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2.1 Introduction

Mankind has reached the current level of civilization of our era and economic order through three different transformations and economic experiences. Production, work and life styles have been differentiated with every transformation and experience in society. The first of these transformations was agricultural transformation and this period is known as agricultural economy. The second transformation was the change to an industrial economy which established automatized production. The third one is the transformation based on knowledge, technology and innovation.

Intensive cognitive effort has been made in order to name this last transformation through which civilization has changed totally. The changes of the 21st century become more evident day by day. This last circumstance which we are currently experiencing has been known by various names such as the third wave, the post-industrial period, and post capitalism by different philosophers, among them Brzezinski's technocratic era definition

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which exhibits a different angle. Naming this period knowledge based economy or knowledge economy has become a scientific approach.

The industrial civilization paradigm which was also named revolution and lasted for 300 years has ended and a new global paradigm which is based on knowledge, technology and innovation has appeared with this last transformation. Now, knowledge has replaced capital which was the main input and evolution dynamic of the old paradigm. Countries which were able to use this as a production factor have become pioneers of a new global paradigm. These developments enabled knowledge to become a main factor of global competition power, economic development and social welfare. The economic structure began to be called “new economy” with this new structuring. The qualitative and all quantitative developments that change the rules and functions of economy are defined as new economy (Atkinson et al. 1999). It is also possible to define new economy as a high level and long term development that has emerged due to the dissemination and adoption of developments and efficiency in ongoing information and intercommunication technology (De Masi et al. 2001). And the concept of new economy also expresses an economic structure in which there are high technologic developments, globalization of the world market, changing economic needs, and an obligation to think and act in this environment (Nakamura 2000).

Consequently, when today’s economies are defined, concepts such as “the knowledge economy”, “digital economy”, “virtual capitalism”, “knowledge based economy”, “economy of net” are used as synonyms for the concept of new economy or new economy’s sub branches.

A more scientific approach is to use the concept of knowledge because it is a driving force of economy and it provides economic and social benefits by passing through scientific processes.

These knowledge-based social and economic changes correlate with other changes and different approaches. For example, a knowledge-based urban transformation is a creation of this change. When cities transform into places where knowledge networks are being woven, some problems such as global democratization, and an identity problem, global migration, and settlement problems have occurred. In connection with these, interactive social movements have also begun to arise in a bipolar social structure, such as knowledge of the poor and knowledge of the rich. These developments have forced local governments and states which are trying to ensure social peace and social balance to establish a structure of civil organization which works for global economy and lives with local culture. Nations, which were unsuccessful in their attempts to develop their civilisation, have to keep up with globalization (Castells 2000).

Today, because global competition has gained a momentum based on knowledge, and knowledge economy has become a key to social development, it is required for countries to transform their economic structures into knowledge economies. How successfully transformation is realized or the success which is achieved is of critical importance to classify countries as developed or developing. In this context; after the theory of knowledge and innovation economics has been explained, the performance of Turkey’s knowledge

economy has been analysed and the situation has been evaluated in order to understand how successful Turkey is in becoming a knowledge society and whether its economy is knowledge based or not. For this purpose, knowledge economy and innovation indexes which are economic indicators have been drawn upon in addition to analyses that have been conducted. The knowledge economy based projections will also be illustrated with an approach that has become a catchword known as goal 2023 in Turkey.

2.2 Knowledge and Innovation Economy: A Techno-Economic Paradigm

The new social structure of our century is called the knowledge society. In the knowledge society, the fundamental resources are knowledge, products of knowledge and innovation. The knowledge society involves interconnected organization, standard protocols for transfers and communication and at the same time knowledge transfer. This new understanding has a unique character which differentiates it from agricultural and industrial societies. The new society is characterized by more knowledge incorporated in the new products and services, by more importance given to learning and innovation, globalization and sustainable development. Information is one of the main phenomena that directs the social and economic life of the new century.

In this context, Drucker (2001) defines the knowledge society as follows:

“The next society will be a knowledge society. Knowledge will be its key resource, and knowledge workers will be the dominant group in its workforce. Its three main characteristics will be:

- Borderlessness, because knowledge travels even more effortlessly than money.
- Upward mobility, available to everyone through easily acquired formal education.
- The potential for failure as well as success. Anyone can acquire the “means of production”, i.e., the knowledge required for the job, but not everyone can win.”

The new society proposes innovation and producing knowledge. Today, evolution is based on the production of knowledge and therefore the knowledge economy concept is now used more.

The target in this society is to have a workforce which can use information efficiently, effectively. Because information has a central position in knowledge society, unlike industrial society, the need for white collar employees namely a qualified workforce has increased instead of the section which is called blue collar employees. The industrial worker who works in the industrial society also lost his value as industrialization reached its highest level, a technical class which consists of professionals who produce science instead of bare products. According to Drucker, this class is “knowledge workers.” Briefly, “knowledge society is a structure in which the most strategic production factor is information.” This trend that has led to fast changes in society is leading to revisions in economic

theories and models. Traditional “production functions” focus on labour, capital, materials and energy; knowledge and technology are external influences on production. Now, analytical approaches are being developed so that knowledge can be included more directly in production functions. Investments in knowledge can increase the productive capacity of the other factors of production as well as transform them into new products and processes (OECD 1996).

