KNOWLEDGE-BASED ECONOMY, SUSTAINABLE DEVELOPMENT AND INFORMATION TECHNOLOGIES

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Abstract. Within the, new economy knowledge is a strategic resource for post-industrial organisations, recognised as the driver of productivity and economic growth, leading to a new focus on the role of information, technology and learning in economic performance and determining the efficient and environmentally use of the other resources. Considering the role of information and communication technologies in the new economy as means for knowledge management processes within knowledge management systems, the bound between knowledge-based economy and sustainable development, the analyze of the use of information and communication technologies in different countries, over time and through comparison with the high human developed group, is very up-to date. The paper focuses on comparisons between Romania and other countries based on two indexes defined by World Bank, KEI – knowledge-economy index – and KI – knowledge index, and also based on the three key variables as proxies for knowledge-based economy. The paper also presents the evolution of Romania's KEI and KI over time and its main accomplishments in the field of ICT.

Keywords: knowledge-based economy, ICT, sustainable development

1. Introduction

Sustainable development has been defined as being "development that meets the needs of the present without compromising our ability to meet the needs of the future" [1].

In response to the challenge of sustainable development in a rapidly changing world – characterized by the lack of resources – will require deep structural changes in economics, society and resource management.

To achieve such major changes requires countries to map out the steps they need to make to move towards sustainable development, and towards knowledge-based economy. This new type of economy, based on organizations that use knowledge management, knowledge management systems and consequently information technologies, represent the most efficient solutions to supply the lack of natural resources and the protection and improvement of environment quality, by generating, using, reusing, stocking and supplying knowledge as alternative to natural resources.

2. The World Bank Group model

In order to appreciate from global point of view the possibility to develop knowledge and using efficiently the environment that favours knowledge, World Bank Group use a system of 80 variables to order 128 countries into a top based on these two coordinates.

The World Bank Group methodology for determining the ability of a country to generate, adopt and diffuse knowledge, representing the possibility to develop knowledge of the analysed country, is materialized into an index of knowledge (KI). This is calculated as an average of normalized values of the performance indicators of that country, grouped on three pillars of the knowledge economy: education and human resources, innovation system, communication and information technologies.

Using a similar methodology, the index of knowledge economy (KEI) is calculated, aimed to quantify the effective use of the environment that favours knowledge for economic development of that country. The index is determined through the aggregation of the indexes that reflect the global development level of that country towards knowledge economy. It is calculated as an average of normalized performance indicators of that country for which analyse is made, grouped on four pillars concerning knowledge economy: economic rewards and institutional regime, education and human resources, innovation system and communication and information technologies.

The model operates with 80 variables and the normalization refers to giving a coefficient on a scale from 0 to 10 of each variable from each 128 countries or regions for which the model is applied, where 0 expresses the weakest performance and 10 the best performance.

The normalization consists of [2, 3]: collecting data for each variable, for each country/region; order the countries, starting from 1 – for the country that have registered the best value of the variable; determining, for each country, the number of the countries with inferior performances (Nw); normalizing the score for each country through the use of a formula: 10*number of the countries with weaker performances/total number of countries.

After applying this formula it is obtained a normalized score between 0 and 10 for each country from those 128. The first 10% of the countries receive a score between 9 and 10, the 10% after receive a score between 8 and 9, and so on.

3. Romania and the progresses toward a knowledge-based economy

Using the interactive instrument of benchmarking offered by World Bank Group there were concluded the following facts, presented in table 1, considering that there were used values reported to the number of people from each country for a more accurate relevance:

- based on 1995 data, Romania occupied the 51 place in the top from the point of view of KEI, having a value of 5.37, compared with 9.2, the value of the country from the first place - Sweden. Compared with 1995, Romania obtained, based on most recent data, the 54 place in the top, with a value of 5.37, compared with the first on top, Denmark, with 9.23;

- Romania occupied the place 54 based on 1995 data having a value of 5.41 and place 47 based on most recent data with a value of 5.58 from the point of view of KI;

- in case of both indexes, Romania have registered improvements, translated both through an better and effective use of the environment that favours knowledge (KEI), and through the increased possibility to develop knowledge (KI).

There were considered the following notations:

- ES - The regime of economic stimulants represents: tariff and non tariff barriers, the quality of politics to regulate the market (politics that favour/does not favour), the rule of law (economic agents trust and obey the rules of society);

- E - Education refers to: the rate of adults' instruction (% with age between 15 and over 15 years), gross rates of students and pupils from high school from total population that is educated, no matter of age;

- I- Innovation refers to: the number of the researchers related to 1 million of people, requests registered to The Office for Marks and Patents from USA related to 1 million of people, articles in scientific and technical journals related to 1 million of people;

- II - Information infrastructure refers to: telephones, computers, Internet access related to 1000, 1000 and 10000 inhabitants [2].

Table 1. Comparison between Romania and Sweden from the point of view of KEI and KI

most recent	Country	KEI	KI	ES	I	E	II
1	Denmark	9.23	9.37	8.82	9.42	9.20	9.48
54	Romania	5.37	5.72	4.31	5.17	5.94	6.05
1995	Country	KEI	KI	ES	I	E	II
1	Sweden	9.2	9.47	8.38	9.76	9.00	9.65
51	Romania	5.37	5.41	5.23	5.3	5.90	5.05

Source: The Knowledge Assessment Methodology (KAM) website (www.worldbank.org/kam)

As for the use of telephones, computers and Internet use, the data for 1995 and most recent data for Romania and Denmark are presented into table 2, and they show huge difference between the two countries.

