

# ANALYSIS OF MOLDOVAN SCIENCE: STRUCTURE, RESULTS, EUROPEAN INTEGRATION, CHALLENGES AND RECOMMENDATIONS

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## ANALYSIS OF MOLDOVAN SCIENCE: STRUCTURE, RESULTS, EUROPEAN INTEGRATION, CHALLENGES AND RECOMMENDATIONS

**Summary.** During the last 25 years Moldovan Science has been confronted with a lot of structural and economic challenges, i. e. continuous reduction of public financial support, very low salaries, ongoing brain drain, authoritarian management styles, limited knowledge of English, and an over aging scientific community. Although there are some academic fields being able to compete on the international level, global competitiveness reports show the scientific decline that has taken place during the last years. The predominant role of the Academy of Science is questioned and necessary reforms of the science management system are discussed, partially highly controversial. EU-Moldova Association Agreement and participation in HORIZON 2020 might have a positive impact on the Moldovan Scientific System and foster integration in the European Research Area. Based on being an integrated expert from Germany for two years, the author submits recommendations in order to implement necessary reforms.

**Keywords:** EU Association Process, Moldovan Science System, Global Competitiveness Report, Public Administration Reform, Moldovan Code on Science and Innovation, Human Resources Development, Salary System, HORIZON 2020, European Research Area.

## ANALIZA ȘTIINȚEI DIN MOLDOVA: STRUCTURA, REZULTATE, INTEGRARE EUROPEANĂ, PROVOCĂRI ȘI RECOMANDĂRI

**Rezumat.** În ultimii 25 de ani știința din Republica Moldova s-a confruntat cu o mulțime de provocări economice și structurale, și anume cu reducerea continuă a suportului financiar public, nivelul foarte jos de salarizare, exodul continuu al „creierilor”, stilul autoritar de conducere, cunoștințe limitate ale limbii engleze și o comunitate științifică îmbătrânită. Deși există unele domenii academice capabile să concureze la nivel internațional, rapoartele cu privire la competitivitatea globală atestă un declin științific ce s-a produs în ultimii ani. Rolul preponderent al Academiei de Științe este pus la îndoială și reformele necesare în sistemul de management al științei sunt discutate, parțial extrem de controversat. Acordul de Asociere Republica Moldova-UE și participarea la Programul ORIZONT 2020 ar putea avea un impact pozitiv asupra sistemului științific moldovenesc și grăbi integrarea în Spațiul European de Cercetare. Fiind un expert integrat din Germania la AȘM timp de doi ani, autorul prezintă recomandări pentru implementarea reformelor necesare.

**Cuvinte-cheie:** Procesul de Asociere la UE, sistemul științific din Moldova, Raportul competitivității globale, reforma administrației publice, Codul cu privire la știință și inovare al Republicii Moldova, dezvoltarea resurselor umane, sistemul de salarizare, ORIZONT 2020, Spațiul European de Cercetare.

The present article aims at providing an independent external analysis of the Academy of Sciences of Moldova (ASM) as well as recommendations to the further development of ASM, according to the Code of Science and Innovation adopted in 2004 the highest scientific forum of the country, representing the only public institution of national interest in the sphere of science and innovation [1].

This article is dedicated to the leadership of the Academy of Sciences, its employees, and those in and outside Moldova who are interested in the ongoing scientific reformation process in a former Soviet Union Member State on its way to EU Association.

From June 2013 until June 2015, it was my task as so called *Integrated Expert* of the German Centre for

International Migration and Development (CIM) [2] to support and advise the Academy of Sciences and its President, Ac. Gheorghe Duca. After having submitted several analyses and recommendations during these two years, the present article can be regarded as short summary of my observations and comments on possible and necessary changes.

It is obvious that the article does not claim to be comprehensive and complete. It is rather based on my individual desk research, interviews and numerous discussions with colleagues in and outside the Academy of Sciences as well as participating observations in meetings, workshops, and public events.

The findings are not the result of a team of international experts, but only outcomes of my individual work.

I hope that my analyses and recommendations, even in case they are in some cases critical, will help the Academy of Sciences on its path to the European Research Area and will be able to contribute to the necessary reformation and improvement process. Of course, critical feedback is highly appreciated by the author [3].

### Historical Development and Structure of the Moldovan Science Management System

During the last 25 years, Moldovan Science and Technology sphere has been confronted with a transition process, affected by the tremendous socio-economic and political changes after the break-up of the former Soviet Union. Unfortunately, since the early 1990s Moldovan science has passed through a period of degradation. The shrinking demand of S&T services, partially caused by the reduction and/or destruction of the military-industrial complex, accompanied by severe reductions in public spending for research, led to 'the ruin of the scientific and technical patrimony' [4]. Shrinking requests by society in large and, especially, by the business sector led to an exodus of scientists and a tremendous reduction of scientific human capital, from more than 20.000 to less than 4.000, accompanied by a process of over aging.