OECD defines the knowledge economy as “economy which is directly based on the production, distribution and use of knowledge and information”. In knowledge economy, it is very important to innovate and to invest in knowledge because these are the elements which make productivity grow.

Organizations of all sizes and industrial sectors are faced with the task of implementing these technologies into their everyday services in order to compete and survive in this new knowledge economy.

In fact, in this economy, knowledge has become the key driver of economic competitiveness and success: it has added massive value to economic production through increases in productivity, and the application of new technologies and new ideas, both in the form of new inventions and also new applications of existing knowledge, has brought revolutionary change to virtually all markets and sectors.

When this new techno-economic paradigm is founded on innovations and entrepreneurship in an institutional structure it emerges and becomes a process which spreads by itself.

This is why this newly developing techno-economic paradigm is very different from the standard (classical) innovation mentality. Three conditions should be pointed out for this newly developing paradigm (Kudyba and Romesh 2002):

- Constant price decline of innovation linked products (microelectronic devices, biotechnologies, wireless communication etc.).
- Unlimited increase in the supply of these products.
- Increase of innovation to a higher level and constant incentives to innovate in other areas which are linked to the basic ones.

When this process begins, production cost declines with an expansion in the market of innovative products. This process continues until it affects the production process of all products. This kind of process narrows the area of old fashioned production and increases the usage of new products and processes. The adaptation of economic, national, international, political, and social institutions provides constant technological development. This kind of development which creates a quantum leap in productivity has the economic potential for a new paradigm.

Some thinkers have argued that the emergence of a knowledge based economy or new paradigm is a major departure, a new paradigm offering endless productivity gains, faster non-inflationary growth and ever increasing stock markets and low unemployment (Brinkley 2008). And also; the formation of “.com”s especially for technology based companies, the rise of the consumer confidence index, the increase of the foreign trade deficit, the

increase of inequality in income distribution, and wage rigidity (stickiness) are among the basic features of this new situation (Kudyba and Romesh 2002).

Many situations which did not exist in the old economy such as:

- Existence of wage rigidity (stickiness) along with low unemployment,
- Existence of low unemployment along with low inflation,
- a situation in which sustainable growth doesn't increase income inequality and
- a situation in which share certificate evaluation doesn't comply with traditional norms can be found in the new economy.

Although the attention of economists to technology dates back to old times, they have recently positioned technology in the centre of economic thought. The emergence of an effect on macro and micro economic variables, technological developments in general, and the advancement of information communication technologies in particular has led to economists becoming more interested in this subject (Yumuşak et al. 2010).

Elements such as production, sharing, usage, and enrichment of information have gradually become more strategic. Countries that want to enhance their global competitive power need a qualified workforce, namely human capital, R&D, information and communication technologies and an institutional structure which prepares a platform to provide all these, and economic development has gradually become more dependent on information (Yeo 2010). This is why developing countries need to transform into knowledge economies with a programmed effort in order to create development by strengthening the economic infrastructure. The character and the quantity of knowledge in countries' economic development also play an important part. Each knowledge based economy is positioned on four main pillars related to production, usage, dissemination, and development of information.

The World Bank has developed the following framework to help countries articulate strategies for their transition to a knowledge economy (World Bank Institute 2007):

- An economic and institutional regime to provide incentives for the enhancement of welfare, growth; usage, dissemination, and creation of information.
- An educated and skilled population to create, share, and use knowledge well.
- An efficient innovation system of firms, research centres, universities, consultants, and other organizations to tap into the growing stock of global knowledge, to assimilate and to adapt it.
- A dynamic information infrastructure to facilitate the effective communication, dissemination, and processing of information.

It is a more scientific approach to use the concept of knowledge because it is a driving force of economy and it provides economic and social benefits by passing through scientific processes.

2.3 Basic Features of the Knowledge and Innovation Economy

Improvements in information and technology affect all economic components. The economic structure becomes dynamic, complicated and difficult to foresee with this interaction. Production, consumption, distribution relations and market structure which are defined as the three main elements of economy are being configured based on knowledge. This structuring could be in the form of constant improvement of standard production processes, of obtaining new and different production processes, products and services by using available knowledge, or using completely new knowledge based on improvement. While production factors are consumed when they are used, knowledge cannot be consumed. A production function that includes information transforms into $TP = f(K, L, I)$ (TP = Total Products, K = Capital, L = Labour, I = Information) (coefficient of technological development/information). And when information becomes a production factor, traditional production also becomes more efficient due to the law of increasing returns.

