

The interaction of science and higher education in the higher education system of the Republic of Moldova

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Abstract

This article analyses the situation in the sphere of science and higher education integration in the Republic of Moldova, produced within the international project FKTBUM "Fostering the knowledge triangle in Belarus, Ukraine and Moldova." The authors consider the main indicators that show the results of research activities at universities and their role in the transfer of the latest scientific achievements in the educational process. The authors attempt to rehabilitate Moldovan universities based on the capacity assessment of higher education institutions of the Republic of Moldova, undertaken by a committee of experts in 2014, which states that the national system of higher education in the Republic of Moldova is focused more on the educational component, considering research activities at universities as a minor component. It is proved that higher education institutions of the country, being a cradle of scientific staff, are so closely associated with science that it is incompetent to separate these phenomena. It is stated that the academic staff actively participates in scientific research and develops an excellent platform to promptly disseminate its results in the society. The comparative data provided in the article include a number of leading universities of the Republic of Moldova and reflect the extent of their participation in publishing and project activities, their role in the training of new scientists. The authors draw attention to the fact that funds for scientific research are distributed unequally, which is a constraint to the involvement of universities in research activities. Comparing investment activities in science in different countries, the level of university graduates' involvement in research activities, the authors arrive at a conclusion about the need to appeal to the European experience, where the involvement of scientific and teaching staff in research activities is encouraged and strongly supported by the state, private business structures and autonomous university policy, which becomes extremely important if we take into account that the Republic of Moldova has signed an Association Agreement with the European Union.

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Introduction

Integration of science and education is a prerequisite for innovation economic development of any country in the world. Expansion of educational opportunities for universities and strengthening their research abilities are the most urgent problems for the Republic of Moldova, particularly in light of the recently signed association agreement with the EU and adoption of the new Education Code, designed to modernize the educational process, to bring it into line with the European standards, whose most important purpose is to ensure the quality of education. Competence assessment of the teaching staff from Moldovan universities greatly depends on the level of its involvement in research activities. Therefore, there is a need to comprehensively analyze the involvement of universities in the Republic of Moldova in scientific activities, their role in the application of the latest scientific results in the educational process.

The connection between science and education can be traced most evidently at the level of higher education institutions, where universities act as an intermediary of educational and scientific institutions integration with industry, cultural institutions and governmental bodies.

According to the Education Code of the Republic of Moldova, research and innovation activities in higher education institutions are carried out as part of their own organizations and / or in partnership with other organizations, economic agents or public institutions [1]. Research institutes, the Academy of Sciences and other higher education institutions involved in joint activities may be among the partners.

According to the data provided by the Ministry of Education and the Central Committee for certification and accreditation of the Republic of Moldova, there are 33 research institutes and 30 universities in the country. These units are studied in accordance with 5 main strategic directions: materials; technologies and innovative products; energy efficiency and renewable energy assessment; health and biomedicine; biotechnology; national heritage and development of the society. The degree of their development depends on the state policy and the way they choose priority directions of the state development, the level of instruction of the specialists involved in research, on the proper allocation of funding for the relevant branches of science.

The universities, which give birth to new specialists, are an essential element and no development of science is possible without it. Every moment of the university activity is associated with scientific activities, whose effectiveness is proved by the following:

- 1) Events that are valuable from the scientific point of view (conferences, seminars, round tables, etc.);

- 2) Publishing activities (monographs, textbooks, dictionaries, scientific publications, etc.);
- 3) Activities related to bachelor, master and PhD theses (providing consultations, supervising experimental, comparative and analytical methods used in the papers written by university, master and PhD students, independent work on dissertations, etc.);
- 4) Lecture activities (systematization and actualization of lecture notes);
- 5) Project activities (research, funded from various sources, etc.).

Thus, we consider that it is incompetent to state that Moldovan universities pay more attention to the didactic, rather than to the scientific activity. However, there are a number of factors that do not always depend on universities, which hamper their ability to do research. In order to identify these factors we should consider the main indicators of science and education interaction in the higher education system of the Republic of Moldova.

