

The Necessity of Economic Structural Transformation in Developing Countries toward a Knowledge-based Economy Case Study: Iran

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ABSTRACT

Since the early 1990s, due to rapid growth of knowledge and globalization of economy, the production patterns, distribution and consumption of financial products have undergone profound changes and the preliminarily signs of the formation of a new economic systemin which knowledge is the most important productive factor have emerged. In knowledge based economic system terms of economic performance have changed, therefore new threats and opportunities have come to existence. The present article applies a descriptive-analytical method to study these threats and opportunities using a new economic system in developing countries.

The main objective of this article is to explain the necessity of structural transformation of economy in developing countries, like Iran, toward a knowledge-based economy in order to avoid under development deepening and achieve an acceptable rate of growth and progress.

KEYWORDS: knowledge, knowledge-based economy, source-based economy.

1. INTRODUCTION

A modern economic pattern that has emerged since two decades ago in a few developing countries was a knowledge-based pattern. The economic model has brought about large amount of theoretical and practical changes in economic and social issues. The economic position and destination of developing countries depends on the waythey deal with this emerging pattern and its resulting changes. Some countries like Singapore, due to early identification of this pattern and adapting themselves, achieved significant gains. But majority of developing countries have not been able to use the tremendous achievements of this pattern in order to make a considerable economic progress yet.

This article tries to explain the necessity of structural transformation of economy in developing countries toward the knowledge-based economy. Here, Iran is subjected to case study. Some important questions arise as follows: 1-What is the production factorsthat Iranian economy mostly dependson their exploitation? 2-What opportunities and threats have been prepared for Iranian economy by the knowledge basedeconomy? 3-How is the knowledge-based economy related to solving the under development problems in Iran? 4- What is the obligation for joining the knowledge-based economy? This paper aims to present answers to these questions. In this study, library and documentary method will be used for gathering data and a descriptive-analytical method will be applied for analyzing data which is based on theoretical principles of economy. Achievements and effects of a knowledge based economy will be divided into two groups which are threats and opportunities and the author tries to explain the necessity of structural transformation of economy in developing countries toward the knowledge-based economy according to these achievements.

2-- knowledge, information and forms of knowledge

Due to the fact that the major component of knowledge-based economy is using the knowledge itself, we briefly mention the concept of knowledge, in order to clarify the subject of the study. To that end, we will go through these questions: what is the knowledge? What is the difference between knowledge and data and information? What is technology? Why knowledge is divided into various groups and levels? What are the different forms of knowledge?

Before defining knowledge, some close concepts to knowledge will be defined in order to clarify the concept of knowledge more clearly. Those concepts are: data, information and technology. Data is the preliminary results of a scientific observation. Data are set of numbers or words which belong to reality which are not arranged

and organized yet. Once they are organized, they are called information (Porat, 1977:2). Technology is a special case of knowledge which deals with how to do the jobs. In a general definition of knowledge, Daniel Bell defines it as a set of organized statements of facts or ideas, presenting a reasoned judgment or an experimental result, which is being transmitted to others through some communication medium in some systematic forms (Castells. M, 2000). To set the boundaries of the discussion about a knowledge-based economy, it is worthwhile here to further explain the concept of knowledge.

3- Knowledge in epistemology's point of view

Lundvall & Johnson, by making use of Aristotle's early division, divided knowledge to four types (Lundvall & Johnson, 1994; and Jenson et al., 2007):

- a. Know what: this type of knowledge refers to facts and realities of the universe. The sun, for example, rises every day from the East. Everest is the highest peak in the Himalayan Mountains. Know what concept is similar to the concept of information.
- b. Know why: it refers to scientific relationsbetweenphenomena and society. This type of knowledgeis generated in universities, laboratories, industrial organizations and firms. In economy, for example, itrepresents the relationship between price and demand, volume of liquidity and inflation, and etc.
- c. Know how: it refers to the procedure of how to get something done. In economy, for example, this kind of knowledge expresses the skills, abilities, methods of production, distribution, marketing and other economic activities. Here, the important point is that most of this kind of knowledge is achieved through the process of doing and experiencing by entrepreneurs and innovators in private organization and institutions which is generally a trade secret and hardly revealed.
- d. Know who: it deals with people; those who have special information or abilities, for example, who is the best heart surgeon and etc. Telephone directories that list jobs are among the "know who" cases.

