culture and Islamic Guidance; Minister of Science, Research and Technology; Minister of Health and Medical Education; Minister of Education; Minister of Youth and Sports; Vice-President for science and Technology; Vice-President for Strategic Planning and Monitoring; Chairman of the Education and Research Commission of the Parliament; Chairman of the Health Commission of the Parliament; Chairman of the Cultural Commission of the Parliament; Head of the Islamic Republic of Iran Broadcasting (IRIB); Head of the Scientific Information Database (SID); and Head of the Islamic Azad University.

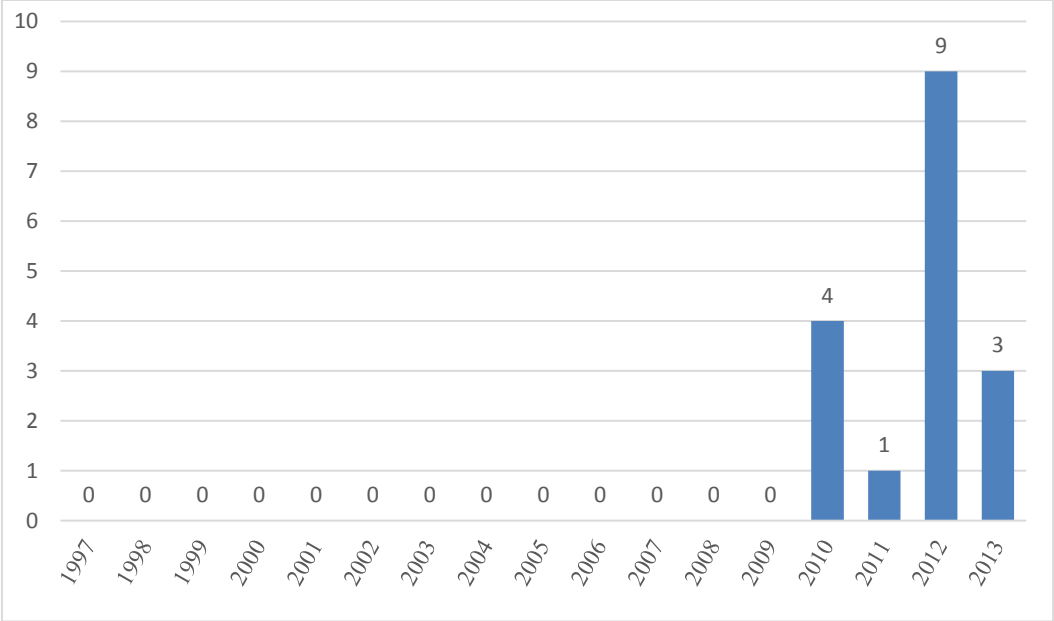


Figure 2. The number of speeches of Iran's Supreme Leader with the subject of "knowledge-based economy" in recent years (*Source: The formal website of Iran's Supreme Leader*[۵])

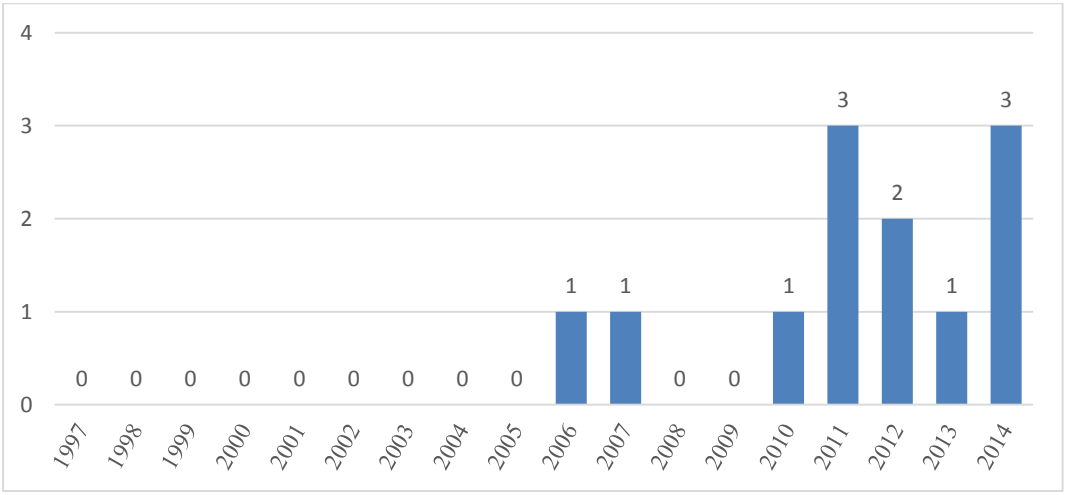


Figure 2. The number of speeches of Iran's Supreme Leader with the subject of "science and technology cycle" in recent years (*Source: The formal website of Iran's Supreme Leader*)

The discourse of science and technology is also evident at the government level. Highlighting the most important ones, we can observe that in three recent *National Developmental Plans*, there is always an important exclusive section devoted to science and technology (Table 1). Founding a cross-ministry agency called *The Vice-Presidency for Science and Technology* in 2008 under the

[۵] farsi.khamenei.ir

direct supervision of the President for direct support of emergent technologies, is also one of the most important structural interventions.

6th National Developmental Plan (2016-2020)	5th National Developmental Plan (2012-2016)	4th National Developmental Plan (2006-2010)
1 chapter from 8 chapters, with the name of "science, technology and innovation affairs"	1 chapter from 9 chapters, with the name of "science and technology"	1 chapter from 15 chapters, with the name of "knowledge-based development"

Table 1. Devotion of an exclusive chapter to science and technology in National Developmental Plans

Discourse of science and technology at the government level, shows itself well in founding numerous incubators and science and technology parks. Based on formal statistics, the number of incubators has multiplied 3.6 and the number of science and technology parks has multiplied 2.6 during just eight years (figure 4 and 5).

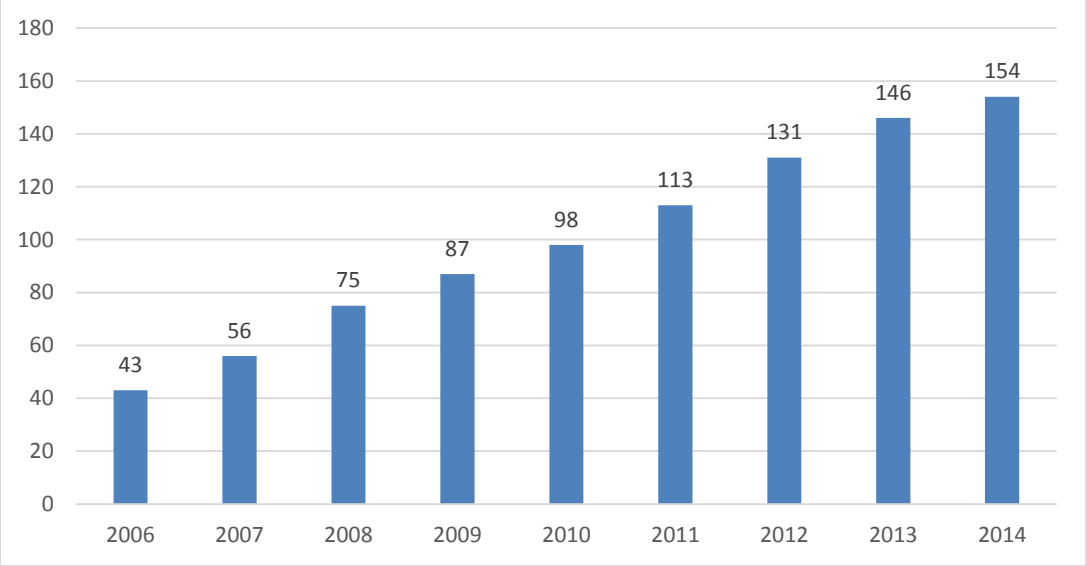


Figure 4. Number of incubators in Iran (*Source: received data from the Deputy of Research and Technology; Ministry of Science, Research, and Technology*)

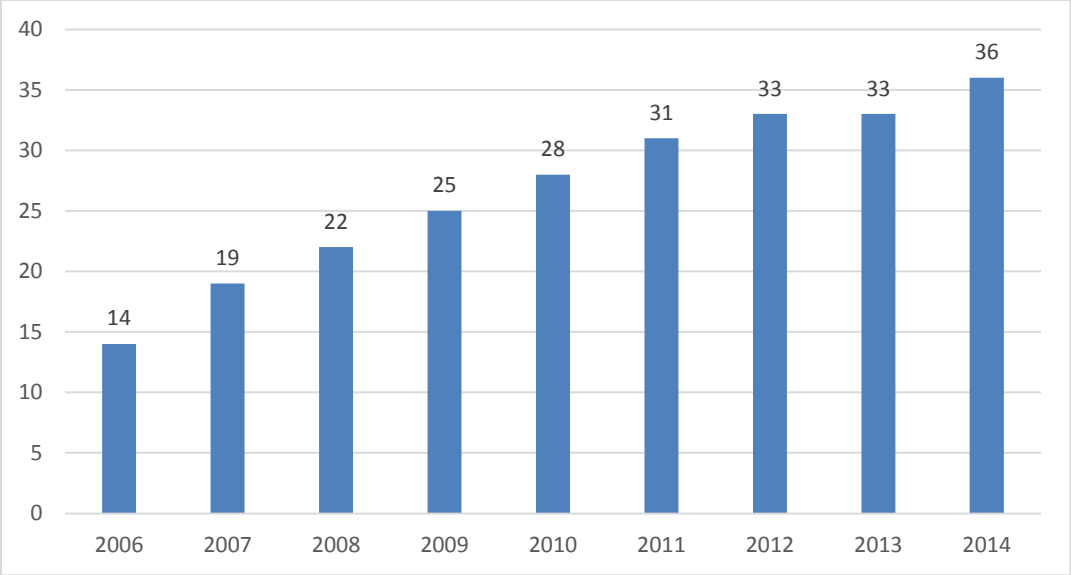


Figure 5. Number of science and technology parks in Iran (*Source: received data from the Deputy of Research and Technology; Ministry of Science, Research, and Technology*)