The main indicators of the university involvement in science include their extensive publishing activities, participation in scientific forums, the number of patents for the inventions the major part of which is involved in the educational process, etc. Thus, in 2013 researchers published 199 monographs, 356 textbooks, dictionaries, educational and teaching materials, 1,701 articles in national collections (category A - 10, category B - 850, category C - 841). There were published 373 articles in scientific journals with an impact factor [3]. There were submitted 3,490 abstracts at scientific forums in the country and abroad. It is significant that there were granted 208 patents for our scientists' inventions, over 70% of which belong to the researchers from six leading Moldovan universities (Table 1).

Table 1. Patenting, licensing and certification activities of the universities from the Republic of Moldova

	UASM ¹¹	UMF ¹²	UTM ¹³	USM ¹⁴	USARB ¹⁵
Licensing of new varieties of plants, breeds of animals and birds	2	0	0	0	0

¹¹ Universitatea Agrara de Stat din Moldova (State Agrarian University of Moldova)

¹² Universitatea de Medicina si Farmacie “Nicolae Testemitanu” (Nicolae Testemitanu University of Medicine and Pharmacy)

¹³ Universitatea Tehnica din Moldova (Technical University of Moldova)

¹⁴ Universitatea de Stat din Moldova (Moldova State University)

¹⁵ Universitatea de Stat “Alecu Russo” din Balti (Alecu Russo State University of Balti)

Integrated patents	2	12	3	0	0
Obtained patents	0	16	18	39	1
Applications to the State Committee	1	17	8	28	1
regarding a patent in the field of new variety tests					
Certificate for a new variety	0	0	0	0	0

Source: Academy of Science's Report on management activities and main scientific results obtained in the field of science and innovation in 2013. Chisinau, 2014, (ASM) - ISBN 978-9975-62-367-4. - 286, p.160-162

Research results of the university academic staff are more often introduced in the educational process (as recommended monographs, text books and lecture material) and later spread in the society as compared to the research carried out by the staff from other departments. This is an important indicator of the role of science in strengthening the country's intellectual potential. The fact that universities support financially the academics who publish their works in scientific journals with an impact factor proves that Moldovan universities strive to support the scientific level and improve their ranking. The effectiveness of this method is proved by its use at State Agrarian University of Moldova, which in 2014 was awarded the first place among all the universities of the country (according to the foreign experts' research) including for its achievements in science [4]. At the same time, according to national experts, Technical University of Moldova occupied the highest position in the university hierarchy.

Nevertheless, according to the study in the field of capacity assessment of higher education institutions of the Republic of Moldova, organized by the Association of Development and Socio-Economic Assistance CATALACTICA, initiated by the Ministry of Education and funded by the Soros-Moldova Foundation in 2014 [4], the national system of higher education in the Republic of Moldova is focused more on the educational component, considering research activities at universities as a minor component.

Experts explain this fact by an imperfect legal framework of education, the absence of strategies aimed to develop science, education and innovations in a number of universities, a special structural unit, which would be engaged in this sphere and would not prefer to allocate funds for the development of scientific research to the Academy of Science of the Republic of Moldova, the Ministry of Education or other establishments, which subordinate 20% of higher education institutions of Moldova.

Participation of universities in institutional projects, which are the basis for fundamental research, is an important indicator of science and education interaction in the Republic of Moldova. Comparative data of the Centre for Fundamental and Applied Research Funding (CFARF) of the Academy of Sciences of the Republic of Moldova about the participation share of higher education institutions in institutional projects and their funding is an example that confirms the uneven distribution of funds (Table 2).