All the above mentioned forms of knowledge are of utmost importance in a knowledge-based economy but the learning channels of these four types of knowledge are different. "Know what" and "know why" may be acquired by studying, attending lectures, or accessing to data bases, but the other two forms of knowledge are widely based on experience. "Know who" is usually learned in social practice and sometimes in specialized educational environments (OECD, 1996:12).

4- Forms of knowledge in he economic point of view

One of the most useful characterizations of knowledge which is in economy's point of view is grouping with emphasis on transmissibility and exchangeability. In this case, those forms of knowledge which are of matter of importance in knowledge-based economy will be privileged. In this regard, knowledge is divided into explicit and implicit or tacit knowledge. This characterization has been done by Nonaka (Nonaka,1995:8) using the characterization of personal knowledge by Polanyi (1958:61). He argued that explicit or codified knowledge is a knowledge that can be organized and communicated through formal tools and systematic language and in contrast the tacit knowledge is the one that cannot be conveyed through developed formal tools.

Here, there are three remarkable points; first, tacit knowledge is not documented yet and cannot be communicated. Only the one who uses and controls this form of knowledge is able to make it explicit. From epistemological point of view, among different forms of knowledge that we mentioned earlier in knowledge division "know what" and "know why" have dominant explicit aspects, in contrast "know how" and " know who" are of more tacit knowledge (OECD, 1996: 12).

The second important point is that acquiring tacit knowledge is much more difficult and is not easily expressed. Therefore, tacit knowledge is often accounted as the basis for competitive advantages (Coates and Wawick, 1999:2). Third, in terms of size and effectiveness hence the importance, tacit knowledge is far beyond the explicit knowledge. As Stiglitz has likened tacit and explicit knowledge to an iceberg floating in water which is only a small part of it that is the mountaintop is usually out of the water (Stiglitz, 1999:5). Explicit knowledge is like the mountaintop, which is the smaller part of iceberg, and tacit knowledge is like the larger part which is the iceberg itself that is in the water.

Dividing knowledge into two forms of tacit and explicit does not mean that in each case there exists only one of them, because most of the time in any particular case there could be both tacit and explicit knowledge.

5- The knowledge-based economy

The knowledge based economy is a new era in people's economic life so that understanding and coordinating with it can be a source of great social and economic achievements for human life. The term knowledge-based economy was first introduced by OECD, the knowledge, technology and industry administration sector under

Lundvall's management (Godin, 2003:6). Knowledge-based economy, according to their definition, is the one which is directly based on production, distribution, and incorporation of knowledge and information (OECD, 1996:7). APEC Economic Committee defines knowledge-based economy as an economy in which, the knowledge is the driving forcefor economic growth, capital, and employment, in all industries (APEC, 2003:4).

5- Resource-based economy

The degree of implementation of each production factor plays a fundamental role in determining the economic structure of productive firms and countries.Because each of the production factors differ in terms of the need for public participation, type of required participation, sustainable level of ascertainable national income and welfare, productivity growth rate, knowledge growth rate, technical innovation growth rate and similar cases. Therefore based on the degree of implementation of various production factors such as labor, capital, national resources, and knowledge, each economic activity, firm or society can be divided to labor intensive, capital intensive or source-based.

Source based economy is conceptually similar to renter economy but these two are not entirely synonymous. Since on one hand, some rents are not due to having raw materials, for example, renter income from tourism in Egypt. On the other hand, even taking advantage of the significant revenues from extraction and sales of raw materials, if it is wisely managed, does not yield to the renter economy and its negative consequences.