When it comes to considering consumers' point of view, consumers buy products and services faster without restrictions of time and place. Economy is on the consumer's agenda. Barriers to enter and exit the market are becoming lower and information is becoming an element of competition. Companies which are innovative and enterprising, information cantered and able to adapt to market conditions, manage change and not only exist in the local but also in the global market can be successful. It is becoming mandatory to develop innovative products and services that can compete with global companies due to lifted borders.

In addition, the economic effect of physical distances and the cost of access to information have been reduced thanks to information and communication technologies. In this way, the cost of founding a new company is lower and the opportunities to compete in new markets increase. While the success criterion of companies was measured in terms of material profit in industry based economies and is now measured by "market value", qualified human resources which have replaced financial capital which was a scarce resource of old times has become a scarce resource. It seems that there is an increasing demand for manpower that can be defined as a sort of knowledge worker. In addition, information and communication technologies create collaboration opportunities in order to produce high quality, low cost products and services (European Commission 2012).

One of the changes which seems to be happening in the knowledge economy that the service sector is coming to the forefront. It seems that humanitarian services, information technologies and scientific improvement based R&D activities are gradually gaining in importance. It is possible to say that the economic model in which knowledge comes to the forefront forces current work processes and jobs to be more qualified (Meçik 2013).

Knowledge based processes, such as production, consumption, distribution etc. and economic developments as far as technological innovation are rapidly changing, because in our society:

- Computer technologies lead the development dynamic and there is an institutional infrastructure that consists of computer networks.
- Intellectual sectors lead the markets.
- Socio-economic system also consists of a voluntary non-governmental organization.
- There is a multi centred and participatory democratic political system.
- There is a strength to produce a high level information.
- Basic values are based on satisfaction that originates from reaching goals.

A knowledge economy which is formed by a society in that way, focuses on information as a production factor. Therefore it is necessary to learn and to use information for organizational development and innovation. In this context there are some factors that make the occurrence of this new knowledge based economy important and distinguish this economy from an industrial economy (Kim et al. 2006; Kevük 2006). Information revolution, flexible organizations, knowledge, skill, learning, innovation, information networks, learning organizations and innovation systems, global competition, clustering with production are some of these features.

Trends which are based on coding the information have intensified and the coded information sharing has increased the information stock of developed economies. Along with information Technologies, the advantage of coded information is to have a feature that can be transferred at minimum cost and maximum velocity. ICT has increased the capacity of producing and processing the information and decreased the cost of carrying out these processes (Houghton and Sheehan 2000). The knowledge economy can be defined as an economy that is spread to other areas and used by organizations and people for more economic and social development. A gradual increase in the importance of information presents a substantial potential to develop more efficient production methods for products and services and enables countries to transfer these techniques to people in an efficient and low cost way to reinforce their economic and social development. Increasing the level of welfare by extracting and processing natural resources is replaced by human knowledge and practices of creativity. Knowledge has become a production factor and a commodity which is of vital importance for people and companies in the 21st century that is defined as a century of knowledge based economies (Kefala 2010).

Interactive connections among companies in the knowledge economy help achieve new research results and gain basic technology components and reduce the cost of innovation and risks. Local clustering of networks and firms is important for the future of the knowledge economy. Firms use the clustering factor to work with other firms and technology based units for reasons such as rising costs and the expansion of technology's scope (Houghton and Sheehan 2000).

Basic components of the knowledge based economy could be classified as consumer demand, technology, globalization. There is a higher demand for services that are produced by knowledge based industries. Technology serves as a provider of both demand and supply. Computers and the internet contribute to the development of the knowledge economy and help reduce the costs of investment and transportation by being used effi-

ciently in production processes. New technologies at the same time enable new markets to be used as well.

Opening new markets and international trade will enable competition to increase in knowledge intensive sectors (Brinkley 2008).

The new knowledge based economy requires a broader mind-set and the understanding of changes in macro and micro units. Furthermore it requires facilities of technological infrastructure but this is not enough. The game of yield maximization which can be obtained from information and communication industries will be possible by behaving according to the new rules of the game. This is necessary for companies and industries as well as for the economy of a country and global economy.

And finally it should be mentioned that there is a need for a new economic theory in the knowledge economy. There should be an economic theory which positions information in the centre of the process of economic value formation. Because this kind of theory can explain innovation and processes of countries' growth only (Drucker 1994). This conclusion

Subjects	Old Economy	New Economy
Economy-wide Characteristics:		
Markets	Stable	Dynamic
Scope of Competition	National	Global
Organizational Form	Hierarchical, Bureaucratic	Networked, Entrepreneurial
Potential Geographic Mobility of Business	Low	High
Competition Between Regions	Low	High
Industry:		
Organization of Production	Mass Production	Flexible Production
Key Factor of Production	Capital/Labour	Innovation/Knowledge
Key Technology Driver	Mechanisation	Digitisation
Source of Competitive Advantage	Lowering Cost Through Economies of Scale	Innovation, Quality, Time to Market and Cost
Importance of Research/Innovation	Moderate	High
Relations with other Firms	Go it Alone	Alliances and Collaboration
Workforce:		
Principle Policy Goal	Full Employment	Higher Wages and Incomes
Skills	Job-Specific Skills	Broad Skills, Cross-Training
Requisite Education	A Skill	Lifelong Learning
Labour - Management	Adversarial	Collaborative
Nature of Employment	Stable	Market by Risk and Opportunity
Government:		
Business - Government Relations	Impose Requirements	Assist Firms' Innovation and Growth
Regulation	Command and Control	Market Tools, Flexibility

