Assessment of knowledge economy

A comparative study between Iran and Turkey and lessons for policy-making

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Abstract

Purpose – The purpose of this paper is to describe the current status of the knowledge-based economy (KBE) in Iran in comparison to Turkey, the challenges encountered and the appropriate policies toward Iran's Outlook 2025 based on which the country is expected to be ranked first in science and technology within the Middle East region.

Design/methodology/approach – This study is a descriptive research. The methodology used for this study is qualitative/quantitative secondary research. The method will be used for two main goals. First, we used the World Bank's Knowledge Assessment Methodology, and the data are mostly collected from secondary sources such as the World Bank's Development Indicators for Iran and Turkey. Second, desktop research will be used to summarize and synthesize available studies on the consideration of policy-making toward KBE, especially among developing economies.

Findings – The paper provides policy considerations around four pillars: information and communications technology (ICT), innovation system, education and human resources development and economic incentives and institutional regime. It suggests that regarding ICT indicators, Iran has to join international programs to attract senior public authorities' involvement and accountability. Regarding its innovation system, lessons for policymakers are implementing development plans and coordinating science and technology policies in the country. Moreover, the quality of education, in-company training, post-secondary technical education and scientific and technological workforce need to be improved. Finally, considering the weak macroeconomic circumstances, legislative measures are needed in addition to, establishing a promotion agency for foreign direct investment to coordinate the inflow and to grant incentives for attracting more investment.

Research limitations/implications – Because of the chosen research approach, the research results have not been confirmed by an experts group. Therefore, using some group decision-making methods, such as panel of experts, could be proposed to further test the findings.

Practical implications – The paper includes implications for public policymakers, especially in developing countries, and for moving toward a KBE.

Originality/value – This paper fulfills an identified need to learn from similar countries experiences in policymaking about the same problem.

Keywords Iran, Assessment, Turkey, Indicators, Knowledge-based economy, Public policies

Paper type Research paper

1. Introduction

Knowledge-based economy (KBE) is the dominant paradigm on economic development that emerged in the 1980s (Harris, 2001). Although knowledge economy is often used as a synonym for KBE, there is a little difference between the

two terms. Cooke and Leydesdorff (2006) argue the term "knowledge economy" is the older of the two concepts, with its roots in the 1950s. The term focused mainly on the composition of the work force, whereas the term "knowledge-based economy" has added the structural dimensions of technological trajectories and regimes from a systems perspective. As a result of the second perspective, intellectual property right (IPR) is known as another form of capital (Cooke and Leydesdorff, 2006). Regardless of this difference, in this paper, we use both terms synonymously to cover both terms within the literature.

As Powell and Snellman (2004) define, the products and services of a knowledge economy depend on knowledge-intensive activities that result in the rapid advancement of technology and science, as well as rapid obsolescence. Therefore, as cars and steel were produced a hundred years ago, knowledge and information are the main productions of today's economy (Stiglitz, 1999). The key component of the knowledge economy is a greater reliance on intellectual capabilities than on physical inputs or natural resources (Powell and Snellman, 2004). More precisely, the products of the knowledge economy, such as computer software, media and entertainment content, new pharmaceuticals and online commerce and banking services, etc., need a relatively high knowledge input and less traditional production factors, such as labor and land (World Bank, 2004). Therefore, in the new paradigm, knowledge generation and distribution are recognized as the primary driver of economic growth. As a result, we witness the growing importance of the distribution of knowledge-based networks among firms, and the interface between government business and citizens in the knowledge economies (Harris, 2001). In parallel, there is a new focus on the role of information, technology and learning in economic performance (OECD, 1996). In these circumstances, innovation-based growth, underpinned by investments in a broad range of knowledge-based capital, is central to raising long-term living standards (OECD, 2013). In other words, the driving forces, such as increase in the knowledge intensity of economic activities and the increasing globalization of economic affairs (Houghton and Sheehan, 2000), make it inevitable to move toward knowledge economy. In this regard, global statistics reveal the following trends (OECD, 1996):

- Output and employment are expanding fast in high-technology industries.
- Investment is being directed to high-technology goods and services.
- More intangible investment is being made in research and development (R&D), the training of the labor force, computer software and technical expertise.
- Demand for skilled labor is increasing in the Organization for Economic Cooperation and Development (OECD) countries.

As a result of these trends, many developed countries started their moves toward a knowledge economy. Specifically, they recognizing the role of knowledge-intensive industries as the core of growth has resulted in increased attention to public policies for science, technology and innovation (Smith, 2002). As followers, developing countries are trying to take policy measures to join the global stream of becoming knowledge-based; however, they face particular challenges and restrictions.

