Exploring the National System of Innovation in Turkey

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Abstract

The economic gap between developing and developed countries has been attributed to several reasons but mainly to their relative capacities to create original knowledge and novel technology. Industrialized nations rely on this capacity for their economic growth while developing nations, due to lack of innovative capacity, seem to be stuck in a vicious growth circle in which they need to import the knowledge and technology they need, thus increasing the very dependence they seek to reduce. Although innovation in a country feeds on the existing technology, the innovative capacity of a country depends on factors such as culture, history, institutions, politics and their interdependent relationship. This foundation is known as the National System of Innovation (NSI). Despite a focus on a single country, NSI also deals with cross-country comparisons. Exploring system differences in terms of these factors could provide a policy framework to enhance economic growth in developing countries. This paper explores the determinants of National Systems of Innovation and their role in explaining economic development in a global context. The case example used is that of Turkey. By providing a detailed examination of NSI in Turkey comparisons are derived for similar and as well as more industrially developed countries. Thus the paper offers national practices (specific to Turkey) that support the creation of differing rates of economic development. More specifically these findings suggest policy measures to support the economic growth of the country.

Keywords

National Systems of Innovation, institutions, development, learning, technology, economy, Turkey

INTRODUCTION

A few years before the concept of National Systems of Innovation (NSI) was popularised by Freeman (1987). Lundvall (1985) had already elaborated on "system of innovation". Freeman added the 'national' element by applying the concept to Japan, which is reasonably easy as Japan stands out as a nation in so many ways. What makes Japan's innovation specific is not just the technology, but also the formal institutions (Lundvall, 2004). Following Freeman, many others welcomed the idea of NSI since it fitted well with the non-linear nature of innovation. It provided a systematic analysis by looking at innovation's deeper roots ingrained in the society rather than relying on a linear input-output analysis where input is the R&D investment and innovation the output. With this emergent outlook, Freeman and Nelson (1988) established the framework of NSI theory, which later on evolved to absorb many other theories of innovation (Lundvall, 1992; Nelson, 1993).

A 'National' system of innovation is now understood to include all the public and private firms and government organisations as well as their interactions with each other to transfer, create and diffuse knowledge and innovation in a country (Freeman, 1987; Lundvall, 2002,

2004). Private and public firms; research institutions; R&D labs; universities, schools, training institutes, financial system, science and technology policies, as well as the institutional set up which shapes the behaviour of these agents, are the components of a national innovation system. As can be surmised from these definitions; the interactions and relationship between the organizations in an innovation system are at least as important as the formal organizations. These relationships constitute the "social dimension" of knowledge creation and diffusion that is the key to innovation. This social dimension is heavily determined by "national institutions" such as culture, history, education system, funding patterns and distribution of political power.

However, there is no common agreement among researchers of a general definition. While some tend to emphasise the deeper socio-cultural roots of rules and routines, others tend to include formal organizations such as universities, business schools, government labs, patent laws, labour laws, trade unions, courts, trade associations and all the regulatory authorities as "economic" institutions of an innovation system (Dosi and Winter, 2002). This flexibility in defining institutions is perhaps related to the fact that the NSI concept originated from developed countries where formal organizations and their socio cultural foundations are meshed together so well that makes it difficult to distinguish them. For this reason, in this paper, we do not separate organizations from the social institutions surrounding them. We separate the economy and technology (physical side) from the institutions (social side). Although we do consider the formal organisations such as universities and the government institutions, we aim mainly at the tension between the formal actors and the groundswell of innovative activities. The distinction is important for the 'national' element of innovation: As an example, the quantity of money held in a Turkish organisation may match that of a British organisation but the lending patterns would be sufficiently different.