The discourse of science and technology is also well evident at the legislation level and enacting of two important acts in Parliament in recent decades. The first important act, which is called *"1 % act"* and enacted in 2007, aims to increase GERD -the ratio of R&D to GDP- by public agencies. Based on the last version of this act in 2014, all public agencies are forced to allocate 1% of their budget to R&D (in addition to their normal yearly R&D budget) based on national research and technological priorities, which are defined yearly by a cross-ministry agency called *Council of Science, Research and Technology (CSRT)*. Since enacted, this act has not applied to large public-nongovernmental holdings - *Bonyads*, which own a large part of Iran's economy- and also agencies in the defense and military sector (due to security reasons)[۶]. Based on resources allocated by 1% Act, CSRT also has defined 47 large national research and technology programs and has assigned their performance to numerous consortiums with the leadership of universities (almost all public) without the presence of private firms. After election of the President Rouhani in 2013, progress of almost all these programs has faced major challenges.

The second important act is the *"support of knowledge-based firms and institutions and commercializing of innovations and inventions Act"* enacted in 2010, which aims to support firms and institutions categorized as *knowledge-based*. In 2013, the execution of the Act assigned to the *Vice-Presidential for Science and Technology*. According to this act, firms and institutions which at least 50% of their income in previous year has been from selling knowledge-based goods/services will be considered as knowledge-based. The criterion for considering a

[۶] Interview with MahdiNejad, the then Research Deputy of Minister of Science, Research, and Technology, and then president of CSRT; Retrieved from: http://www.farzaninstitute.com/index.php?option=com_content&task=view&id=۱۸۴۰

goods/service to be knowledge-based is a very long list composed of 13 main categories and 104 subcategories which is subcategorized by more four levels[۷]. Until now, the most important supports has included:

- Exemption from payment of taxes, duties, and customs duties
- Taking advantage of low-interest or no-interest long-term or short-term loans as well as a variety of guaranties
- Exemption of the some personnel from mandatory military service

It denotes attention that above long-term or short-term loans are given through a large national fund which is called "Innovation and Development Fund". This fund is managed under direct supervision of the President and has begun to work by a public budget of 250 m$.

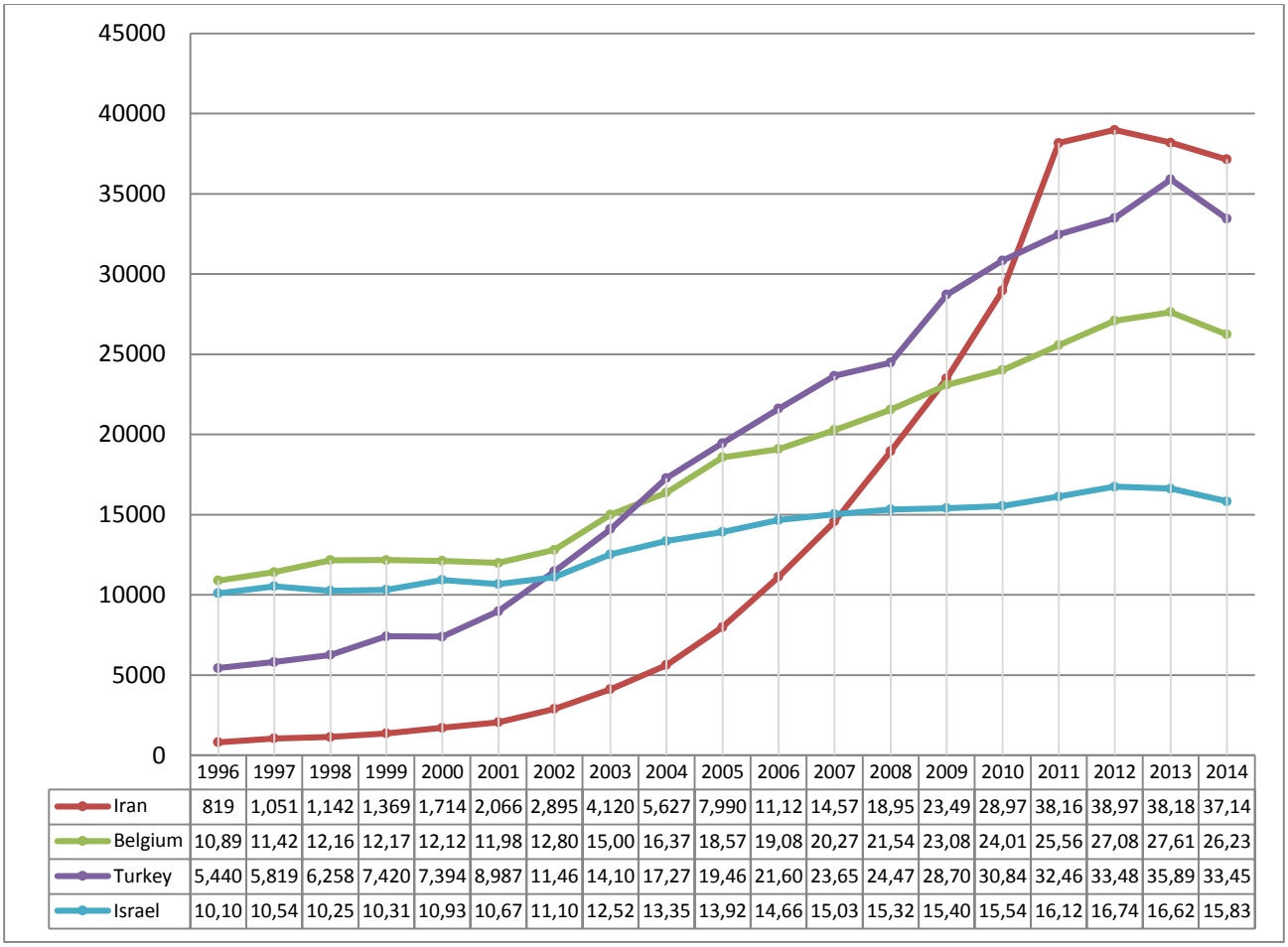
The discourse of science and technology is also well evident at the higher education. The stunning growth of Iran's published articles has been such that based on Thomson Reuters (Adams et al., 2011) Iran has had the fastest growth in world in recent decade. Table 3 shows Iran's rank in total published articles in SCOPUS (accumulated since 1996) in 2014. Figure 5 also demonstrate well the very fast growth of Iran.

Rank	Country	Documents
1	USA	8626193
2	China	3617355
3	Britain	2397817
…		
20	Turkey	390874
21	Belgium	372093
22	Iran	287010
23	Israel	272352
24	Austria	268472

Table 3. Iran's rank among world countries in published articles in the SCOPUS (1996-2014) (*Source: SCImago*[۸])

[۷] For the complete list of goods/services which are categorized as knowledge-based, see: http://daneshbonyan.isti.ir/uploads/fehrest_۹۴۰۴۲۹__۳۲۲۷۵.pdf

[۸] SCImago Journal & Country Rank: www.scimagojr.com



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Iran	819	1,051	1,142	1,369	1,714	2,066	2,895	4,120	5,627	7,990	11,12	14,57	18,95	23,49	28,97	38,16	38,97	38,18	37,14
Belgium	10,89	11,42	12,16	12,17	12,12	11,98	12,80	15,00	16,37	18,57	19,08	20,27	21,54	23,08	24,01	25,56	27,08	27,61	26,23
Turkey	5,440	5,819	6,258	7,420	7,394	8,987	11,46	14,10	17,27	19,46	21,60	23,65	24,47	28,70	30,84	32,46	33,48	35,89	33,45
Israel	10,10	10,54	10,25	10,31	10,93	10,67	11,10	12,52	13,35	13,92	14,66	15,03	15,32	15,40	15,54	16,12	16,74	16,62	15,83

Figure 5. Number of yearly published articles for Iran and three other countries with the same rank in the SCOPUS (*Source: SCImago*)

The stunning number of Iran's science and engineering graduates is also noticeable. Iran has the most number of science and engineering graduates (233695 persons in year) after China, India, Russia and United States (figure 6; albeit in the figure, information of China and India does not exist, but because of these countries' billion population, it's obvious that they have rank of 1 and 2).