In this regard, scholars have done various studies on the topic of "knowledge economy". The targets of some of the studies are about the necessities or requirements

of moving toward a knowledge economy in developing countries (Aubert and Reiffers, 2003). An important point is that knowledge is different from traditional goods because it is recognized as a public good, more exactly, a global public good. Therefore, the government has a markedly different role in the knowledge economy, as a case in point, for defining property rights, protecting these rights and preventing monopolization (Stiglitz, 1999). However, some features of these countries, such as their expanding gap with developed countries, depending on oil resources, and not involving in the globalization process (Aubert and Reiffers, 2003), make it difficult to build a knowledge economy. Therefore, studying developing countries paying attention to their specific requirements is of importance. Iran, as a developing economy with a moderate scientific capabilities and human capital, faces specific challenges to become a knowledge economy. However, according to Iran's Outlook 2014 and the 20-year comprehensive plan for science, the country has to reach number one scientific and technological position within Middle East region. Along the way, Turkey is the most important rival which is currently number one in some of the KBE indicators among the region's countries. Therefore, comparing the two countries with the aim of prescribing appropriate policies is justifiable.

In this paper, we are going to:

- assess the current status of Iran's KBE indicators in comparison with Turkey's;
- clarify the challenges encountered; and
- propose appropriate policy options and considerations to handle them.

The rest of this paper is organized into five sections. In Section 2, a literature review will be done. Section 3 describes the research methodology. In Section 4, findings and discussion are presented. Finally, the conclusions are presented in Section 5.

2. Literature review

2.1 Assessment of KBE

Despite the importance of the concept of knowledge economy for all developed (and developing) countries, there is no definitive, comprehensive list of indicators for assessing and measuring the KBE (Tocan, 2012). Some studies focus on the basic processes of KBE, such as knowledge generation, dissemination, transfer and application (Aubert and Reiffers, 2003). Then, the current status of KBE and the success of implemented policies regarding each of the processes could be measured by means of a set of indicators (Table I).

Based on another study by OECD (2001), there are five categories to be evaluated in moving toward KBE:

(1) Economic and social fundamentals, which could be assessed by indicators such as macroeconomic stability, openness, functioning of markets and institutions.

(2) Diffusion of information and communications technology (ICT), which could be assessed by indicators such as the level of competition in telecommunications and technology, skills and presence of electronic government.

(3) Innovation, which could be assessed by the level of importance of fundamental research, the effectiveness of public R&D funding and the flow of knowledge between science and industry.

KBE process	Indicators
Knowledge generation	R&D intensity (R&D expenditure/gross domestic product [GDP])
	R&D expenditure (million US$)
Knowledge dissemination (diffusion)	ICT infrastructure: telephones per 1,000 people, Internet users (per 1,000 people); mobile cellular subscriptions (per 1,000 people), etc.; ICT expenditure/GDP; ICT expenditure (per capita)
Knowledge transfer	FDI/GDP
Knowledge application	High-tech exports (million US$)
	High-tech exports/total manufactured exports
	Patent application (residents/non-residents)
Source: Compiled by the authors	

Table I.
KBE processes and
indicators

(4) Investment in human capital, which could be assessed by education and training quality, attractiveness of teaching profession, the linkage between education and the labor market.

(5) Firm creation, which could be assessed by the easiness of access to high-risk finance, favorable administrative regulations and optimistic attitude regarding entrepreneurship.

The World Bank also defines the Knowledge Assessment Methodology (KAM) including the following pillars as four critical requisites for a country to be able to fully participate in the knowledge economy[1] (World Bank, 2013):

• *Education and training*: An educated and skilled population is needed to generate, share and use knowledge. It means that increasing the quality of the stock of human capital by giving technology-related skills will results in more productivity. In fact, adequate supply of technical and scientific personnel is needed both for development and for adoption of new technologies (Fuente and Ciccone, 2003).

• *Information infrastructure*: A dynamic information infrastructure – ranging from radio to the Internet – is required to facilitate the effective communication, dissemination and processing of information.

• *Economic incentive and institutional regime*: A regulatory and economic environment that enables the free flow of knowledge, supports investment in ICT and encourages entrepreneurship is central to the knowledge economy. As another case in point, IPRs could be mentioned as an institutional tool that stimulates private initiatives for invention. In fact, creating monopolies on knowledge results in serious problems in the allocation of economic resources. Patents and copyrights impede monopoly formation on knowledge and may encourage innovators to invent (Foray and Lundvall, 1997).

• *Innovation systems*: A network of research centers, universities, think tanks, private enterprises and community groups is necessary to tap into the growing stock of global knowledge, assimilate and adapt it to local needs and create new knowledge.

Considering the above-mentioned pillars, the Knowledge Index (KI) measures a country's ability to generate, adopt and diffuse knowledge. This is an indication of the overall potential of knowledge development in a given country. The key variables for calculating the KI are education and human resources, the innovation system and ICT. Moreover, the Knowledge Economy Index (KEI) takes into account whether the environment is conducive for knowledge to be used effectively for economic development. It is an aggregate index that represents the overall level of development of a country or region toward the knowledge economy. The KEI is calculated based on four pillars related to the knowledge economy – economic incentive and institutional regime, education and human resources, the innovation system and ICT (Figure 1) (World Bank, 2013)[2].

Looking deeply at KBE indicators, it could be concluded that there are serious challenges for developing countries in moving toward KBE. These countries have to follow knowledge-related policies fitted to their circumstances. For instance, as Bhatiasevi (2010) concludes about Malaysia and Thailand, in addition to four common variables influencing knowledge economy which are innovation, ICT, human resource development and business environment, developing countries have to consider the following variables too: government incentives, better human capital and institutional factors.

