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Knowledge-based economic development of Iran: Mitigating sanctions and enhancing national competitiveness

Ismael Rezaeinejad, Sergey N. Lavrov, Alexander G. Simonov

RUDN University,
6 Miklukho-Maklaya St, Moscow, 117198, Russian Federation
✉ simonov-ag@rudn.ru

Abstract. The knowledge economy is an economic system in which the production of goods and services is based principally on knowledge-intensive activities that contribute to advancement in technical and scientific innovation. A knowledge-based economy is a kind of economy without limitations. This study studies the prospects of Knowledge Economy in Iran. In recent years, the scope of innovative activity and the necessity of a knowledge economy in Iran has grown. However, this study shows that knowledge development alone is not efficient: it is useful only when knowledge is being generated and applied in a real business environment. Iran would probably benefit as well in the case the expertise of national academia and business community is used more intensively; otherwise, it would grow vulnerable if the foreign innovative technologies were only used. Under the current circumstances, Iran, dealing with ever-expanding sanctions, should be seeking opportunities to commercialize its domestic researches and developments.

Keywords: Knowledge Economy, Iran, World Economy, Sanctions, Economic System, Macroeconomics, National Competitiveness

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Развитие Ирана в рамках концепции экономики знаний: преодоление санкций и повышение национальной конкурентоспособности

И. Резаинежад, С.Н. Лавров, А.Г. Симонов

Российский университет дружбы народов,
Российская Федерация, 117198, Москва, ул. Миклухо-Маклая, д. 6
✉ simonov-ag@rudn.ru

Аннотация. Концепция экономики знаний подразумевает создание экономической системы, в которой производство товаров и оказание услуг принципиально основывается на интенсивном использовании знаний и технологий, что способствует продвижению технических и научных инноваций. Экономическая система в рамках экономики знаний лишена множества ограничений, присущих традиционной экономики. Данная статья посвящена анализу перспектив внедрения экономики знаний в Иране. В последние годы возрос масштаб инновационной деятельности, а значит и потребность в переходе к экономике знаний. Однако данная работа демонстрирует, что развитие исключительно с упором на создание знаний не может быть эффективным: полученное знание должно внедряться и применяться реальным бизнесом. Иран может получить выгоду в том случае, если экспертиза национального научного сообщества и бизнеса будет использоваться более интенсивно; в противном случае может возрасти уязвимость, вызванная опорой исключительно на иностранные инновационные технологии. В рамках сложившихся условий Иран, находящийся в условиях возрастающего санкционного давления, должен искать возможности для коммерциализации отечественных исследований и разработок.

Ключевые слова: экономика знаний, Иран, мировая экономика, санкции, экономическая система, макроэкономика, национальная конкурентоспособность

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Introduction

The term knowledge-based economy or knowledge economy was coined by Organization for Economic Co-operation and Development (OECD), as the economies that are based on the production, distribution, and use of knowledge and information. Knowledge-based economy is derived from the emerging economic structure, which is formed as a result of a significant revolution, based on knowledge and innovation. In modern economics, it is known as one of the leading causes of economic development and prosperity in developed nations (Alvesson, 2004).

The UK was among the first countries to welcome and adopt this concept. The UK Ministry of Industry and Commerce stated that their future national competitiveness is based on stimulating the economy with knowledge. Such approach was also adopted by countries like Australia, Canada, China, Romania, Lithuania, Finland, New Zealand, Thailand, and international organizations, including the United Nations (Abbas, Sağsan, 2019; Bejinaru, 2019).