Fig. 2.1 Differences between Old and New Economy. (Source: Bonnett 2000)

can be inferred from these expressions; the economic theory that focuses on the dynamics of the industrial community is not enough to explain today's economy.

In this sense, the basic differences between the old and the new economy are shown in Fig. 2.1.

2.4 Components, Parameters and Indicators of the Knowledge and Innovation Economy

Features that differentiate the knowledge economy can be stated as follows:

- *It is an economy in which the service industry is gaining in importance.* The service sector has also continuously grown more diverse with the development of the knowledge economy.
- *It is an economy that is based on credit.* The evolution of electronic money and credit cards is an information sourced development.
- *It is a digital and virtual economy.* All sorts of information, such as voice-recordings, writings, images etc. are transmitted by computer networks in the form of bits. A large amount of information reaches its receivers in a very fast, cheap and safe way.
- *The knowledge based economy is a network economy.* Information technologies and communication networks present a chance for small scale companies to have advantages like bigger companies. For example, they present a chance to compete in the global arena.
- *The knowledge economy eliminates middlemen.* Intermediary firms that producer firms use in order to reach end users vanish because of communication networks in the knowledge economy.
- *The dominant sector of the knowledge economy is a triple formation.* The dominant economic sector in the knowledge economy that is formed by the integration of computers, communication and entertainment as the new media sector. People change methods of doing business, producing, working, having a good time, living and thinking.
- *The knowledge economy includes innovation.* Constant regeneration of processes, market, people is an innovative foresight of today's economy. The secret of being successful is innovation and creativity.
- *The knowledge economy reduces the difference between producer and consumer.* Consumers in the knowledge economy can contribute to production and have the opportunity to direct production through increasing communication technologies.
- *The knowledge economy is a rapid economy.* Success of companies and decision units depends on capacity of ability to adapt to innovation and speed of information. "An adage of big fish eats small fish is replaced by an adage of fast fish eats slow fish" (Jennings and Haughton 2001).

- *The knowledge economy also includes some social problems in its structure.* It also seems that a new political economy is beginning that brings some problems such as power, security, equality, quality, quality of work life and the future of the democratic process with it. The possibility of information and fast growing technologies being misused by dictatorial powers and governments is a serious social problem.
- *The knowledge economy is a harmonious economy.* Usage of computers and the internet is effective to reduce the cost of friction that is a problem which causes conflicts between sellers and buyers in the industrial economy.

Because the knowledge economy is a concept which is about humans, it is defined as “a shape of activity subject to human owned scientific, systematic, organized information to be applied to production, consumption, sharing“. Knowledge economy can be defined with twelve main elements (Tapscott 1996):

- Knowledge
- Digitalisation
- Virtualisation
- Molecularization
- Integration/Internetworking
- Disintermediation
- Convergence
- Innovation
- Prosumption
- Immediacy
- Globalisation
- Discordance

There are different classifications for basic components of the knowledge economy in academic literature. There are four components of the knowledge economy (Fig. 2.2).

Economic and Institutional Regime	A country's economic and institutional regime provides stimulation to use information efficiently and develop entrepreneurship.
Education and Talent	A country's citizens need education to produce, share and use information effectively.
Infrastructure of Information and Communication	Infrastructure of dynamic information facilitates effective communication, spread of information, the functioning of the information,
Innovation System	A country's innovation system - firms, research centres, universities, think tanks, consultants and other organisations - is able to attract, adopt increasing global information stock and form new technologies by adapting to local needs.

Fig. 2.2 Four Basic Components of the Knowledge Economy

The knowledge assessment methodology developed by the World Bank K4D is a method which helps to identify problems and opportunities that can be encountered in the route of transition to a knowledge economy by using these components. These components can be summarized as follows:

- R&D and innovation: National innovation system in which innovation policies can be found that aim to develop and commercialise local and global innovations, institutions and support mechanisms which include R&D systems. Here, some important indicators are the number of patents, copyright payments, number of scientific publications.
- Education: An innovative and dynamic education system that includes public and private institutions which educate knowledge experts, technology literates, the workforce, qualified human resources that are the most important components of the knowledge economy (David and Foray 2002).

Here, some important indicators are rate of adult literacy, participation in secondary and higher education.