Although different models have been proposed to assess KBE, all of them have elements in common. As Kriščiūnas and Daugėlienė (2006) describe, the main elements of a knowledge economy are human capital, new and configured knowledge, innovation policy, ICT and entrepreneurship. Regarding these elements, the World Bank's four pillar model seems suitable for the purpose of this paper which is comparing KBE indicators between two developing countries. Furthermore, the Bank's database could be used for quantitative analyses of KBE indicators.

3. Research methodology
This study is a descriptive research that clarifies the characteristics of KBE in developing countries, the current status of Iran in KBE indicators, the challenges encountered and appropriate policy options and consideration to handle them. The methodology used for this study is qualitative/quantitative secondary (desktop) research. Desktop research as a field study method provides the opportunity to investigate the information about the topic of KBE and highlights the existing gaps. In
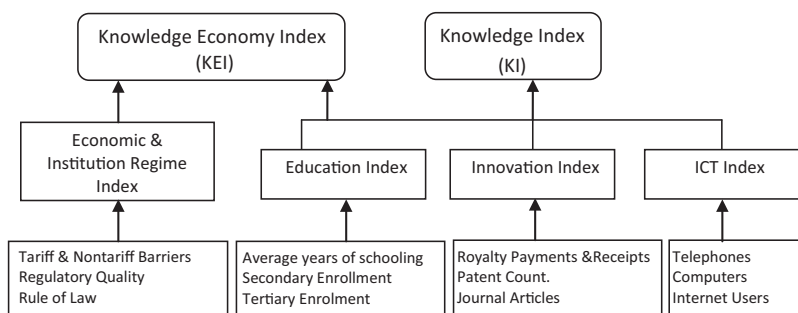
Source: World Bank, 2013

Figure 1.
Knowledge indexes

fact, the method extracts information from various sources to learn the findings not specified by any previous references until now (Kamins, 1993).

The method will be used for two main goals. First, quantitative secondary research will be used for gathering data on KBE indicators in Iran and Turkey from the World Bank database on knowledge economy indicators. The indicators that are going to be assessed are indicators regarding ICT Index (telephones, computers and Internet Users), Innovation Index (royalty payments and receipts, patent count and journal articles), Education Index (average years of schooling, secondary enrollment, tertiary enrolment) and Economic and Institution Regime Index (tariff and non-tariff barriers, regulatory quality, rule of law). Second, desktop research will be used to summarize and synthesize available studies related to the consideration of moving toward KBE, especially among developing economies (Gummesson, 2000).

More precisely, the tools used for data gathering in quantitative secondary research are databases; in addition, the tools used for data gathering in qualitative secondary research are books and research papers on the KBE that are available from international databases using the Web.

4. Findings and discussion

4.1 KEI and KI in Iran and Turkey

As it was mentioned earlier, according to the national Outlook 2025 and the 20-year comprehensive plan for science, Iran has to reach the number one scientific and technological position within Middle East region[3]. In Turkey, since 2002, the Vision 2023 project was started in line with the decision of the country's Supreme Council of Science and Technology. The objective of the project has been set as formulation of new national science and technology policies and setting priority areas for the next couple of decades to create a prosperous society and economy based on innovation by 2023, the 100th anniversary of the Turkish Republic (Elci, 2003).

However, according to the World Bank database the current position of Iran in some KBE indicators is not satisfactory in comparison to its rivals, among which Turkey is the most important one because it is currently number one in some of the KBE indicators among the region's countries. Iran ranked 13 among 18 countries, mainly because of its weak performance in economic incentive and institutional regime, whereas Turkey has a better performance in economic incentive and institutional regime and ranked eight. Iran's KI in comparison to its rivals within the Middle East region is acceptable to some extent; it is better placed than Turkey in KI and ranked nine among 18 countries. In better words, Iran has a better ranking in KI than in KEI. The reason is that the economic incentive and institutional regime pillar has no role in calculating KI. This pillar is not of a good situation in Iran (Figure 2); however, the other pillars, such as innovation, education and ICT, which are in a better condition, lead to a better score for KI in Iran.

4.2 Lessons for public policymaking toward KBE

Although each country needs a specific framework for public policies toward a KBE, we refer to the World Bank KAM. The KAM helps to identify problems and opportunities that a country may encounter, and where it may need to take policy measures or future investments, regarding the transition to a knowledge economy. The most important advantage of the KAM is its cross-sectoral approach that provides a comprehensive view of the various factors related to the knowledge economy. Its transparency,
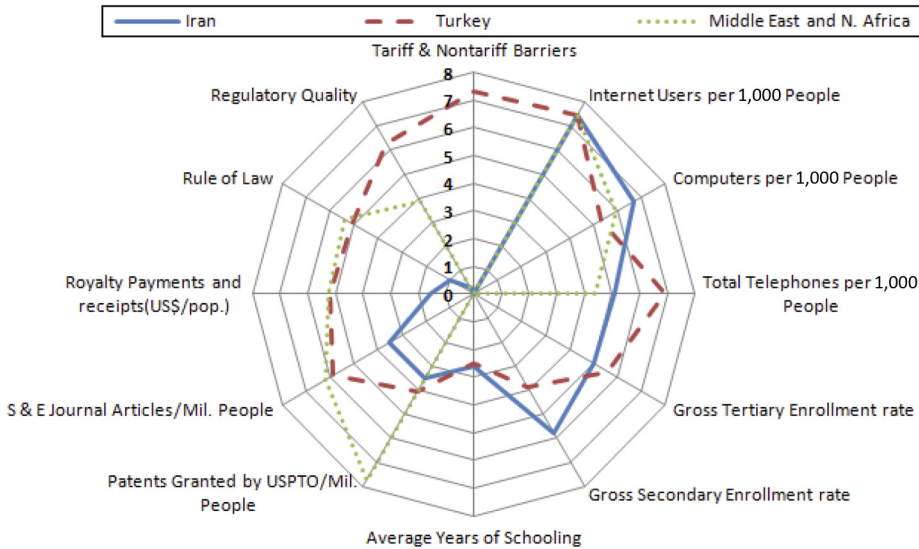
Source: World Bank (2013)

simplicity and versatility has characterized KAM as a user-friendly method which facilitates policy discussions with government officials (Chen and Dahlman, 2005).

Therefore, we use the following four-pillar classification to develop a comprehensive framework for policymaking lessons from the comparison of Iran and Turkey and propose policies related to each pillar.

4.2.1 ICT policies. The importance of ICT policies for a knowledge economy is that the technologies decrease the costs of various knowledge activities, such as knowledge gathering and diffusion (Cowan and Paal, 2000). Therefore, ICT indicators such as Internet users, mobile cellular subscriptions and telephone lines (per 1,000 people) have constantly increased since 2005 in both Iran and Turkey (World Bank, 2013). In addition, as Figure 2 illustrates, Iran is better placed in ICT indicators comparing to the average of Middle East and North Africa or Turkey; however, total number of telephones per 1,000 people in Iran is less than that in Turkey. Turkey suffers from some problems too. In Turkey, in spite of the low cost of access to the Internet, the usage is not high. There are several contributing factors to this paradox of low cost but low penetration, such as the lack of investment in infrastructure and the Internet, insufficient competition in the provision of electronic communications networks and ICT products and services, insufficient use by the government of e-services, the low quality of local content and poor computer literacy (World Bank, 2004).

In a specific manner, some factors affect the formulation of national ICT policies in Iran and Turkey (UNESCAP, 1999):

- *The price and the quality of ICT-related goods and services*: Mostly, ICT-related goods and services are provided based on suppliers' terms, and markets could not mature because of low per capita purchasing power in developing countries. In other words, as the development and trade of ICT products are almost entirely

supply-driven, the needs of all of potential users could not be considered. Some solutions are: producing simpler hardware, reliable and small operating system and applications, reducing import taxes and creating a favorable business environment. In Iran, the Communications Regulatory Authority (CRA) was established in 2003 by virtue of Article 7 of the Law of Scope of Duties and Powers of Ministry of ICT, by combination of Deputy Minister for Telecommunication Affairs Department and Directorate General of Telecommunications. The aim of establishing of CRA was to execute governmental powers as well as supervision and executive powers of The Ministry of Information and Communication Technology in the sector of Radio and Communication Regulatory, so that as a supervisory foundation, it could strengthen the competitive market of telecommunication and increment, promotion and optimization of service quality [4].

- *The existence of telecommunications monopolies*: Reforming the telecommunications sectors in developing countries is under the tight control of the government; as a result, government monopolies form. More liberalization in the domestic markets is needed. In this regard, in Iran, private Internet service providers have become commonplace. Cell phone providers have expanded to one public provider (Hamrah-e-Aval) and three private providers (Irancell, Rightel and Talia). Consequently, today there is no waiting time for cell phone services as before. However, the liberalization of international telecommunications is not achieved to an acceptable limit, and transmission costs are still very high. Governments in developing countries collect heavy tax from monopolies and attempt to change the international accounting rate settlement system (which is an additional reason for the high price of international telephone calls). Therefore, an important point is that national ICT policies in developing countries have to consider the need for lowering the price of telecommunications services.

- *The weakness of ICT infrastructure*: The lack of computer and telecommunications infrastructure is a critical obstacle in many developing countries. As it could be read from Figure 2 indicators, total number of telephones per 1,000 users and computers per 1,000 users need to be improved. Therefore, national ICT policies in the form of a master infrastructure development plan have to be designed and supported by detailed policies related to infrastructures, administrative sectors, geographic areas, types of service, types of educational institute, etc. Government involvement is vital in implementation of the plan in a rational time frame for rural and distant areas as well as big cities.

- *Low level of Internet penetration*: Internet is changing the way of data collection and dissemination and the style of service preparedness for clients. Thus, Internet penetration has to be increased within all cities and rural areas.

- *The lack of qualified ICT human resources*: Governments in developing countries encounter with the shortage of qualified human resources in many technological sectors, as a case in point, ICT sector. The lack of ICT skills of other related personnel is challenging too. These difficulties affect the time, harmony and security dimensions of ICT development in a reverse manner. Hence, the supply of qualified human resources in the ICT sector should be one of the policymaking goals.