The World Bank defines four pillars of a knowledge-based economy:

a) **motivational system**: an appropriate organizational economy and an organizational regime shall provide incentives for the appropriate use of knowledge. Economic factors shall provide incentives for efficient use and knowledge creation. Moreover, they should create a clear and stable macroeconomic economy in competition (Chen, Dahlman, 2005). The economic system should provide a minimum of price disorders. The economy needs to be open to international trade and the diversification of the domestic industry to increase free competition. A proper economic system shall be held responsible and free of corruption, and a legal system shall support and strengthen the business environment and protect property rights;

b) **education**: only a trained and skilled people can effectively create, distribute, and use knowledge. Skilled and educated people are essential to create efficiency, acquisition, dissemination, and deployment of knowledge, increasing production factors' overall efficiency and thereby leading to economic growth and development. While basic training helps individuals to increase their learning capacity and use information, it is necessary to use more sophisticated techniques and higher education (especially in high-tech areas, such as IT, space, optics, etc.) for technology innovation (Wong, Ho, Singh, 2007);

c) **information and communications technology (ICT)**: a dynamic information infrastructure that facilitates effective communication, dissemination, and processing of information. ICT is an essential part of KBE (knowledge-based economy) and is recognized as an effective tool for increasing economic growth and competitiveness. ICT infrastructure refers to the availability and efficiency of computers, the Internet, telephones, radio devices, and networks that link them. The more open and broader the communication space of society is, the more educated and motivated its members are (Cooke, Leydesdorff, 2006);

d) **innovations**: the existence of an efficient innovation system is necessary to create new markets. Based on the economic theory, technical progress is the primary source of production growth, and an efficient innovation system is a key to such technical progress. The ability to produce depends now on the ability to research, develop, and launch (Foray, Lundvall, 2009).

The knowledge-based economy is a mode of economy, where actors create and disseminate knowledge effectively for economic and social development (Ghassib, 2012). In a knowledge-based economy, knowledge is the most crucial production factor. The KBE can become a modern foundation of knowledge creation,

exploitation, and wealth creation; growth and economic development play a dominant role in this case (Godin, 2006).

Attention to the role of the knowledge in the economy is not actually new: Adam Smith focused on the role of expertise in production and economy, and Georg Friedrich List emphasized that the creation and distribution of knowledge would help improve efficiency in the economy (Hadad, 2018).

Joseph Alois Schumpeter's followers, such as Hirschman, Galbraith, and Goodwin, paid special attention to the role of innovation in the economy's dynamics, and Paul Michael Romer and Michael Grossman also contributed to the understanding of the long-term economic growth by presenting a new theory on human capital (Héraud, 2021).

The knowledge industry can also be defined as an industry based primarily on applying new technologies rather than just processing raw materials into products; there are two main classes of industries within this approach (Mejri et al., 2018). The first class is presented industries that use complex scientific knowledge to produce products or render services, like high-tech industries such as nanotechnology, biotechnology, nuclear, information, aerospace, chemical, petrochemical, electricity technologies, and electronics. Second class is represented by industries that produce intelligent products or use smart metering in product manufacturing. Intelligent products produced by knowledge-based industries are interactive; repeating their use makes them more intelligent, and they have customization capability and train users. The tier, informing the driver of the pressure, or the garments, reacting to temperature changes or rain, are examples of knowledge-based or intelligent products, which are shaping a new market trend in knowledge-based economic systems (Partha, David, 1994).

The knowledge-based industry includes all manufacturing industries with advanced technology, such as the aircraft industry, manufacturing scientific and administrative equipment, medicine, radio, television, and communication equipment. The knowledge-based services industry includes financial, insurance, communication, business, personal and social services (White, Gunasekaran, Ariguzo, 2013).

Research methods

The research is conducted within an analytical-descriptive method. The method of gathering research data is library study, including books, magazines, papers, and electronic resources. This paper explores the Knowledge Economy in Iran's economy in general and business in particular.

Literature review

The knowledge economy (or the knowledge-based economy) is an economic system in which the production of goods and services is based principally on knowledge-intensive activities that contribute to advancement in technical and scientific innovation. The critical element of value is the greater dependence on human capital and intellectual property to source innovative ideas, information,

and practices. Organizations must capitalize on this «knowledge» in their products to stimulate and deepen the business development process (Soete, 1997). There is less reliance on physical input and natural resources. A knowledge-based economy relies on the crucial role of intangible assets within the organizations' settings in facilitating modern economic growth.