It is mainly for this reason, the socio-cultural foundations of NIS that we see great diversity among different countries. As Van der Steen, (2003) points out, the NIS institutions are different in nature and are history-bound. Their memory of the past is carried to the future. The variety of experiences, events, cultures, and so on creates unique innovation systems for each nation (Dosi and Winter (2000). Globalisation enthusiasts may think that national variety is ephemeral. Practically, however, the variety is lingering on, and globalisation is still a fair way from removing it. The variety is not limited to the difference between advanced and developing countries. Even the industrialised countries differ in terms of their innovation systems' components and the overall innovation performance. The difference in innovation levels and quality is of course much more striking when the two sides of the chasm are compared. In what follows we look at the innovation systems of developed countries, Japan and the NIEs and explore the case of Turkey in the context of developing countries. The experience of Turkey so far is similar to most developing countries except that the tensions are higher which may either facilitate a dramatic rise in innovations or turn the country into a demographic stem cell of ailing European labour.

THE DEVELOPED COUNTRIES

The Articulation between institutions and the economy

The NIS approach to development started with the developed countries, and fits in with their institutions much more coherently. To begin with, they allow large amounts of funds to be invested in their innovation systems for R&D activities, education, and establishing intermediary

institutions to coordinate the relationships between the innovation institutions (OECD, Key indicators 2003). On the other hand, institutional set-ups of the developed countries support the economy by providing stability in times of uncertainty and technological change (Ostry and Nelson 1995). In Europe, the coordination is thought to be rooted in social capital. Lundvall (2004), sees social capital as "*…a set of mostly informal institutions - social habits and norms which affect the levels of trust, interacting and learning in a social system"*. To illustrate the importance of this harmony we look at some different types of advanced countries who have managed to match their social and economic capital despite enormous differences in the type of their institutions. Three groups are distinguished: Europe and the US, Japan and the NIE's. No doubt there are many differences within each category but the main intention is to use them as a whole, in contrast to developing countries, to highlight the differences between the harmonised institutions and those ridden with evolutionary tension.

Europe and the US

Nordic European countries such as Finland, Sweden, and, Netherlands are probably the best examples of the harmony within innovation systems. In these "high income-high social capital" countries, economic development and social capital are highly articulated and they build on each other. The welfare state is the most important component of the innovation systems. Cooperation is seen as the major component of social capital that integrates all the agents towards economic progress and innovation. It is believed that companies in the Nordic countries are encouraged to innovate in partnerships. Governments support this directly and indirectly through investment in education and vocational training. The financial system also supports innovation by providing venture capital (Lundvall, 2004).

France has some similarities with Nordic nations in terms of its welfare state but is faced with strong capitalist opposition. Among larger European states, the French innovation system is unique with its central structure. The state presence is strongly felt in French technology and innovation system. Basic research in science and technology is the main characteristic of the technology policies and these research activities are spread over a large basis to cover as many areas as possible rather than diverting all resources to one single area. With the same level of economy as France, the UK has been very different. Science and engineering in the UK have become very unpopular, and the number of people studying in these disciplines has dropped drastically since the early 90's. The UK government regard this as bad for innovation, and therefore have adopted a set of policies to attract home and overseas students into areas such as maths, physics and engineering. On the other hand, British industry makes up for this weakness by cooperating with universities to give good support to R&D (DTI Innovation Report, 2004). Thus, the UK's innovation system is particularly strong with its coordination among industry-university and government. Germany is a ***late developer*** among other European nations but their catching up was relatively easy as they were like their forerunners in many ways except for their institutions (Gu, 1999). Most important of these institutions was the priority given to research and teaching which led to the accumulation of social capital, economic development and technological progress. This innovation culture is the biggest strength of German innovation system as it has resisted the economic fluctuations the country faced during the last century. In the US, radically different from Europe, the emphasis of NSI moves to the accumulation of hard capital and technology rather than building up the social capital. The US is particularly strong with its industry that perceives and responds to technological change rapidly. It has a flexible financial system and large amounts of venture capital. This ***myopic behaviour*** in markets,

however, is to some extent compensated by a highly R&D active industry that cooperates with the government (Popper and Wagner, 2001).

Japan and the NIEs

Japan, despite being a developed economy is a specific case. Technological development of the country has been realized through reverse engineering of imported goods and machinery. Learning through reverse engineering and imitation is a common practice for many late developers. However, Japan's development experience is unique because it is one of the very few successful examples in creating sustainable technological development by relying on the country's existing social capital. Close social networks, dedication to work and hierarchical social structure have served as a sound social basis that has facilitated the internalisation of the accumulated technology (Odagiri, 2004).