- Information and communication technologies: Here, some important indicators are the number of telephone subscribers, the number of computers and usage of internet.
- Proper work environment in which the knowledge economy can develop: Here, some important indicators are restrictions with and without tariffs, quality and feasibility of regulations, local credits for private sectors, number of days required to initiate work, the intensity of local competition, political stability (World Bank Institute 2007).

Kevük (2006) states that components of the knowledge economy are ICT, innovation, knowledge workers. Alexander and Butcher (2011) also state that production, usage, acquisition of information are the main components of the knowledge economy. Oort et al. (2009) remark that R&D is also a component of the knowledge economy besides these components. In conclusion, it can be remarked that in literature, components of the knowledge economy develop in the factors' orbit of ICT, innovation, R&D, knowledge workers and human capital (Godin 2008).

When decision makers set a target for the knowledge economy and knowledge society, they must be able to evaluate countries' conditions in terms of information and communication technologies.

Several indexes can be used for this particular subject. Some institutions that have developed these indexes are: McConnell A Global Technology Policy and Management Consulting Firm, The Centre for International Development at Harvard University, The Economist Intelligent Unit, The United Nations Conference on Trade and Development (UNCTAD), The United Nations Development Program (with its Technology Achievement Index), World Economic Forum, The Mosaic Group and The World Bank (Beig et al. 2007).

The KAM Knowledge Index (KI) measures a country's ability to generate, adopt and diffuse knowledge (Fig. 2.3). This is an indication of the overall potential of knowledge

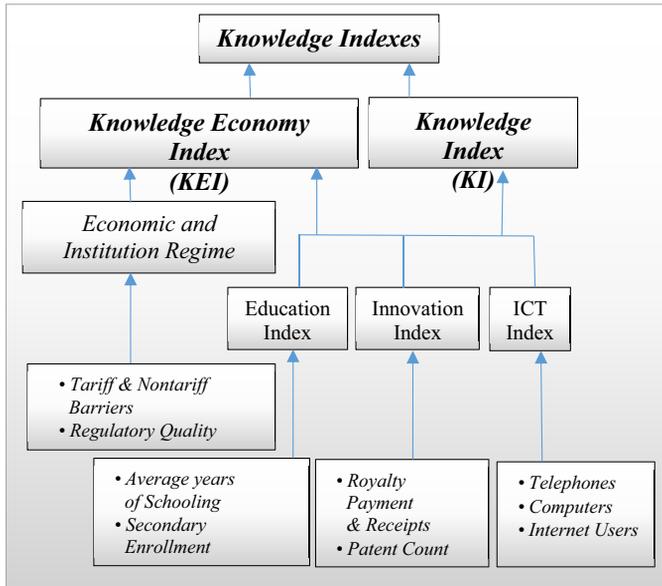


Fig. 2.3 Knowledge Indexes. (Source: <http://web.worldbank.org/WBSITE/EXTERNAL/WBI/WBIPROGRAMS/KFDLP/EXTUNIKAM/0,contentMDK:20584278%23menuPK:1433216%23pagePK:64168445%23piPK:64168309%23theSitePK:1414721,00.html>)

development in a given country. Methodologically, the KI is the simple average of the normalised performance scores of a country or region with the key variables in the three knowledge economy pillars education and human resources, the innovation system and information and communication technology (ICT).

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 towards the Knowledge Economy. The KEI is calculated based on the average of the normalized performance scores of a country or region with all 4 pillars related to the knowledge economy – economic incentive and institutional regime, education and human resources, the innovation system and ICT.

For the purposes of calculating KI and KEI, each pillar is represented by three key variables (more on these variables):

The Economic Incentive and Institutional Regime

- Tariff & Nontariff Barriers
- Regulatory Quality
- Rule of Law

Education and Human Resources

- Average years of schooling
- Secondary Enrolment
- Tertiary Enrolment

The Innovation System

- Royalty and License Fees Payments and Receipts
- Patent Applications Granted by the US Patent and Trademark Office
- Scientific and Technical Journal Articles

These three variables are available in 2 forms: scaled by population and in absolute values. Thus, both KE and KIE are also available in “weighted” and “unweighted” forms. In innovation, the absolute size of resources matters, as there are strong economies of scale in the production of knowledge and because knowledge is not consumed in its use.

Information and Communication Technology (ICT)

- Telephones per 1000 people
- Computers per 1000 people
- Internet users per 10,000 people

