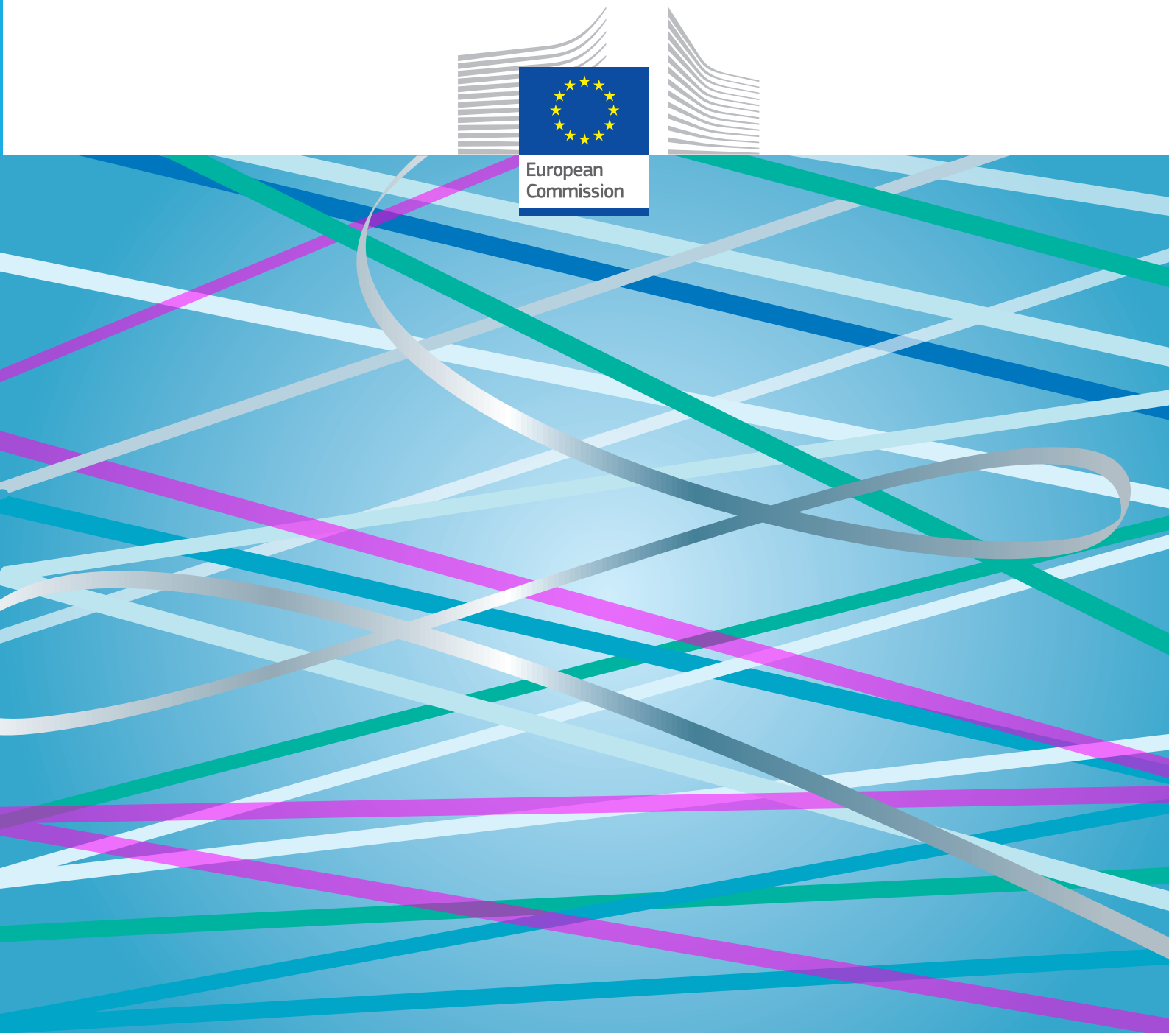


Open Innovation

2012

Information Society and Media

3.7 Mapping the intellectual capital of post-Soviet states

Introduction

Each era poses its own challenges not only for individual countries but also for mankind as a whole. It is undeniable that the main challenge of the 21st century is the creation of a knowledge-based society that ensures a country's position, its prosperity and status in the rapidly changing global landscape.