Table 2. The list of ongoing institutional projects for the period 2008-2014

Year	The total of institutional projects		The total Universities		USMF		UTM	
	Projects	The sum	Projects	The sum	Projects	The sum	Projects	The sum
2008	314	210,098.5	114	22,762.3	18	7,425.2	28	3,840.4
2009	314	285,341.4	116	24,953.3	19	8,668.2	28	4,270.4
2010	314	208,226.9	116	25,824.7	20	8,880.4	26	3,762.9
2011	269	200,402.1	108	25,236.7	21	9,080.4	25	3,262.9
2012	268	223,240.1	109	29,196.3	20	9,547.9	25	4,243.2
2013	262	212,583.6	105	25,639.4	20	8,355.2	25	3,833.9
2014	260	246,790.1	103	30,430.4	20	10,387.1	25	4,747.8
Year	ASEM ¹⁶		UASM		USARB		Un. AŞM ¹⁷	
	Projects	The sum	Projects	The sum	Projects	The sum	Projects	The sum
2008	1	208.9	8	760.5	11	1,714.6	-	-
2009	1	211.9	8	760.5	12	1,788.0	-	-
2010	1	199.8	8	1,083.0	12	1,216.6	2	1,332.7
2011	2	491.8	7	693.0	14	1,316.6	1	892.7
2012	2	500.1	7	804.7	14	1,337.1	1	977.9
2013	2	425.8	7	706.4	11	1,152.6	1	840.6
2014	2	459.8	7	838.4	10	1,258.9	1	913.2

Source: developed by CFARF according to the database of Monitorul Oficial of the Republic of Moldova "MoldLex" (Monitorul Oficial al Republicii Moldova. Editie speciala of June 27, 2008; July 531, 2009; June 29, 2010; June 24, 2011; June 22, 2012; August 16, 2013; September 5, 2014).

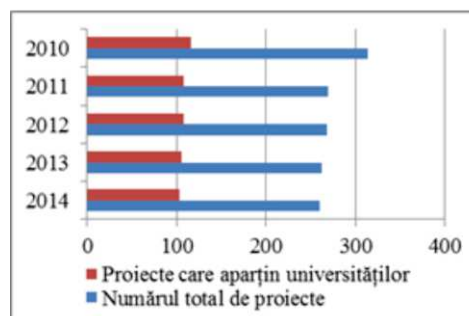
¹⁶ Academia de Studii Economice din Moldova (Academy of Economic Studies of Moldova)

¹⁷ Universitatea Academiei de Stiinte din Moldova (University of Academy of Sciences of Moldova)

The data in the table accurately reflect the state policy, which, apparently, aims to fund only major fields of economics (unfortunately, agriculture is no longer among these priorities). Agriculture is not paid as much attention as it was before. This can be illustrated by the amount of 913.2 thousand lei allocated for the only project of the University of Academy of Sciences in 2014 and the amount of 848.4 thousand lei, allocated for 7 projects of State Agrarian University of Moldova in the same year. The same situation occurred in 2010 - 2013 (Table 1). Such research funding in SAUM covers neither physical nor material nor moral costs of the scientific and academic staff involved in projects: the allocated funds are not always enough to purchase all the necessary equipment; the experiments that are carried out require much time, depend on the season, climatic conditions, etc.

Project activities in the vast majority of universities are poorly funded and average calculations prove this fact: funds allocated for the institutional projects, in which universities of the Republic of Moldova were involved in 2008-2014 is 11.7% of the total number of the funded projects of this kind. At the same time, the share of their participation is almost one half of all projects. The charts provided below illustrate this fact more evidently (Chart 1, Chart 2).