Thus the meaning of a source-based country or a source-based economy is an economy that earns major part of its income through sale and export of raw materials. If we want to propose a quantitative criterion for identifying a resource-based economy, we should say that it is an economy that at least 10% of its income comes from selling its resources. For, in a country or a firm, if the income associated with one of the production factors is lower than the criterion, it does not have a serious impact in shaping the structure of the economy.

6- Research questions

In the present study the researcher seeks to answer a few questions that in fact arise from the issue of underdevelopment in Iran and find ways to solve the problem.

1-2-What are the production factors that Iranian economy is mostly depended on its exploitation?

2-2-What opportunities and threats the knowledge based economy, proposes to Iranian economy?

3-2-How the knowledge-based economy is related to solving the under development problems in Iran?

4-2-What is the necessity of joining to the knowledge based economy?

7-METHODOLOGY

The present study incorporates documentary and library method for data gathering. The needed information is collected from books and articles related to the subject of the study. A descriptive-analytical method is used for data analysis. The analysis is based on economic theoretical framework.

8- The consequences of knowledge revolution on Iran's economy

Before opening the discussion, in order to provide a background for the relationship between knowledge revolution and Iran economy, we must review the structure of Iran's economy from the production factor's aspect briefly. Afterwards the consequences of knowledge revolution of an economy like Iran will be argued.

9- Iran's economy from the production factor's point of view

In some studies which are related to the effectiveness of various production factors on countries' production, focused on measuring the role of technology in the production process. Lall classified the technology used in the production process to five groups (Lall, 2000:7) namely:

10- primary products

This group, do not depend on technology and here technology does not play any role in competitive advantage. Although technology is of little of importance in the production process of certain goods, it is unlikely to find a product that technology plays no role in its production.

11- Resource Based (RB) products

The products in this group are usually labor intensive that their predominant production advantage is local natural resource, e.g. simple food and leather production. However some parts of their production process could be capital intensive or high technology intensive, like oil extraction and refining.

12- Low Technology (LT) products

Here the production is based on simple and low level technology. Usually in this group, the products are of the same level of quality. Therefore, in offering such products, the competition is on the price not the quality. Labor cost tends to be the major production costs in this group. Some of such products are: textile products, clothing and shoes.

13- Medium Technology (MT) products

The products in this group are based on medium level technology incorporation and need high level of research and development, skills and long term learning courses. Automotive, chemical industry and primary metals are among these products.

14- High Technology (HT) products

The products in this group are based on high technology use, namely: computer, software, and aerospace industry. One of the common features in this group is that the knowledge and technology level incorporated in the production has a direct relationship with value added of production.

The objection to this classification is that, it is based on the intellectual paradigm of the industrial revolution where the level of technology used in the product of each category is generally fixed, but in knowledge based economy era that so much effort is made to apply the highest technology available to the production and economic activities even activities like fishing, this classification does not seem to be true.

From one side the objection is correct, because in knowledge based economy the level of used technology in production and the level of produced value added in a production process of various goods are not fixed. However, this classification helps us to check goods, at any point in time, regarding the dependency of their production rate to their production factors.

According to the report presented by Jahangard(2006: 218), source-based production in Iran makes up about 50% of industrial productions. Also, nearly 20% of industrial productions are devoted to simple tech industries. Hence, simple and source oriented industries totally make up about 70% of industrial production which is demonstrative of low level industrial technology in Iran. Medium technology products contain slightly less than 30% of the industrial production that is largely made up of chemical and petrochemical industries. High-tech industry makes up a small proportion, between 1.9- 2.5%, of all industrial productions which are mainly electronic products.