Unarguably, modern development trends are basically affected by overall integration. Among one of the most affected and the targeted aspect of integration still remains science. Science, technology and innovation become key components in assuring sustainable socio-economic development of the state, which, in turn, encourages social integration, enhances international cooperation and facilitates the dissemination of information. Integration not only challenges the economy, technology and research, it also affects countries and regions deeply to their core. Together with industry and economy, social structures are also changing and renewing, raising new needs in society. In this context, the science sector need to adopt new roles and importance. Nowadays, the most important resource for economic development is well-educated, creative human capital, and the only way to secure this capital is by investing in human capital, which has become an imperative.

Assessing the huge work carried out by Prof. Leif Edvinsson and Dr Carol Yeh-Yun Lin [1], we intend to cover a gap in their study, which, because of some objective reasons, did not cover the post-Soviet area. Whereas, the mere numbers of some basic factors reveal the huge importance and potential of the region. Twelve republics of the former Soviet Union[1] occupy more than 16 % of world territory. Their total population is nearly 300 million people, which is nearly 5 % of the total world population. Assessing the scientific human capital of these states, it is worth mentioning the following: the number of people engaged in science is 583 000, of which 34 000 are doctors and 107 000 are candidates of science [2].

The post-Soviet countries form, in some respects, a cultural shed between much deviating science policy concepts, which either stand in the Russian or western tradition. This divide is deepened by language barriers. To overcome these problems hampering both educational and scientific systems, the post-Soviet countries and its European partners intend to suggest international, interdisciplinary projects, which, the the longer term, aim to provide different transnational tools for the science-innovation policy and future harmonisation of the regions. As a first and most important step towards the long-term goal, there is a need to create the logistical and technical frame as well as the much needed political platform. Diverse projects carried out between the scientific communities of both these sides, clearly demonstrate the path towards the achievement of the above mentioned goal.

The appraisal of intellectual capital

Traditionally, economists consider physical and human capital as key resources for facilitating productive and economic activity. However, knowledge, too, has been reorganised as a valuable resource. Alfred Marshall suggested that 'capital consists in a great part of knowledge and organisation ... knowledge is our most powerful engine of production' [3]. Elaborating on this point, another economist, Quinn, mentioned that 'the economic and producing power of the firm mainly lies in its intellectual and service capabilities than its hard assets' [4]. Although the role of knowledge has been acknowledged long ago, its investment into everyday life processes came to existence later, particularly in some regions and states.

Eventually, IC becomes a key component of modern development. It is now widely used to produce wealth, multiply output of physical assets, gain competitive advantage, as well as enhance value of other types of capital [5]. Investments in human resources are tantamount to investments in physical assets. Although in professional literature, IC includes different forms of capital (customer capital, intellectual property, structural capital) the main focus of this paper will be on the human capital part of IC.

According to the World Intellectual Property Organisation, Intellectual Property (IP) refers to creations of the mind: inventions, literary and artistic works, and symbols, names, images, and designs used in commerce. In appraising a country's IP, the latter is divided into two categories: industrial property, which includes inventions (patents), trademarks, industrial designs, and geographic indications of source; and copyright, which includes literary and artistic works such as novels, poems and plays, films, musical works, artistic works such as drawings, paintings, photographs and sculptures, and architectural designs [6]. Table 1 demonstrates the IP of post-Soviet states (WIPO Statistics Database).

1 Baltic States are not included in this survey.

Table 1. Intellectual Property (IP) of post-Soviet countries (2010)

State	Patent	Trademark	Industrial design	GDP (million USD)
Russian Federation	28 843	42 744	2 962	1 230.72
Belarus	3 228	4.82	277	49.04
Ukraine	2 868	17 868	1 607	117.40
Kazakhstan*	351	2 478	119	109.16
Azerbaijan*	320	1 178	25	43.02
Georgia	261	784	56	10.74
Uzbekistan	239	1 488	57	32.97
Kyrgyzstan	220	244	7	4.58
Moldova	160	1 527	171	5.40
Armenia	160	1 224	54	8.54
Tajikistan	29	206		263.89
Turkmenistan*	0	0.01	0.01	17.36

* Data provided for these states are for the previous year due to absence of current information.

