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THE KNOWLEDGE ECONOMY – THE DIAGNOSIS OF ITS CONDITION IN SELECTED COUNTRIES

Summary: The article presents the concept of the knowledge economy and the conditions affecting its shape. The assessment of how effectively an economy is transforming into the KE is conducted with the use of two methodological approaches: sector-based and holistic. The article applies the KAM methodology to determine the level of the KE in the world economy and in selected countries.

Keywords: Knowledge-Based Economy, Knowledge Economy Index, Knowledge Index.

Introduction

The knowledge economy (KE) is the latest stage in the development of societies. P. Drucker defined it as an economic system where knowledge – instead of labour, resources or capital – becomes the key asset and a social order where social knowledge-related inequalities pose the greatest challenge [Drucker, 1999].

The measurement of knowledge in the economy is a difficult task. The article presents two major trends in assessing the transition towards the knowledge economy: sector-based and holistic. The holistic approach includes one of the available comprehensive methods, KAM (*Knowledge Assessment Methodology*), developed by the World Bank. The primary assumption of this methodology is that the building of a national knowledge economy relies on a country's economic and institutional regime, an efficient innovation system, the education and quality of its human capital, and, finally, a modern information and communication infrastructure.

The article aims to compare the global economy with its selected regions and with Poland on how the transition progresses. The application of KAM allows for the determination of the Knowledge Index (KI) and the Knowledge Economy Index (KEI) for different countries and the creation of the country ranking based on the indexes.

1. Knowledge economy

Dynamic changes re-writing the rules of the economy, observed since the 1990's, have led to the emergence of „the new economy", „the economy of the information era", or „the knowledge economy". Following the basic definition, developed by the OECD and the World Bank, the knowledge economy is an economy built, assimilated, transferred, and effectively used by enterprises, organisations, individuals and societies, being a source of growth and progress for the society and economy [Kukliński, 2003, p. 196; www 1].

As literature provides numerous definitions of the knowledge economy, table 1 presents the compilation of its major constituent components.

Table 1. Knowledge economy – major components

Components	Characteristics
Foundations of the knowledge economy	– increased education levels in the developed countries, – growing internationalization of the economies through global trade in services, – advancements in and dissemination of information and communication technologies.
Indicators of the knowledge economy	– transition from the industrial economy to the service-based system, – increasing number of professional and technical workers and their growing impact on the economy, – information society organized around knowledge and information, – scientific research and development, alongside the merger of science and technology with the economy, are the key to the information society, – advancements in intellectual technology.
Pillars of knowledge in the knowledge economy	– ICT, – human capital, – social capital (trust, cooperation and social networks), – knowledge management in organisations.

Source: Compilation based on [Skrzypek, 2011, p. 279].

In micro-economic terms, the knowledge economy is the economy where many enterprises derive their competitive advantage from knowledge [Koźmiński, 2001, p. 87]. This can be supplemented with the statement that „its mechanisms lead to the use of knowledge with the purpose of increasing the competitiveness of enterprises" [Kukliński, 2003, p. 123].

The most important characteristics of such an economy are: the changeability of the immediate and general environment, the necessity to acquire and use knowledge, the need to transform the industrial society into the information society, the reliance of organisations on the access to information, its skillful use, and adaptability in order to survive, but also a global view of the economy, markets, the environmental protection, and the recognition for the growing role of intangible assets, i.e. knowledge, intellectual capital, and information [Skrzypek, 2009, pp. 34-46]. Other factors contributing to the growth of the knowledge economy are increasing education levels in societies, the internationalization of economies through global trade in services, and the advancements and dissemination of information and communication technologies.

The World Bank also defines the conditions that it considers instrumental in stimulating the growth of the knowledge economy: the economic and institutional regime ensuring the free movement of knowledge, ICT investments boosting entrepreneurship, a country's people having both education and skills allowing them to create and use knowledge, the dynamic information infrastructure (Internet) facilitating effective communication, dissemination and processing of information, the network of research centers, universities, think tanks, private firms, adapting existing knowledge to local needs and creating new knowledge.