Newly industrialising economies (NIE), namely, Taiwan, South Korea, and Singapore resemble in success to Japan in terms of their high growth levels and intensive learning which led to rapid industrialization. However, their innovation systems are not as independent and self-reliant as Japan's and were much more hardly hit during the Asian crisis in 1997. These countries have developed in the footsteps of Western countries and through reverse engineering as in the case of Japan but could never reach to technological independence. Unlike Japan, their R&D investments remained at insignificantly low levels since they only aimed to develop through ***quick learning***, that is, by imitating the existing innovations. They started by duplicative imitation of Western technologies and moved on to creative imitation through process innovations. However, the lack of sufficient investment and in-depth focus created a big hurdle locking in their production capacity in mature manufacturing industries which no longer produced high profit margins (Dutt and Ros, 2003). NIEs' innovation systems were founded on labour-cost advantage and imitation, not on building a strong innovative capability. This short-term profit maximising behaviour and quick learning turned out to be destructive in the long run as the exploitation of knowledge was much faster than the exploration of knowledge in these countries (March, 1994, Moe, 2003). There were further weaknesses on the social side of the innovation system. The science system was good at adapting technology but not creating it and the education system never fostered innovative thinking and creativity (OECD, 2000). Also, cooperation among businesses in these countries was not as strong as it was in Japan, because interdependence between the Japanese suppliers and manufacturers was replaced by dependence upon the outside world and the Western brand names. This inhibited the development of network relationships in the domestic market (Dutt and Ros, 2003, Moe, 2003).

TURKEY ECONOMY

Turkey took a similar route as the NIEs and developed through a state-led import-substitution model from the early 1950's till 1980. The import substitution period was dominated by several problems such as input shortages, economic crises and political coups. After 1980, Turkey still continued to struggle with economic problems despite moving towards an open and liberal economy model. As Table 1 shows, the economic performance during the last 10 years has been poor with serious consequences on innovative capacity of the country.

Table 1 Some macroeconomic indicators

	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
GNP per capita($)	2784	2934	3032	3159	2828	2987	2105	2619	3390	4112
GDP Growth	8	7.1	8.3	3.9	-6.1	6.3	-9.5	7.9	5.9	10
Inflation (CPI %)	65.6	84.9	91	54.3	62.9	32.7	8.6	30.8	13.9	12.8*
Unemployment %	7.6	6.6	6.8	6.9	7.7	6.5	8.4	10.3	10.4	

*3rd quarter
Source: www.hazine.gov.tr

FDI inflows have been unusually low as a result of the poor economy and high political uncertainty. This has further reduced the innovation opportunities of the industry which is concentrated in traditional and low technology sectors. The recent sprint of the economy (after the financial crisis in 2001) has been monitored by the IMF and European commission. The economic improvement will no doubt have an important role in transforming the social institutions and boosting innovativeness in the country. Furthermore, accession to EU will be a crucial factor to solve the technological backwardness problem. However, the recent economic improvements remain fragile and there are many issues and areas in the innovation system of the country that need deep consideration.

TURKISH INNOVATION SYSTEM

Industry

Agriculture is mainly based on low and medium technology, and relies primarily upon the application of technology and cheap labour rather than knowledge. Industry, until recently was not much better. The automotive and textile industries, the engines of industrial development in Turkey, are the best examples of low technology and dependence on cheap labour. Despite its long existence, textiles and apparel industry has been stuck with imitation of Western brands and fashion but has not been able to move on to higher value added, knowledge-based activities such as collection-creation. Automotive industry has failed to develop the required knowledge base to innovate and move on to higher value added echelons of production. It has been mostly limited to technology application and assembly of Western car brands with cheap labour. There are social factors that limit the innovativeness of firms in high-tech industries like automotive industry. One of these factors is the hierarchical structure of the Turkish society. Important issues like technology and innovation are regarded as the job of managers (who are usually from engineering background) and lower level staff does not have much say in decision making. Similarly, corporate strategies tend to be inward looking and short term in nature. Technology is acquired by looking at the competitors' technological assets at a given time. Afterwards, there is usually very little competitive benchmarking until the technology becomes totally obsolete and requires high levels of investment (Ulusoy et al., 2001).

Services, mainly tourism and travel industry, have always been a major component of Turkish economy. The share of services in GDP reached 57.1% in 2001. Similar to manufacturing sector, services in Turkey are not usually knowledge based. Except for the financial and business and personal services, they rely on the exploitation of low skilled cheap labour. Moreover, social problems such as environmental pollution and security concerns tend to

drag down the hotel and travel industry which mainly depends on foreign markets. Unlike in developed countries, industry in Turkey has not been the locomotive for economic development. Lacking infrastructure, finance, training and education as well as the volatile economic environment have damaged the innovative capability of the business. It has traditionally relied on the support from public institutions as a driving force for progress. This worked well especially in the early years of the Republic, but then the institutions lost their dynamism and the inertia crept in gradually. As a result, the industry received less support from the government and became increasingly isolated. In addition, FDI on which so much hope had been placed proved illusory failing to revive the business environment and technological capabilities.

R&D Spending patterns

In Turkey, the resource intensive production also shapes the R&D spending and a majority of R&D funds are used for acquiring machinery (Gu, 1999). Like in many developing countries, in Turkey, R&D is concentrated on manufacturing sector where innovation is almost identical to machinery acquisition (Taymaz, 2001). Therefore 67.5% of the R&D expenditures are used for upgrading the technological capabilities. Table 2 shows the second most important area of R&D expenditures is the trial production. The dominance of these two categories suggest that Turkish Innovation system is still busy building the physical framework for the technology and expanding its absorptive capacities which are necessary to assimilate the imported technology (Radosevic, 2000).

Table 2: Breakdown of R&D in Turkey

Intra-Mural R&D	Extra-Mural R&D	Acquisition of Machinery and Equipment	Industrial Design and Production	Trial Production	Training Directly Linked To Innovation	Market Introduction of Technological Innovation	Other
4.6%	2%	67.50%	2.9%	17.2%	----	2.5%	3.3%

Source: Turkish Institute of Statistics, 2003

In developing countries, the low shares of knowledge-intensive activities can be attributed to low levels of R&D spending. In Turkey, the gross domestic expenditure on R&D as a proportion of GDP has increased from 0.45% in 1995 to 0.64% in 2000 (Elci, 2003). Despite the increase in the R&D spending, the 0.64% is still very low compared to developed countries that allocate between 2% and 3% of their GDP for R&D expenditures (OECD, 2003).

The low R&D spending in developing countries also indicates the industry's lack of innovation-orientation. Most of the firms, including the large ones, avoid innovation and prefer to utilise foreign technology transfers in the form of turnkey agreements or foreign alliances. In Turkey only 29.5% of enterprises in manufacturing sector and 38.5% of enterprises in service sector are involved in innovation whereas this ratio is 53% on average in the EU (Radosevic 2000; SIS, 2004). The ratio of innovative companies has increased by 4.8% in manufacturing sector since 1995 but the ratio has declined by 9.7% for service industry (SIS, 2004). The decreasing innovative capacity of the service sector can be attributed to the recent events such as September 11, Iraq war, and bombing of British Embassy in Istanbul, which adversely affected the tourism sector and pushed it to compete on lower costs rather than better quality and

innovation. It is not just the low levels of R&D activities and expenditures that hamper the progress in developing countries but there is also the issue of learning "how" and "why" in technology. The firms are more interested in knowing *"how"* to produce, which is easy to learn, generate returns in the short run, and does not require much spending on R&D but they do not deepen their knowledge by trying to understand "why", which means accumulating knowledge in the underlying science-base (Nelson, 1993).

The levels of know-how are insufficient in Turkish companies. Therefore, even R&D departments of high-technology firms are usually occupied with developing methods to cut costs and improve the quality. They dismiss the basic innovation activities of product and process development (Ulusoy et al., 2001). More than 95% of the companies are SMEs and their productivities tend to suffer from poor use of technologies due to lack of technology operating knowledge. Moreover, low levels of know-how create a serious entry barrier for many local companies in technology intensive industries such as telecommunications, electricity generation, and retail banking (OECD Observer No 243).

THE GOVERNMENT ROLE IN R&D AND INNOVATION

Higher role than in Europe

In advanced countries the government plays a small role in innovation (See *OECD 2004 Key Innovation Indicators* for the figures showing government and industry R&D funding in developed countries). In most developing countries, including Turkey, the main R&D fund provider is the government. This is partly because the industry is not capable of managing the majority of R&D activities. According to the Innovation Survey conducted by the State Statistics Institute of Turkey (1995-2000), Turkish industry finances only 42.9% of the R&D activities. Turkish firms give two main reasons for low levels of industrial R&D and innovation: excessive risk and uncertainty. Other reasons are: lack of financial incentives, opportunities, as well as the red tape in financial institutions (SIS, 2004).

Government help is too formal and not in Industrial Context.

The R&D role of government in developing countries is rather a recent innovation. In many developing countries, science and technology policies are only a part of other plans and are not given the priority they deserve. The situation in Turkey is similar. The first, large scale and detailed science and technology policies were made in the early 1960s at the height of import substitution program. However, until 1983, it was only a part of the 5-year economic development plans and was mostly used only as a guide. In 1983, the government issued the first separate science and technology policy document "Turkish Science Policy, 1983-2003" and the main aim was to increase the R&D expenditures and to define priority technology areas (Taymaz, 2001). Turkish "innovation" policy was identical to "R&D policy" until 2002 when "Vision 2003 Project" set the official target as "Establishing Turkish Innovation System" and broadened the scope of innovation by taking 11 different socioeconomic areas into consideration (Radosevic , 2000; Elci, 2003). Thus, it is only very recent that Turkey has taken serious steps towards considering the environment in which innovation evolves. This tardiness for realizing the importance of innovation and the factors that determine it creates several problems in terms of applying government policies for innovation.

First of all, governments tend to concentrate their activities in a small number of areas such as the military and ignore the rest of the industry. In Turkey, the government, especially after 1980, have focused on defence and the related industries. Most of the firms in the defence industry are government owned and receive extensive support to upgrade their technologies to international levels. Peripheral industries such as microelectronics industry have developed through cooperation with the relatively well-developed defence industry and the specific incentives of government R&D allocations. These firms also cooperate with the US and Israeli defence industries to gain in technology. Secondly, like many developing countries, the public R&D institutions in Turkey carry out their R&D activities in isolation and on behalf of the industry rather than cooperating with firms and supporting them to undertake R&D. Main Government Research Institutions have had an academic orientation and have kept close relationships with the universities rather than directly relating to the industry (EU report, 2004). As will be discussed later, universities are the main organizations in Turkey's innovation system which strengthens the government-university links though at the expense of the government-industry links. Even though this was known for a long time, it was only in 1993 that the need for cooperation to increase the industry's share in innovation was formally admitted (Science and Technology Policy, 1993-2003).

Thirdly, the government's efforts to update the technological capabilities have been restricted in Turkey. There are two methods used by the government to stimulate innovation in industrial sector: financial support and regulations. According to the law, companies are entitled to get 50% off their R&D expenditures if they are granted the right by the related public institution. However, the number of companies who receive the grant has been very low: 151 companies in 1998 (Taymaz, 2001). The quality of the funding, the endemic corruption, and socially accepted favouritism add to the problem.

Government regulations do not seem to stimulate innovation and technology diffusion in industry either. Companies aim to fulfil the formal regulation enforced by the government but do not actually internalise and adapt to it. As in the case of fertilizer industry, the regulations regarding waste disposal had to be taken on board by firms but none of them were willing to adapt their system to the new environmental friendly technology. They only partially utilised the modern technology to reduce the pollution to the accepted level but never attempted to integrate the new technology at firm level. Most of the firms tend to stick to the existing old technology they have and make minor changes on the surface to satisfy the government requirements (Cetindamar, 2001).

EDUCATION

General background

Only around 17% of working age population participates in a tertiary education and this rate is much lower than the EU average of 57% (European Commission Regular Report, 2004). Average years of adult schooling is 5.3 years in Turkey and this rate is much below many developed countries such as the US (12), Germany (10.2) and the UK (9.4) (Worldbank, 2000). The participation rates in tertiary education are higher, around 28% among younger population. Yet, it is low enough to cast a shadow on labour productivity in Turkey. The participation rates are lower at rural areas and less developed regions of the county and women's participation rate is significantly lower than men in these areas. The only bright spot seems to be in the field of

engineering and manufacturing, particularly for women. According to Euro Stat (2004), the ratio of female graduates in engineering, manufacturing, and construction to all graduates in this field is 34%, a ratio only below that of Sweden. The total number of male and female graduates in this field has also risen to a middle rank in Europe. The number of Science graduates at around 10% is almost average for Europe. However there might be qualitative differences. The high levels of unemployment make it difficult for Turkey to provide students with placement facilities, part time jobs and practical experience during their education. Moreover, the technical facilities such as laboratories, technical tools and field surveys are restricted due to financial constraints of universities. Hence, Turkish science and engineering graduates lack practical experience and this may be seen as a negative factor for employability.

Besides low participation levels, there are major problems regarding the quality of the education provided. First of all, the limitations on the funds allocated for education are not satisfactory to restore and upgrade the facilities of schools and universities. In Turkey, 3.5% of GDP is spent on education system and yet, the amount of facilities such as computers and modern laboratories are not sufficient (OECD, 2003). Also, there are often teaching staff shortages at universities and these decreases the student-staff interaction time. Resource shortages, as a whole, limit the capacity of the education system. A traditional teaching pattern applies all through the education system, which encourages imitating and memorising rather than creative thinking. Another serious issue that is related to low quality of education is the brain drain. The low quality of education, high levels of unemployment; economic and political instabilities encourage well educated and intelligent students to leave the country for their higher education never to return. The return rates are very low due to lower pays in Turkey, unorganised life styles and instabilities. As a result of low education levels, low quality of education and the brain drain, the workforce is not in a position to lift the productivity levels up and support the innovation system.

University-Industry Relationship

Yet another problem is the isolation of the universities from their environment. Turkey's university-industry links have been traditionally weak and their relationship has been dominated by tension, mismatch and suspicion rather than cooperation. This is mainly because of low levels of financial incentives from the government and the lack of trust between companies and the universities. Companies often refuse to cooperate with universities for being concerned with their confidential information and the universities are unwilling to allocate their already scarce funds for industry cooperation. In the past, universities have shown lack of commitment to deadlines assigned by the industries and this has created a culture of mistrust. Also, universities tend to isolate themselves from the business as it is mainly regarded an "inferior" activity to work with a local industry rather than doing "academic" research. More importantly, there are technological mismatches between the activities of the industry and the university since industries are keen on cost reducing simple adaptations of existing processes whereas the academic work, with its more sophisticated and scientific orientation, fails to match this need (Thiruchelvam, 2004, SIS, 2003).

Industry-university cooperation is a new practice in Turkey and mainly it is promoted through establishment of techno-parks within or near university campuses. The firms in these incubators work in knowledge-based industries such as information and communication technologies, electronics, life sciences and biotechnology. Firms are usually small and young and yet they have shown good evidence of success in the last few years. However, it is difficult to

conclude that they mostly owe their success to integration with the universities. Being near to a university is only one factor among many (such as tax exemptions and linking up to a network of high tech firms) that makes techno-parks attractive for entrepreneurs. Sharing resources and cooperative research between universities and the industry is common practices in techno-parks. However, the industry-university relationship is not mature yet as the levels of technology transfers between the two still remain at low levels. Clearly, this is disappointing, especially for the science and engineering students and academic staff who cannot adequately get involved in practical developments in high technology industries.

Turkish Universities are still far Behind Europe

In 2002, Turkish universities produced 9303 scientific publications raising Turkey's rank from 42nd in 1980 to 22nd place in the world. However, inadequate research remains a big weakness of Turkish Innovation System. Turkey is a better performer in terms of the publication numbers compared to countries such as Romania, Czech Republic and Greece but still lags behind many EU countries (YOK, 2003). In Turkey, there are 23083 researchers and this corresponds to less than only 2% of the working population. Seventy seven percent of researchers are employed at universities (OECD, 2003, Elci, 2003) but only one third of the teaching staff has PhD degrees. The main reasons for the low levels of publications and research at universities are attributed to the low payments for academic staff who have to undertake extra jobs, the large number of students per academic staff (exceeds 50) and lack of financial resources for research projects (YOK, 2003).

TURKEY AND THE EU: WHAT LIES AHEAD?

Not many developing countries can find a way out or an opportunity to utilise the tension that exists between backward institutions and modernity, between pre-capitalist relations and borrowed modern technology. With accession to the EU looming, Turkey is now in a fortunate position to utilise the mounting tension to take a leap forward leaving the underdevelopment vicious circle behind. Since 2001, Turkey has shown a successful recovery. The GDP continuously grew and inflation fell to the lowest levels of the last three decades. Declining foreign debt and a public budget at surplus are a novelty. This is encouraging for innovation (Vision, 2023). Turkey's new STI program has already started reforming the innovation institutions. *By* 2023, it aims to *create an economy* ***based on innovation***. The main objective is to improve the education and human resources and support R&D and infrastructure development in strategic industries (Elci, 2003). The program aims to divert the resources allocated to R&D into these industries and encourage related projects in universities. Moreover, the formal and informal cooperation among these industries, public R&D institutions and the universities are to be restored as a priority under this program. However, the most impressive objective of Vision 2023 is to establish the Turkish Innovation System by improving the quality of organizations and the coordination among them (Vizyon 2023; 2004). Turkey is a country which accommodates 1.1% of the world population but only produces 0.6% of the world output and 0.9% of the knowledge (Vizyon, 2004). Joining Europe may not be without problems, but on the whole it is good both ways. While Turkey's young population can act as a balancing factor for EU's aging population, the gained human skills can help Turkish innovation system (EU Commission, 2004). The added flow of FDI with increased involvement of the local suppliers would also

contribute to Turkish Innovation System (Vizyon, 2004). The strong trade relationships with the EU and alliances with European companies that already exist will support this process of joining EU's production system and gaining expertise in production, technology and innovation. By integrating to EU's production system, Turkey will get opportunities to enter into industries such as ICT and gain further expertise in industries such as automotive industry. There will also be further opportunities to upgrade the technology, agriculture and education system with the assistance of funds from Europe. The proximity to Russia and Turkish Republics may give Turkey a unique position to enlarge the European market towards the east. The pipes that transport the Azeri and Iranian oil and gas through Turkey may serve as a medium of communication to warm up the regional relationship and contribute to innovations at least in the energy sector.

CONCLUSION

We examined the NIS in advanced countries, and in the NIEs to evaluate the Turkish national innovation system. Although the '*quick learning'* NIEs seem to be the most plausible examples to follow, looking at the Asian crisis that crippled these countries, we opted for a joint venture with Europe to vitalise innovation in Turkey. It is the blessing of the location and the initial steps taken by Ataturk to modernise the country and its institutions that makes it a realistic proposition. Although the economy suffered for a long time, this has created a tension between the potentials of the economy and the retarded institutions. We argued that the hope to join Europe may divert these tensions from potentially destructive to a creative one which is good for sustainable innovation. However, the opportunities of Europe will not come very easily to Turkey. As previously discussed, Turkish innovation system has several weaknesses which need to be strengthened in a short time. The low education levels of the population and the weaknesses of the technological capacities require long-term commitments for improvements. The university-industry and government relationships have to be reshaped which would call for a 'Triple Helix' conference in Turkey as a starting point. Other concerns and hopes are related to the future sustainable growth of the economy and the *reformability* of the institutions. These institutions that have grown on the cultural backbone of the country lie on her like the stony shell of a Mediterranean turtle. In evolutionary terms, joining with Europe may transform this *co-evolution* into a *community evolution*.

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