The concepts of the knowledge industry were first proposed by Fritz Machlup (1962) and by other researchers, including Drucker (1965, 1993), Antonelli (1999), Yukinori (2007), Ghassib (2000), Rooney, (2005). They have distinguished activities in the knowledge industry into three categories: knowledge generation, knowledge distribution, and knowledge dissemination. Producing new knowledge is performed through scientific and technological research and creative activities such as filmmaking, music, and writing. The economical basis of knowledge is directly based on the production, distribution, and consumption of knowledge and relevant information (Smith, 2002).

The terms knowledge-based economy and knowledge economy entered the American economy literature in the 1960s. However, further developments followed in the 1990s and later, with various efforts of the OECD to set indicators for the knowledge field of economy (Nakano, 2007). Although, by 1995, it did not reach a full scale until it was published for the first-time codified framework of the term knowledge economy by the OECD as the ministerial document of the science policy-making committee of Canada. This document determines the position of growth models and the role of innovations in the economy (Ibidunni, 2020).

From that period on, numerous studies on the development, reinforcement, and consolidation of the concept of the knowledge economy have been conducted, and the scope of the knowledge economy has been clarified. According to the OECD, most developed economies are directly based on the production, distribution, and consumption of knowledge and information. In a knowledge-based economy, knowledge is the primary driver of growth, wealth creation, and employment in all activities. According to this approach, basic knowledge is not only dependent on a limited number of industries based on highly developed technology; instead, in this type of economy, all economic sectors are looking for knowledge (Popkova, 2019).

The Asia-Pacific Economic Cooperation (APEC), expanding the idea of a knowledge-based economy proposed by the OECD, considers it as an economy in which production, distribution, and application of knowledge is the primary driver of economic growth, wealth generation, and employment in all industries. According to this definition, all economic activities depend on knowledge (Popkova, Ragulina, 2019).

KBE is an economical basis in which knowledge is created and disseminated, and effectively used by economic actors for economic and social development. In the transition economy, the roots of a knowledge-based economy formed when using these technologies and their effects on the economy (Ode, Ayavoo, 2020).

In KBE, land, work, or capital will not be only import issues for development, but knowledge is an engine of economic growth and the production of wealth in the

economy. For the first time in human economic history, the richest of the landowners, capitalists, would not be, in its traditional sense, politicians, army commanders, and mines owners, but the people who have the art of using knowledge in their economies (Brinkley, 2006). In the present era, the term KBE/KE indicates the emphasis on the role of knowledge and technology in the economy's development; hence, it can be stated that in a knowledge-based economy, knowledge is qualitatively and quantitatively compared with the past. Although the term knowledge-based economy was introduced into American literature in the last century, the evolution of IT changed the term recently and has become a widespread topic in economic development (Yang et al., 2018).

Results and Discussion

Characteristics of a Knowledge-Economy

The knowledge economy has an open-stream flow of knowledge, meaning that knowledge of other processes flows into knowledge production. In fact, one of the main channels of knowledge flow is its current from production to distribution. The knowledge that flows through this channel is how to deal with process issues.

The characteristics of a KBE compared to a traditional economy can be expressed by the following:

1. KBE is not dealing with the scarcity of resources; it is the economy of an abundance of resources: unlike most of the resources that are amortized when consumed, information and knowledge can be consumed repeatedly, hence, they cannot be over-consumed.
2. In KBE, knowledge is converted into goods and can be capitalized. Now, virtual markets are formed to buy and sell knowledge worldwide, and people exchange it by setting a price of their knowledge. The knowledge market is very heterogeneous, and each item has its unique quality and price. Knowledge owners operate in a monopolistic or quasi-exclusive way.
3. A knowledge-based economy is a kind of economy without strict and severe physical limitations (e.g. the objects of a physical economy are steel factories, power plants, etc.). The elements of KBE are usually intangible and integrated (ideas, know-hows, etc.).
4. The value of products and services in the knowledge-based economy depends on personal attitudes and terms. A given knowledge or technology can have a different value for different people and firms at different times and locations.
5. In a knowledge-based economy, knowledge depends on a set of systems and knowledge processes of the society and market; therefore, it has a more permanent value, whereas individual knowledge (stored in human brains) is easily degraded and eliminated.
6. Within the KBE, knowledge and information are increasingly gaining value as long as the demand for them is rising and the barriers for communication are being lifted.