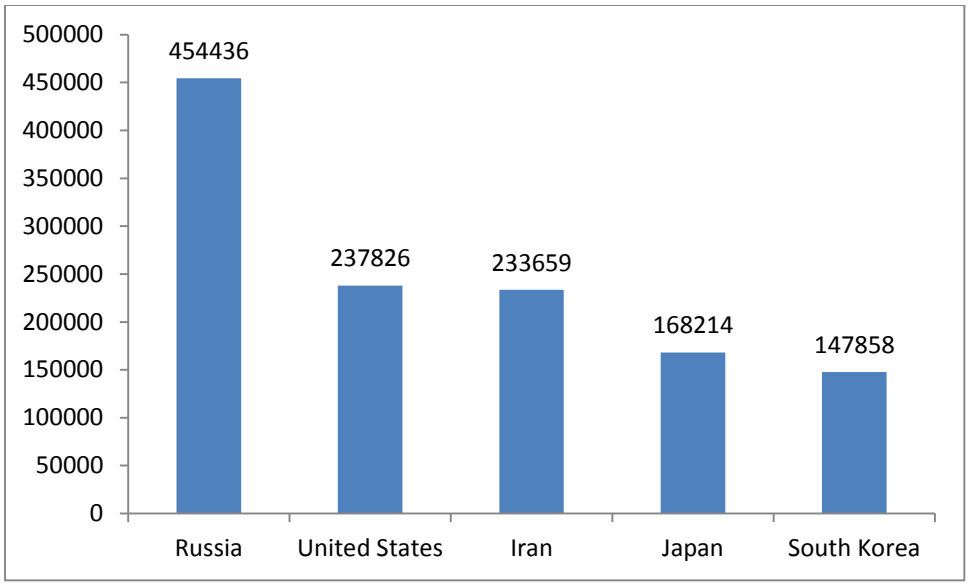


Figure 6. Number of yearly engineering graduates in first ranked countries (*Source: World Economic Forum report*)

5. Iran's Innovation and economy output

Now let's see the other side of science and technology in Iran: To what extent, science and technology policies in Iran has been successful in heightening Iran's innovation? Indicators can answer this question well. First, let's consider one of the most important innovation indicators, i.e. patent applications by country's population. The most important database used in measuring patent applications is the triadic databases of EPO[9], USTPO[10], and JPO[11], called *Triadic Patent Families*.

The below figure demonstrates "the ratio of patent applications in Triadic Patent Families to published articles" for Iran and some same rank countries (in Scopus). This indicator, in some way illustrates the ratio of innovation output to innovation input. As evident in the figure, Iran has the lowest rank among the countries, ¼ of the next country, i.e. Turkey.

[9] European Patent Office
[10] United States Patent and Trademark Office
[11] Japan Patent Office

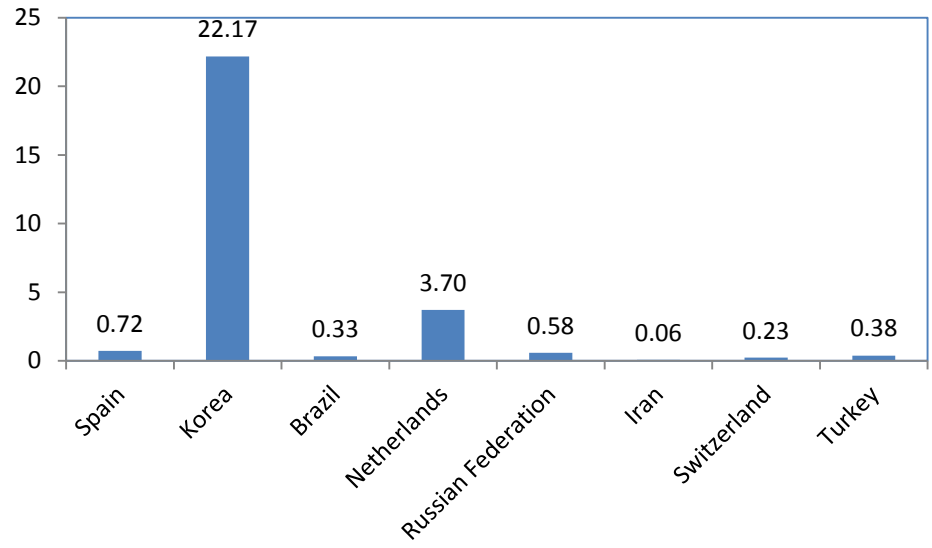


Figure 7. The ratio of patent applications in Triadic Patent Families to published articles for Iran and some same rank countries (in Scopus) in 2014 (*Source: SCImago & WIPO statistics database*)

The next indicator is the amount of Iran's manufactured exports. We can compare "the ratio of manufactured exports to GDP" for Iran and some same rank countries (in GDP) plus South Korea -the country began its industrial development at the same time with Iran- (Figure 8). In this indicator, Iran has the lowest rank, too, which means Iran's low competitiveness compared to other countries.

Country	GDP (million dollar)
Turkey	798,781
Saudi Arabia	753,831
Iran	425,236
Sweden	573,817
Argentina	529,726
Belgium	531,761
South Korea	1,411,333

Table 3. GDP of some same rank countries, plus South Korea in 2014 (*Source: World databank*[۱۲])

[۱۲] http://data.worldbank.org/indicator

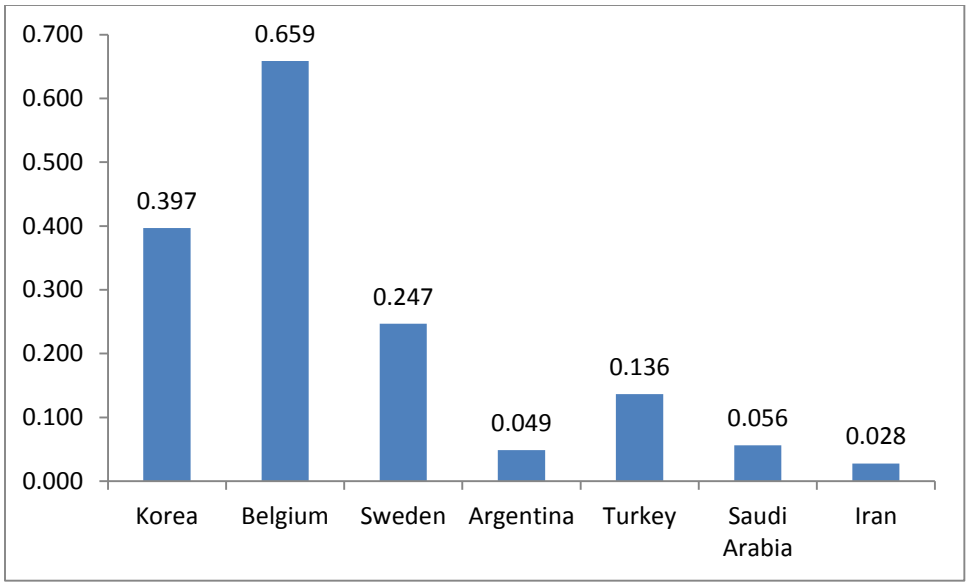


Figure 8. The ratio of manufactured exports to GDP for Iran and some same rank countries (in GDP) plus South Korea in 2011 (*Source: World databank*)

The next indicator is high-tech exports and comparison of it to GDP for Iran and some same rank countries (in GDP) plus South Korea. Figure 9 illustrates that only Saudi Arabia has the lower rank than Iran.

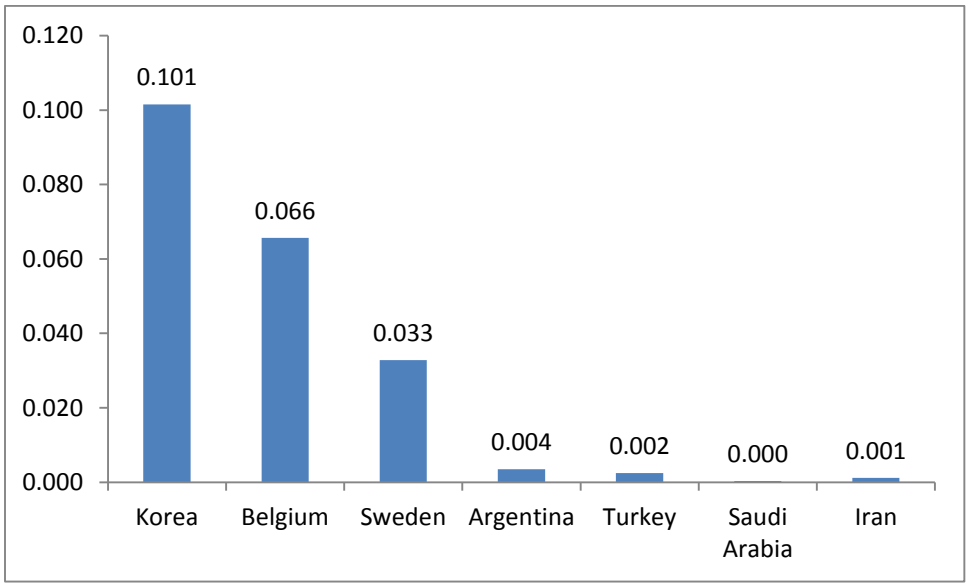


Figure 9. The ratio of high-tech exports to GDP for Iran and some same rank countries (in GDP) plus South Korea in 2011 (*Source: World databank*)

It's interesting that even in the only indicator that seems Iran has an acceptable position (i.e. number of published articles) a deeper look at *more qualitative indicators* -"number of citations", "number of citations per document", and H-index, and comparison of Iran with the same rank

countries (figure 5, above) reveals another important hidden fact. Figures 10-12 illustrate that with respect to qualitative indicators, Iran has a meaningful distance from same rank countries.

