The human capital – foundation
National System of Innovation in the innovative economy

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Abstract: The progress in developing countries contributed to the formation of the new economy, knowledge economy, innovation, new technologies and business venture. The human capital is the foundation of this new economy.

Key words: new economy, knowledge economy, innovation, innovation economics, human capital

National System of Innovation

1. Introduction.

In recent years a general mood was created about the role of human capital in economic growth and the formation of "new economy" as a necessary step in economic evolution of society. The New economy is based on knowledge and ideas, key factors to the creation of high standards of living where ideas and innovative technologies are essential.

2. Theoretical background

In the professional literature, the "new economy" is perceived as a complex phenomenon and interpreted differently by economists. There are used different names: the "new economy" post-industrial society, postmodern society, information, knowledge, "net-economy", "digital economy", "virtual economy", but all have contemporary features of society development. In the post-industrial society are found the information society, knowledge and science society [1]. All these are based on innovative ideas of human capital, resulting in innovative nature of post-industrial society and its role in building them. In our opinion the next stage of post-industrial society is the innovative society, determinant of the innovation economy, as necessary step in the evolution of society. Synthesizing the opinions of foreign and native authors about the post-industrial society, the author establishes the correlation between the expressions of the new society (Figure 1).

Fig. 1  Postindustrial society phrases
3. Problem solution

3.1. Hypotheses of the research consist in the deepening and developing the concept of human capital and efficiency in the formation of innovative economy. The achieving of the goal led to formulate the following objectives:
- the argumentation of the importance of human capital as a prerequisite for the development of innovative economy and its multiplier effects;
- the shaping of economic policies and increase efficiency of human capital and its creative potential;
- the development on the strength of recommendations on investigations under the National System of Innovation training effectiveness;

3.2. Means and tools of research

The methodological basis of research knowledge is dialectical method, device and philosophical categorical general systems theory, comparative analysis method.

3.3. Research results and interpretation

Innovative economy is the economy of knowledge-based society, innovation, the positive acceptance of new ideas, systems and technologies and their implementation in various spheres of economic activity. This is a type of economy based on innovation flow, the constant technological perfection, the production and export of high tech products with high added value and export of technologies [2]. Basic notions of innovative economy are: innovations, innovative activity and innovative infrastructure [3]. This type of economy is based on human capital as a measure of individual skills and qualities made from investments which are actually used, leading to increased productivity and income. These qualities of human being have opened new horizons in individual perception of economic phenomena, based on innovative ideas that give rise to innovative economy. The particularities of human capital in the innovative economy have multiplicative value that consist in the fact that, after the process of production, newly created value in the input exceeds its output. As a result, the author proposes the following definition of human capital in innovative economy representing all socio-economic relations on the formation and accumulation of knowledge with innovation multiplicative effect. Individual human capital is crucial for innovation activity and the representation of a nation's human capital can be an expression of relevant skills for innovation. According to these skills we can say that the innovative component of human capital represents all intellectual capacities of the worker to generate new knowledge and achievement in its structure with the physical capabilities and those intellectual of the worker. Its structure includes the following elements: education, training, reproductive capacity and renewal of knowledge, skills and personality types, health and genetic background, motivations, migration ability. Skills of innovation is expressed through the annual growth rate of GDP per capita, share of GDP spending in this area, number of patents, number of staff involved in research, development and innovation, all of a link between them and economical increase.

1. The annual growth rate of GDP per capita

![Fig. 1 Annual growth rate of GDP per capita and Research and development expenses after the development of countries](image)

World states lie at different rates of GDP per capita, which is, in 2009, the highest for Luxembourg - U.S. $ 78,395, U.S. - 46381 USD, Switzerland - 43007 USD[4], while the Republic of Moldova - only 2843 USD, by purchasing power parity [5].