7. The location of activity in a KBE is more vital since it is created using appropriate technologies and methods, markets, and virtual organizations and is active in service. What is important is the speed of action in the activities and the connection to the rest of the world.

Iran's opportunities and challenges in terms of the knowledge-based economy

The Knowledge Indexes were designed as a tool for benchmarking a country's position vis-à-vis others in the global knowledge economy. It was created by the World Bank Institute using the Knowledge Assessment Method (KAM). The World Bank discontinued publishing the index after 2012. «A joint initiative between the United Nations Development Programme (UNDP) and the Mohammed bin Rashid Al Maktoum Knowledge Foundation (MBRF)» created «The Global Knowledge Index (GKI) from Knowledge4All» as a replacement. An EBRD «Knowledge Economy Index» documented in a 2019 publication uses indicators like institutional & legal frameworks (as a basis for patents etc.), number of technical graduates, research spending, number of patents, some measure of collaboration, and amount of venture capital. There are 38 contributing indicators described in the ERBD index method (Chaharband, Momeni, 2012).

Having realized the need to shift from a natural resource-based economy to KBE, policymakers in Iran have tried to facilitate the transition through different policy measures and initiatives. Laws that aim to support knowledge-based firms (KBFs) have been devised, and as of October 2016, 2732 KBFs have been benefiting from the facilities, both financial and non-financial. Today, these firms account for almost 70,000 jobs and $6.6 billion in annual turnover (Valibeigi et al., 2020).

Thriving KBFs relies upon solid infrastructure, which has been improved significantly in recent years. The mobile phone penetration rate has increased from 12 % in 2005 to 93 % in 2019, and 65 % of the population used the Internet in 2018, compared to 8 % in 2005. Despite these facts, ICT infrastructure requires additional investment to facilitate e-commerce and e-government, improve ICT services, and make them more efficient for businesses (Table 1, Figure 1) (Rezaeinejad, 2022).

Table 1

Iran's ranks in Global Innovation Index (GII) report

Indicator	2014	2015	2016	2021
Institutions	131	126	112	124
Human capital and research	46	46	48	49
Infrastructure	81	68	91	70
Market sophistication	139	139	102	82
Business sophistication	136	130	111	115
Knowledge and technology outputs	113	90	65	46
Creative outputs	128	116	75	46

Source: Retrieved May 27, 2023, from https://www.globalinnovationindex.org/

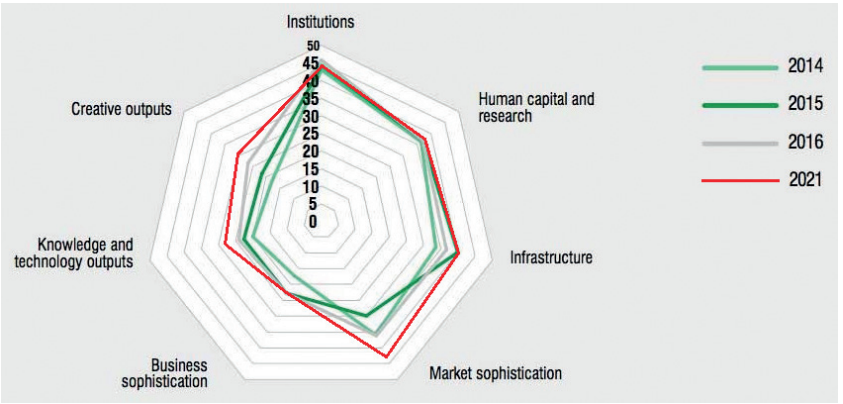

Figure 1. Iran's scores in the global innovation index (0–100 grading scale)
Source: WIPO.