Assessing the knowledge economy, we should define its entry parameters, which are the following factors [Kleer, 2009, pp. 72-74]:

1. The economy needs to achieve a high growth rate, which nowadays is about USD 20,000 per person, and services generate 70% of GDP.
2. The society enjoys a high education level, which is relatively generally considered to be secondary education, while 50% of people in active employment have higher education.
3. R&D outlays account for about 3% of GDP.
4. The innovativeness of the economy involves minimum regulation, support for innovative undertakings not only in business, but also through substantial investments of the public sector in research that contributes to growth in a direct and indirect manner.
5. The economy and the society have an open dimension, i.e. they participate in what is referred to as external exchange, involving goods and services as well as ideas.
6. The modern public sector must follow a mixed model and cannot be an exclusively liberal system.

Parameters 1-3 are „hard" parameters, as they refer to specific numerical data, whereas parameters 4-6 are „soft", as their evaluation is biased with a researcher's subjectivity.

2. Assessing the knowledge economy – concepts

The literature provides numerous concepts on how to assess the transition towards the knowledge economy. D. Coyle and D. Quah argue that an assessment method can focus on ICT advancements and analyse changes in the sectors related to new technologies, or it can be applied to the post-industrial economy as a whole based on a wide range of dimensions [Coyle, Quah, 2002, p. 6]. Accordingly, the most general classification of the assessment models of the knowledge economy breaks them down to sector-based and holistic. Table 2 presents the major determinants of these concepts.

Table 2. Characteristics of the main approaches to measuring KE

Sector-based concept	Holistic concept
– It underlines the significance of the growth of the ICT sector as the one determining the transition to a knowledge economy. – It focuses on these sectors which use modern knowledge and technologies to a greatest extent (as they are identical with a knowledge economy). – The knowledge economy is assessed through the prism of changes occurring in the information sector (which comprises activities involved with the production, use, protection, collection, storing, and transfer of information). – It applies the classification of industries and services developed by OECD and Eurostat.	– It is based on the idea of sustainable development, the core of which is the balance between three spheres: ecology, economy and society. – It uses the selection of indicators referring to these three spheres. – The applied methods include, for example, KAM (World Bank), Coyle and Quah's approach (the British Work Foundation), SINE (Eurostat).

Source: Compilation based on [Coyle, Quah, 2002; www1; European Commission 2000].

One of the most frequently used holistic methods of measuring a knowledge economy is the Knowledge Assessment Methodology (KAM), developed by the World Bank Institute. Chart 1 presents its general framework.

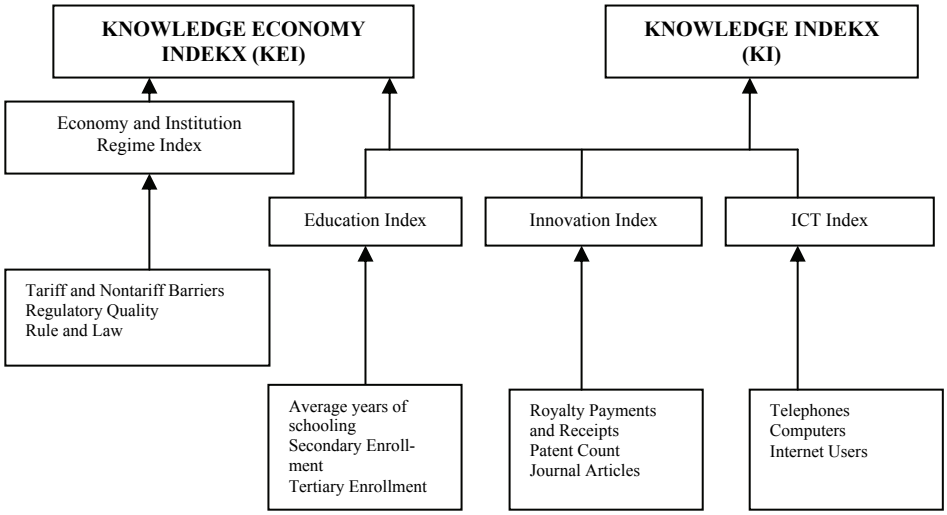

Chart 1. Knowledge Indexes

Source: [www 1].