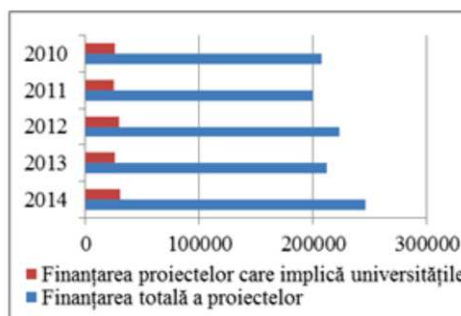
Chart 1. The ratio of the total number of institutional projects to the number of projects that belong to Moldovan universities



Note:

- Projects that belong to universities
- The total number of projects

Chart 2. The ratio of funds allocated to institutional projects that belong to Moldovan universities to the total funding of all projects



Note:

- Funding of the projects that involve
- The total funding of projects

Source: developed by CFARF according to the database of Monitorul Oficial of the Republic of Moldova "MoldLex" (Monitorul Oficial al Republicii Moldova. Editie speciala of June 27, 2008; July 531, 2009; June 29, 2010; June 24, 2011; June 22, 2012; August 16, 2013; September 5, 2014).

Poor funding of institutional projects, in which higher education institutions of the republic are involved, cannot motivate their employees to participate in research activities.

It is rather difficult to look for alternative ways in order to financially support research activities at universities in the Republic of Moldova, because funding of science and innovations in the Republic of Moldova is largely dependent on the public sector that subsidizes 90% of costs for scientific activities, while this figure is 35% in the EU which is a great incentive to look for the best scientific results that are able to generate income.

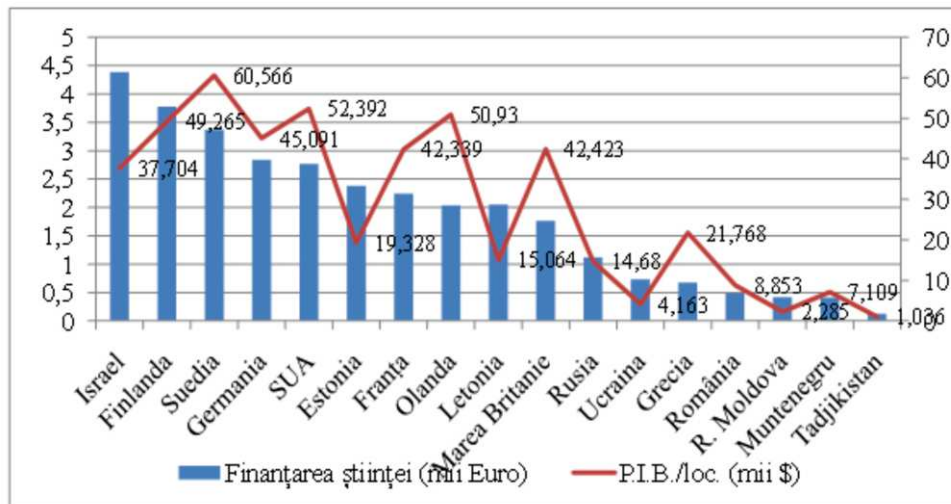
Unfortunately, the European practice of interaction between universities and business structures (the latter act as clients that demand scientific research) is poorly distributed in the Republic of Moldova. Meanwhile, the private economy sector is more responsive to the demands of the times and aspires to own new technologies, investing a lot of money and employing qualified specialists. The majority of Moldovan researchers (71%) work at public research institutes, 18% - at universities, 11% - in the private sector [4, p.24], which is different from the European model of science and education interaction.

In the EU 13% of researchers work at public research institutes, 40% - at higher education institutions, 45% - in the private business sector. It is obvious that such active participation of universities in research activities provides a high level of intellectual support of the society. The level of costs for a researcher is in its turn an incentive to be engaged in scientific studies. In the Republic of Moldova it is 9000 euro, while in the EU it is 150,000 euro per year [4].

The Republic of Moldova allocates 3 times less funds for one researcher as compared to Russia and Romania. If compared to the USA, our country allocates 80 times less.

The following chart proves that the development of science and education depends on financing. You may find the gross income share of some countries, which is allocated for scientific research (Chart 3):

Chart 3. A comparative study of funds allocated for science in different countries



Note:

Israel	France	Greece
Finland	Netherlands	Romania
Sweden	Lithuania	Republic of Moldova
Germany	Great Britain	Montenegro
USA	Russia	Tajikistan
Estonia	Ukraine	

■ Funds allocated for science (thousand euro)

— GDP/capita (thousand US dollars)

Source: developed by the author in accordance with the World Bank data.

Available: <http://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS> (visited on December 17, 2014); United Nations Statistic Division.

Available: <http://unstats.un.org/unsd/snaama/selbasicFast.aspla> (visited on February 10, 2014).

The chart mentioned above shows that the higher the investment in science is, the more developed the country is. At present it is rather difficult to overestimate the contribution of science to the country's economy. Therefore, taking into account the fact that the Republic of Moldova has signed the Association Agreement with the European Union, one should reconsider scientific research in terms of European standards as they need appropriate financial support.

One of important indicators of the degree of interaction between science and education is the ability to reproduce the research staff, the essence of which is to reproduce at least 50% from the present number of potential researchers with scientific degrees every 15 years. It is necessary to provide adequate functioning of scientific fields. Thus, the graduates' decision to dedicate their lives to science provides a kind of continuity, the interrelation of higher education and scientific research.

On average, for the last 15 years the Moldovan science, based on the university activity aimed to train specialists - future scientists - reproduced 63.9% of doctors of the existing potential. At first glance, the situation with the qualification increase of the research staff does not seem to be bad. However, having analyzed the data about the reproduction of scientists in each field, we can state that the human potential with scientific degrees is poorly reproduced in the following fields: physics, mathematics, chemistry, agriculture and veterinary medicine. On the other hand, there is an unusual increase of high-quality staff, PhDs and Doctors Habilitatus in political sciences, psychology, law, sociology, pedagogy and economics, which may be due to the social trends of our times, status prestige, etc. (Table 3).

Table 3. Statistics data related to the reproduction of scientific staff in the Republic of Moldova (in every field of science) in 1996 – 2010

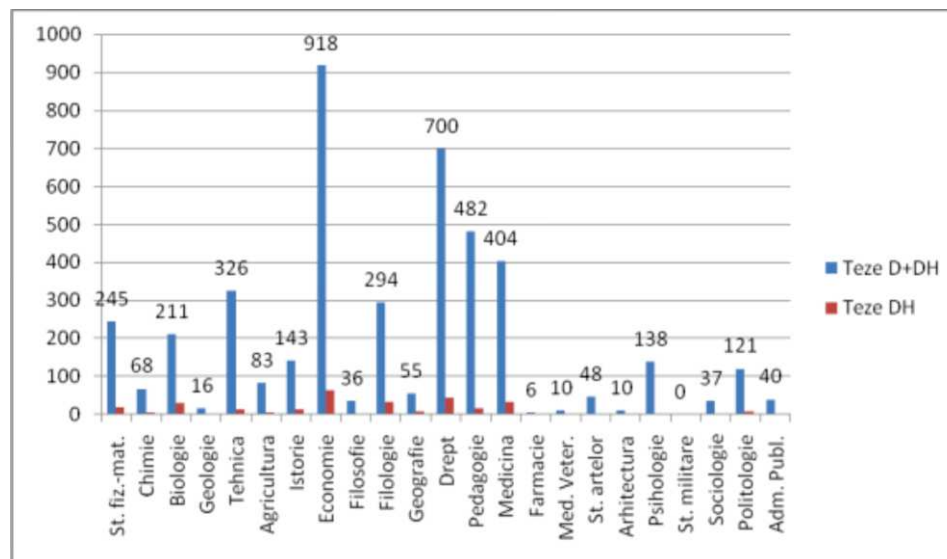
Field of science	The total number of people with a scientific degree registered in the Republic of Moldova in 1965			The total number of people who took scientific degrees in the Republic of Moldova in 1996 – 2010			Reproduction coefficient (r = d / a) (%)
	Total (a)	DH	D	Total (d)	DH	D	(r = d / a)
Total	4780	572	4208	3054	367	2687	63.9
Physics and mathematics	582	82	500	171	26	145	29.4
Chemistry	238	24	214	64	10	54	26.9
Biology	546	55	491	278	40	238	50.9
Geology	24	3	21	0	0	0	0
Engineering	669	58	611	126	23	103	18.8
Agriculture	490	67	423	90	16	74	18.4
History	236	29	207	100	18	82	42.4
Economics	421	31	390	503	51	452	119.5
Philosophy	147	21	126	31	7	24	21.1
Philology	232	27	205	168	25	143	72.4
Geography	22	3	19	18	3	15	81.8
Law	59	6	53	320	20	300	542.4
Pedagogy	197	4	193	313	15	298	158.9
Medicine	806	150	656	639	79	560	79.3
Pharmacy	16	3	13	29	4	25	181.2
Veterinary Medicine	34	5	29	11	2	9	32.4
Arts	40	4	36	38	5	33	95.0
Architecture	1	0	1	0	0	0	0
Psychology	5	0	5	50	4	46	1000.0
Military sciences	3	0	3	0	0	0	0
Sociology	8	0	8	31	7	24	387.5
Political science	4	0	4	74	12	62	1850.0
Public Administration	0	0	0	0	0	0	0

Source: Holban I., Cotun C. Dezvoltarea durabila a societatii - problema fundamentala a stiintei Republicii Moldova (probleme, principii, criterii, standarde, date statistice, analize, omologari, opinii). Materials of International Scientific and Practical Conference "Economic Growth in conditions of globalizations". Chisinau, 2014.

The situation with the reproduction of scientific researchers provided above has not changed to this day. Thus, according to the Central Committee for Certification and Accreditation of the Republic of Moldova, as of January 1, 2013 there were 4,391 people who worked on their theses, of which 4,112 - on PhD theses, 279 – on Doctor Habilitatus theses. It is logical to assume that the largest share in the production of certified PhDs belongs to the economic sciences -

20.91%, the smallest share – to military sciences (0.0%), architecture (0.23%) and veterinary medicine (0.23%) (Figure 4).

Chart 4. Statistical data on the distribution of the people who were working on thesis on 01/01/2013 depending on the fields



Note: Physics and mathematics; Chemistry; Biology; Geology; Engineering; Agriculture; History; Economics; Philosophy; Philology; Geography; Law; Pedagogy; Medicine; Pharmacy; Veterinary Medicine; Arts; Architecture; Psychology; Military sciences; Sociology; Political science; Public Administration.

■ Doctor + Doctor Habilitatus theses

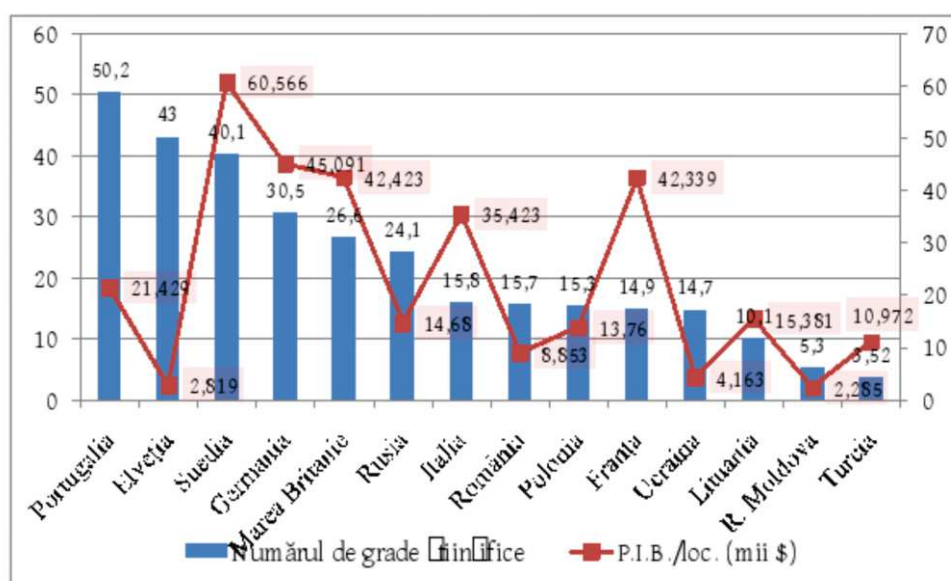
■ Doctor Habilitatus theses

Source: Holban I., Cotun C. Dezvoltarea durabila a societatii - problema fundamentala a stiintei Republicii Moldova (probleme, principii, criterii, standarde, date statistice, analize, omologari, opinii). Materials of International Scientific and Practical Conference "Economic Growth in conditions of globalizations". Chisinau, 2014

Thus, the lack of financial incentive for PhD students, prospects for further development (due to the lack of funding) leads to the decrease of graduates' interest to engage in research activities in various branches of science and, consequently, to the decrease of the number of theses that are ready to be defended on time. The conducted research demonstrates that in 2008 - 2012 only 4.64% of the total number of enrolled PhD students defended their theses on time (2008 - 446 (2.7%), 2009 - 335 (7.8%), 2010 - 422 (3.3%), 2011 - 318 (3.1%), 2012 - 318 (3.1%), 2013 - 380 (6.3%)) [5].

Comparative data about the number of scientific degree holders in different countries show that the level of PhDs involved in research as well as the level of socio-economic development of the Republic of Moldova is not the highest in the world. During 1993 – 2013 scientific degrees were annually awarded in the Republic of Moldova (3,488 PhDs and 502 Doctor Habilitatus), on average 5.3 people per 100,000 inhabitants, which is much lower than in other countries (Chart 5).

Chart 5. Comparative data related to the scientific degrees awarded per 100,000 inhabitants in different countries of the world



Note:

Portugal	Rusia	Ukraine
Switzerland	Italy	Lithuania
Sweden	Romania	Republic of Moldova
Germany	Poland	Turkey
Great Britain	France	

■ Number of scientific degrees

—■ GDP/capita (thousand US dollars)

Source: developed by the author in accordance with Holban I., Cotun C. Dezvoltarea durabila a societatii - problema fundamentala a stiintei Republicii Moldova (principii, criterii, standarde, date statistice, analize, omologari, opinii).Intellectusnr. 2, 2014; United Nations Statistic Division.

Available: <http://unstats.un.org/unsd/snaama/selbasicFast.aspla> (visited on February 10, 2014)

It is obvious that the authorities of the Republic of Moldova should adopt European best practices of supporting the PhDs' status, assume specific measures in order to inspire them from the financial point of view and attract young creative scientific researchers.

Conclusions:

The interaction of science and education in the system of higher education institutions of the Republic of Moldova is an objective process, contributing to the intellectual development of the society, transition to the innovative type of development, reproduction of human capital, and universities play a leading role in this process.

However, social transformations that have been taking place in the Moldovan society over the past decades as well as numerous interdepartmental contradictions led to certain defects of the existing system of science and education management. The facts that hinder the development of research activities at universities include: the decrease of funding in scientific and educational fields; uneven distribution of funds among the units involved in institutional projects; the lack of motivation for career development among young researchers; the lack of flexible policies to support major fields of science and economy.

Moldovan universities, being a cradle of the scientific staff and a forge of the society's development, must be supported by governmental structures as to funding, cooperation with the private sector, which serves as a client that demands scientific research, motivation of the university teaching staff to maintain their status. European best practices show that science and education should be regarded as a national asset that determines the level of development and the future of the country

Integration of science and education in the system of higher education of the Republic of Moldova promotes its quality, develops new socio-cultural values shared by the majority of countries in the world community.

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17.12.2014