2. Regarding the expenses on R & D in the EU in 2007 has allocated 229 billion research and development. CD costs as a percentage of...
GDP, which rose from 1.85% in 2007 remained stable compared to 2006. The highest intensity of CD was recorded in the Nordic countries and Austria and Germany. In 2007, expenses as a percentage of GDP CD (CD intensity) was highest in Sweden (3.6% of GDP) and Finland (3.47%) followed by Austria (2.56%), Denmark (2.55%) and Germany (2.54%) and lowest values and is registered in Cyprus (0.45%), Slovakia (0.46%), Bulgaria (0.48%) and Romania (0.53%). In 2010, the economic crisis has deeply affected research in Romania, the total allocations for research, public funds, is approximately 1.64 billion lei, which represented an increase of 8.6% since 2009 (1, 53 billion), but only a return to around the year 2008 and well below the planned launch of the National Research and Development and Innovation 2007-2013, about 4 billion. States with a higher share of R & D expenditures in GDP have a better position in global competitiveness rankings, resulting in the need to increase investment in science.

3. Patents per 1 million people in 2000-2005, 189 were in high human development countries (Korea 1113, Japan 857, Sweden 166, Romania 24, Chile 1, Bosnia and Herzegovina 3).

4. Employment in C-D in 2007 the equivalent of 2.3 million people working full time in the EU-27. CD staff corresponded to 1.6% of total employment, the highest proportion being in Finland (3.25 of total employment), Sweden (2.7% in 2005), Luxembourg (2.6 % in 2006), Denmark 82.4% in 2006) and Austria (2.1% in 2006), and the opposite stands Romania (0.5%), Bulgaria (0.6%), Cyprus (0 , 7% in 2006), Poland (0.8%) and Portugal (0.9% in 2006). Researchers representing 0.9% of total labor EU-27 in 2007, this proportion varies in Romania and Finland in 2005 to 2.1%. Staff on CD, at the end of 2009 in Romania, operating in research and development 42,420 employees, decrease of approximately 1082 employees from the one recorded at the end of the year 2008.

On the background of global economic developments recorded globally in 2008, there is a tendency to focus government efforts to effectively use innovative capacity of human capital.

Before the economic crisis of 2008, the firms were concerned to maintain market position by reducing costs for standardized products. For this stage, they must take concrete measures by which investors turn to technology and innovation sector. Faced with new challenges, Romania is facing a fragile economy, uncertain, and this time that minimizes the role of knowledge and effective transfer of new technologies. Given the macroeconomic situation of Romania in 2008-2010, it is estimated that Romania is in the domination of classical macroeconomic environment and the competitiveness of Romanian economy is far surpassed by the EU Member States. In this circumstance, in which Romania has the rank 64 of 133 worldwide, in terms of competitiveness, technological information and knowledge are required to constitute key factors of renewal and sustainable growth. In terms of innovative component, the author made an analysis by comparing the average performance results in Romania from EU27. The results are based on analysis of elements such as institutions, human potential, information and communications technologies, market development, business development through the innovative environment, the ecosystem of innovation, openness to foreign and local competitors, scientific achievements and creative activities as an element of Innovative Capacity Index (ICI). According to the Global Innovation Index 2009/10, Sweden is the top position fall index (0.871), followed by Denmark (0.834) and Finland (0.810) and the last position is located in Romania (0.136) and Bulgaria (0.130)[6]. Placing on the last places of Romania and Bulgaria demonstrates the low degree of openness of political society
and economic development implementation and application of elements of a knowledge society without setting priorities in this regard and without the use of existing infrastructure before '89. The author concludes that developed countries have high levels of correlation between the degree of development and innovation, this situation being true for Romania but in reverse. Poor economic results recorded once again confirms that the modest activity of the Romanian companies in the CD-I is a divergent path towards the EU. The main reasons identified are:

1. the low volume of financing for CD-I, Romania is among countries with the lowest investment in this area, only 0.58% in 2008. The situation worsened in 2009 when public spending returned to the level existing before the boom, 0.2% of GDP respectively;
2. the increasing of the public debt and budget constraints from the IMF agreement raises questions about Romania's ability to increase public expenditure on education innovation and short and medium term even if the National Strategy for Research, Innovation 2007-2013 provides for the allocation of significant amounts in this sector;
3. poor cooperation on innovation especially weak link between academic research and industrial applications;
4. weak development of clusters, in Romania was encouraged development of industrial parks at the expense of clusters, and the Romanian government was not financially involved but was limited to a business information on the major role that those have in competitive economic development;
5. human capital deficiency in the CD-I, mainly due to lack of interest given to the sector and lack of motivation to young researchers;
6. Based on these facts, the major role of human capital in the formation of the National Innovation System, is materialized as a solution to speed up implementation and development of innovative economy. But, above all, should be considered the importance of innovation infrastructure, namely the role played by technoparks, business incubators, clusters, business angel and, not least, of venture capital in the formation of a reliable and performant National Innovation System.

Innovative infrastructure in all countries is formed with the full participation of the state. Formation of innovative infrastructure in Romania is one of the main directions of the country's development and integration into global innovation system. This can be achieved through a stable innovative policy and using the levers of state structural reform-oriented branch and creating innovative growth models [7]. It should be noted however, that each economy is characterized by evolving with specific characteristics that customize and individualize it. The stability of an economy is relative and it depends on global economic and social context, so it is necessary for the innovational management to pursue to continually adapt to these changes. [8]. The author carried out a parallel between this innovative model from Romania and Moldova (Table 1).

**Table 1 Innovative design features**

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<th>Romania</th>
<th>Republic of Moldova</th>
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<td>Liberal ideology only in privatization of state and business.</td>
<td>Liberal ideology too simplistic.</td>
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<td>Financial sources both internal and external.</td>
<td>External financial sources which are fluctuating due to remittances from abroad.</td>
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<td>The average work motivation.</td>
<td>A lower motivation to work.</td>
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<td>Transposition of the results is done moderately.</td>
<td>Innovative passive (slow implementing the ideas into reality).</td>
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<tr>
<td>Fundamental research is characterized by external expertise.</td>
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<td>The “brain drain” effect continues to be an obstacle to the proper development of the national economy.</td>
<td>Export of labor resources which appears as a brake on economic development.</td>
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From the presented analysis, the author notes that Romania meets the business model innovation more than Moldova, primarily due to the advantage of being a member of the EU. It should be noted that each of these faces a major problem, namely a high degree of corruption, which is an obstacle for the development of innovative activity. To transform the economy of Romania in an innovative development, the main task is setting staged the National System of Innovation [9].
Research conducted in Romania about the National System of Innovation allowed the determination of the fundamental problems of formation and use of innovative human capital, embodied in a SWOT analysis (Table 2).