- *Poor management of ICT development plans*: Lack of resources and incorrect technology choices affect ICT development plans reversely. Bureaucracy in the government body creates many hinders for innovative ideas and decreases the expected benefits from ICT application. Therefore, national policies should highlight the need for senior public authorities' involvement and accountability. As a case in point, Turkey has been a member of the e-Europe+ program. The full and effective implementation of the program will advance ICT and enhance the global competitiveness of the sector. However, tight coordination of the operation, in parallel with a comprehensive knowledge economy program, is required (World Bank, 2004).

4.2.2 Innovation system policies. Regarding innovation system in developing countries, there are two main challenges. First, the policy path dependency does not allow the acceptance of the system of innovation approach in these countries. In other words, prevalent tendency to linear approach to innovation affects the innovation policymaking at different government levels (Intrakumnerdi and Chaminade, 2007). Iran as a developing country is not excluded from the trend. As an evidence for the linear thinking about innovation, we witness the rapid growth of the scientific and technical journal articles during the past decades, as the number of the articles increased from 96 in 1986 to 6,313 in 2009 (Figure 3); however, indicators such as high-tech export (Figure 4) or patent applications (Figure 5) have not jumped so surprisingly (World Bank, 2013). This weakness is also observed in Turkey to some extent; however, as Figure 4 shows, the country has a better performance in increasing the high-tech export in parallel with the raising scientific papers. The weakness of the network linking large companies and small businesses still remains as an important hindrance to the commercialization of knowledge in Turkey (World Bank, 2004). Patent applications are decreasing during recent years. This is particularly true for international patents applications such as at the European Patent Office or the USA Patents and Trademarks Office.

Second, the innovation systems in these countries are weak and segmented. Consequently, systemic problems are of great importance in the countries. Therefore, policy recommendations have to cover these two main categories. On the one hand, there is a need to educate policymakers and mainstream academics about the limits of the linear thinking of innovation and neo-classical economics paradigm. One the other hand, after the commonness of systemic thinking and the creation of capacity in formulating and implementing policy measures with the system of innovation approach, systemic problems within national, sectoral and regional levels should be targeted (Intrakumnerdi and Chaminade, 2007).

Paying attention to these challenges the public policies in developing countries have to be designed with the following considerations:

- Supporting both types of components (organizations, institutions) and relationships among them in the system of innovation.
- Paying attention to all of the functions of the system of innovation, such as entrepreneurial activities, knowledge development, knowledge diffusion through networks, guidance of the search, market formation, resources mobilization and creation of legitimacy/counteract resistance to change (Hekkert *et al.*, 2007).
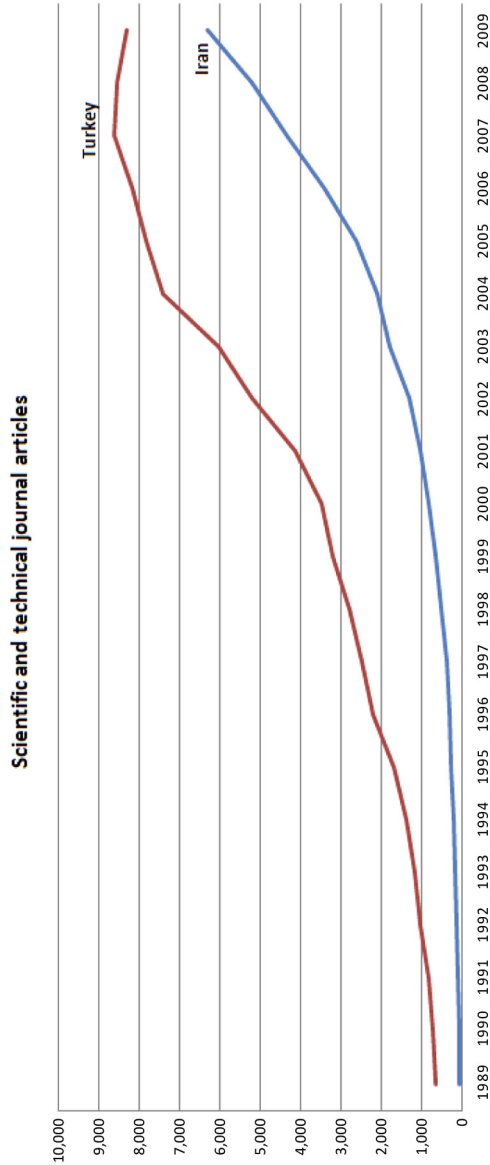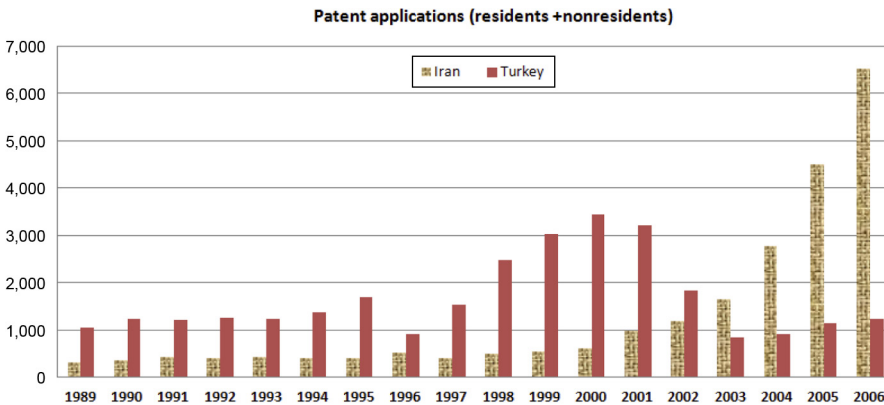
Scientific and technical journal articles