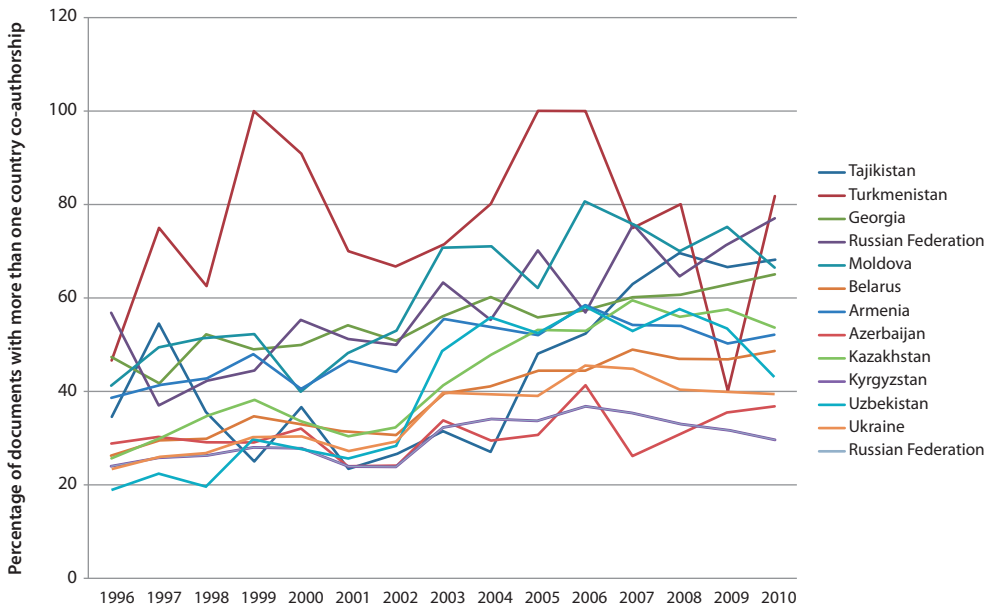
Viewing the process of knowledge creation, the role and importance of integration and innovation is more than evident. The knowledge is being created through two generic processes, namely, combination and exchange: combination as a process for gathering materials and forces; and exchange combines the efforts and resources held by different parties as a prerequisite for development. The first condition for the above mentioned to become reality is accessibility to the collective forms of social knowledge. Deep integration and IT provides real opportunity for exchange and development [7].

Figure 1 demonstrates the international scientific collaboration of post-Soviet states 1996–2010 [8].

The current state of science in the post-Soviet area

In Soviet times, the education and science sector was regulated by a centralised governing body, as

Figure 1. International scientific collaboration of the post-Soviet countries (1996–2010)



institutes, education and science systems of the Soviet Republics were dependent parts of the whole Soviet educational and science system. The strategy and operation of the system were strictly planned and monitored as was every other facet of institutional society. The science sector was not regulated by free market forces: the demand-supply balance was more or less defined by central regulation only.

Meanwhile, the collapse of the Soviet Union did not match a breakthrough in the R & D sector. All economic and social sectors of the newly formed republics were faced with a deep crisis and challenged by sharply decreasing state financing [9] [10] (see Table 2).

To face the impending challenges, newly established post-Soviet republics entered a stage of sharp reforms and imperative developments. The reforms and strategically important initiatives were developed in nearly all spheres. However, the reforms towards the reanimation of intellectual capital began to be implemented only after significant delay. Moreover, they were far from conformity with economic needs. One of the past heritages still remained: a significant gap between what industries need and the quality of human resources.

Initiatives were launched to abolish the disconnection and establish linkages between knowledge and market. The key drivers of change in the science sector and the key trends in the sector were connected to the following factors.

- *Economic integration:* Economic integration has had several implications for former Soviet republics' labour force markets and science sectors. While operating in open markets, local industries were faced with a necessity to compete with global companies. The new market rules in turn lead to new requirements by local companies in the education, knowledge and skills of the labour force. Local companies often suffer from the brain-drain phenomenon, given the heightened international mobility of workforce [11].
- *IT revolution and innovations:* In the era of integration, the flow of information is very much accelerated. It is estimated that each year the existing volume of global information doubles. As a result of unveiling the past ideological curtain and the information revolution, the post-Soviet republics have gained access to global information. Alternative sources and channels of information began not only better inform the population about external opportunities, but their presence as information channels poses the first serious questioning of the hegemony of Soviet (and via inertia, post-Soviet) instruction. The emergence of new platforms of knowledge content delivery creates demand for a new generation of specialists for both the gathering and consumption of advanced technologies [11].

The World Bank Institute developed a Knowledge Index[2] (Table 3) to measure a country's ability to generate, adopt and diffuse knowledge, representing the overall level of development of a country or region concerning the knowledge economy. It demonstrates whether the environment is conducive for

2 Methodologically, the KI performs the simple average of the normalised performance scores of a country or region on the key variables in three knowledge economy pillars — education and human resources, the innovation system and information and communication technology (ICT).

Table 2. The dynamics of changes in the expenditure on science in CIS Republics (% of GDP)

CIS Republics	1990	1995	2000	2003	2004	2005	2006	2007	2008	2009
Azerbaijan	1.00	0.30	0.30	0.30	0.20	0.20	0.20	0.20	0.20	0.20
Armenia	2.50	0.10	0.30	0.30	0.30	0.30	0.20	0.20	0.20	0.20
Belarus	2.30	1.00	0.80	0.70	0.70	1.20	0.70	0.70	0.60	0.70
Georgia	1.20	0.10	0.20	0.10	0.10	0.10	—	—	—	—
Kazakhstan	0.70	0.30	0.20	0.30	0.30	0.30	0.30	0.20	0.30	0.20
Kyrgyzstan	0.70	0.30	0.10	0.20	0.20	0.20	0.20	0.30	0.20	0.10
Moldova	1.60	0.80	0.60	0.40	0.40	0.40	0.40	0.60	0.50	0.50
Russian Federation	3.00	0.80	1.20	1.30	1.90	1.20	1.20	1.30	1.20	1.70
Tajikistan	0.70	0.10	0.10	0.06	0.06	0.10	0.10	0.10	0.10	0.10
Ukraine	2.30	1.30	1.10	1.20	1.20	1.10	1.00	0.90	0.90	0.90
CIS	1.60	0.51	0.49	0.39	0.54	0.51	0.48	0.50	0.52	0.51

Table 3. The Knowledge Economy Index (KEI) of post-Soviet countries

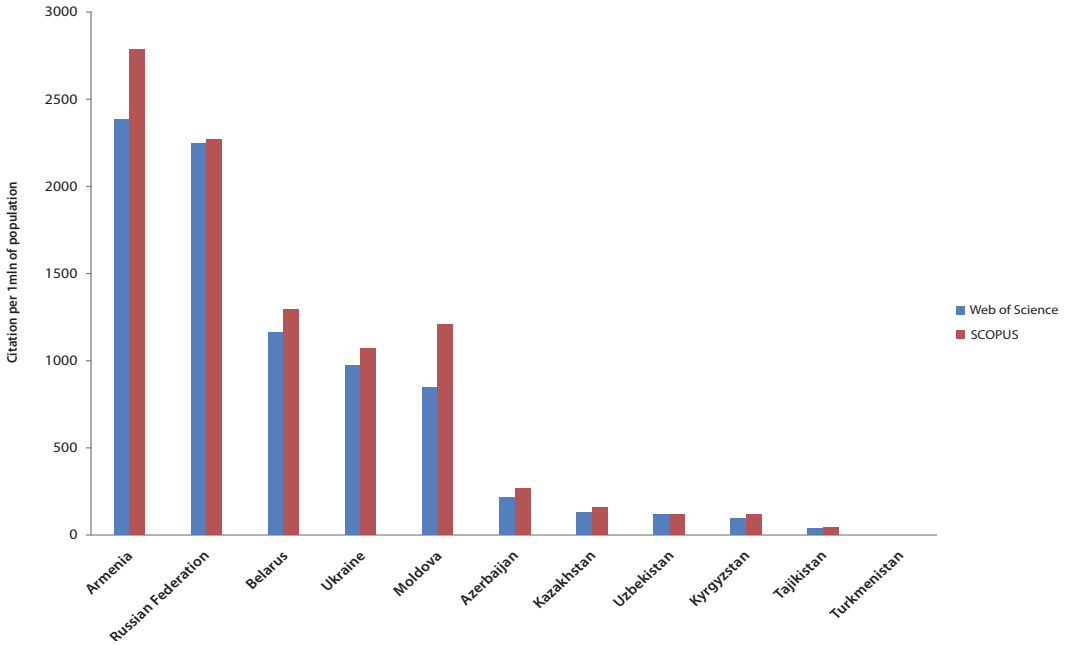
	KEI		Economic Incentive and Institutional Regime		Innovation		Education		ICT	
Country	recent	1995	recent	1995	recent	1995	recent	1995	recent	1995
Ukraine	6.00	5.97	4.27	3.18	5.83	6.10	8.15	8.26	5.77	6.32
Armenia	5.65	5.35	6.48	3.69	6.25	5.76	6.36	6.14	3.52	5.83
Russian Federation	5.55	5.73	1.76	2.55	6.88	5.64	7.19	8.12	6.38	6.60
Georgia	5.21	5.63	5.36	3.20	5.22	5.38	6.46	7.47	3.78	6.45
Moldova	5.07	5.11	4.38	3.47	4.79	4.43	6.05	7.00	5.08	5.55
Kazakhstan	5.05	5.08	4.70	2.18	3.68	4.03	7.07	7.63	4.76	6.48
Belarus	4.93	5.80	1.15	2.37	5.79	5.42	8.02	8.37	4.74	7.03
Kyrgyz Rep.	4.29	4.44	4.49	2.42	2.93	3.41	6.35	5.77	3.40	6.17
Azerbaijan	3.83	4.85	3.18	2.25	3.64	4.97	5.01	6.02	3.49	6.17
Uzbekistan	3.25	4.46	1.13	0.76	3.35	4.24	6.15	6.90	2.35	5.93
Tajikistan	3.22	4.05	2.88	0.14	2.01	3.59	5.53	6.77	2.46	5.72

knowledge to be used effectively for the economic development of the particular state [12].

The knowledge economy is based on the four pillars, which clearly demonstrate the potential of the particular state.

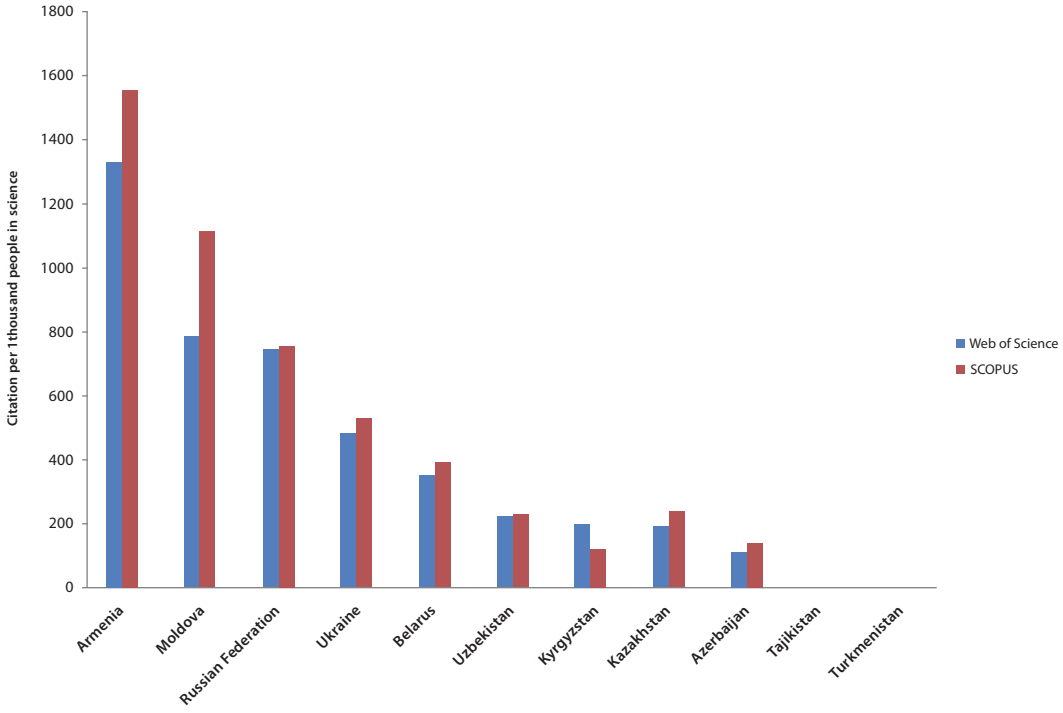
- Economic incentive and institutional regime provide incentives for the efficient use of existing and new knowledge and the development of entrepreneurship.
- An efficient innovation system of firms, research centres, universities and other organisations is

Figure 2. Scatter plot of citation index for 1991–2010 v million of population in CIS countries



Source: SCImago (2007) (http://www.scimagojr.com) (retrieved 31 October 2011)

Figure 3. Scatter plot of citation index for 1991–2010 v thousands of researchers in CIS countries



making it possible to tap into the growing stock of global knowledge, assimilating and adapting the latter to local needs, as well as creating new technology.

- An educated and skilled population can properly and efficiently create, share, and use knowledge.
- Information and communication technology facilitate the effective creation, dissemination, and processing of information.

Once the macroeconomic stabilisation was achieved (with the support of international financial institutions), structural reform programmes became the next policy focus area. Promising GDP growth prepared the ground for a new social context for the country's development policy [13]. Structural reforms spread into the science sector as well. The prioritisation given to the science sector and the high level of state intervention were supported by significant budget allocations for education and science. Some of the positive effects on the educational sector and the overall economy were highlighted by:

- boosting innovation and technological progress;
- linking education and the learning process with science;
- linking science with industry;
- the opportunity for internationalisation.

The current state of affairs in the science sector of post-Soviet republics is demonstrated in Table 4 and in Figures 2, 3, 4 and 5 [14].

Meanwhile, the attempts to enact long-term policies and initiatives were soon challenged by a new recession, this time triggered by global financial crisis. The government again diverted resources into anti-crisis programmes without, however, abandoning the long-term fundamental programmes aimed at increasing the competitiveness of the republics' economies.

The establishment of the Commonwealth of Independent States in 1991 constituted a new forum for cooperation and development for the post-Soviet states, which share a common past, common threats and common needs [15]. However, the overall integration processes demand not only regional cooperation. The European Union and the integration of some post-Soviet states into the EU greatly affected the R & D sector of the mentioned states. These alterations have demonstrated the necessity, along with the economic and political unity, to implement the tasks, aiming to unify the social, scientific and educational systems as well. To these ends, initiatives and reforms have been undertaken to harmonise different sectors to that of the EU [16] [17].

Table 4. Post-Soviet countries ranking by the publication activities (1996–2010)

Country	Documents	Citable documents	Citations	Self-citations	Citations per dvocument	H index
Russian Federation	479 095	474 317	2 288 869	693 521	4.87	274
Ukraine	88 612	87 669	320 194	92 231	3.71	118
Belarus	20 414	20 257	85 425	18 429	4.26	86
Armenia	6 990	6 865	45 442	8 353	7.03	83
Georgia	6 056	5 894	36 333	4 875	7.16	67
Moldova	3 642	3 605	18 448	3 854	5.29	47
Uzbekistan	6 037	5 943	20 037	4 039	3.50	46
Kazakhstan	4 088	4 028	13 388	2 067	3.61	41
Azerbaijan	5 252	5 189	10 686	2 764	2.55	35
Kyrgyzstan	733	727	3 337	320	5.12	27
Tajikistan	673	666	1 616	254	2.55	20
Turkmenistan	123	121	833	34	6.19	12

Funding

The role of funding is undeniable for the further development of science, research and innovation. The fundraising processes are in a very poor position in the mentioned states, which were further challenged by the overall world economic situation. After the collapse of the Soviet Union, there was a sharp decrease in the financing of science. The global economic crisis revealed that post-Soviet republics' economies are more vulnerable to external events. Still, the wealth of the nations is highly dependent on technology innovation, which develops with high speed. In line with new imperatives, there is a constant need for societal progress, which is largely connected with funding. Using modern societal innovations, this problem can be solved by also attracting private capital in the development of science, particularly private contributions and launching different social initiatives, aiming at combining possible resources towards the revival of the science sector.

However, despite multiple challenges, IC in some republics holds promise, particularly from the perspective of economic competitiveness. Bearing in mind past experiences and mental threats, there is a possibility to adopt new societal innovations and make a breakthrough.