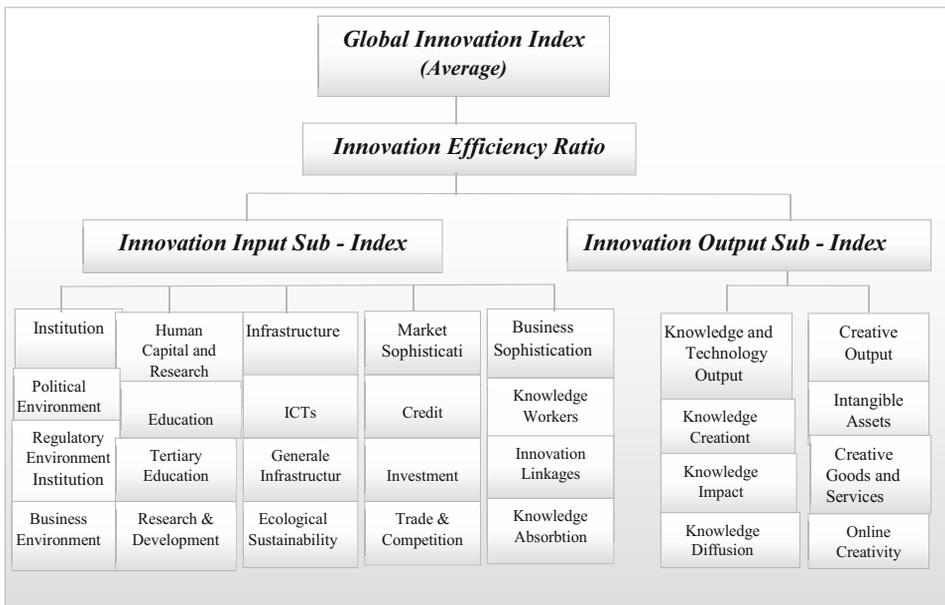


Fig. 2.4 Innovation Index. (Source: <https://www.globalinnovationindex.org/content/page/data-analysis/>)

The other performance analysis related to the usage of information communication technologies with an effect on development dynamics is conducted by the Networked Readiness Index which was developed by The World Economic Forum. The index aims to measure the readiness level of countries to use communication information technologies. It is one of the studies to measure how well countries adopt these technologies in terms of individual, business world and public administration (World Economic Forum 2014). This index has four main elements such as environmental conditions, readiness, usage, creation of an effect.

Similarly, indexes have also been developed to measure innovation structures of countries. The European Union (EU) and INSEAD use innovation indexes as indicators when they measure innovation performance and put countries in order according to this measurement in studies which are performed by The Economist Intelligence Unit (Fig. 2.4). And also the World Bank analyses countries' performances and creates rankings according to index scores under the frame of the knowledge economy that accepts innovation as an input as well.

2.5 Knowledge and Innovation Economy in Terms of Turkey

Because transition to a knowledge economy has become a key to an increase in social development and welfare, it requires implementations of economy policies that are in this direction and a structural transformation. But it is really important how successfully this structural transformation is implemented or how much progress is made in the transformation process.

R&D and innovation studies which were neglected for years have increased significantly in the economic transformation process that was experienced in 2000s. And progress has been made in financial and human resources. At this point it is observed that these resources are still growing but it is not enough yet according to levels which were set by Turkey for 2023 and beyond.

First, the second and third waves defined by Toffer were implemented. Turkey was able to become a young industrial country through protectionism and incentive policies. But the transition to knowledge equipped understanding is necessary to increase productivity in production and to professionalise by producing high value added products.

Turkey is aware of the fact that the role of the information and communication technology sector will be more important in the future compared to today. In this respect, Turkey has become more interested in the sector of information and communication technologies in recent years, and accelerated necessary studies to have a higher involvement in this sector in future. At this point it should be mentioned that information might have been bought from outside without having been produced in the country. What is important to ensure the production of information and its sustainability. Due to the given situation it is important for the knowledge economy profile of Turkey compared with high, moderate and low countries to reach ICT's about the average level of welfare of each country's cit-

izens and by socio-economic indexes (Table 2.1). And also although information can be obtained about the average wealth level of countries by looking at GDP figures from the table, it is not enough to indicate the development level of countries. The Human Development Index is therefore also included in the table. Political rights and freedom that affect creativity of people's happiness and wealth are added as further indexes. Political rights and freedom are indexes that are effective in terms of the work climate. The existence of knowledge workers shouldn't be ignored. For this reason, the number of working researchers is considered in R&D activities. One of basic activities related to the production of information and innovation is R&D activity. The share of R&D expenditures are also included in GDP. The other important index is the number of patents, which can represent the process of innovation creation. Low figures of this variable mean there are problems in terms of creating innovation.

Table 2.1 Country Group and Turkey's Socio-Economic Indicators (2012)

	World	High-Income Countries	Middle Income Countries	Low Income Countries	Turkey
Growth Rate	2.88	1.84	6.28	5.61	8.77
GDP Per Capita (\$)	10,196	38,165	4366	1899	10,605
Gross domestic expenditure on R&D (%)	2.20	2.48	1.25	–	0.92
ICT Goods Exports/Export (%)	10.01	8.72	14.31	4.39	1.66
ICT Goods Imports /Import (%)	11.06	10.76	12.24	6.36	3.83
Internet Usage (100 Kişi başına)	32.55	72.74	26.44	15.78	43.07
Patent Applications (Residents)	1,277,816	820,994	448,655	14,052	4543
Patent Applications (Non-Resident)	705,504	482,209	222,760	52,363	7056
Secure Internet servers (per million people)	184.17	938.22	11.12	3.45	143.64
Human Development Index ^a	0.89	0.66	0.66	0.50	0.76
Index Economic Freedom ^b					62.1
Freedom Index ^c					7.10
Personal Freedom ^c					7.16
Economic Freedom ^c					7.03
Computer Usage ^d					93.5
Internet Access ^d					92.5
Having Website ^d					58.0

^a Source: <http://hdr.undp.org/en/composite/HDI>.