Source: World Bank (2013)

High-technology exports (current US$)
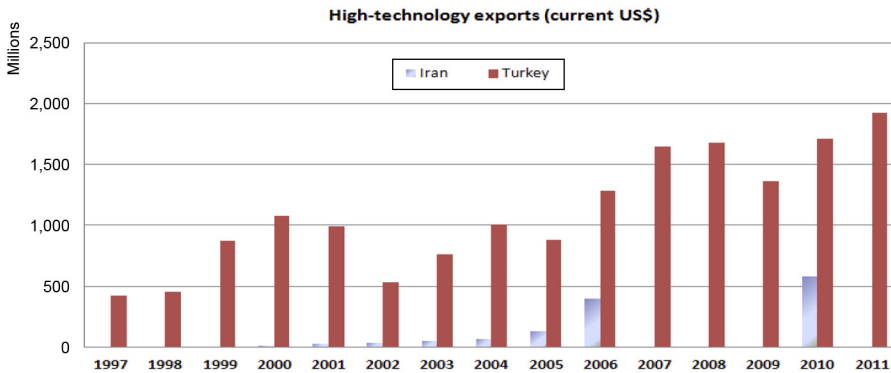
Source: World Bank (2013)

Figure 4.
Moderate increase in
high-tech export for
Iran in comparison to
the rise of export for
Turkey (1997-2011)

Patent applications (residents +nonresidents)

Source: World Bank (2013)

Figure 5.
Increase in patent
applications for Iran
in comparison to the
fluctuation of the
applications for
Turkey (1989-2006)

- Instead of reducing the cost of innovation, the main goals of the policies should be building capability, networking, flowing knowledge and improving institutional framework to support learning.

Therefore, policy instruments such as R&D tax incentives, research grants and subsidies for educating human resources will be partially replaced or complemented by systemic instruments such as networking/clustering programs (Yu *et al.*, 2014; Zhao *et al.*, 2010; Finegold *et al.*, 2004), training plans with the aim of capability building within firms (Athreye, 2005) and business development services (Chaminade and Vang, 2007).

Another important point is the lack of integration and coordination in conducting the innovation policies in Iran, whereas in Turkey, the Five-Yearly Development Plans provide the necessary budgetary allocation for innovation policy. In addition, one of the most important steps in this respect is the establishment of the Scientific and Research Council of Turkey (TUBITAK) in 1963 as a result of the First Five-Year Development

Plan (1963-1967) to prepare and coordinate implementation of Turkish Science and Technology Policy (Elci, 2003).

4.2.3 Education and human resources development policies. The third pillar for KBE is education and human resources development (HRD). In the knowledge economy, knowledge-based capabilities are the cornerstone of competitive advantage. In this regard, enterprise's people, their knowledge and innovative capacity is the key of strategic potential, and attracting, creating, managing and sustaining knowledge capabilities is of great advantage for countries (Whicker and Andrews, 2004).

As Figure 2 shows, Iran has an almost acceptable performance on sub-indicators of the pillar. Also, the trend of Human Development Index (HDI) of Iran confirms this performance. The HDI is a comparative measure of life expectancy, literacy, education, standards of living and quality of life. The trend of the index, as shown in Table II, is continuously increasing for both Iran and Turkey; however, Iran is in a better situation compared to Turkey.

However, there are some global and regional trends which influence the HRD policy design and implementation (ILO, 1996):

4.2.3.1 Globalization. Rapid technological change and the continuous falling costs of communication and transport, in addition to the market-oriented development strategies of developing countries in Asia and the Pacific and the necessity of joining to the world economy, amplify globalization. In such situation, national competitiveness is not of great importance but international competitiveness is. One of the most critical requirements for situation, national competitiveness is not of a great importance, but the international is the knowledge and skills of the human resources. As a result, enterprises have to update the skills of their employees to seize the opportunities or to opposite the threats created by globalization and rapid technological change.

4.2.3.2 Economic restructuring. In a KBE, comparative advantage will be the key element for enterprises wishing to assure a competitive edge over their rivals. For example, as China moves into labor-intensive manufacturing, it will compete with countries like Indonesia and Thailand which move into medium-technology manufacturing. The economic restructuring strategy of a country will determine the skills or education requirements of its human resources.

4.2.3.3 Cross-border investments. Absorbing cross-border investment (e.g. in the form of foreign direct investment [FDI]) is critical for many developing countries. Regardless of the financial aspects of such investments, making the best use of technological spillovers requires appropriate policies to select the right technologies for investment and recruit or train workforce, especially executives for working in international alliances who have needed skills in managerial, technical and even cultural dimensions.

	HDI (value)							Average annual HDI growth (%)			
	1990	2000	2005	2007	2010	2011	2012	1980-1990	1990-2000	2000-2010	2000-2012
Iran	0.540	0.654	0.685	0.703	0.740	0.742	0.742	1.99	1.94	1.25	1.05
Turkey	0.569	0.645	0.684	0.702	0.715	0.720	0.722	1.85	1.26	1.04	0.95
Source: UNDP, Human Development Report (2013)											

Table II.
HDI trends,
1980-2012

4.2.3.4 *Changing organizational structures/work patterns.* Work organizations and working patterns have changed in today's rapidly changing competitive global marketplace. Mass production is replaced by increasingly more flexible production of goods and services. Repetitive tasks are being replaced by flexible automation. Instead of segmented tasks, the use of teams and multiskilled workers is increasing. Organizations tend to be more flat, and hierarchy tends to decrease. As a result of the changes, the role and the accountability of human resources have expanded, which necessitates expanding and deepening of skills too. Because of the ICT advancements, the workforce has become more mobile than ever, and the concept of virtual organizations has emerged. In this regard, besides the levels of expertise required to use information technologies, other requirements such as teamwork, communication and learning skill are also needed (David and Foray, 2003).

4.2.3.5 *Rapid knowledge obsolescence.* Another global trend affecting the HRD policies is rapid change of science and technology; as it said, knowledge is doubling every 7-10 years. Therefore, HRD policymakers have to keep in mind the effects of rapid obsolescence of knowledge on workforce skills.

Following the above-mentioned trends, there are some issues or challenges about human resource development for KBE:

- There is a need to improve the quality of primary and secondary education which develops basic skills of literacy, numeracy, communication and problem-solving skills, as well as the required attitudes which enable the people to acquire job-specific knowledge and skills. In fact, primary and secondary education is a foundation for further education and training which has become increasingly important in today's fast changing technological world with rapid obsolescence of knowledge and the intense competition in globalized marketplace.

- Upgrading the basic literacy and numeracy of the workforce is essential to have the ability to adapt to changing production routines and technologies.

- Expanding and improving in-company training (either on or off the job) is recommended because this kind of training is cost-effective and efficient. Training in enterprises should be based on a training needs analysis of the enterprise. On-the-job training provides the specific skills needed for job performance and adaptation to quick change in technology.

- An issue for many developing countries willing to move into medium-technology manufacturing is the need to expand post-secondary technical education and training because higher-technology manufacturing involves fewer but more skilled workers and more technicians and engineers.

- Expanding scientific and technological workforce is needed for those developing countries which are starting their moves toward high-technology manufacturing because a qualified workforce is necessary to develop indigenous R&D capability. Therefore, tertiary education has to be expanded to train more scientific and technological workforce.

- Developing countries need to pay more attention to the development of the service sector and improvement of the skills and productivity in this sector.

- Continuous education and training is another issue related to HRD. Government training agencies, employers' organizations, education and training institutions and trade unions could be involved in designing and implementing continuous training.
- Greater employers' involvement as consultants in national education and training policymaking is required.
- Adult education and training should not be neglected because it is expected for workers to have more than one job throughout their working life. Furthermore, education and training have to be adapted to the market economy. Therefore, subjects such as economics, management science, law and psychology have to be included in the curriculum.

4.2.4 Economic incentive and institutional regime policies. The forth pillar for moving toward a KBE is a supportive system of economic incentives and institutional[5] regimes to facilitate interactions among different actors in the economy. In fact, some scholars believe that the first requirement for the feasibility of KBE development is stable economic circumstances (stable fiscal policy, law inflation, effective money policy and currency policy) (Kriščiūnas and Daugėlienė, 2006). Blomström *et al.* (2002) also focuses on the importance of good economic policies for transition of countries such as Finland, Sweden and Singapore from depending on raw material-intensive or labor-intensive production to highly competitive economies with a relatively high degree of technological knowledge.

As it could be seen from Figure 2, Iran is not of a desirable situation in economic incentives and institutional regimes. In contrast, Turkey has a more acceptable score in this pillar. Moreover, there is a macroeconomic program in Turkey including the following legislative measures:

- financial sector restructuring;
- increasing transparency in the state and strengthening of public finances;
- enhancing of competition and efficiency in the economy; and
- strengthening of social solidarity (Elci, 2003).

To be more specific, about this pillar, the following points have to be considered by developing countries like Iran (OECD, 2013):

- *Openness*: Several policy measures constrain the competitive environment, for example, controls on the price and quantity of credit, entry barriers and investment restrictions, tariff and non-tariff barriers, restrictions on FDI and weak mechanisms for exit.

  The liberalization should be increased by the government, especially more emphasis should be on deregulation in services (telecommunications, financial news and legal services).

- *FDI*: In most cases, FDI has been highly restricted in developing countries such as Iran. Many scholars believe that granting supportive incentives for attracting more FDI, considering international relation is a critical policy measures in less developed countries like Iran (Salami and Soltanzadeh, 2012). Therefore, more liberalization of FDI is needed to increase domestic competition and improve

management models. In this regard, Turkey is also one of the few countries that have not yet established a promotion agency for FDI. The creation of such an agency would not guarantee an increased inflow of FDI, but the failure to introduce one significantly is representative of the government's attitude toward foreign investors (World Bank, 2004). Moreover, improvement of innovation policies (e.g. IPRs) will be useful for attracting FDI in high-tech sectors which has positive results, like spillovers to the country.

- *Soundness and efficiency of financial markets*: Financial policies should aim at improving soundness and efficiency of financial markets through diversifying investment alternatives. Moreover, government has to provide banks with incentive to develop their institutional capacity to analyze credit and risks. Additionally, multiple guarantees for loans and debt instruments prevent capital market development. There is a need to strengthen regulatory and institutional framework instead of expanding guarantees. A systematic regulatory framework will, in addition, improve the credit culture of banks and financial institutes. Further openness of financial institutes to FDI is also required to enhance the quality of domestic services and learn the managerial skills. As a case in point, suitable incentives for FDI resulted in the attractiveness of Singapore for pharmaceutical and biotechnology multinational corporations, and they are now establishing R&D collaborations with government-funded programs, local universities and research institutes (Finegold *et al.*, 2004). Last but not the least, the transparency and accountability of financial system should be strengthened. Regarding venture capital, like many other developing countries, there is a cultural tendency to collateral-based debt; as a result, risk aversion is associated to many investments. To change this trend, more emphasis on equity-based debt has to be put.

- *Strengthening IPRs and enforcement*: During the past two decades, many efforts have been made to administer and enforce IPRs over scientific and technological knowledge by means of patents, copyrights and other, more novel forms of legal protection (David and Foray, 2003). Well-defined IPRs provide firms with the incentive to innovate (OECD, 2013). Greater public awareness of the importance of IPRs is needed for Iran to improve documentation and knowledge databases and upgrade the hardware and software of the Industrial Property General Office (Edare-e-Malekiat Sanati), besides a redesign of the administration procedure and the laws governing IPRs.

- *Redefining the role of government*: As a result of decades of public resource-based economy, Iran's government tends to be highly centralized and interventionist in the financial and industrial sectors. Direct intervention should be gradually replaced by incentives and regulatory framework targeting market failures. It should support entrepreneurship and industrial restructuring to develop well-functioning enterprises. At the same time, the government is expected to join more actively to international economic institutions (World Trade Organization, OECD, etc.).

5. Conclusion

According to Iran's Outlook 2014, the country has to be at the first scientific and technological position within Middle East region. Achieving the Outlook, Turkey is one of the most important rivals of Iran among the region's countries. More precisely,

considering the World Bank's KI and KEI indicators of Iran and Turkey, there are some problems to be solved to achieve the Outlook. To have a better understanding of the problems, we used The World Bank's KAM and concluded the some policy considerations in four pillars: ICT, innovation system, education and HRD and economic incentives and institutional regime. First of all, although Iran has a better situation in ICT indicators comparing the average of Middle East and North Africa or Turkey, a lesson from Turkey for Iran is joining to international programs (e.g. e-Europe+ program in Turkey) to attract senior public authorities' involvement and accountability and enhance the global competitiveness of the sector. On the other hand, a good lesson from Iran for Turkey is establishment of CRA to control the quality of ICT services and strengthen the competition between services providers. Second, in Iran, there is tendency to linear approach to innovation among policymakers. As a consequence, in both Iran and Turkey, we witness the rapid growth of the scientific and technical journal articles during the past decades, whereas indicators such as high-tech export or patent applications have not jumped so surprisingly. However, Turkey has a better performance in increasing the high-tech export. A good lesson from Turkey for Iran is creating and implementing development plans to guarantee necessary budgetary allocation for innovation policy, in parallel with the establishment of a National Council to prepare and coordinate implementation of Science and Technology Policies in the country. Third, regarding education and HRD, the trend of the HDI is continuously increasing since 1980. However, some policies need to be observed by Iran, such as improving in-company training based on a training needs analysis of the enterprise, expanding scientific and technological workforce to develop indigenous R&D capability and redesigning adult education and training based on the market economy, with emphasis on economics, management science, law and psychology. Forth, Turkey has a more acceptable score in economic incentives and institutional regime than Iran. Therefore, a lesson from Turkey for Iran is designing a macroeconomic program including required legislative measures such as financial sector restructuring, increasing transparency in the State and strengthening of public finances, enhancing of competition and efficiency in the economy and strengthening of social solidarity. Another key point is that, in Iran, the low level of FDI is a barrier for knowledge economy. Therefore, establishing a promotion agency for FDI to coordinate the inflow of FDI and to grant supporting incentives for attracting more FDI, considering international relation, is another policy measure regarding macroeconomic environment.

Notes

1. http://go.worldbank.org/5WOSIRFA70

2. http://go.worldbank.org/SDDP3I1T40

3. www.vision1404.ir/fa/News48.aspx Iran's Outlook 1404 (the year 2025) (in Persian).

4. http://cra.ir/Portal/View/Page.aspx?PageId=bd0030cf-946a-4125-9734-01ce8cf2725b&t=4 (accessed 10 February 2014).

5. About the concept of "institution", Douglass North defines institutions as "rules of the game in a society". In fact, he believes that the institutions are constraints which shape human interaction and the way that societies evolve through time (Hollingsworth, 2000).

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