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<th>STRONG POINTS</th>
<th>WEAK POINTS</th>
<th>OPPORTUNITIES</th>
<th>THREATS</th>
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<td>the existence of a framework for stimulating innovation activities, research, development; innovation activities in both productive and service sector and research institutions and innovation; significant increase of budgetary funding for research, innovation, technology transfer and innovation infrastructure creation, so that by 2020 they reach 2% of GDP; a number of patents registered annually compared to 1 million inhabitants, the European average; high level innovators, holders of claims in international salons of inventions; share of exports of products of medium and high technology (high tech products are considered those with a content of innovation based on about 3.5 to 8.5% of their M &amp; IT), 50.14% total exports in Romania, compared to 47.36% EU 27 [10]; share of exports of services with intensive contribution of knowledge, a total of 44.91% export services in Romania, compared to 49.43% EU 27; Romania’s participation in actions of Joint Research Centre, EUREKA programme; Enrollment of Romania as a full member of the ENIAC Joint Undertaking - a public-private partnership in nanoelectronics in 2009; scientific research is present in almost all areas, particularly in priority 7, where, according to Strategy Action Plan, Romania will lead a project to set up a dedicated pan-European research activities in the Danube river, Danube Delta and Black Sea; full contraction of the structural funds allocated through SOP IEC Priority Axis 2, by the public beneficiaries; accession of Romania to the initiative of establishing the Association of Technology Parks Black Sea region;</td>
<td>low level of innovation culture in both productive and service sector and research institutions and innovation; lack of information, especially statistics on the innovation activities of companies and businesses; deficiencies of the educational system for training and continuing education of specialists in the management of innovation, protection, evaluation and marketing of intellectual property rights; weak involvement of private sector in the activity of CD-I; insufficient motivation of young people to follow careers in research; poor collaboration between universities and private sector business; poor of Romania’s participation in Framework Programme FP7; partial contracting by private beneficiaries of structural funds for CD-I SOP IEC Priority Axis 2; weak venture capital financing;</td>
<td>continuous growth in demand for innovative products and technologies; the existence of the legal framework for the development of beneficial public-private partnerships in innovation and technology transfer through the initiation and implementation of joint projects (consortia / clusters, technology platforms, etc); capitalization of funding mechanism through the Structural Funds; increase of integration in education, research, innovation and entrepreneurship; increase of motivation and prestige of innovators; expanding international cooperation on CD-I, in the EU and beyond; continuation of EUREKA Eurostars programs, part of the EUREKA network to harmonize and synchronize national programs to support SMEs with research activity; supplementation of Nucleus Program IFIH-HH with a new project for ELI (Extreme Light Infrastructure - Nuclear Physics).</td>
<td>Continuation of exodus of skilled professionals in the field of innovation research into other fields and in other states; low level of attractiveness for youth activities in innovation compared to other activities related to modern advanced technologies; regional gaps in development of innovation processes especially in EU regions; insufficient degree to achieve the rights on the objects of intellectual property;</td>
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The author demonstrates, based on SWOT analysis, that in recent years have been taken actions related to stimulating innovation processes and have been created the premises for achieving innovations in Romania’s industry, to enhance competitiveness of domestic industrial products and production capacity. Thus are proposed for Romania the innovative development strategy components (Figure 2).

**Components innovative development strategy of Romania**

- Integration into global innovation chains
- Creating innovative technology clusters
- Formation of priority innovative directions
- Forming a strategy for innovation funding

**Fig. 2.** Components of innovative development strategy in Romania

4. Conclusions

1. Global processes taking place at the beginning of the III-rd millennium related to accelerating the development of the tertiary sector, individual production, intellectualization of human activity, creating an efficient information system, etc. forming a new motivational mechanism, are the premises of post-industrial economy, which requires creative interpretations by economics.
The changing of the role of the individual, his intellect transformation into a decisive factor of the progress of society, argues the need to form a new development paradigm. Its essence lies in the transition to a new level of socialization, the changing of development priorities and the transfer from the anthropocentric to technocratic approach, oriented towards the needs and human capabilities.

2. Human capital in innovative economy represent all socio-economic relations on the formation and accumulation of knowledge innovation multiplicative effect, that consist, after the production process, in the newly created value that at the input exceeds its value at the output. The innovative component of human capital represent all intellectual capacities of the worker to generate and to achieve new knowledge, containing both physical and intellectual capacities of the worker.

3. The research of human capital role in innovative economy, undertaken in this paper permit the assessment of the real situation in Romania, reducing negative effects of

4. The practice making of the CD-I strategies in Romania will have positive impact and help to: enhance national economic competitiveness on domestic and foreign markets through the implementation in economic practice of scientific achievements and innovation, increasing the scientific and innovative support of the and socio-economic development of the country, acceleration economic growth rates and improvement of its quality, creating new jobs, increase exports of goods and services with high added value, especially those scientointensive (IT, nano-technology, pharmaco-genetics, biotechnology); increasing the domestic and foreign investments in the economy, intensification of regional development; improvement of the environment and enhancing its protection; improving of management in SNI, implementation of programs and projects of technology transfer in all economic fields and faster integration in the innovative structures worldwide.

References:


