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# FORMATION AND DEVELOPMENT OF THE KNOWLEDGE ECONOMY AS A PRECONDITION FOR THE COUNTRY'S COMPETITIVENESS.

## Abstract:

The paper considers the interdependence between the formation of the country's economy based on knowledge, its competitiveness and pace of economic development. Shows the ranking of countries in the Global Competitiveness Index and the indices that characterize the knowledge economy. On the basis of a comparative analysis concluded that the country's competitiveness level depends on scientific and technological development, and the states leading the global innovation space were singled out. With the help of comparative analysis of positioning on the index of the knowledge economy and knowledge index makes it possible to distinguish knowledge exporting countries and knowledge importing countries. A cluster analysis made it possible to establish that the orientation of the economy more towards the production and export of knowledge leads to the acceleration of economic growth and competitiveness, and to identify the tendency of increasing of the share of exporting knowledge countries. This paper uses a methodology of World Economic Forum for assessing the country's competitiveness index, the World Bank methodology expertise of knowledge economy and other methodologies to assess the level of innovation development of economy of the world.

## Keywords:

competitiveness, economic development, knowledge economy, innovation, research and technological development.

**JEL Classification:** O33, A14, R11

## Formation and development of the knowledge economy as a precondition for the country's competitiveness.

According to UNCTAD (2008) report the determining factor in economic growth and a high level of competitiveness of a country is its scientific and technological development that transforms virtually all spheres of human society and supports the transition to a higher level of social and economic development based on the formation of a new technological method of management. He (1999) underlines that since the 1970s global growth has passed several major turning points: the decline of the industrial economy, the emergence of an economy based on knowledge and the emergence of the knowledge society. Global development is uneven. While the leading developed countries entered the era of the post-industrial economy, developing countries, only seeking to restructuring the industrial economy and lagging countries and regions are still in agriculture or even the initial stage of social development. Currently, developing countries, tend to industrialize and urbanize, and developed - to move away from industrialization and towards decentralization of urban agglomerations. Economy based on knowledge, changes the world.

According to the World Economic Forum methodology of the Global Competitiveness Index the technological capacity to innovate is one element for evaluation. At the same time you can get substantial profits by improving institutions, creating infrastructure, reducing macroeconomic instability, or improving human potential population. The same applies to labor market efficiency and financial and goods markets. Therefore, in the long run, when the yield all other factors is decreasing, quality of life and competitiveness can be increased only through technological innovation. Of particular importance the innovation is for economies that are close to the borders of the knowledge economy. Although less developed countries can still improve performance, adopting existing technologies or gradually improving other areas, this approach is not enough to improve performance in those countries that have reached the innovative stage of development. Companies in these countries should develop and create advanced products and processes to remain competitive. This requires favorable for innovation environment, supported by public and private sectors. In particular, it requires sufficient investment in research, particularly from private qualified academic institutions, cooperation between universities and industry, and the protection of intellectual property.

The level of economic competitiveness, therefore, inextricably linked with the process of increasing the innovation component in the economic structure and the formation of the country's economy based on knowledge. Introduction to knowledge society means that no technological (as well as economic, environmental and social) solution cannot be made without the support of science, without full consideration of patterns of factors and cyclic dynamics trends in the general flow of scientific, technical and socio-economic development. Thus, the effective functioning of the knowledge economy leads to increased competitiveness of the economy, which is why we have considered the value of the position on the Global Competitiveness Index, on the one side, and

leading indices related to the degree of development of the knowledge economy - the other side.

The main criterion for selection of countries was the place they occupy on the Global Competitiveness Index. To review the top 10 countries on this indicator rating 2012-2013 were selected. It should be noted that over the past three years the list of the top 10 has not changed, there is only a change in the alignment of places during this selected period (Table 1).