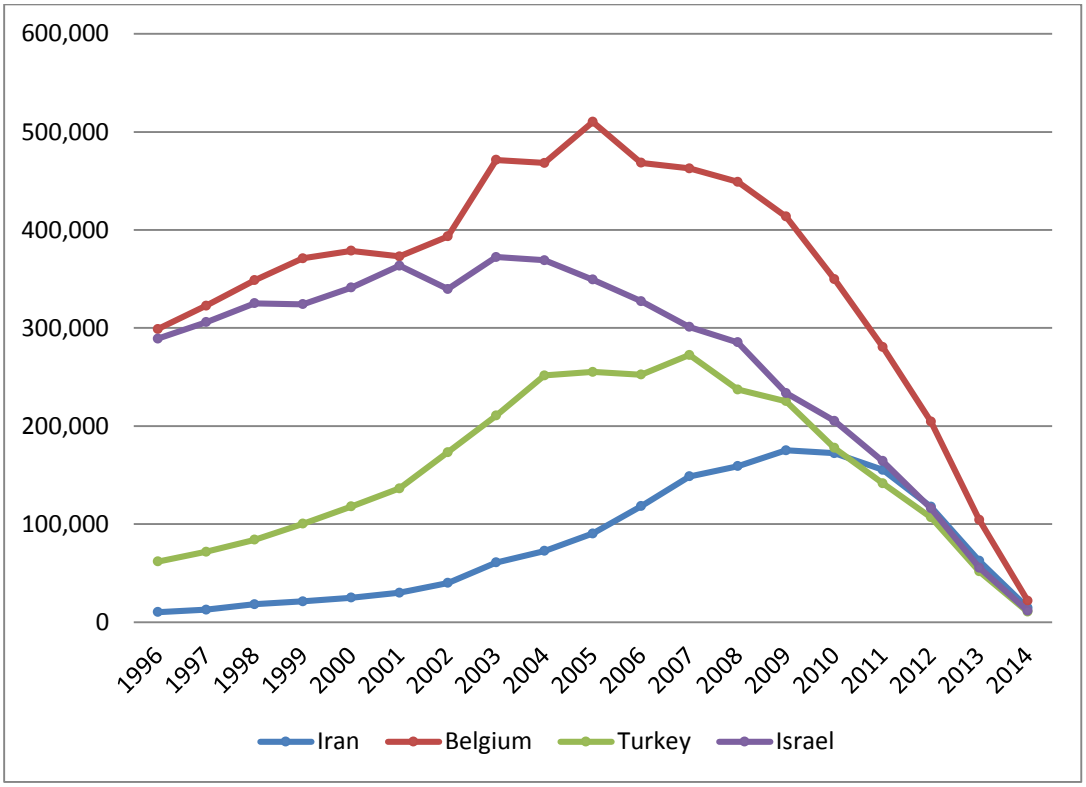


Figure 10. Number of citations for Iran and some same rank countries (*Source: SCImago*)

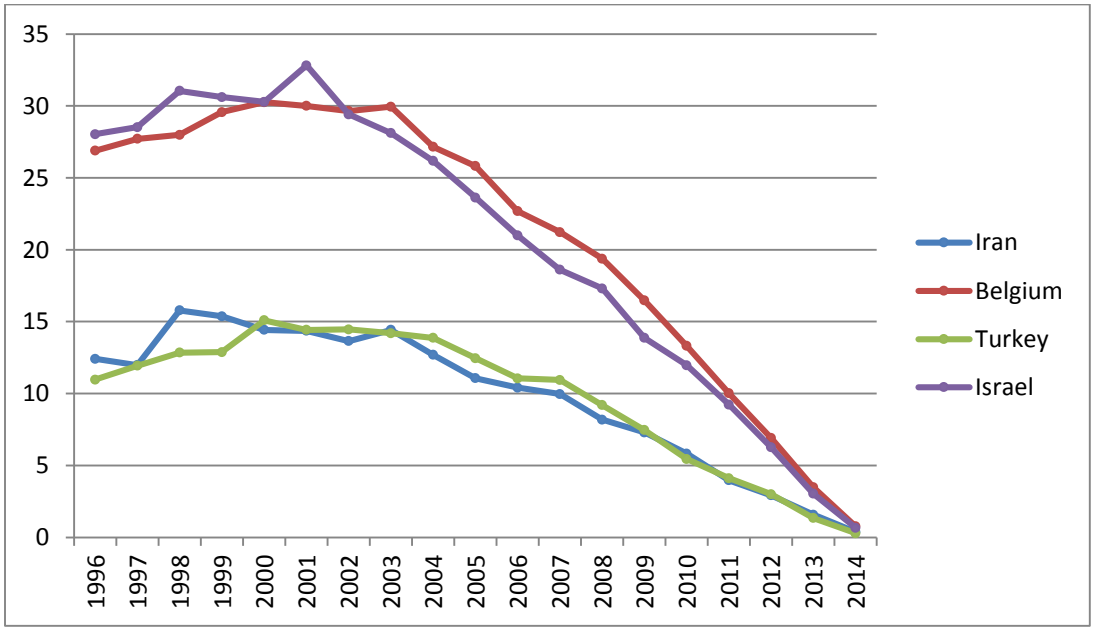


Figure 11. Number of "citations per document" for Iran and some same rank countries (*Source: SCImago*)

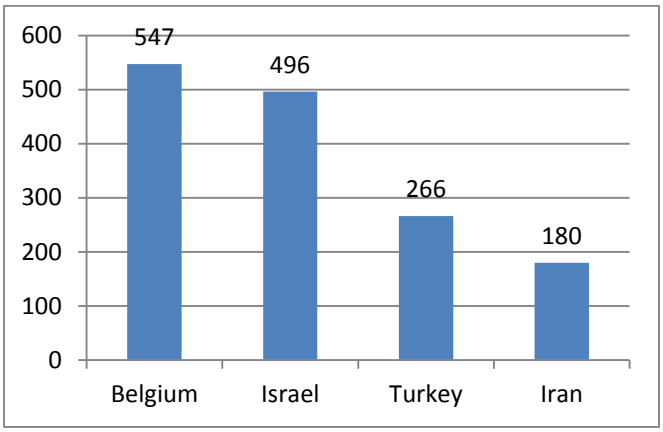


Figure 12. H-index for Iran and some same rank countries (*Source: SCImago*)

6. What is the root cause of the paradox?

As illustrated in the literature review section, in National Innovation System studies three factors is enumerated for high innovation output: 1. The excellence of firms in important general capabilities; Albeit, developing such general capabilities is never possible without exposing firms to an intense international competition. 2. The existence of a strong education system, which can provide a continuous supply of knowledgeable and skillful labor for firms. 3. The separation of the country's universities and research centers from the Ivory Tower, and their continuous efforts to solve the society's problems. Because in previous sections, we showed well numerous evidences about the existence of a strong education system in Iran, we can conclude that the root cause of the paradox should be found in deficiency of two other characteristics. Then, in our second level of analysis, we will show that the cause of these two deficiencies is rooted in another one: "the power of incumbents and their efforts to maintain the status quo" and "governance of a particular rule of game on science and technology field's actors which has directed them to show ineffective behaviors"

6. 1. Power in hands of incumbent firms

As Nelson (1993) shows, in all historical cases of catch-up, from the United States in 19th century to new industrialized East Asian tigers, we can well observe the protection of domestic industries by governments. However, there are also many historical evidences in which, domestic industry

protection has never lead to a strong and competitive industry; For example, consider electronics industry in France or import substitutions in Latin America especially in Brazil and Argentina. Hence, an important question arises: When does policy of domestic industry protection lead to a favorable result? Nelson (1993) answers:

> "… Do the [protected] infants ever grow up? Some do and some do not … If I were to make a bet it is that the differences reside in two things. First, the education and training systems that in some cases did and in others did not provide the protected firms with the strong skills they needed to make it on their own. Second, … the extent to which economic conditions, including government policies, provide strong incentives for the firms to quickly start trying to compete on world markets, as contrasted with hunkering down in their protected enclave (۱۹۹۳, p. ۵۱4)"

In spite of the above importance of exposing of firms in an international competition, unfortunately we must say that Iran's industrial policies have never been in such a way. For an important example, in Iran, there is not any policy which stipulate getting help from government -especially getting loans from banks (almost public) - to export output. To prove this, we can take a look at the automobile industry, the second controversial industry in Iran, after oil industry, which has received numerous kinds of support from government in recent decades. The automobile industry was the only industry which its name included in the *Recession Package* of President Rouhani in 2015[۱۳]. In this industry, at the peak of production before severe international sanctions, i.e. in 2011, the automobile production of Iranian automobile producers equaled 1.603.250 automobiles, while just 24.373 of them were exported, i.e. 1.5%[۱۴]. A glance at the destinations of this export, Venezuela, Iraq, Azerbaijan, and Senegal[۱۵], shows well that this trivial export, is more the result of close political relationships between Iran and mentioned countries, especially during President Ahmadinejad's presidency.

Now, if we put the fact of "lack of any pressure on firms to export" near the fact of "the very high tariff rate on imported goods -the highest in the region (table 6)" we get to what Rodrik (2008) calls *"too much of the carrot and too little of the stick"*:

> "… Since self-discovery [discovery of which new activities can be done at low enough cost to be profitable in a country] requires rents to be provided to entrepreneurs, one side

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[۱۳] Nobakht, the Deputy of the President Rouhani, in an interview with press; Retrieved from: http://www.farsnews.com/۱۳۹۴۰۷۲۵۰۰۰۹۹۶

[۱۴] The formal website of Iranian automobile producers association: http://ivma.ir/

[۱۵] Ali Elmi, the Deputy of Export and International Affairs of Iran Khodro, in an interview with Mehr Press; Retrieved from: http://www.mehrnews.com/news/۲۴۱۹۱۶۷

The formal website of Saipa; Retrieved from: http://www.saipanews.com/view-۶۱۶۷.html

of the policy has to take the form of a carrot. This can be a subsidy of some kind, trade protection, or the provision of venture capital … To ensure that mistakes are not perpetuated and bad projects are phased out, these rents must in turn be subject either to performance requirements (for example, a requirement to export), or to close monitoring of the uses to which they are put. In other words, there has to be a stick to discipline opportunistic action by the recipient of the subsidy. East Asian industrial policies have typically had both elements … Latin American industrial policies typically have used too much of the carrot, and too little of the stick, which explains why Latin America has ended up with much inefficiency alongside some world-class industries … (٢٠٠٨, p. ١٠٦)"

	٢٠١١	٢٠١٢	٢٠١٣	٢٠١٤
Iran	20.1	19.6	19.6	21.8
Saudi Arabia	3.8	3.9	3.9	3.9
Egypt	8.0	8.1	8.1	8.1
Israel	1.1	3.5	3.5	3.5
Turkey	1.8	2.4	2.4	2.7

Table 6. Weighted tariff rate on imports (*Source: Global Innovation Index, 2014*)

A glance at punitive policies of South Korea, from Linsu Kim -one of well-known historians on South Korea's industrial development- illustrates well the deficiency of Iran's industrial policies from another aspect:

"… Where Korea differs from other developing countries in promoting big businesses was in the discipline its state exercised over these chaebols by penalizing poor performers and rewarding only good ones … [T]he government refused to bail out relatively large scale, badly managed, bankrupt firms in otherwise healthy industries, instead selected better managed chaebols to take over them … As a result, only three of the largest ١٠ chaebols in ١٩٦٥—Samsung, Lucky-Goldstar, and SsangYong—remained on the same list ١٠ years later. Similarly, seven of the largest ١٠ in ١٩٧٥ remained on the same list in ١٩٨٥ … (١٩٩٣, p. ٣٦٣)"

But why in Iran, policies have been so deficient? We believe the answer is laid in power structure and especially in *incumbents' power* and their efforts to maintain the status quo. These incumbents have become an impartible part of the state, and their interests encourage them to stay against and block any new policy which aims to force them change (e.g. to put them on international competition). But from where these incumbents have emerged? A historical look will answer this question.

After the Islamic Revolution, and influenced by the revolutionary atmosphere of that period, the private sector and almost all entrepreneurs excluded from the economy, which peaked in confiscation of all properties of 52 well-known entrepreneurs by Islamic Revolution Council [۱۶] which is known as the *"52 persons list"*:

> 'After the Revolution [in 1979] the popular belief was that, capitalists are related with Pahlavi Family and have helped the establishment of the regime. If one could find any relationship between a capitalist and the Pahlavi regime, this lead to confiscation … which done for the relief of people … Therefore, confiscations at the early periods of the Revolution, was a revolutionary step to general satisfaction … [۱۷]

This negative atmosphere against entrepreneurs and the private sector, could be seen well in the considered position of the private sector in the *article 44 of the Constitution*, the most important article related with the national economy:

> "The Islamic Republic of Iran's economy is based on three sector, the public, the cooperative, and the private, with discipline and proper planning.
>
> The public sector includes all large-scale industries, upper-hand industries, foreign trade, large minerals, banking, insurance, power generation, dams and large-scale irrigation networks, radio and television, post, telegraph and telephone, aviation, shipping, roads and railroads, among others, which is in the ownership of the state.
>
> The cooperative sector includes production and distribution companies and institutions that are formed in towns and rurals in accordance with Islamic criteria.
>
> The private sector includes those part of agriculture, livestock, industry, trade and services **that supplement the economic activities of the public and the cooperative sector** (Bolds added)".

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[۱۶] The Islamic Revolution Council was established with Ayatollah Khomeini's command. This Council was the main pillar of political and administrative power of the revolutionaries.

[17] Mohsen Khalili Iraqi in an interview with Tejarat Farda magaizne:
http://tejarat.donya-e-eqtesad.com/fa/packagestories/details?service=economy&story=c۰۲۷۳۳df-۴-۹۶۰۰dab-۸۵a۸-d۹۱ba۶۰ac۱۱b
Khalili Iraqi is one of 52 persons who remained in Iran and finally recaptured his assets.

In other words, influenced by the revolutionary atmosphere of that period, the private sector was considered not as the main actor of the economy, but as the supplement to the public and the cooperative sector[۱۸].

After a while, the Islamic Revolution Council nationalized all banks and passed a new order, according to it, the state was able to assign one or more persons to the CEO or board of directors of firms to prevent their closures and bankruptcy, which finally lead to a new order[۱۹], according to it, the Islamic Revolution Council nationalized all metals production (such as steel, copper, aluminum), manufacturing and assembly of ships, planes and cars, and large minerals, in addition to oil, gas, railways, electricity, fisheries, which were formerly nationalized.

Albeit, many analysts, attribute these articles and orders to the breach of leftists and Marxists into the revolutionary groups:

> "What led to the enacion of the article 44 was not the efforts of revolutionary groups or political parties, but was the impact of the overall atmosphere of Iran in those years. In that atmosphere, the leftism was dominant, and even religious groups were influenced by it. It was a dominant atmosphere in those years … Leftists' slogans was bread, housing, and freedom; freedom was the last part. The slogan meant all utilities must be distributed equally. They were looking for a utopia in which, all work, all are paid the same, and no difference be between engineer and the labor. Everyone should seek and consume according to his needs[۲۰]"

> "In that period, anti-capitalist spirit was all over. Most of the students and some of labors, were sloganed everyday "Down with the capitalist". We said to them 'you should at least distinguish between national capitalist and dependent capitalist", but they considered all the capitalists as the same. They said "no difference between capitalists, all of them are dependent". They argued that we must fight imperialism and capitalists are the representatives of imperialism. The Revolution won in this atmosphere …[۲۱]"

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[18] In 2006 and due to the inefficiencies of the article 44 for Iran's economy, a new interpretion was made by Iran's Supreme Leader on this article. According to this new interpretion, transfer of 80% of state-owned enterprises' shares was allowed to the private sector, cooperatives, and non-governmental institutions.

[۱۹] http://rc.majlis.ir/fa/law/show/98153

http://rc.majlis.ir/fa/law/show/98134

http://rc.majlis.ir/fa/law/show/98129

[۲۰] Morteza Nabavi, the then Minister of Industries and Minerals, in an interview with Donya ye Eghtesad newspapaer:

http://donya-e-eqtesad.com/news/۷۱۶۴۵۳

[۲۱] Izzatollah Sahabi, a member of the Council for Protection of Iran's Industries, in an interview with Mehrnameh magazine:

http://www.mehrnameh.ir/article/۳۶۱۸

After confiscation, most of the firms were possessed by newly established institutions called Bonyads (now called non-governmental public organizations) and hence became a part of the Iran's ruling system. Bonyads are not in the control of the government and according to law, the monitoring agencies are not allowed to monitor them; these Bonyads are not even under supervision of national Business Law and they are also exempt from paying taxes. Some informal statistics estimate that Bonyads have 25 to 30 % of Iran's GDP[۲۲]. The share of these institutions from the economy is such that the president Rouhani describes them as the "giant creature":

> "… In the constitution, three sectors are listed: the public, the private, and the cooperative. But today, we are faced with a fourth kind with the name of non-governmental public organizations. How to monitor this giant creature? …[۲۳] "

During time, other conglomerates, this time by governmental agencies and especially by governmental insurance and pension funds, have been founded. Most of these conglomerates have businesses in numerous industries and based on current estimations, 70 % of the value of stock market belong to them[۲۴].

The share of the above ruling-governmental conglomerates from Iran's economy is such that the president of the Council for Competitiveness speaks of the need for new legislation to restrict theses conglomerates' share to 40 % of the Iran's market[۲۵]. According to a research by Parliament, 61.2 % of transfers in the privatization process of the economy in recent 14 years, again has been possessed by ruling-governmental conglomerates[۲۶]. The following table, demonstrates some of these conglomerates, their businesses, and their estimated assets.

Name	**Complementary explanation**	**Businesses**	**Sales Volume or Estimated Assets**

[۲۲] Saeed Lylaz, the famous Iranian economist, in an interview with Iran newspapaer:
http://www.ion.ir/News/۱۲۰۲۱۴.html

[۲۳] President Rouhani in Kermanshah:
http://dolat.ir/detail/۲۸۱۶۲۶

[۲۴] Mohammadreza Pourebrahimi, the deputy of the president of the Parlimant's Economic Commission in, in an interview with a TV show *Payesh*, June 2014

[۲۵] Reza Shiva, the president of Council for Competitiveness in an interview with press:
http://www.mehrnews.com/

[۲۶] Hosseini, the parlimant member, in an interview with Mehr press:
http://www.mehrnews.com/news/۳۸۲۳۵۲۲

Bonyad Mostazafan Enghelab Islami	Aim of establishment: Identification, confiscation and management of properties of the Pahlavi's associates with the aim of helping the poors	Agriculture, mining, engineering and urban development, power and energy, information technology, food industry, finance and investment, insurance	Sales volume: upmost 6.4 billion $[۲۷]
Shasta Investing Company	Aim of establishment: A source of revenue for the Iran's Social Security Organization (largest social insurer in Iran)	Oil, gas, petrochemical, pharmaceutical, cement, metal and non-metallic minerals, construction and transport, energy and power, food, housing and urban development, medical, mobile operator (third operator in Iran)(	Estimated assets: 11.7 billion $ Possessor of 10% of the value of the stock market Annual profit: upmost 1 billion $[۲۸]
Razavi Economic organization	It has responsibity of management and exploitation of endowments to Astan Quds Razavi, shrine of the eighth Imam of the Shiites	Pharmaceutical, finance and investment, agriculture, construction and building, automotive, food industry, textile, animal husbandry, information technology, oil and gas, mining industries	No accurate information till now
Qadir Investing Company	Its main shareholder is the Armed Forces' Social Security Organization	Maritime transport, industry and mining, trade and finance, power and energy, oil, gas and petrochemical industry, construction, cement industry	Sales volume: upmost 7.9 billion $[۲۹]
Oil Industry Employees' Pension Fund Investing Company	-	Financial, mining and metals, oil, gas, petrochemical and refining, ICT, transport, real estate	Sales volume: upmost 4.2 billion $[۳۰]