^b Source: https://freedomhouse.org/report-types/freedom-world#.U48oVPI_usd, http://www.sithi.org/admin/upload/media/%5b2013-02-12%5dHighlights%20of%20the%202013%20Index%20of%20Economic%20Freedom/2013_02_12_Index2013_Highlights.pdf.

^c Source: <https://www.cato.org/human-freedom-index> (04.08.2017).

^d Source: www.tuik.gov.tr/PreIstatistikTablo.do?istab_id=1615.

As can be seen in Table 2.1, most of Turkey's socio economic indexes are low compared to the average of the world and country group. But it can be said that Turkey has a tendency towards rapid increase since the beginning of the 2000s. The World Bank developed a "methodology of information evaluation" to highlight the importance of the knowledge economy in global competition and formed knowledge based economy indexes to measure knowledge based economic structures of countries by using this method (World Economic Forum (2014)). Education, innovation, information and communication technologies form the knowledge index (KI) by clustering. The knowledge economy index (KEI) is formed by adding indexes related to economy and institution. The knowledge economy index (KEI) examines the ability of a country to spread, to customize, to create information. As a country approaches 10 it shows that there is progress in the field of the knowledge economy variable. We tried to make a situation analysis by using indexes related to the knowledge economy and indexes related to elements of the knowledge economy. There are KI and KEI indexes and sub components related to the knowledge economy in Table 2.2 which allow it to compare present conditions of countries. The KEI and KI figures of Turkey are close to the World average but lower than the average of high income countries. It can be said that Turkey is situated within the group of middle income countries.

According to measurements of innovation performance that are carried out by the EU, INSEAD, the Economist Intelligence Unit and the World Bank, the index value of Turkey's innovation increased from 0.18 s in 2007 to 0.24 s in 2011. This value increased from 0.52 to 0.54 in the same period of time in the EU. It can be said that Turkey is defined as an innovative state and a member of moderate non-assertive European countries. But it also seems that Turkey shows a below-average performance. There are areas such as open, perfect, and convenient research systems, finance and support, innovation foundations, and their economic effects where Turkey is relatively strong. Areas where Turkey's performance is low are human resources, company investments and intellectual assets (Karaata 2012). If growth rates are taken into consideration, areas such as R&D

Table 2.2 Country Group and Turkey's KEI and KI Indicators (2014). (Source: World Economic Forum 2014)

	World	High- Income Countries	Middle Income Countries	Low Income Countries	Turkey
Knowledge Index (KI)	5.01	8.67	5.07	1.58	4.81
Knowledge Economy Index (KEI)	5.12	8.60	5.01	1.58	5.16
Economic Incentive and Institution Regime	5.45	8.39	5.18	1.61	6.19
Innovation	7.72	9.16	6.21	2.13	5.83
Education	3.72	8.46	4.72	1.54	4.11
Information and Communication Technology	3.58	8.37	4.28	1.05	4.50

expenditures ensure that the performance of Turkey's growth is high. It seems that Turkey shows above average growth performance in fields such as human resources, open, perfect, and convenient research systems, finance and support, investments of firms.

Turkey's position can be seen in Table 2.3 according to global innovation index value and order. Turkey is 58th with a score of 37.81 among all other countries.

In other studies Turkey also ranks 71st with a score of 41.68 according to Innovation Input Sub-Index rankings. Singapore is the 1st with a score of 72.12 in this field. Within another study Turkey is 52nd with a score of 5.42 among 82 countries according to the most innovative countries ranking of World Bank. The expected innovation performance index of Turkey is higher than index that occurred with 5.81. The World average of innovation performance index is 6.28 (EIU 2009).

Political and economic decision mechanisms comprehended better that R&D and innovation have a critical importance and strengthen Turkish economy while reducing external dependence. In this context, some assertive goals have been set by the supreme council for science and technology for the year 2023 when celebrations will take place for the 100th year of the Republic of Turkey. In the direction of this goal Turkey is:

- to allocate at least 3% of its GDP (60 billion dollars), two thirds of it will come from firms, to R&D
- to become one of the world's top 10 economies and to have 300,000 full-time employees of whom 180,000 work in private sector.
- to increase the number of broad band subscribers to 30 million.
- to provide 14 million households with internet connections of 1000 Mbps.
- to increase the sector share to 8% in GDP.
- to become one of the top 10 countries in the field of e-transformation
- to enable 80% of the population to use a computer.
- to increase growth of the information and communication technology sector to reach 160 billion US dollars with an annual rate of nearly 15%.
- to increase the share of R&D spending in GDP from 0.85 to 3%.