Thus, they reveals that there have to be made important steps by Romania, to achieve the level of the first on top, especially with the new status of EU country, of which goal is to become the most developed country in the world until 2010.

Thus, considering recent data, from the point of view of using the telephones, Romania is situated at 39% from the use of Denmark, from the point of view of computer use – at 17% and from the point of view of Internet use – at 30%. Still there are some improvements, considering the comparison with data from 1995, when, from the point of view of telephone use Romania was at 17% from the use of Denmark, from the point of view of computer use – at 5% and from the point of view of Internet use – at 2%.

The data for the high human development group of countries are presented into table 3, and the comparison with the most recent data for Romania shows that from the point of view of telephone use Romania was at 56% from the use of

high human development group, from the point of view of computer use – at 30.62% and from the point of view of Internet use – at 51%.

Table 2. The use of telephones, computers and Internet in Romania and Denmark

Variables	Most recent		1995	
	actual	normalized	actual	normalized
Total Telephones per 1,000 People - Romania	673.5	5.91	131.3	5.38
Total Telephones per 1,000 People - Denmark	1598.8	9.55	768.10	9.77
Computers per 1,000 People - Romania	113	5.87	13.2	4.72
Computers per 1,000 People - Denmark	655.60	9.21	267.8	9.51
Internet Users per 1,000 People - Romania	207.5	6.36	0.7	5.15
Internet Users per 1,000 People - Denmark	696.20	9.70	38.30	9.32

Source: The Knowledge Assessment Methodology (KAM) website (www.worldbank.org/kam)

Table 3. The use of telephones, computers and Internet in high human development group

Variables	Most recent		1995	
	actual	normalized	actual	normalized
Total Telephones per 1,000 People	1184.64	7.46	413.2	7.99
Computers per 1,000 People	369.19	8.06	115.34	8.17
Internet Users per 1,000 People	405.11	7.92	20.17	8.79

Source: The Knowledge Assessment Methodology (KAM) website (www.worldbank.org/kam)

The results obtained reflect the progresses made by Romania on its way toward a knowledge-based economy, inducing thus an increase in the quantity of knowledge used and produced as a path for sustainable development.

Table 4. The use of telephones, computers and Internet in Romania and Bulgaria

Variables	Most recent		1995	
	actual	normalized	actual	normalized
Total Telephones per 1,000 People - Romania	673.5	5.91	131.3	5.38
Total Telephones per 1,000 People - Bulgaria	966.3	6.82	307.6	7.42
Computers at 1,000 People - Bulgaria	113	5.87	13.2	4.72
Computers at 1,000 People - Bulgaria	59.4	4.6	16.7	5.45
Internet Users per 1,000 People - Romania	207.5	6.36	0.7	5.15
Internet Users per 1,000 People - Bulgaria	283.5	7.2	1.2	5.98

Source: The Knowledge Assessment Methodology (KAM) website (www.worldbank.org/kam)

Regarding the other country that have joined EU at January 2007, Bulgaria, the data are presented into table 4, and shows that Romania has the advantage of a greater use of computer, of 113 users per 1000 people compared with approximately 59 users per 1000 people. Both countries have the potential to contribute to the development of knowledge-based economy goal of EU, considering the evolution of indicators concerning communication and information technologies.

4. Romania and the sustainable development

As a new member of EU, Romania embraces its goal to become the most developed knowledge-based economy in the world until 2010 [4], consequently applying the principles of sustainable development through using knowledge as a resource instead of material resources. In order to achieve this goal, a National Development Plan was developed for the period 2007-2013 [5], which will conduct to improved economic competitiveness and the development of knowledge-based economy, set as national priorities.

There were also established six national development priorities [5]:
- increasing economic competitiveness and developing knowledge-based economy;
- developing and improving the transport infrastructure;

- protecting and improving the quality of environment;

- developing the human resources, promoting occupation and social inclusion and improving administrative capacity;

- developing rural economy and improving the productivity of agricultural sector;

- decreasing the development disparities between the country regions.

There were also set strategic objectives in order to contribute to the accomplishment of prioritise, that combine both the elements of regional development politics, including National Strategy for Sustainable Development "Horizon 2025" [6] and the strategic European orientations, the main objective being the one of developing the national economic competitiveness reducing in the same time negative effects on the environment.

This objectives and priorities may be accomplished through the use of information technologies both by the people and by the organizations, the Romania' developments highlighted before giving the measure of the importance, the necessity and the possibility of achieving this goal.

5. Conclusions

Over the past twelve years, Romania has registered important progresses towards knowledge-based economy, this becoming a national priority from the moment of its accession to EU. Thus, Romania have evolved from 54 place in 1995 to 51 place according to the most recent data.

Knowledge-based economy is very bound to the sustainable development, which may be achieved through the use of information technologies, Romania registering developments concerning the use of information and communication technologies.

Considering the role of these modern instruments in new knowledge-based economy, their increased use over the years, and the bound between sustainable development and knowledge-based economy, and also the objective of Lisbon Agenda of EU to become the most developed knowledge-based economy in the world until 2010 [4], Romania have the potential to contribute to this goal and to evolve in the top of developments concerning KI and KEI.

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