Other types of infrastructure are also critical for developing a diverse economy (Rezaeinejad, 2021). Transportation infrastructure in Iran needs enormous investments for modernizing and increasing the capacity of road, aviation, and maritime transportation (Rezaeinejad et al., 2023). High production capacity and distribution, good coverage and quality, the need to improve the efficiency of electricity production, distribution, and energy intensity, and a recent and gradual shift towards renewable energies are the main features of Iran's power infrastructure.

The government has increased its efforts to build more schools, universities, laboratories, Science and Technology Parks (S&T parks), and incubators. The government introduced S&T parks in 2002 to facilitate the development of a knowledge-based economy. There are currently 39 active S&T parks in Iran. These parks provide space, facilities, and other incentives for KBFs to develop new technologies/products/services and to commercialize research results. As of today, Pardis Technology Park, for example, accommodates over 150 KBFs.[1] Innovation accelerators and centers have also been rising in recent years.

Investments have also been made to establish incubators and laboratories to develop and produce marketable technology-based products and processes. Reportedly, 170 incubators, 12,594 research and technology development laboratories, 233 private research institutes, 356 research institutes affiliated with universities, and 71 research institutes affiliated with the government were active in 2020[2].

To increase funding for Research & Development, from the current 0.47 % of the GDP to 1 % of the GDP, the government has implemented a rule that obliges public organizations and agencies to spend at least 1 % of their budget on R&D. Another prominent fact about R&D funding in Iran is that unlike many developed countries where the private business sector accounts for most of the R&D, in Iran the business sector only

[1] Retrieved from https://en.techpark.ir/

[2] Retrieved from https://techrasa.com/2017/05/27/iran-swiftly-moving-towards-knowledge-based-economy-part-2/

accounted for 20 % of the total R&D spending in 2016. In the same year, the government and the higher education system financed 41 and 37 % of R&D spending, respectively.

While it can be stated that Iran has made significant progress toward a knowledge-based economy, especially in terms of human resources and infrastructure, the overall impact of the S&T parks on the economy remains moderate. To use the full potential of these resources, emphasis should be placed on creating new patents and producing export-oriented innovative products/services (Fakhari, 2014).

Table 2

Iran's position in Scimago Journal & Country Rank

Rank	Country	Documents	Citable documents	Citations	Self-citations	Citations per document	H index
1	United States	15271333	13318470	470710187	197949027	30.82	2898
2	China	9291533	9080674	120085954	70514069	12.92	1231
3	United Kingdom	4530689	3775825	129263214	27310297	28.53	1840
4	Germany	3897900	3548032	100068252	22598641	25.67	1602
5	Japan	3347987	3174415	64875161	15496330	19.38	1251
6	France	2661917	2443975	68250316	12904442	25.64	1442
7	India	2648539	2425509	31871316	10965434	12.03	812
8	Italy	2368279	2124484	55537943	12330209	23.45	1275
9	Canada	2295697	2037734	66867121	10689383	29.13	1481
10	Australia	1889159	1649784	50641555	9398256	26.81	1293
11	Spain	1862637	1699701	41775964	8420670	22.43	1154
12	Russian Federation	1596907	1549285	13954803	4696551	8.74	728
13	South Korea	1507665	1451865	27132733	4774580	18	879
14	Brazil	1335056	1255994	19775746	6020735	14.81	751
15	Netherlands	1273414	1133964	43606481	5911178	34.24	1305
16	Switzerland	946636	852776	33144973	3807492	35.01	1233
17	Poland	902167	853882	12365699	2795506	13.71	707
18	Sweden	861788	784502	27460448	3546526	31.86	1109
19	Turkey	842469	779735	11452625	2296105	13.59	577
20	Taiwan	839730	803978	15047497	2407862	17.92	663
21	Iran	813481	783223	10959460	3394879	13.47	463
22	Belgium	699460	632181	20968118	2353625	29.98	1015
23	Denmark	537423	483227	17892859	2137064	33.29	969
24	Austria	523442	471300	13954294	1556031	26.66	841
25	Israel	488177	440752	14235445	1630592	29.16	883

Source: Scimago Journal & Country Rank. Retrieved May 27, 2023, from https://www.scimagojr.com/countryrank.php

The latest update of the Scimago ranking system shows that in the period from 1996 to 2020 the United States of America, China, England, Germany, and Japan are in the top 5 list. In this ranking, Iran is 21st in the world and 2nd in the Middle East. Although in 2021, Iran was ranked first by providing 65 thousand articles in the middle-east region, in the same year, it was ranked 15th in producing scientific articles, and these research projects failed to link with the economy and industry sectors.

In recent years, we have seen the growth of different fields of science in Iran, although Iran is at a medium level regarding education, innovation, and infrastructure, it can be stated that the country's scientific knowledge cannot become productive knowledge. Iran's rank in the export of knowledge products is deficient; although Iran has growth in the knowledge economy, Iran has a small share of knowledge exports worldwide. The problem of Iran is that it is still in the first stage of the knowledge of the economy; Knowledge has not yet been able to reach practical and productive knowledge from the theoretical and scientific stages (Table 3).

Table 3

Iran's High-technology exports, US$

	2013	2014	2015	2016	2017	2018
Iran	270.444,996	299.133,342	248.619,292	249.197,113	278.924,954	153.101,893

Source: World Bank. Data. Retrieved May 27, 2023, from https://data.worldbank.org/

The Necessity of knowledge economy in Iran

The role of science and knowledge in the economy due to the creation of expertise and improving the productivity of production factors has been considered a lot. The place of technology and knowledge as endogenous factors in economic growth has been emphasized. Given that in the knowledge-based economy, production, distribution, and application of knowledge and information is the primary driver of economic growth, wealth generation, and employment in all economic activities, knowledge creation, knowledge acquisition, and dissemination and its scientific application should be carefully planned to ensure the development of economy. To achieve a KBE, the necessary conditions for innovation must be provided to enable the ability to convert ideas into products through investments into producing new products. Since new technologies and a knowledge-based economy have increased productivity and production efficiency, most countries have been determined to promote education and skills for the knowledge economy.

Although KBE, could reduce unemployment and increasing incomes, boost non-oil exports, it can affect the economic growth and development of Iran in different aspects:

1. KBE increases resource efficiency, increasing production resources' productivity and economic growth.
2. KBE reduces costs by increasing global competition and also increasing economic growth.

3. The development of information and communication technologies reduces information exchange costs in all aspects of the economy. Reducing the costs of the exchange of information and the possibility of swift communication will increase the motivation of economic actors, and this will provide the grounds for economic growth.
4. KBE increases personal income, which in turn increases demand for knowledge. This will also lead to economic growth. In fact, with an increasing knowledge economy, dependence on oil revenue will come down; these two cases are the most critical indicators of endogeneity.
5. Knowledge and creativity of elite and active thinkers are critical factors in attracting, maintaining, and increasing the abilities of knowledge producers and providing a suitable environment for innovation and creativity. The digital age is not just the age of computing machines; it is the age of humans who combine intelligence, knowledge, and creativity through networks to achieve considerable social, economic, and development progress. The most valuable assets in the knowledge-based economy are intellectual assets, which rely on knowledge and experience gained by employees or stored in digital networks or databases.
6. The KBE has already changed all fields of commerce, economic structure, productivity, type of management, etc. It deals with liberalization and globalization, knowledge management, structural change in the economy, changes in location and workforce, selecting consumers, the rise of e-government and e-business.
7. However, from the twenty-year perspective of Iran, it is not clear how the Iranian society will get adjusted on the expected future horizon; a description of Iran in the governmental vision document implies a knowledge economy. If such an interpretation is correct, it is necessary to emphasize the knowledge base of Iranian society and the formation of KBE in the vision documents.
8. Since knowledge is the main factor for preserving national wealth in the most developed economies, the economy based on foreign technologies and information becomes sufficiently vulnerable. An economy whose national wealth is majorly a result of exploiting natural resources cannot sustain its current status if unable to develop indigenous skills and expertise in other areas.
9. Another reason for developing KBE in Iran is the difficulty and time consumption of these products. Knowledge-based products usually require a high investment and time, and this usually creates a monopoly. This feature has led to the possibility of its production in the short-term if the shipment of these products to Iran is cut off. This can cause numerous threats to the country's internal production. Therefore, planning to provide the infrastructure for developing knowledge-based products is vital.
10. Due to the pressure of international sanctions, knowledge-based activities should be developed in their broadest sense.