These are the predictions (www.invest.gov.tr, n. d.).

Table 2.3 Global Innovation Index Rankings. (Source: Dutta et al. 2015)

	Score	Rank	Efficiency
Switzerland	68.30	1	1.01
United Kingdom	62.42	2	0.86
Germany	57.05	12	0.87
Russian Federation	39.32	48	0.74
Turkey	37.81	58	0.81
Brazil	34.95	70	0.65

Turkey launched “The National Science, Technology and Innovation Strategy 2011–2016” to reach these goals. The national STI Strategy conducted by the Scientific and Technological Research Council of Turkey focusses six different horizontal policies and it has the goal to provide support to competitive sectors (such as automotive, machine production, information and communication technologies) in which the R&D and innovation capacity of Turkey is strong compared to other sectors which are already developing (defence, energy, space, water, food) (TÜBİTAK 2013).

Conclusion

Knowledge and innovation that is an important reflection of knowledge have become the most important components of global competition and economic development in our age in which social and economic structures are transforming in a knowledge based way. Now economy administrations comprehend that it is necessary to benefit more from global scaled knowledge resources in order to strengthen elements of competition and development, because, it is not possible to be excluded from this gripping global transformation trend. It can be said that although this process is relatively in favour of developed countries with effect of neoliberal policies, developing countries are also benefiting from this on a large scale. In this study, Turkey’s situation, which could be said to be on one of the highest levels in the ranking of developing countries, but with much further potential in terms of knowledge economy and innovation. We tried to benefit from indexes that try to measure knowledge economy and innovation performance to realize this goal. Turkey, which saw the need for a paradigm change to reach a new economy based scientific technologic development that is targeted in the medium and long term, has implemented some reforms since the beginning of the 2000s.

Thanks to these reforms which were applied successfully, Turkey has shown significant improvement in many macro-economic indexes and experienced a development adventure that set an example by showing extraordinary economic performance. It is observed that Turkey has made evident progress to use both human and financial resources in recent years and has increased investment into R&D and innovation and outputs. Turkey, which believes that transformation is inevitable and necessary, has been making efforts to implement result oriented mechanisms especially in terms education, economy and social state policies.

It has become an inevitable strategic dimension necessity for Turkey to make bigger moves in the field of R&D and innovation for the purposes of making a history in economy by attaining the figures of exports and GDP set out in the vision of 2023 and keep going in its track without being caught by the middle income trap. Consequently, Turkey attaches importance to increasing R&D target driven projects, stimulus policies, effectiveness in allocating resources, and, for this purpose, obtaining coordination between institutions and organizations. It seems that the active policies of especially TÜBİTAK and other institutions affiliated to the ministry of science, industry and technology in the fields of patent, scientific publication and copyright have

increased innovation index values although it is late. And Turkey is rising towards an upper ranking in the knowledge economy index.

Although Turkey's goals "of increasing allocated resources for RD to 3% (60 billion dollars) and increasing GDP to 2 trillion dollars" seem ambitious. It doesn't look impossible when potential values such as exhibiting this performance in a steady economic, social, politic environment, its active population, its SME performance, its openness to innovation, its geographical and strategic position, its willingness to use new technologies and having a population that is prone to interaction, are taken into consideration. But it must also be mentioned with realistic approaches such as the "Report of Inventiveness Union Progress" (2013) of the European Commission that Turkey ranks 27th of 33 European countries in terms of growth rates. Regarding the increase in science and technology (it is a composite index which includes the share of a country in the most cited publications, the number of good university per one million inhabitants, patent applications, the number of prestigious European Research Council grants), Turkey has made very limited progress in knowledge intensiveness of its economy in the last ten years. And this shows that Turkey needs to go a long way in terms of transformation into the knowledge economy. In general, one can say in Turkey:

- fixed capital, investment into the information and communication sector are not adequate
- spending of R&D lag behind those of fast growing economies.
- human capital is not successful in increasing the level of its education.
- the inclination to high tech products in the structure of production remains limited and it seems that the low tech based production structure will continue.

While Turkey shows relatively good performance according to criterions such as given incentives to R&D and innovation and the existence of institutions that are needed in national innovation system and scientific publications, Turkey needs to make progress to have qualified human resources in order to make innovation in the fields of general education and intellectual property rights as a more comprehensive criterion. Education reforms should be implemented, the infrastructure of information and communication technologies should be extended for the purposes of producing, using and sharing information and implementing institutional-legal regulations in order to create knowledge workers and human capital.

Opportunities such as the gradual increase in the number of universities in recent years, the programme for alignment with the *acquis* in the EU membership process, the development of the financial system, the rapid acquisition of information and communication technologies, the existence of new job opportunities in the long term, the existence of science based prominent sectors in the economic field increase hopes to become a knowledge society, to transform knowledge into an economic value and to achieve a position among developed countries.

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