Therefore, with respect to the level of technology incorporated in production, the structure of economy in Iran mostly (more than 70%) depends on producing source based and low-tech goods, yet the share of high-tech goods is very trifle. According to statistics, the share of oil and gas of the total government revenue and the ratio of Iran's national and export income are good indicators that put Iran among countries with a resource based economy. The statistics presented in the following table:

| | The share of value added in the oil sector (GDP) | The share of oil and gas in total exportation of goods and services | The share of oil incomefrom total government revenues |
|------|--|---|---|
| 1988 | 4.9 | 90.3 | 38.8 |
| 1989 | 7.3 | 92 | 47.7 |
| 1990 | 10.6 | 93.2 | 59.9 |
| 1991 | 8.5 | 85.8 | 51.2 |
| 1992 | 9 | 85 | 52.1 |
| 1993 | 21.1 | 79.3 | 72.5 |
| 1994 | 20.2 | 75.1 | 73.4 |
| 1995 | 16.7 | 82.3 | 70.8 |
| 1996 | 16.8 | 86.1 | 66.8 |
| 1997 | 14 | 84.2 | 58.4 |
| 1998 | 8.6 | 75.7 | 42 |
| 1999 | 14.6 | 81.3 | 47.8 |
| 2000 | 17.6 | 85.3 | 56.8 |
| 2001 | 15.1 | 80.9 | 57.3 |
| 2002 | 22.8 | 81.3 | 62.1 |
| 2003 | 22.6 | 80.5 | 61.7 |
| 2004 | 24.1 | 82.8 | 59 |
| 2005 | 28.2 | 83.6 | 48.1 |
| 2006 | 27.1 | 81.5 | 43.9 |
| 2007 | 27.9 | 83.5 | 36.7 |
| 2008 | | 81.4 | 36.2 |

Source: The Central Bank of Islamic republic of Iran

The Central Bank of Islamic republic of Iran, economic time-series database. www.CBI.ir

As it can be seen in the above table, in recent years, nearly 30% of total GDP, over 36% of total government revenues and over 80% of country's export income have beenearned from oil and gas extraction and their sales. The high ratio of oil income from total government revenues is a good indicator of a resource based economy, owing to the sales of raw material. Other developing countries also have a significant economic dependency on raw material extractions. For example, 80% of the Nigerian government revenue is earned from sales of crude oil. This ratio, in Saudi Arabia reduces to 75%, Kuwait, Oman, United Arab Emirates, Angola are more or less the same. Venezuela's income depends on oil by 50% but in the case of Russia it reduces to 30% (Toffler. Alvin and Toffler.Heidi, 2006).

The economy of these and other developing countries not only depend on oil but also depend on other raw materials such as natural gas, bar, copper, and other metals.

15- The threats of a knowledge based economy in Iran

The knowledge revolution has brought about changes that caused threats in developing countries. Here are some of the threats that rendered by the knowledge based economy in Iran.

16- Decreasing in raw material consumption

One of the features of the knowledge based economy is shrinking the product size. In fact, based on the degree and the level of knowledgeapplied, economic products are gradually getting smaller (The United States Commission: National Security in 21st century, 2001 and Toffler. Alvin and Toffler. Heidi, 2006). The process is called product miniaturization. For example, in 2004, Toshiba Corporation presented a computer memory as big as a stamp (Toffler, Alvin and Toffler. Heidi, 2006).

Decreasing in consumption of raw materials which is used in the product itself is one of the outcomes of miniaturization; i.e.in order to produce every single product, on average, demands for raw material decreases sharply. According to micro economic hypothesis, all other things being equal, decrease in demands for raw material causes that the demand curve is shifted to left and bottom, thus it will reduce the prices. In developing countries (e.g. Iran), that are earned their income mainly through sale of raw material and export, this would cause some serious threats.

17- Decreasing in fossil energy consumption

The reduction in size and weight of every single product, the progress in technologies associated with production, energy consumption and revolution in productivity has declined energy consumption per every single of product or fixed level of income. It ends up in decreasing production in each unit and therefore decreasing economic dependency on energy as whole.

18- Reducing the relative share (price) of raw material in the total added value

In knowledge-based economythe majorcompetitive advantage is not just rely on price or quality, since the products are not similar to compare with each other. The variance is getting broader over time, so the productsmove toward personalization¹. At this stage the innovation, knowledge and technology incorporated in the production, are the main factors in competitionand the price determination. Hence, the raw materials prices, that their supply need nearly no knowledge and innovation, even though may be growing with a slow rate, the relative share of the raw material prices in the total added value of every single product and economy as a whole is decreasing sharply.

Estimates show that only 3% of sale of a computer chip goes to the pockets of the raw material and energy owners, 5% of its sales goes for the owners of the machinery and instruments, 6% for the labor and over 85% is devoted to their designers, license and patent (Reich, 1992: 109). There are so many facts. One of the most common is the software's raw material prices compared with the software itself. According to theUnited States currency, the price of regular expensive software, such as windows 7, is nearly 300\$. Whereas the used raw materials in producing a DVD containing Windows², according to the current prices of crude oil, is between one to two cents³ i.e. about four or five-thousandth. Rapid advancing in knowledge and technology and supplying products with the latest technology, the relative share of knowledge and innovation in the total value added is growing with the higher rate too. This may be accounted as a threat in countries exporting raw materials.

¹-personalization here means adjusting with various demands in each case

²-Based on the writers' calculation.

³-Based on the writers' calculation

19- Decreasing in the relative share of low technology production sector in the total value added

As discussed about raw material prices which their relative share in value added is decreasing, the same change is ongoing for the products with low technology.Becauseafter the revolution of the knowledge based economy products demand are based on the incorporated knowledge and technology. Consider, for example, the prices of the various cell phones in the global retail market fluctuate between the range of 30\$ to 1200 \$. It means that a price of the cheapest cell phone is 2% of a price of the most expensive one¹. This price discrepancy origins from the application of different level of knowledge and technology in their production. Hence it is quite natural to see the relative share of products with low technology sectors such as handicraft including the carpet, clothing, leather and so on, in the global total value added is decreasing. It may endanger the economy in developing countries like Iran. The following chart outlines some of the threats caused by the knowledge-based economy in developing countries, especially in Iran.

Decrease in energy consumption The **Decrease in Decrease in raw material** the relative **Knowledge**of value consumption based added in features with Decrease in the relative share countries respect to of the price of raw material in exporting the total value added raw raw material, materials, energy and energy with

Figure 1.Threats caused by the knowledge-based economy for developing countries

According to the discussion about the economic structure and the impacts of the knowledge-based economy across Iran, one may come to the conclusion that the knowledge-based economy brings a set of economic consequences to developing countries, particularly economies that are based on raw material exporting (Iran). These consequences may be divided into two categories; Threats and opportunities.

Decrease the relative share

of low-tech production

Sector in the total value added

technology

consumption

low-tech

Production

¹-The prices are approximate and based on retailed market prices. Although the prices vary in different countries, but the outcome, i.e. the price ratio of the cheapest phone to the most expensive one will not have a significant change, which proves the inference above.

Figure 2. The necessity of economic reconstruction in Iranin order to move toward knowledge-based economy



20- The opportunities provided by knowledge-based economy in Iran

Knowledge-based revolution has provided Iran with several achievements that play the predominant part in increasing the growth rate and advancing the developing countries. Here, only some of the achievements will be mentioned:

21- Decrease the relative role of physical capitalscarcity in the process of economic growth

During the industrial revolution either depending on capitalism or Marxist model, physical capital is considered the most prominent constrain for the economic growth; For example, the Marxist model of Feldman (1928), Harrod-Domar model (1936-1946), and Rostow's models of capitalism (1960). Since providing the adequate physical capital to reach the Rostow's rise level was very unlikely, for people in developing countries, achievingthe development was as big as a dream.

According to the fact that in a knowledge-based economy, the most important production factor is knowledge, the role of physical capital scarcityin the process of economic growth, will be less impressive. This is because the priority and emphasis production factor is transferred to knowledge and knowledge based productions and economic products are produced by tremendous applications of knowledge. For example, in 1950s, the United States manufacturing products consist of 80% raw material and 20% knowledge, the proportion changed later on in 1995 to 30% and 70% respectively (Cooke, 2002:2). Since the last decade of the 20th century, for the first time in the history of economy, the world's richest people were those who had no physical capital, no land, no mine and no factory. Bill Gates who had nothing but the knowledge is a good example. This is the best evidence that shows how the role of physical capital fades in the process of wealth creation. It is very valuable for developing countries which suffer greatly from the lack of physical capital.

22- The non-linear progress of the knowledge-based economy

During the industrial revolution, heading the strategies of capitalism, specifically Rastow's model, and also heading the Marxist approaches, specifically Feldmann, ended in two common features. First, economic growth was considered as development. Second, the main growth constraint was capital accumulation. However, after experiencing such a failure in developing countries, economists gave up following the first one, but the second one remained vital. They believed that, based on the model taken from developed countries, raw materials for industrial development should be supplied through saving of value added in the agricultural sector. Then through investment on energy, communication and transmission, transportation and so on, production foundations would be provided. To that end, investment was made in source industries such as steel and then final industries in order to achieve industrial development. This was a linear process and anyone aimed to achieve the industrial development should have paved the same way. Doing the same procedure was long and time consuming because it was required going through all phases and moreover investing in this way was long and time consuming in under developing countries with a primitive agricultural sector and fewvalue added. However, in the knowledge-based economy the most significant factor in creating wealth is knowledge and innovation. Also knowledge may be acquired in different ways. Innovation may be applied in various fields, too. So the above linear pattern of development has been abandoned. The individuals and corporations that in a short time gained a legendary fortune are good proofs on this issue; People like Bill Gates, Mark Zuckerberg, Steven Jobs, Pierre Omidyar, and corporations like Microsoft, Apple, Facebook, and eBay are good examples.

Demolishing the need to go through that linear path and providingshortcuts for economic growth was a valuable opportunity for under developing countries to solve their problems quickly. At macro level, India has benefit from this opportunity very well and it is relatively a good example in this area.

23- The young intensity of knowledge based economic activities

One of the characteristics of the knowledge-based economy is its young intensity, i.e. in the age pyramid, the degree of youth participation in leadership, creativity and leading innovation in this economic model is more than other age groups. Bill Gates, for example, founded the Microsoft Company when he was studying BA. The company's stock value during the first 20 years rose from zero to 500 billion Dollars. It was the highest value that a company may have in the entire history of the world economy. Such a growth rate has never been experienced during the industrial revolution and perhaps evenimaginable.

Steve Jobs funded the Apple Macintosh Corporation when he was a BA student, too. It was one of the most glorious companies, producing hardware and a pioneer of leading innovations. When studying BA, Mark Zuckerberg founded the Facebook Corporation. The corporation stock values, within three years, reached to 25 billion Dollars and continued rising since then. Google, one of the most popular internet search engines has been founded by two students. Jerry Yang and David Filo, Stanford university students, through ranking their favorite websites simply invented Yahoo. Fred Smith founded Federal Express which is America's best known agents tracking postal packets, when he was a student, (Toffler, Alvin and Toffler. Heidi, 2006).

The role of youth in the knowledge-based economy is growing rapidly. Michael Ford, a sixteen years old boy from Torento (Canada), founded My space network which has now more than 20 million visitors every month. It is now as effective as apublic media (Tapscott, 1999).

As the evidence shows, almost all the leaders of the knowledge based economy are young people. They have relatively more advantage than other people to work in such an economic system. As a result, the younger the population of a country, the more is the opportunity for growth and development. So Iran as a relatively young country has a great opportunity for growth and development in the knowledge-based economy which its exploitation may be very effective in economic development. According to the current statistics, the age distribution of Iranian population in the following table is indicating its young age.

| Census year | Mean age | Median age | The rate of under 20 | The rate of under 40 |
|-------------|----------|------------|----------------------|----------------------|
| 1956 | 20/20 | 20/2 | 49/7 | 78/6 |
| 1966 | 16/60 | 16/6 | 54/5 | 80/1 |
| 1976 | 17/40 | 17/4 | 55/2 | 79/3 |
| 1986 | 17/01 | 17/01 | 55/9 | 81/1 |
| 1991 | 24/03 | 17/6 | 54/8 | 82/3 |
| 1996 | 24/03 | 19/42 | 51/3 | 80/4 |
| 2006 | 27/97 | 23/89 | 37/46 | 75/35 |

Table1. Different criteria measuring the young age of the population during the census years

Source: SaiiErsi, Iraj. 2009

24- Increase the rate of productivity

Productivity is used as a mean of measuring the ways a country (or a person, industry, organization) effectively changes the resources (e.g. workforce, materials, machinery, natural resources, knowledge, etc), to products and services. Productivity is one of the key variables in the economic performance. Therefore North believes that the way that economic and political institutions change to increase the productivity is the key subject of economic history and development (North, 1991).

Productivity is one of the main factors in economic performance, since affects the most important economic variables (e.g. export inflation and occupation). Some important aspects of productivity are:

• Increasing productivity increases the exploitation of available resources which increases the economic growth rate.

- Increasing productivity decreases the production cost of each unit, therefore enables the producer, in a competitive process, to sale with lower prices. This entails reduction in domestic inflation rate and increasing the ability of the country, in an international competitive process, to export more products.
- Increasing productivity increases the profitability of production. Therefore it causes producing some new products make profit. Consequently some new employment opportunities will be created.

The knowledge-based economy is associated with productivity through 4 channels, i.e. increasing marginal return, positive externalities, no depreciating and knowledge spillover.

In industrial economy both labor and capital productivity factors entails decreasing marginal return. Therefore, increased use of such materials gradually lessens the final production. But knowledge, unlike those factors, increases through "learning by doing" process and successively runs branches. Therefore the final output is rising, so it increases the rate of productivity in the knowledge-based economy. Knowledge entails spillover and positive externalities. The two factors may have a steady increase through increasing knowledge stock.

The relationship between knowledge, as a production factor, and productivity with its increasing mechanism is presented in the following figure.



Figure 3: The role of knowledge in increasing productivity

Generally, the knowledge-based economy, through at least four channels, may deliver positive and significant achievement to Iranian economy. Making use of these opportunities may be of a great importance in sustainable raise of growth rate, economic development, solving the problems caused by poverty and other shortcomings, and considering the problems of under development. Wisely use of these opportunities yields in sustainable rise of growth rate and a new platform to solve the problems of under development.

The following chart briefly outlines some of these opportunities provided by knowledge-based economy in Iran.



Figure6. Positive achievements (opportunities) of the knowledge-based economy in Iran

25- Conclusion

- Since the early 1990s, the global economy entered a new era which is called the knowledge-based economy.

-In the knowledge-based economy many economic performance rules have changed. For example, the most significant production factor, i.e. physical capital has changed to knowledge which is a non-physical and intangible phenomenon.

-The structure of economy in Iran and the majority of developing countries is depended on source-based production, raw material, and low or mid-tech products. Just about 1/5% of the total production in Iran includes high-tech products.

- Changing dominant rules of the knowledge-based economy caused the emergence of certain threats and opportunities. In Iran, some of the threats that the knowledge-based economy entails are: decrease in consumption of raw material, decrease in energy consumption, decrease the relative share (price) of raw material in total value added, and decrease the relative role of low-tech product sector in total value added.

6-5- The knowledge-based economy has brought many opportunities for Iran to cut off lacks and issues related to the country's under development. The most significant opportunities are: reducing the relative share of physical capital scarcity in the process of economic growth, the non-linear progress of the knowledge-based economy, and no scarcity of knowledge as a main production factor in this economic system.

- Lack of attention to already existed threats may yield in dramatic decline in Iran's relative share of global revenues, and even more poverty and more underdevelopment for the country. Exploiting the opportunities of the knowledge-based economy may pave the way to cut off the historical underdevelopment of the country and aid in solving the problems of underdevelopment. Therefore, to get away from the threats and to make use of the opportunities, it is essential to move Iran's economic structure toward the knowledge-based economy.

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