**Table 1. Top 10 countries in the Global Competitiveness Index in 2010-2013**

| Country | 2012-2013 | | 2011-2012 | | 2010-2011 | |
|---|---|---|---|---|---|---|
| | Rank [144] | Score[7] | Rank [142] | Score [7] | Rank [139] | Score [7] |
| Switzerland | 1 | 5,72 | 1 | 5,74 | 1 | 5,63 |
| Singapore | 2 | 5,67 | 2 | 5,63 | 3 | 5,48 |
| Finland | 3 | 5,55 | 4 | 5,47 | 7 | 5,37 |
| Sweden | 4 | 5,53 | 3 | 5,61 | 2 | 5,56 |
| Netherlands | 5 | 5,50 | 7 | 5,41 | 8 | 5,33 |
| Germany | 6 | 5,48 | 6 | 5,41 | 5 | 5,39 |
| United States | 7 | 5,47 | 5 | 5,43 | 4 | 5,43 |
| United Kingdom | 8 | 5,45 | 10 | 5,39 | 12 | 5,25 |
| Hong Kong SAR | 9 | 5,41 | 11 | 5,36 | 11 | 5,30 |
| Japan | 10 | 5,40 | 9 | 5,40 | 6 | 5,37 |

*Source: The Global Competitiveness Report 2012-2013 data*

In addition, according to the results of 2012-2013 rating Denmark and Canada left the top ten countries, although in the report for 2010-2011 they demonstrated seventh and tenth results respectively. And countries like the United Kingdom and Hong Kong, in contrast, have become leaders in the 2012-2013 rating.

For comparative evaluation were selected following indicators:

- to assess the level of innovation - Global Innovation Index;

- to determine the ability of the economy to produce knowledge - Knowledge Index;

- to assess the ability of the economy to use knowledge for economic growth - Knowledge Economy Index;

- to characterize the level of ICT (information and communications technology) development in the country - Networked Readiness Index;

- comparison of the economic development of selected countries - GDP growth rate for the last three years;

- to evaluate the effectiveness of human resources - the country's population.

To determine the dynamics we need to analyze data from 2000 ratings without Global Innovation Index which started only in 2007 (Table 2).

**Table 2. Comparative characteristics of the Competitiveness Index, the leading indices that characterize the knowledge economy, GDP growth and population in 2000**

| Country | GCI – Global Competitiveness Index | KEI – Knowledge Economic Index | | KI – Knowledge Index | | NRI – Networked Readiness Index | | GDP Growth | | | | Population |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2000 | 2000 | | 2000 | | 2000-2001 | | | | | | |
| | Rank [59] | Rank [141] | Score [10] | Rank [142] | Score [10] | Rank [75] | Score [6] | Avg. Value | 1998 | 1999 | 2000 | 2000, m |
| Switzerland | 10 | 5 | 9,28 | 9 | 9,14 | 16 | 5,2 | 2,6 | 2,7 | 1,4 | 3,7 | 7,2 |
| Singapore | 2 | 25 | 8,57 | 23 | 8,3 | 8 | 5,5 | 4,4 | -2,2 | 6,2 | 9,0 | 4,0 |
| Finland | 6 | 8 | 9,22 | 10 | 9,12 | 3 | 5,9 | 4,8 | 5,0 | 3,9 | 5,3 | 5,2 |
| Sweden | 13 | 1 | 9,65 | 1 | 9,73 | 4 | 5,8 | 4,4 | 4,2 | 4,7 | 4,5 | 8,9 |
| Netherlands | 4 | 2 | 9,34 | 3 | 9,36 | 6 | 5,7 | 4,2 | 3,9 | 4,7 | 3,9 | 15,9 |
| Germany | 15 | 15 | 8,84 | 18 | 8,78 | 17 | 5,1 | 2,3 | 1,9 | 1,9 | 3,1 | 82,2 |
| United States | 1 | 4 | 9,28 | 4 | 9,35 | 1 | 6,1 | 4,5 | 4,4 | 4,8 | 4,1 | 282,2 |
| United Kingdom | 9 | 12 | 8,89 | 15 | 8,83 | 10 | 5,3 | 3,6 | 3,6 | 2,9 | 4,4 | 58,8 |
| Hong Kong SAR | 8 | 25 | 8,15 | 28 | 7,84 | 13 | 5,2 | 1,4 | -5,9 | 2,5 | 7,7 | 6,6 |
| Japan | 21 | 17 | 8,81 | 14 | 8,87 | 21 | 4,9 | 0,0 | -2,0 | -0,2 | 2,3 | 126,9 |

*Source: The Global Competitiveness Report 2012-2013, World Bank and World Economic Forum data*

After the analysis of the data presented in Table 2, we can identify several groups of countries.