The Knowledge Assessment Methodology is comprised of two main indexes, namely the Knowledge Index (KI) and the Knowledge Economy Index (KEI). Both the indexes are based on four knowledge economy pillars, which are [Chen, Dahlman, 2006, pp. 5-9]:

1. The Economic Incentive and Institutional Regime are responsible for improved economic policies and the ways institutions operate. The generation, dissemination and application of knowledge in these entities are to contribute to more efficient operations by the adequate allocation of resources and the stimulation of creativity.
2. Education and Human Resources, where the workforce can adapt to constantly improving technological solutions by acquiring and developing adequate skills.
3. The Innovation System comprising economic entities, research centres, universities, consulting agencies and other organisations, which are able to adapt to the needs of increasingly demanding consumers.
4. The Information and Communication Technology (ICT), which ensures effective communication and data transfer of data. These aspects facilitate the dissemination and processing of information and data.

The four pillars are supplemented with the indicators reflecting the general performance of the economy, which measure the degree to which knowledge is used to boost socio-economic growth. Moreover, all the time new variables affecting the KAM indexes are being introduced. The latest survey conducted by the

World Bank in 2012 comprised as many as 148 specific variables (quantitative and qualitative). Due to the difficulties involved in the analysis of all available indicators, however, the Basic Scorecard was developed. It includes basic indicators (14) reflecting a country's preparedness for a knowledge economy (table 3).

Table 3. Examples of specific indexes used in KAM

Area		Index
OVERALL PERFORMANCE OF THE ECONOMY		− Human Development Index (HDI), − Gross Domestic Product (GDP) Per Capita, − Gross Domestic Product (GDP) (current US$ bill.), − Multidimensional Poverty Index, − Gender Inequality Index, − Seats in Parliament Held by Women (as % of total), − Composite Risk Rating,
THE ECONOMIC INCENTIVE AND INSTITUTIONAL REGIME	**THE ECONOMIC REGIME**	− ***Tariff and Nontariff Barriers, (1)*** − Trade as % of GDP, − Exports of Goods and Services as % of GDP, − Domestic Credit to Private Sector (% of GDP), − Cost to Register a Business (% of GNI per capita), − Days Required to Start a Business, − Interest Rate Spread,
	GOVERNANCE	− ***Regulatory Quality, (2)*** − ***Rule of Law, (3)*** − Political Stability, − Control of Corruption, − Press Freedom,
THE INNOVATION SYSTEM		− ***Royalty and License Fees Payments and Receipts (US$ millions), (4)*** − ***Royalty and License Fees Payments and Receipts (US$ millions) Per Million Population, (5)*** − ***Scientific and Technical Journal Articles, (6)*** − ***Scientific and Technical Journal Articles Per Million Population, (7)*** − ***Patent Applications Granted by the USPTO, (8)*** − ***Patent Applications Granted by the USPTO Per Million People, (9)*** − FDI Outflows as % of GDP, − FDI Inflows as % of GDP, − Researchers in R&D, − Researchers in R&D Per Million Population, − Total Expenditure for R&D as % of GDP,
EDUCATION AND HUMAN RESOURCES	**EDUCATION**	− ***Secondary Enrollment (% gross), (10)*** − ***Tertiary Enrollment (% gross), (11)*** − Adult Literacy Rate (% age 15 and above), − Average Years of Schooling, − Average Years of Schooling, female, − Internet Access in Schools, − Public Spending on Education as % of GDP, − No Schooling, total, − No Schooling, female
	LABOUR	− Unemployment Rate (% of total labor force), − Unemployment Rate, female (% of female labor force), − Employment in Industry (% of total employment), − Employment in Services (% of total employment), − Pay and productivity, − Redundancy costs, − Labor tax and contributions (%), − Adult unemployment rate, total, − Firms offering formal training (% of firms) ,
INFORMATION AND COMMUNICATION TECHNOLOGY		− ***Telephones Per 1,000 People, (12)*** − ***Computers Per 1,000 Persons, (13)*** − ***Internet Users Per 1,000 people, (14)*** − Mobile Phones Per 1,000 People, − TV Households with Television, − Daily Newspapers Per 1,000 People, − Availability of e-Government Services, − Government Online Service Index, − ICT Expenditure as % of GDP,
Note: Indexes of the Basic Scorecard are marked in italics.		