For this purpose, all country facilities should be provided with factors of knowledge-based development to improve the quality and efficiency of locally produced products and increase the level of innovation in the country. It will increase the strength of the national economy and accelerate economic growth. This means that the requirements for developing a knowledge-based economy should be satisfied and given priority.

Overcoming the economy dependent on the initial resources and relying on selling raw and low-processed materials only through the innovator's economy knowledge production is possible.

Moving toward the production of a KBE becomes imperative. In order to create a knowledge economy, besides changing universities, knowledge-based and technological structures should be developed and supported. Undoubtedly, science can lead to producing wealth and welfare, but without planning and creating suitable infrastructure, it is impossible to achieve industry based on the knowledge economy.

The challenges of knowledge-based businesses in Iran

The six problems and obstacles that delayed Iran development have been studied. One of the most critical issues in Iran's economy has also been emphasized in the policies of the sanctions resistive economy and can contribute to the prosperity of production and employment in the country is a knowledge-based economy that is being done by developing knowledge-based companies. Besides the existence of knowledge-based companies in the country and the business activity of about seventy thousand people, it is necessary to say that supporting knowledge-based companies and trying to expand them is essential.

From 2014 to 2017, knowledge-based companies have demonstrated a significant growth. During this period, we have seen over 50-times increase in the number of the firms. At the end of 2013, the number of knowledge-based companies was fifty-five, which increased to two thousand and three hundred by the end of 2018, and so far, their number is four thousand. Although there has been a great deal of attention to the creation and support of knowledge-based companies and innovative businesses in recent years, there are still some critical obstacles for these companies' survival, growth, and acceleration.

The most significant obstacles and difficulties of knowledge-based businesses that have been spotted shall be named:

1. Company registration problems and bureaucracy

One problem that numerous managers of knowledge-based companies refer to is the long steps in registering companies as knowledge-based companies and getting activity permits. It is expected that doing things for knowledge-based companies will be accelerated, and the receipt of company registration permits, taxes, insurance, etc., will be systematically done through the Internet. Instead of focusing on their original work, already operating knowledge-based businesses have long engaged in these marginal issues. Therefore, administrative bureaucracy, one of the main problems, should be fixed.

2. Lack of financial resources

Since most of the time, knowledge-based firms provide a portion of their capital to research and development through bank loans, high interest rates can be a restricting

factor for knowledge-based firms. Also, many knowledge companies lack loans offered by the Fund for Innovation and Prosperity.

3. Lack of confidence towards Iranian knowledge-based products

Another problem with Iran's knowledge-based businesses, which is sometimes the same for other producers, is unwillingness to support domestic products and use foreign products, especially in government apparatuses. Imports of some products have caused damage to domestic producers and the domestic market by similar foreign goods; even for governmental purposes, foreign products instead of domestic ones are used. So there is a need for trust among people and authorities towards domestic products, especially regarding knowledge-based companies.