1. Countries whose positions on indices of knowledge and the knowledge economy higher than positions in the Networked Readiness Index in the Global Competitiveness Index. This shows the potential for countries to produce and use knowledge for the economy, but the level of ICT is not enough to create a competitive economy. Among these countries - Switzerland, Sweden and Japan.

2. Countries whose positions on indices of knowledge and the knowledge economy lower than positions in the Global Competitiveness Index and in the Networked Readiness Index. This may indicate that these countries cannot effectively produce knowledge and do not use it for their economic growth, while an advanced ICT acts as one of the incentives to increase the competitiveness. Among these countries - Finland, Singapore, USA, UK and Hong Kong.

3. Countries that occupy almost identical positions on all listed indexes - the Netherlands and Germany, but the Netherlands who are in the top 5 for all parameters (except the Networked Readiness Index, which ranks at the sixth position) show higher GDP growth rate (4,8% on average in 1998-2000.), other than in Germany, which takes place on 15-18 rating and a lower GDP growth (averaging 2.3% over 1998-2000.). This may indicate a dependence of the economic development from the degree of development of ICT economy's ability to produce and use knowledge for their development and competitiveness.

Next step is to analyze the ranking of countries by the abovementioned indices and indicators on the basis of 2012-2013 years. The data for the analysis are presented in Table 3.

**Table 3. Comparative characteristics of the Competitiveness Index, the leading indices that characterize the knowledge economy, GDP growth and population on the basis of 2012-2013 years.**

| Country | GCI – I Global Competitiveness Index | | GII - Global Innovation Index | | KEI – Knowledge Economy Index | | KI – Knowledge Index | | NRI – Networked Readiness Index | | GDP Growth | | | | Population |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2012-2013 | | 2013 | | 2012 | | 2013 | | 2012 | | | | | | |
| | Rank [144] | Score [7] | Rank [142] | Score [100] | Rank [145] | Score [10] | Rank [145] | Score [10] | Rank [144] | Score [6] | Avg. Value | 2010 | 2011 | 2012 | 2012, m. |
| Switzerland | **1** | 5,72 | **1** | 66,6 | **10** | 8,87 | **14** | 8,7 | **6** | 5,7 | **1,9** | 2,95 | 1,8 | 1,05 | **7,9** |
| Singapore | **2** | 5,67 | **8** | 59,4 | **23** | 8,21 | **31** | 7,8 | **2** | 6,0 | **7,1** | 14,8 | 5,2 | 1,32 | **5,3** |
| Finland | **3** | 5,55 | **6** | 59,5 | **2** | 9,33 | **3** | 9,2 | **1** | 6,0 | **1,8** | 3,36 | 2,7 | -0,83 | **5,4** |
| Sweden | **4** | 5,53 | **2** | 61,4 | **1** | 9,43 | **1** | 9,4 | **3** | 5,9 | **3,5** | 6,56 | 2,9 | 0,95 | **9,5** |
| Netherlands | **5** | 5,50 | **4** | 61,1 | **4** | 9,11 | **2** | 9,2 | **4** | 5,8 | **0,4** | 1,53 | 1,0 | -1,25 | **16,8** |
| Germany | **6** | 5,48 | **15** | 55,8 | **8** | 8,9 | **10** | 8,8 | **13** | 5,4 | **2,7** | 4,01 | 3,3 | 0,69 | **81,9** |
| United States | **7** | 5,47 | **5** | 60,3 | **12** | 8,77 | **9** | 8,9 | **9** | 5,6 | **2,4** | 2,5 | 1,9 | 2,78 | **313,9** |
| United Kingdom | **8** | 5,45 | **3** | 61,3 | **14** | 8,76 | **16** | 8,6 | **7** | 5,6 | **1,0** | 1,66 | 1,1 | 0,12 | **63,2** |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hong Kong SAR | **9** | 5,41 | **7** | 59,4 | **18** | 8,52 | **23** | 8,2 | **14** | 5,4 | **4,4** | 6,79 | 4,9 | 1,5 | **7,2** |
| Japan | **10** | 5,40 | **22** | 52,2 | **22** | 8,52 | **18** | 8,5 | **21** | 5,2 | **2,0** | 4,65 | -0,6 | 1,95 | **127,5** |

*Source: The Global Competitiveness Report 2012-2013, World Bank, World Economic Forum, Global Innovation Index 2014 data*

Based on the above comparative table we come the following conclusions.