Source: Compilation based on [www 1].

The indicators included in the four pillars of the KAM Methodology make up the two main indexes: the Knowledge Index (KI) and the Knowledge Economy Index (KEI). The former one shows the overall potential of knowledge development in a given country, including the generation, adoption and diffusion of knowledge. The KI is the average of the normalized performance scores of a country in three Knowledge Economy pillars – the effective innovation system, education and human resources, and information and communication technology (ICT).

The calculation of the KI does not take into account the pillar of economic incentives and institutional regime. The KEI Index, on the other hand, is the average of all four pillars related to the knowledge economy, using also three variables from the pillar of the economic incentives and institutional regime. Since KEI takes into account whether the environment is conducive for knowledge to be used effectively for economic development, it aims to represent the overall level of development of a country towards the knowledge economy. The index is used to make global compilations of economies according to different economic aspects. Its basic features are groups of variables corresponding with the pillars of the knowledge economy.

KAM uses variables that are measured in different units and on different scales. In order to calculate the aggregate indexes of the Knowledge economy, the variables need to be normalized[1].

3. Analysis and assessment of the level of the knowledge economy in selected countries

The World Bank regularly publishes the KEI and KI indexes. The latest publication comprised 146 countries and the indexes were calculated for the years 2000 and 2012. Due to a large number of countries and a multitude of numerical data, this article will analyse the level of the knowledge economy in selected countries only.

Taking into account the entire world economy, both the KEI and KI indexes decreased in 2012 compared to 2000, but a more significant drop affected the latter one – about 17% (table 4).

[1] The normalization process involves assigning particular values to the countries (on a scale from 1 to 10, where the higher the value, the more advanced the knowledge economy). Then, partial indexes are calculated and weighted until the final index is estimated [www 1].

Table 4. KAM Indexes for the world economy in 2000 and 2012

Index	Year		Trend
	2000	2012	
KEI	5.95	5.12	Decrease
KI	6.06	5.01	Decrease
The Economic Incentive Regime Index	5.61	5.45	Decrease
Innovation Index	7.75	7.72	Decrease
Education Index	3.89	3.72	Decrease
ICT Index	6.63	3.58	Decrease

Source: Compilation based on data [www 1].

In the four main pillars in the KAM methodology, the largest decrease affected the ICT Index – it fell by almost 50%. The drops in the remaining indexes ranged from 1% to 4% in the researched period.

While taking into account the world's regions, North America (Canada, USA), Europe and Central Asia (all the European countries and, for example, Russia, Ukraine, Kazakhstan, Turkey) have the highest values of the indexes related to the knowledge economy in the researched years. South Asian countries (Bangladesh India, Nepal, Pakistan, Sri Lanka) and Africa (without the South African countries) have the lowest values, practically three times as low as the regions ranked top in terms of the knowledge economy (chart 2).

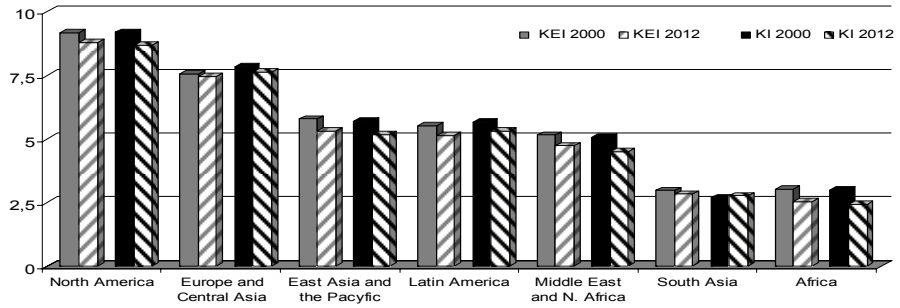

Chart 2. KAM indexes for the world economy – a regional breakdown, 2000 and 2012

Source: Compilation based on data [www 1].

The comparison of the data for all the 146 countries reveals the top 10 economies in the world (table 5).