[۲۷] Retrieved from the formal website of the company:
http://www.irmf.ir/

[۲۸] NejatAmini, the Economic and Planning deputy of Iran's Social Security Organization, in an interview with Mehr press:
http://www.mehrnews.com/

[۲۹] Retrieved from the formal website of the company:
http://ghadir-group.com/

[۳۰] IMI 100, a ranking of Iranian companies based on sales volume:
http://imi100.imi.ir/SitePages/RankingFirst100.aspx

Table 8. Some of Iran's conglomerates, their businesses, and their estimated assets

The interests of these incumbents encourage them to hinder any policy aimed to make change in the status quo (e.g. to put them on international competition) and because they are impartible part of the state, it has been not so difficult for them: from security breach into the *National Privatization Organization (NPO)* to eliminate the most important rival from the private sector, to bring in the Iran's Supreme Leader to prevent the reduction of tariff rates by the Parliament.

First, we narrate the incumbents' security breach into the NPO and elimination of the most important rival from the private sector in the biggest privatization deal in the history of the nation, i.e. privatization of *Telecommunication Company of Iran*:

> '… Suddenly it was announced that Pishgaman Kavir Yazd Co [the incumbent's rival from the private sector] has been disqualified and concurrently has quit the deal. According to the CEO of the Iran Stock Company, the NPO has just sent the approval of only two consortia [associated with military and security agencies] and the name of Pishgaman was not on the list …[۳۱]'

> '… Because Telecommunication Company of Iran is a high risk and security company, it was decided that security qualification of buyers to be approved, too … after that decision, it was announced that security qualification of Pishgaman Kavir Yazd Co has not been approved …[۳۲]"

> "… The evening at 15:39, we received a letter from NPO that security qualification of Pishgaman Kavir Yazd Co for participation in the privatization of Telecommunication Company of Iran has not been approved …[۳۳]"

Now we narrate another controversial event, in which, incumbents brought in the Iran's Supreme Leader to prevent the reduction of tariff rates by the Parliament:

> "Advocates of high tariff rates argued that high rates lead to increase of foreign cars prices and hence, people incline to domestic cars and therefore, the car industry goes on and the job security of hundreds of thousands of labor protected. But opponents believed that tariff support for car makers has led to their laziness and their demotivation to increase the

[۳۱] Retrieved from Tabnak news website:
http://www.tabnak.ir/fa/news/66149
[۳۲] Oghadaii, the deputy of NPO in an interview with press:
http://www.tabnak.ir/fa/news/66149
[۳۳] RezaiiNejad, the CEO of Pishgaman Kavir Yazd Co in an interview with press:
http://www.tabnak.ir/fa/news/66149

> quality of products and decrease the cost of production, and believed that by decreasing the tariff rate, a competitive condition should be created between domestic and foreign carmakers so domestic carmakers consider the quality improvement more seriously… This debate, at last arrived at Parliament and lawmakers finally approved decrease of 20% in tariff rate…[۳۴] ‘

First, President Ahmadinejad opposed the parliament’s decision:

> “I don’t use to complain, but we face increasing tariff rates for people’s everyday products, but we face decreasing tariff rates for products like car that we have in our country … what is the outcome of these decisions for the nation? If the industry needs to be improved, the way ahead is not decreasing the price of the imported cars. These decisions show that some lawmakers want to impede the way of Iran development …[۳۵]”

Lastly, incumbents brought in the Iran’s Supreme Leader:

> “There are some points which I want to emphasize. First, if we care the domestic industry, like car industry here or other industries, we must adjust our trade policy, i.e. excessive imports surely harm our economy. Policy makers must pay attention to this. Albeit abundance and cheapness is a very good thing but what is more important is the growth and establishment of domestic industry. This is not right that we open our gates to imports, almost because of false reasons …[۳۶]”

However, Hamidi et al. (*in press*) have shown that how when incumbents leaving the field and challengers arriving into field, the Iran’s biopharmaceuticals industry has been able to transit from the “*production capacity stage* (with domination of incumbents)” to the “*technological capability stage* (with domination of challengers)”. In fact, in Iran, the first efforts for biomedicine production were from dominant incumbents, i.e. governmental and semi-governmental firms, in the production capacity stage. *Red Crescent Organization*’s efforts were followed by those of *Shafaye Bandargaz* to achieve antibiotic technology, and *Darou Pakhsh*’s efforts in the Hepatitis B vaccine, were the first projects. These firms, by using the *full package* method, started the process of technology acquisition from European companies. However, all of these projects failed. In this method, incumbents paid little attention to achieving technological knowledge, and they tried to acquire technology as a *ready to use package*. At other hand, the bureaucratic structure of

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[۳۴] Retrieved from Asr Iran news website:
http://www.asriran.com/fa/news/105933

[۳۵] President Ahmadinejad in an interview with press:
http://www.asriran.com/fa/news/105933

[۳۶] Ayatollah Khamenei in a visit from carmakers:
http://farsi.khamenei.ir/speech-content?id=9071

incumbents did not allow them the *try and error* required for achieving more complex technologies.

But in the next generation of firms, in which, challengers entered and technological capabilities began to develop, a group of university professors and researchers started founding *science-based private firms (POSBs)* at the periphery of universities and research centers. *Tehran University of Medical Sciences (TUMS)* and the *Pasteur Institute of Iran* were the two most important ones in igniting this generation. *Pouyesh Darou* and *Zistdarou Danesh* were the first private firms founded by TUMS professors. In addition, *Cinagen* was founded by a number of Pasteur Institute researchers. Finally, *Pars Notarkib* was founded by a professor of *Shahid Beheshti University of Medical Sciences*. These firms changed the method of achieving bio-medicine production technological knowledge because there was not so much historical successes from full-package procurement method. Hence, these firms, full of expert human resources, tried to achieve technology from diverse sources. In sum, the most important characteristic of this generation of firms was spillover of university researchers into private sector and as the result, emergence of science-based firms.

Noticing the success of these pioneer firms, similar firms with the same structure and characteristics began to grow rapidly and almost 40 firms emerged around Tehran's big universities. After some years, their geographic distribution moved beyond Tehran's borders and reached other states, like Tabriz, Mashad, Isfahan, and Gorgan.

Now, some of the biosimilar produced in Iran are the first in the world after the origin firm. For example, Interferon Beta 1A (IB1A) produced by Cinagen Co., with the trade name of Cinnovex, is the world's second commercially produced IB1A. Aryogen Co. and SamanDarou Co. are also the first producers of blood-coagulation factor (VII) and (VIII) biosimilars. These companies are successful at commercializing biosimilar. These firms have caught-up to R&D capability, and several products of them are in the process of development which could be available in the market by 2018.

6. 2. Leave the problem; be a machine of article production

Nelson (1993) and Mazzeloni and Nelson (2007) have shown in their important studies that universities and research centers have been a very important institutional player in the catch-up process of new developed countries. Albeit they note an important point about the structure of these research institutes: the researches that have played an important role in the catch-up process, never have been directed from the *Ivory Tower*; In contrast, they have been defined in close collaboration with firms -user community- and defined in such a way that can help firms solve their problems, and consequently, advance technology..

It's interesting that we can observe a similar situation in developed countries, like United States. In other words, the impact of these countries' universities and research centers on industries and national innovation has not been directed from the Ivory Tower. According to Bozeman and Broadman (2004) this impact has been almost through *Multipurpose, Multidiscipline University Research Centers (MMURCs)* and even some believe that the most important policy of United States in *interlinking university, industry, and society* has been creating such centers:

> "… While the vast majority of American universities are principally oriented toward undergraduate education, a new type of institution has emerged among the ۱۵۰ or so "research universities" that lies outside usual academic core university departments and brings together several fields of science and technology for research and development purposes. The Multipurpose, Multidiscipline University Research Center (MMURC), together with its participating research universities, has become the starting point for policy makers looking for solutions to large-scale science and technology problems that require an integrated research approach. Often, MMURCs are created and called upon to play leading roles in programs that are critical to the national interest, which historically was the province of the federal laboratory system. More recently, they are playing a leading role in regional and state economic development (Bozeman & Boardman, ۲۰۰۳, p. ۴)"

In fact, in United States, although until 1983, university departments and affiliated laboratories were the only place for doing academic research, now and after three decades, there are hundreds of MMURCs which have accommodated almost one third of the United States' scientists. Through these MMURCs, universities are encouraged to work with industry and beyond traditional academic disciplinary borders (Bozman & Boardman, 2004). In an important and high cited study, Feller and his colleagues found that MMURCs have had a very effective and influential impact on industrial innovation in United States in two last decades of 20th century. According to the United States' NSF, MMURCs are special and unique in United States' history of science and technology policy due to three reasons (Feller et al., 2002):

1. MMURCs emphasize very much on building linkage between research and education.
2. MMURCs strongly pay attention to problems which industries cannot solve.
3. MMURCs are designed in a way that can bridge between academic research world and engineering world. According to NSF, no other institution in science and technology structure of United States have covered this.