1. It is necessary to highlight the Nordic countries such as Finland, Sweden and the Netherlands - they are consistently in the top 5 of all proposed indices. This demonstrates the ability of the economies of these countries use their innovative potential to build a knowledge economy, which leads to increased competitiveness of economies. In addition, despite the slowdown in GDP growth, resulting stagnation of the world economy and the recession in the European Union, the aforementioned countries show positive GDP growth. This indicates the positive development of the economy of these countries. A small population compared with other indicators demonstrates the high efficiency of human resources. Thus, the Nordic countries can be identified as a separate science and technology center of the world, not only with a consistently high dynamics of economic growth, but also high rates of technological development.

2. Switzerland and Singapore should be mentioned separately, as in recent years they have been leaders in the Global Competitiveness Index. A characteristic feature of the economies of these countries is high rates for the Networked Readiness Index and the Global Innovation Index, but in the indices of knowledge and the knowledge economy these countries are not in the list of leaders, especially Singapore. This indicates a high level of innovation and ICT in these countries, but they have not fully utilized their potential for the production and use of knowledge for economic growth. However, both countries show a positive GDP growth rate and high efficiency of human potential. Singapore has the highest GDP growth rate - 7.1% (average for 2010-2012.).

3. It should be selected Japan, which is among the leaders on the Global Competitiveness Index, although in recent years is losing ground and moved from sixth place in the 2010-2011 rating to tenth in the report for 2012-2013. However in all other indices Japan occupies lower positions, in addition, the use of human potential in this country is not effective. This again suggests that the development of a competitive economy is not possible without the development of innovation, ICT and formation of the knowledge economy. However, Japan is listed as world leader in scientific and technological domain, and along with Singapore and Hong Kong form the active center of scientific and technological development in the Asia-Pacific region. Hong Kong in recent years demonstrates improving positions in the Global Competitiveness Index, mainly due to the development of innovative component. Relatively high GDP growth rate and efficiency of human potential indicate that Hong Kong is gradually moving to world leaders.

4. Countries like USA, Germany and the UK, not only is the forefront of economic development but are already established centers of scientific and technological

innovation - American and European. Each has its own characteristics. These countries are in the top 10 in the Global Competitiveness Index, but Germany is there due to the ability of the economy to produce knowledge and use them for their growth, while the US and UK use for this innovative potential and develop ICT. These countries show a stable low GDP growth and efficiency of human resources is among the lowest in the above analysis.

According to the analysis of the data from Table 2 and Table 3, we made the following conclusions.

In the period from 2000 to 2013 redistribution of seats in the Global Competitiveness Index has occurred. Countries such as Luxembourg, Ireland and Canada, left the top 10 countries in 2000 and is currently the 22, 27 and 14 respectively. Instead, Sweden, Germany and Japan during the 2000-2013 rose in rank and have rating of 4, 6 and 10 respectively.

The Nordic countries - Sweden, Finland and the Netherlands for the period were able to form a world-leading center of scientific and technological development. Sweden has managed to keep its leading position on indices of knowledge and the knowledge economy and for the Networked Readiness Index and the Global Innovation Index. Finland managed to improve their performance indices for knowledge and the knowledge economy and for the Networked Readiness Index. The Netherlands has been one of the top 5 on all counts. It should also be noted that the national innovation systems of these countries have their own characteristics: small European countries (Sweden, Netherlands, Denmark, Switzerland, Finland) emphasizes the development of basic science university, funded mainly by the state. An important role in the innovation system of these countries belongs to national academy of sciences. In Sweden and the Netherlands there are Institutes of Advanced Scientific Studies. Applied research in small European countries is funded primarily by grants and joint projects with large transnational corporations. However, active participation in the financing of research and development takes small and medium business. According to Ivanov (2006) great importance are also regional projects in high technology, using as an example of Silicon Valley in the USA.

It should be noted Singapore, Hong Kong and the UK - these countries hardly changed their positions Global Competitiveness Index: Singapore is in second place by improving performance for the Networked Readiness Index, which also led to the fact that Singapore has become the world leader in ICT goods exports; Hong Kong for the selected period improved performance indices for the knowledge economy and that made it possible to stay in the top 10 in the Global Competitiveness Index; United Kingdom, improving their performance on the degree of development of ICT also managed to stay in the top 10 countries in the Global Competitiveness Index.

European countries like Germany and Switzerland during this period were able to significantly improve its position in the Global Competitiveness Index, but Germany did so by increasing the ability of the economy to the production and use of knowledge and Switzerland - the development of ICT.

A striking example of the interdependence of the above indices is an example of the US, which for the period 2000-2012 worsened their positions in all ratings that characterize the degree of development of the country's knowledge economy. This led to a drop in the country's global competitiveness ranking. Today basis of the national innovation system (NIS) is about 150 US universities, where the basic research in basic science and much of the applied research conducted. Fundamental research activities are also conducted by the Institutes of Advanced Scientific Studies. Their main task is training of highly qualified personnel and cooperation with representatives of the world of science. Also, in the USA there are National Laboratories which develop various areas of applied science. According to Sergeev (2008) technology transfer is carried out mainly from universities to industry via venture capital companies, or by creating companies within the same major research divisions.

During this period, Japan was able to significantly improve their position in the Global Competitiveness Index (due to the development of ICT), but worsened its position on index of knowledge and the knowledge economy, indicating non-use of the potential knowledge. Formation of Japan’s NIS was through successive transition from importing foreign technology and know-how to developing original scientific and technological achievements on the basis of national basic research. Most of the basic research in Japan is carried out in universities and government laboratories. However, the degree of implementation remains insufficient. Most of the applied R&D is performed in the laboratories of large industrial corporations, without reference to potential users within the industry. Public basic research and applied developments in the private sector are not always coordinated. The major share of expenditure on R&D in Japan is the private sector. This approach ensured Japan is the biggest successes in those areas of technological progress associated with the production of consumer goods of mass demand. In the field of basic research and niche products development Japan has a noticeable lag from other developed countries.(Avdokushin, 2010)

In our opinion the best characteristic of the country’s economy development is rating in the Knowledge Index and Knowledge Economy Index. Ratings of the leading countries for Global Competitiveness Index, the indices of Knowledge and the Knowledge Economy are given in Table 4.

As a result of grouping countries according to the positions they occupied the indices of Knowledge and the Knowledge Economy, we offer to divide them into 2 groups. The first group includes countries that occupy higher positions in the Knowledge Index than in the Knowledge Economy Index, and the second - countries whose position in the Knowledge Economy Index is higher than the position in the Knowledge Index. Rating in 2012 was chosen as a basis for selection (Table 5).

As a leading indicator of the state and dynamics of economic development of any country is the GDP growth rate of this indicator has been chosen for comparison of the economic development of countries selected for the group.