Figure 4. Post-Soviet countries ranking by H-factor (1996–2010)

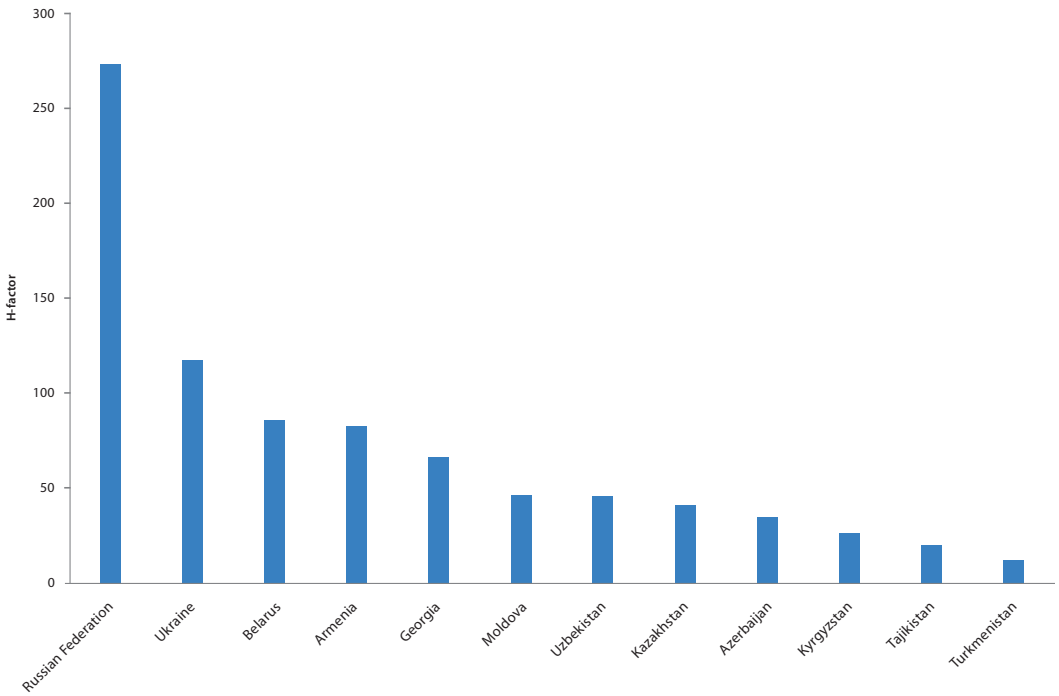
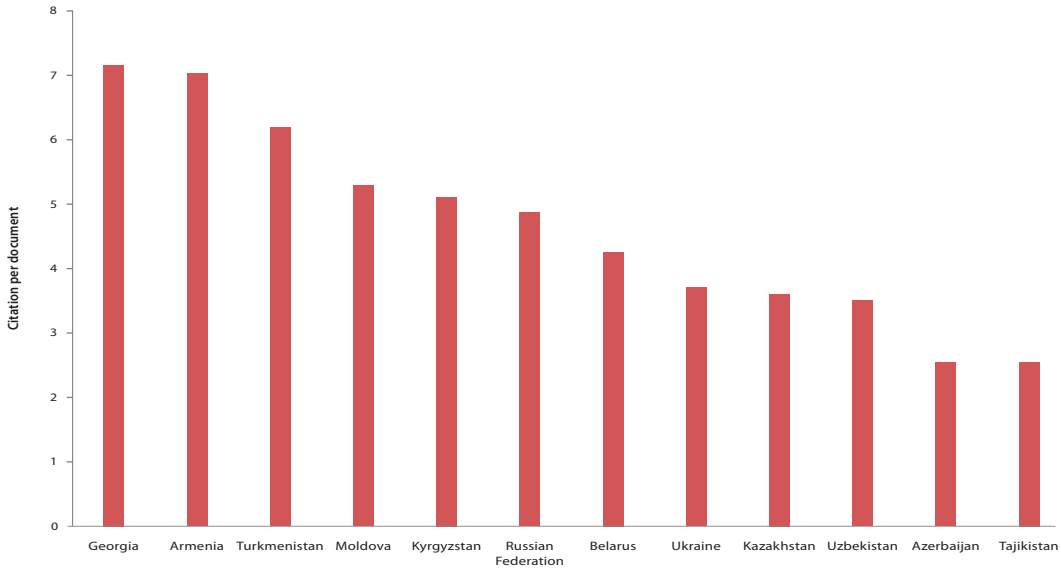


Figure 5. Post-Soviet countries ranking by per document citation (1996–2010)



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