In Iran, however, in spite of establishment of numerous research centers, these centers could not take effective steps to solve problems of industry and society, due to governance of an important rule of game: *Leave the problem; be a machine of article production*:

> " … Personally, I've seen a lot of authorities who have created research center to solve their problems, but after a while, that research center has become their new problem itself, i.e. they don't know how to deal with it. Then they are forced to go to other research centers

> to solve their remained problems. For example, the research center for […] has come to us and has asked us we say to them what their mission should be. I told with myself that you were established to solve the problems of your organization, now you have come to us for your problem?!. They tell me that all of their professors are busy writing articles and don't care with the society's problems. In other words, under the pressure of macro institutional rules, the center which has been established to solve the society's problems, has forced to become a machine of article production (almost with low quality and unrelated to society's problems) and has lost its capability to solve the problems facing the society…[۳۷]"

But from where this rule of game has originated? We believe, the origin should be found in *centralized control of universities and research centers* by state, and particularly, in using a *centralized quantitative performance measurement system* by state. To understand better this phenomena, it's better to take a look at organizational structure literature, especially at the thoughts of the most famous, Henry Mintzberg. Mintzberg believes that among existing structures, the only structure which can yields itself to a quantitative performance measurement system (founded on quantitative performance standards) is the *machine structure*:

> "… [I]n the less formal configurations - entrepreneurial and innovative - which are less stable, such performance standards are difficult to establish, while in the professional configuration, the complexity of the work makes it difficult to establish such standards. Moreover, while the entrepreneurial configuration may lend itself to being integrated around a single set of goals, the innovative and professional configurations do not. Thus, only the machine configuration of the major types fits comfortably … by virtue of its integration and its operational goals … (Mintzberg, 1989, pp. 158-159)"

Mintzberg goes on, when a structure yields itself to a quantitative performance measurement system, the performance system does not encourage the structure to innovative initiatives, but become itself a real hinder against the structure to turn into such strategic innovative initiatives (1989, 166). In other words, the quantitative performance control system is almost encouraging short-term thinking and shortsightedness; attention is focused on the carrot just in front instead of the fields of vegetables beyond (Mintzberg, 1989, p.166). It's interesting that these problems would be worse in government and nonprofit sector:

> "… In fact, these problems would be worse in government because its sphere is social, and so its goals are largely ill-suited to performance control systems. In other words, many of the goals most important for the public sector - and this applies to not-for-profit organizations in spheres such as health and education as well - simply do not lend themselves to measurement, no matter how long and how hard public officials continue to try … (Mintzberg, 1989, p.171)"

[۳۷] A semi-structured interview with a research center manager

This is the exact issue we observe in Iran: the existence of a centralized quantitative performance control system which has defined by state to monitor the professors and their promotion and upgrading. And it's more interesting that such a centralized quantitative performance control system has been applied to promotion of faculty members of research centers who were supposed to solve the problems of society and industry. In fact, for promotion of faculty members of research centers, in addition to quantitative indicators for teaching, other quantitative indicators have been defined, which is must be accompanied by explicit and measurable documents:

- Scientific papers published in domestic and international academic journals
- Scientific review articles
- Science papers for the public, critical notes, and encyclopedias
- Peer reviewed papers in conference proceedings
- Peer reviewed abstracts in conference proceedings
- Papers based thesis and dissertations
- Technical knowledge, invention or patents leading to a commercial product or process
- Reports of research and technology projects solving one major problem in the country
- Inventions or explorations registered locally or internationally
- Securing local or international grants
- Other technological activities

But what has been the result of this much emphasis on quantitative measurable indicators? Quietly according to Mintzberg's prediction, the result has been the conversion of universities and research centers into machine structures: *Machines for production of articles*. To restate the Mintzberg's words: the quantitative performance control system is almost "encouraging short-term thinking and shortsightedness; attention is focused on the carrot just in front instead of the fields of vegetables beyond". This problem is well evident in words of critics of Iran's research system's status quo:

> "The incentive systems of the research institutes are not aligned to solve the problems. They are set to produce quantified outcomes largely based on the number of the papers. Once the evaluation criteria are quantified and research funds are also very limited, due to

the lack of a grant system, it divert the academics from dealing with real problems of the society towards the topics which are more prone to be easily converted to the papers[۳۸]"

With this much emphasis on quantitative indicators, it is not surprising that in Iran, just during a decade (from 2000 till 2013), the number of journals approved by the Ministry of Science, Research and Technology increased by 5380%, i.e. multiplied by 54 during just 13 years!. For example, one of research centers in social science which had just 1 approved journal in 2010, owned 21 more approved journals during just 2 years![۳۹]

When we add to this, the mechanism of allocation of funds to universities and research centers, which is based on faculty and students *per capita*, and the *lack of a grant system*, the low quality of published articles in Iran (i.e. low H-index and low citations) would not be surprising:

"In the Gold Rush movie, produced by Charlie Chaplin, one person who is hungry, see another person as a chicken and tries to capture it. Similar to this, it could be said that some of the faculty members view the students as the bag of money whom should be captured. They view the students as a hunt who should be hunted. The university faculties who approach the dissertations as a source of revenue, need to supervise or give advice multiple dissertations at one. But since they teach or research in a limited number of fields, they will receive a limited number dissertations if they are to stick to their fields of expertise. In this condition, they have two options: They either force the students to keep away from their desired topic and change to what their teacher wants, or they [faculties] diversify to a larger number of topics in which they do not have deep expertise. For the second way, it is sufficient to look at the list of dissertations in education groups … to understand the depth of the disaster. For example, one of the faculty members accepted to supervise a thesis about Foucault, even not knowing how to spell the name of this French philosopher in English. It is also interesting that other faculty members often do not object, as they do not want to receive similar objection from their colleagues. Unfortunately there are some unwritten laws in educational groups: I do not object your dissertation, so you do not object mine. But if someone break this bilateral rule of reciprocal silence, the others will retaliate[۴۰]"

"In Science, the debate should be about the validity, so that the science progress. However in Iran, the debate in Science is about economics. The struggle is about having PhD students to have its revenue share. The struggle of each faculty is to have its own doctoral

[۳۸] A semi-structured interview with a research center manager

[۳۹] Extracted from approved journals list by the Research Deputy of Ministry of Science, Research and Technology; Retrieved from: http://farhangemrooz.com/news/6442

[۴۰] Hedayat Alavitabar, Revayat magazine, number 5, autumn 2015:

http://www.cgie.org.ir/fa/news/۸۳۷۷

student and about the number of students. The criteria is not whether he/she works in my field or not[۴۱]"

7. Discussion and Conclusion

The discussion and conclusion section of this study will be presented in two sections. First, it seems that our results are more compatible with Dosi et al. (2006). In other words, as the weakness of the Europe is rooted in both sides of the story and there is not such a thing like European Paradox, we believe the same for Iran: there is not such a paradox; the real problem, at one hand, is the weakness of university research and lack of problem orientation in universities and research centers, and at other hand, is the lack of demand from the side of firms due to lack of pressure on them to export and compete internationally and to be more innovate. However, we elaborated another important aspect to both weaknesses: "the power of incumbents and their efforts to maintain status quo" and "governance of a particular rule of game on science and technology field's actors which has directed them to show ineffective behaviors".

Second, at a deeper look, the effect of incumbents and centralized state on the field's actors, is like the effect of *isomorphism* in *institutional theory* literature: the emergence of powerful forces which direct or force all field members to become similar to each other (DiMaggio & Powell, 1983; Scott, 2013) and at last, hinder innovation. Kondra and Hinings (1998) explain this phenomena like this:

> " … Operating within institutional norms provides a high probability (low risk) that the organization will receive an acceptable return for its efforts: that is, performance will be acceptable, based on the standards of the organizational field. It is assumed that organizations operating within the institutional range of performance will have their performance judged acceptable by shareholders because their performance is within the 'normal' (read institutional) range of performance. Shareholders' difficulty in monitoring organizational performance may provide them with few objective standards on which to judge performance, and this could be in the best interest of the dominant coalition ... (1998, p. 748)"

We can see similar explanations in *innovation system* literature too (Lundvall et al., 2006; Storz, 2008). Moreovor, supposing a nation as a field (Lundvall, 1992; Nelson, 1992) the more cultural coherent a nation is (like initial periods of revolutions) or the more politically central is, the more isomorphic forces will be (Hung & Whittington, 2011).

However, numerous historical cases have shown that a society's innovation, will be finally dependent on diversity and emergence of *new organization forms* in that society (Hannan &

[۴۱] A semi-structured interview with a social science department faculty

Freeman, 1989; Romanelli, 1991; Kondra & Hinnings, 1998): emergence of R&D based firms in Germany and catch-up of this country at initial decades of 20th century (Murmann, 2003); emergence of M-form firms in the United States and consequent emergence of mass production in this country and overtaking the Europe (Chandler, 1962; 1977); emergence of Keiretsus in Japan and Chaebols in Korea and professional firms in Taiwan and catch-up of these countries (Amsden, 1992; Fagerberg & Godinho, 2005; Hung & Whittington, 2011); emergence of new biotechnology firms in the United States and leading position of this country in world (Mowery et al., 2005; Nelson, 2008); emergence of application-oriented research centers in East Asian countries and impact of these research centers on the catch-up process (Mazolleni & Nelson, 2007); emergence of Multipurpose, Multidiscipline University Research Centers in the United States as the most effective linkage between university and industry (Feller et al., 2002; Bozman & Boardman, 2004); and many others, all point to the importance of formation and emergence of new organizational forms in each society. As Hoff and Stiglitz (2001) have expressed:

> "[D]evelopment is no longer seen primarily as a process of capital accumulation but rather as a process of organizational change" (Hoff and Stiglitz, 2001, p.389).