**Table 4. Comparative characteristics of positioning Knowledge Economy Index and Knowledge Index in 2000 and 2012**

| Країни | KEI – Knowledge Economy Index | | KI – Knowledge Index | | KEI – Knowledge Economy Index | | KI – Knowledge Index | |
|---|---|---|---|---|---|---|---|---|
| | 2000 | | 2000 | | 2012 | | 2012 | |
| | Rank [141] | Score [10] | Rank [145] | Score [10] | Rank [145] | Score [10] | Rank [142] | Score [10] |
| Switzerland | **5** | 9,28 | **10** | 8,87 | **14** | 8,7 | **9** | 9,14 |
| Singapore | **25** | 8,57 | **23** | 8,21 | **31** | 7,8 | **23** | 8,3 |
| Finland | **8** | 9,22 | **2** | 9,33 | **3** | 9,2 | **10** | 9,12 |
| Sweden | **1** | 9,65 | **1** | 9,43 | **1** | 9,4 | **1** | 9,73 |
| Netherlands | **2** | 9,34 | **4** | 9,11 | **2** | 9,2 | **3** | 9,36 |
| Germany | **15** | 8,84 | **8** | 8,9 | **10** | 8,8 | **18** | 8,78 |
| United States | **4** | 9,28 | **12** | 8,77 | **9** | 8,9 | **4** | 9,35 |
| United Kingdom | **12** | 8,89 | **14** | 8,76 | **16** | 8,6 | **15** | 8,83 |
| Hong Kong SAR | **25** | 8,15 | **18** | 8,52 | **23** | 8,2 | **28** | 7,84 |
| Japan | **17** | 8,81 | **22** | 8,52 | **18** | 8,5 | **14** | 8,87 |

*Source: World Bank and World Economic Forum data*

Based on the data, we can note the following results. Countries included in the first group (KEI<KI) show a high ability to produce knowledge to a greater extent than capable of making use of their economies. Thus, the first group of countries are potential exporters of knowledge. Countries belonging to the second group (KEI>KI) show a higher need for knowledge than the economy of these countries is able to produce. These countries are potential importers of knowledge. Sweden should be mentioned that not only is a stable leader during this period in the indices that characterize the knowledge economy, but it can be attributed to the first group of countries since its Index score of knowledge is higher than the Knowledge Economy Index.

**Table 5. The leading countries (top 10) in Global Competitiveness Index and comparative characteristics of their positioning in Knowledge Index and in Knowledge Economy Index for 2012**

| I group (KEI<KI) – knowledge exporters | | | | | | II group (KEI>KI) – knowledge importers | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Country | GCI Rank 2012-2013 | GDP Growth | | | | Country | GCI Rank 2012-2013 | GDP Growth | | | |
| | | Average Value | 2010 | 2011 | 2012 | | | Average Value | 2010 | 2011 | 2012 |
| Switzerland | 1 | 1,97 | 3 | 1,9 | 1 | Finland | 3 | 1,93 | 3,3 | 2,7 | -0,2 |
| Singapore | 2 | 8,20 | 14,8 | 4,9 | 4,9 | Netherlands | 5 | 1,20 | 1,6 | 1 | 1 |
| Sweden | 4 | 3,77 | 6,6 | 3,9 | 0,8 | Germany | 6 | 2,63 | 4,2 | 3 | 0,7 |
| United States | 7 | 2,30 | 3 | 1,7 | 2,2 | Hong Kong SAR | 9 | 4,37 | 6,8 | 4,9 | 1,4 |
| United Kingdom | 8 | 1,13 | 1,8 | 0,8 | 0,8 | | | | | | |
| Japan | 10 | 1,90 | 4,4 | -0,7 | 2 | | | | | | |
| *Average* | | 3,21 | | | | *Average* | | 2,53 | | | |

*Source: World Bank and World Economic Forum data*

Average GDP growth in the first group is higher than in a second group, which may indicate higher development rates of economies of exporting knowledge than importing knowledge countries. The first group includes most of the leaders in the Global Competitiveness Index, which indicates the interdependence of the considered parameters. Thus, based on cluster analysis revealed that the country's economic focus on the production and export of knowledge leads to faster economic growth and competitiveness.

In addition, among the countries considered (countries leading in the Global Competitiveness Index) between 2000 and 2012 the tendency of increasing the proportion of countries belonging to the first group, i.e. exporting countries knowledge, was determined.

Thus, the determining factor of economic growth and a high level of competitiveness of the country is its scientific and technological development that transforms all spheres of human society and supports the transition to a higher level of social and economic development based on the formation of a new technological method of management. The intensive use of knowledge is not only a catalyst for the growth of economic competitiveness, but also leads to the overall growth of the economy as a whole. Thus, focus on using their own competitive scientific knowledge and innovation that strengthens and develops the national innovation system and eventually lead to improved economic well-being is critical in building a knowledge economy and competitiveness of the country.

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