4. Using foreign products

A problem, faced by knowledge companies, is the preference for foreign products over the domestic product, although usually the quality of the domestic product is not different from that of the foreign product, and the cost of using it is less. Middle and downstream managers are reluctant to use these products and equipment, preferring foreign products, and do not risk using domestic ones. In addition, it is preferred to use foreign products because of the benefits that some people and brokers are obtaining through importation.

Sometimes, such a lack of trust of senior managers towards domestic products are due to the lack of quality in the past, the existence of interest for some agents to sell foreign products and tempting offers to market these products have a significant impact on the preference towards foreign products.

5. Delays in payments under contracts with the government

Another major problem of knowledge-based companies in Iran is working capital shortage. In order to produce knowledge-based products, research and investigation, raw materials, equipment, and human resources, it is necessary to have a sufficient amount of capital. When companies sell the product to the government or state institutions, it takes a long time to get the payment, making the companies suffer cash flow gaps. So the lack of capital is a problem numerous companies face.

6. Low marketing expertise of the knowledge-based companies

Although practitioners in knowledge-based companies are among the intelligentsia of the country, many are not advanced in product marketing. They have problems, such as product launching, promoting, advertising, negotiations for getting orders, and communication with international export markets. The problem of marketing in start-ups and knowledge-based companies is more than that of the other companies, which is why these companies need to obtain support of the government in this field too.

Conclusions

The knowledge-based economy is based on producing, distributing, and using knowledge and information. The essence of the knowledge economy is not new; however, the knowledge-based economy is becoming critical in the present era. In order to create useful knowledge and apply it, it should be clearly and widely conveyed to all economic actors that this is a new economic mode and a top national priority and policy.

Only in case of integrated and shared approach the country can achieve success. But first, necessary conditions for innovation and innovative businesses shall be created.

Production in knowledge-based industries can be divided into three stages: the first one is the production of knowledge, the second is its distribution, and the third is the promotion and consumption of knowledge. The knowledge economy is based on production and distribution, and the consumption of knowledge is the driving force behind economic growth and development.

Iran's rank in the export of knowledge products is deficient; although Iran has progress towards the knowledge economy, Iran has a small share in global knowledge exports. The problem of Iran is that it is still at the very first stage of the KBE — the knowledge has not been able to reach practical and productive stage from the theoretical and scientific stages yet.

Reducing dependence on oil production is a significant requirement for Iran's economy; a knowledge-based economy mode can reduce and decrease this dependence. It can also be helpful in mitigating sanctions and resisting pressure from western political actors and interest groups.

The new information and knowledge economy era has been replacing physical capital and energy. Knowledge-based economy could reduce unemployment, increase income from non-oil exports, and accelerate economic growth, national identity, political power, and independence. Knowledge-based economy reduces costs by increasing global competition, leading to economic growth and economic development in Iran.

Knowledge development alone is not efficient, but can be useful when knowledge is generated in combination with production. Iran should use the knowledge gained by its scientists; otherwise, it would be vulnerable if only the knowledge products of foreign origins were used. Under the current circumstances, Iran, dealing with numerous sanctions that are being expanded daily, should be looking intensively for the commercialization of scientific findings.

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Bio notes / Сведения об авторах

Ismael Rezaeinejad, PhD student, International Economic Relations Department, RUDN University. E-mail: 1042225184@pfur.ru

Резаинежад Исмаэль, аспирант кафедры международных экономических отношений, Российский университет дружбы народов. E-mail: 1042225184@pfur.ru

Sergey N. Lavrov, Doctor of Science (in Economics), professor, RUDN University. Contact information: e-mail: lavrov_sn@rudn.ru

Лавров Сергей Николаевич, доктор экономических наук, профессор, Российский университет дружбы народов. E-mail: simonov_ag@rudn.ru

Alexander G. Simonov, PhD (In Economics), Associate Professor of the International Economic Relations Department, RUDN University. E-mail: simonov_ag@rudn.ru

Симонов Александр Геннадьевич, кандидат экономических наук, доцент, Российский университет дружбы народов. E-mail: simonov_ag@rudn.ru