But how can a society escape from isomorphism and establish an appropriate conditions for emergence of new organizational forms. The literature reply is in creativity and initiatives of *institutional entrepreneurs*. For example, Tracy et al. (2011) argue that an important way in which new organizational forms are created is when institutional entrepreneurs combine elements of established institutional logics and create a new organizational form underpinned by a new, hybrid logic. Suddaby and Greenwood (2005) argue that new organizational forms are created through a discursive process of theorization on the part of institutional entrepreneurs. Rao et al (2000) conceptualize the construction of new organizational forms as a political process by institutional entrepreneurs who lead efforts to identify political opportunities, frame issues and problems, and mobilize constituencies and by so doing, they spearhead collective attempts to infuse new beliefs, norms, and values into social structures, thus creating discontinuities in the world of organizations.

But in which society, the conditions for emergence and presence of institutional entrepreneurs is more favorable? This can be a research question for future research.

Resources:

Acs, Z.J., Audretsch, D.B., Brunerhjelm, P. and B. Carlsson (2010) "The Missing Link, The Knowledge Filter and Entrepreneurship in Endogenous Growth." Small Business Economics 34:2, 105-125.

Adams, J., King, C., Pendlebury, D., Hook, D., & Wilsdon, J. 2011. Global Research Report Middle East: Exploring the Changing Landscape of Arabian, Persian, and Turkish Research.. *Thomson Reuters*.

Adner, R., & Levinthal, D. (2001). Demand heterogeneity and technology evolution: implications for product and process innovation. *Management science*, *47*(5), 611-628.

Afuah, A. (2000). How Much Do Your" Co-Opetitors"' Capabilities Matter in the Face of Technological Change?. *Strategic Management Journal*, 387-404.

Amsden, A. H. (1992). Asia's next giant: South Korea and late industrialization. Oxford University Press on Demand.

Arora, A., & Gambardella, A. (1994). The changing technology of technological change: general and abstract knowledge and the division of innovative labour. *Research policy*, *23*(5), 523-532.

Audretsch, D. B., & Keilbach, M. (2008). Resolving the knowledge paradox: Knowledge-spillover entrepreneurship and economic growth. *Research Policy*, *37*(10), 1697-1705.

Bell, M., & Pavitt, K. (1995). The development of technological capabilities. *Trade, technology and international competitiveness*, *22*(4831), 69-101.

Bitard, P., Edquist, C., Hommen, L., & Rickne, A. (2008). The paradox of high R&D input and low innovation output: Sweden. *WP Lund Universitiy Paper*, (2008/14).

Bozeman, B., & Boardman, C. (2003). Managing the new multipurpose, multidiscipline university research center: Institutional innovation in the academic community.

Bozeman, B., & Boardman, C. (2004). The NSF Engineering Research Centers and the university–industry research revolution: a brief history featuring an interview with Erich Bloch. *The Journal of Technology Transfer*, *29*(3-4), 365-375.

Braunerhjelm, P. (1998). Organization of the firm, foreign production and trade. In *The geography of multinational firms* (pp. 77-97). Springer US.

Chaminade, C., Lundvall, B. A., Vang, J., & Joseph, K. J. (2009). Designing innovation policies for development: towards a systemic experimentationbased approach. *Handbook on Innovation Systems and developing Countries: Building Domestic Capabilities in a Global Setting*.

Chandler, A., (1962). Strategy and Structure: Chapters in the History of the Industrial Enterprise. MIT Press, Cambridge.

Chandler, A., (1977). The Visible Hand: The Managerial Revolution in American Business. Harvard University Press, Cambridge.

Cunningham, P. (2009). *Demand-side innovation policies.* Pro Inno Europe Policy Brief, 1, 1-15.

Danneels, E. (2002). The dynamics of product innovation and firm competences. *Strategic management journal*, *23*(12), 1095-1121.Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic management journal*, 509-533.

Di Stefano, G., Gambardella, A., & Verona, G. (2012). Technology push and demand pull perspectives in innovation studies: Current findings and future research directions. *Research Policy*, *41*(8), 1283-1295.

DiMaggio, P. & Powell, W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. American Sociological Review, 48, 147–160.

Dosi, G., Llerena, P., & Labini, M. S. (2006). The relationships between science, technologies and their industrial exploitation: An illustration through the myths and realities of the so-called 'European Paradox'. *Research policy*, *35*(10), 1450-1464.

Edquist, C., & McKelvey, M. (1998). High R&D intensity without high tech products: a Swedish paradox?.

Fagerberg, J., & Godinho, M. M. (2005). Innovation and catching-up. *The Oxford Handbook of Innovation. Oxford University Press, New York*, 514-543.

Feller, I., Ailes, C. P., & Roessner, J. D. (2002). Impacts of research universities on technological innovation in industry: evidence from engineering research centers. *Research policy*, *31*(3), 457-474.

Fligstein, N., & McAdam, D. (2012). *A theory of fields*. Oxford University Press.

Gatignon, H., Tushman, M. L., Smith, W., & Anderson, P. (2002). A structural approach to assessing innovation: Construct development of innovation locus, type, and characteristics. *Management Science*, *48*(9), 1103-1122.

HamidiMotlagh, R., Isaai, M. T., Babaee, A. (in press). Inter-Institutional Circulation and Flow of Institutional Knowledge among State and Pioneer Entrepreneurs; the Case of the Emergence of the Biopharmaceutical Field in Iran.

Hannan, M. T., Freeman, J. (1989). Organizational Ecology. Cambridge, Mass: Ballinger

Hausmann, R., & Rodrik, D. (2003). Economic development as self-discovery. *Journal of development Economics*, *72*(2), 603-633.

Hoff, K., & Stiglitz, J. (2001). Modern economic theory and development. *Frontiers of development economics*, 389-459.

Hung, S. C., & Whittington, R. (2011). Agency in national innovation systems: Institutional entrepreneurship and the professionalization of Taiwanese IT. Research Policy, 40(4), 526-538.

Kim, L. (1993). National system of industrial innovation: dynamics of capability building in Korea. *National innovation systems: A comparative analysis*, 357-383.

Kogut, B., & Zander, U. (1996). What firms do? Coordination, identity, and learning. *Organization science*, *7*(5), 502-518.

Kondra, A. Z., & Hinings, C. R. (1998). Organizational diversity and change in institutional theory. Organization studies, 19(5), 743-767.

Lall, S. (1992). Technological capabilities and industrialization. *World development*, *20*(2), 165-186.

Langley, A. (1999). Strategies for theorizing from process data. *Academy of Management review*, *24*(4), 691-710.

Langley, A., & Abdallah, C. (2011). Templates and turns in qualitative studies of strategy and management. *Research methodology in strategy and management*, *6*, 201-235.

Lundvall, B. A. (1992). National innovation system: towards a theory of innovation and interactive learning. *Pinter, London*.

Lundvall, B. Å., Intarakumnerd, P., & Vang, J. (2006). Asia's innovation systems in transition: An introduction. *Asia's innovation system in transition*, 1-20.

Mazzoleni, R., & Nelson, R. R. (2007). Public research institutions and economic catch-up. *Research policy*, *36*(10), 1512-1528.

Mintzberg, H. (1989). *Mintzberg on management: Inside our strange world of organizations*. Simon and Schuster.

Mowery, D., Nelson, R., Sampat, B., Ziedonis, A., (۲۰۰۵). Ivory Tower and Industrial Innovation. Stanford Business School Press, Stanford.

Murmann, J. P. (2003). Knowledge and competitive advantage: The coevolution of firms, technology, and national institutions. Cambridge University Press.

Nelson, R. R. (1992). National innovation systems: a retrospective on a study. *Industrial and corporate change*, *1*(2), 347-374.

Nelson, R. R. (2008). What enables rapid economic progress: What are the needed institutions?. Research Policy, 37(1), 1-11.

Nelson, R. R. (Ed.). (1993). *National innovation systems: a comparative analysis*. Oxford university press.

Rao, H., Morrill, C., & Zald, M. N. (2000). Power plays: How social movements and collective action create new organizational forms. *Research in organizational behavior*, *22*, 237-281.

Rodrik, D. 2008. One economics, many recipes: globalization, institutions, and economic growth. Princeton University Press.

Romanelli, E. (1991). The evolution of new organizational forms. Annual review of sociology, 17(1), 79-103.

Scott, W. R. (2013). Institutions and organizations: Ideas, interests, and identities. Sage Publications.

Storz, C. (2008). Dynamics in innovation systems: Evidence from Japan's game software industry. *Research Policy*, *37*(9), 1480-1491.

Suddaby, R., & Greenwood, R. (2005). Rhetorical strategies of legitimacy. *Administrative science quarterly*, *50*(1), 35-67.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic management journal*, 509-533.

Tijssen, R. J., & Van Wijk, E. (1999). In search of the European Paradox: an international comparison of Europe's scientific performance and knowledge flows in information and communication technologies research. *Research policy*, *28*(5), 519-543.

Tracey, P., Phillips, N., & Jarvis, O. (2011). Bridging institutional entrepreneurship and the creation of new organizational forms: A multilevel model. *Organization science*, *22*(1), 60-80.