Table 5. Top 10 Economies in the KAM ranking, 2012

Ranking, 2012	Compared to 2000	Country	KEI	KI	Economic Incentive Regime Index	Innovation Index	Education Index	ICT Index
1	0	Sweden	9.46	9.38	9.58	9.74	8.92	9.49
2	+6	Finland	9.33	9.22	9.65	9.66	8.77	9.22
3	0	Denmark	9.16	9.00	9.63	9.49	8.63	8.88
4	-2	Netherlands	9.11	9.22	8.79	9.46	8.75	9.45
5	+2	Norway	9.11	8.99	9.47	9.01	9.43	8.53
6	+3	New Zealand	8.97	8.93	9.09	8.66	9.81	8.30
7	+3	Canada	8.92	8.72	9.52	9.32	8.61	8.23
8	+7	Germany	8.90	8.83	9.10	9.11	8.20	9.17
9	-3	Austarlia	8.88	8.98	8.56	8.92	9.71	8.32
10	-5	Switzerland	8.87	8.65	9.54	9.86	6.90	9.20

Source: Compilation based on data [www 1].

The Scandinavian countries are the most developed knowledge economies. Table 5 shows the spectacular success of Finland, moving up 6 positions, and Germany, rising by 7 position, in the ranking. It is also notable that Sweden has consistently ranked first for many years. Switzerland, on the other hand, has suffered the largest fall – by 5 positions.

The detailed analysis of the indexes in the four KAM pillars reveals that education and human resources adopt the lowest values – this index is relatively lower for the analyzed countries than the indexes in the other pillars. On one hand, the study of the KEI index for 27 EU member states shows the leaders, such as Sweden, Finland, Denmark, the Netherlands, where the index exceeds 9.00 (chart 3). Poland's position, on the other hand, is remote – third from the bottom. With respect to the KEI index, Poland performs better than Romania and Bulgaria only. Although it should be mentioned that these two countries have improved greatly in the researched period, which has allowed them to move up 9 and 6 positions respectively.

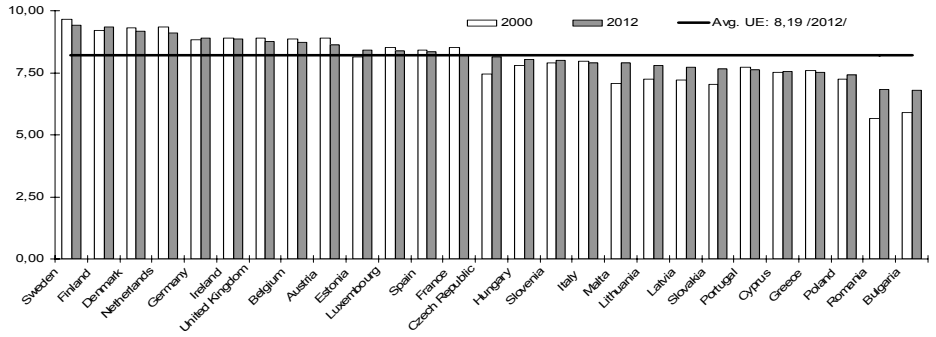

Chart 3. KEI Index for the EU economies – 27, 2000 and 2012

Source: Compilation based on data [www1].

The other basic index measuring the level of the knowledge economy is KI. Its values for particular EU countries are shown in Chart 4. Similarly to KEI, Sweden, Finland, the Netherlands, and Denmark rank top with the value of the index exceeding 9.00. Poland ranks fourth from the bottom, achieving a better result than Latvia, Romania and Bulgaria.

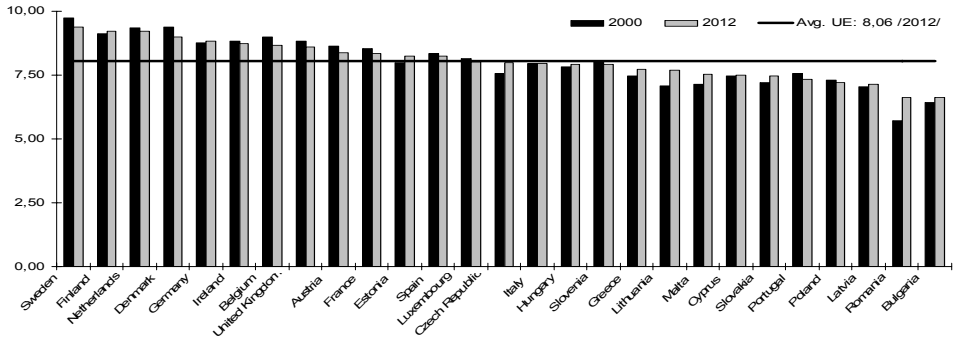

Chart 4. KI Index for the EU economies – 27, 2000 and 2012

Source: Compilation based on data [www 1].

Finally, it is worthwhile to examine the indexes corresponding with the four KAM pillars for Poland (Chart 5). Their values are significantly lower than the values achieved by the world and EU leaders. In 2012, Poland had the 38th position in the world ranking, which meant a drop of 3 positions (2000 – 35th position).

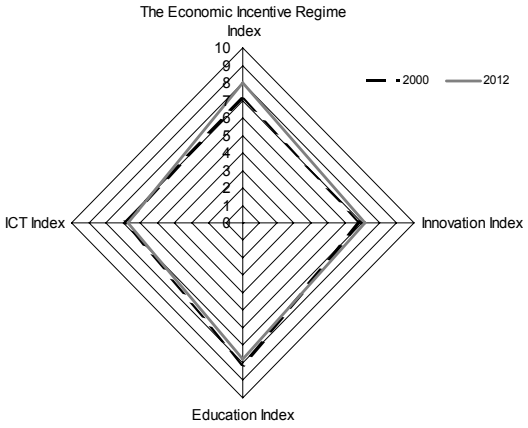

Chart 5. The indexes of the four KAM pillars for Poland, 2000 and 2012

Source: Compilation based on data [www 1].

What can be perceived as a change for better is an increase in the Economic Incentive Regime Index by 14% in 2012 compared to 2000, while the Innovation Index rose only by 4% in the corresponding period. However, both the Education Index and the ICT Index fell by 4% and 3% respectively. This caused that KEI rose by 2% in 2012 compared to 2000, whereas KI decreased by 1% in the same period.

Conclusion

The growth of the knowledge economy affects not only firms and economies, but also societies and individuals. For KE to develop, certain institutional and financial conditions have to be created, in particular in the area of R&D. Success in the transition towards KE usually requires long-term investments in education, increased innovation capacity, modernizations in the information infrastructure, and the economic environment conducive to market transactions [Chen, Dahlman, 2006, p. 4].

Different countries attach different importance to particular pillars in their overall vision. The transparency of the KAM methodology allows for the analysis of the specific indicators assigned to the four pillars, which helps asses the weaknesses of a given country.

Based on the data presented in the article, the following conclusions can be formulated:

- The KE level varies greatly from country to country. There is a huge development gap between the top economies and the poorest performers.
- The countries that joined the EU at the same time as Poland (2004) perform better than Poland in the knowledge economy pillars.
- Poland's economy is in transition toward to the knowledge economy, but (a lot of) time, effort and resources are needed to improve its position in the World Bank ranking.

Recommendations for the Polish economy: the world of science should be merged with the world of business, the involvement of the government needs to be increased, the government should implement pro-innovation policies facilitating the application of knowledge in business, for example, more funds should be allocated to the R&D sector. The education sector must focus on developing adequate training programmes responding to the needs of the labour market. Finally, entrepreneurs should be able to use computers and the Internet more extensively in their operations.

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GOSPODARKA OPARTA NA WIEDZY – DIAGNOZA JEJ REALIZACJI W WYBRANYCH KRAJACH ŚWIATA

Streszczenie: W artykule przedstawiono istotę gospodarki opartej na wiedzy oraz uwarunkowania ją kształtujące. Ocena stopnia przeobrażenia danej gospodarki w kierunku GOW dokonuje się przy wykorzystaniu dwóch podejść metodologicznych: sektorowym lub holistycznym. W artykule wykorzystano metodologię KAM w celu określenia poziomu realizacji koncepcji GOW w gospodarce światowej i jej wybranych krajach.

Słowa kluczowe: gospodarka oparta na wiedzy, wskaźnik wiedzy, wskaźnik gospodarki opartej na wiedzy.