In addition, the field of science and innovation itself partially ignored the needs of society and its responsibility for the quality and condition of research elaborations, and thus degraded significantly. Missing capital investments in laboratory equipment resulted in degradation, and the prestige of research and innovation activities have become very low since the national Independence in 1991. On the other hand, the intellectual level of Moldovan researchers remained in some areas high (i.e. Physics, Medicine, Chemistry, and partially Economy).

Furthermore, the previous Moldovan conservative and bureaucratic science management system, in contradiction to other former Soviet Union Member States like i. e. Estonia or Latvia, has not really changed. Hierarchical, authoritarian, and inefficient structures have been surpassed and are obstacles as well as a not always transparent budget financing.

However, the main reason for the scientific potential decline was the sudden reduction of investment in science. In conditions where investment in scientific research constitutes less than 1% of GDP the degradation of science and innovation is the inevitable result. Thus, after gaining independence, the science funding in the Republic of Moldova varied between 0.73% (in 1990) and 0.18% of GDP (2000-2001). While having being increased from 2004 till the economic crisis in 2008 (0.70 %) a new decline has taken place during the last years (2014 – 0.35 % of GDP).

In the first decade of the new century the need for structural reforms led to the *Code on Science and Innovation* which was ratified on 15 July 2004 and regulates i. e. the state policy in this field, transfer of technology, accreditation of organizations, attestation of scientific degrees, and protection of intellectual property rights. The provisions foreseen by the *Code* can be regarded as fundamental change in Moldovan science by strengthening the position of the Academy of Science and allowing it to function as *quasi* Ministry of Science.

1. The Academy of Sciences is the sole public institution of national importance in the field of science and innovation, the plenipotentiary coordinator of the scientific and innovational activities, the supreme scientific forum and scientific adviser to the public authorities (Article 71).

2. Based on a Partnership Agreement with the Moldovan Government the Academy of Sciences coordinates all activities in the field of scientific research, innovation and technology transfer. The Partnership Agreement authorizes the Academy of Sciences to distribute all budgetary funds designated for scientific research and innovation (Article 72).

All in all, the state policy in science, innovation, and technology transfer is, up to now, elaborated and implemented by the Academy of Sciences.

In addition, the *Partnership Agreement* [5] stipulates the strategic priorities in the development of science and innovation, which are coordinated with the strategic directions stipulated by the European Union (HORIZON 2020). Strategic key elements are:

1. Innovative materials, technologies, and products;
2. Efficient energy and valorification of renewable energy resources;
3. Health and Biomedicine;
4. Biotechnology;
5. National heritage and society development.

The objectives of the *Partnership Agreement* are basically in line with the ones set in the *National Research Strategy 2014 - 2020* [6] which includes i. e. a thorough SWOT analysis of Moldovan science (Paragraph 35), aims to be reached in the forthcoming years, and principles of an effective and autonomous science management system (cf. Paragraphs 45–55).

The *Strategy for the Development of Research and Innovation 2020: Knowledge Moldova* [7] from 2012 includes, based on empirical data, a critical analysis of Moldovan's research system as well, i. e. over aging scientific personnel, decrease in modern equipment, missing or underdeveloped links between university and the science sector as well as science and business sectors. Regarding research and innovation *Knowledge Moldova* has developed three objectives:

12 Innovation	
Criteria	Ranking
Capacity for Innovation	128
Quality of scientific research institutions	121
Company spending on R & D	135
University – industry collaboration in R & D	124
Government procurement of advanced technology products	127
Availability of scientists and engineers	128
PCT patent applications applications/million pop.	72
Other Criteria	
5.07 Availability of research and training services	119
5.08 Extent of staff training	120
7.08 Country capacity to retain talent	140
7.09 Country capacity to attract talent	139
9.03 FDI and technology transfer	97

1. Orientation on research priorities;
2. Commercializing of research results;
3. Evaluation of the research and innovation activities (p. 23).

In order to achieve these aims and goals, the strategy paper identifies the following science management principles:

1. Autonomy and self-administration in the R & I sector
2. Performance and excellence in the R& I sector
3. Continuous prioritization of research infrastructures (p. 25)

4. In addition, *The Innovation Strategy of the Republic of Moldova for the period 2013-2020: "Innovations for competitiveness"* [8] defines a vision, objectives and measures for developing innovation activities in the Republic of Moldova.

#### Scientific Comparison to other European States and Global Competitiveness

According to the latest *Global Competitiveness Report 2014 - 2015* [9], there is a severe discrepancy between Moldovan's overall economic ranking on the one hand (Rank 82 out of 144, improved from rank

93 in 2011/2012 ) and the one of Moldovan's science and innovation (129 out 144). All in all, GDP is very low (2,229 US \$ in 2013) and the development stage is categorized as 'Transition 1 – 2'.

In pillar 12 Innovation we find the following negative rankings:

The numbers of annual documents published by subject areas give proof of the main areas of Moldovan research (2013): While Agriculture (21) and Medicine (37) are rather underrepresented, Chemistry (70), Engineering (82), Material Sciences (124), and, especially, Physics and Astronomy (156) have more scientific publications. Furthermore, in 1996 246 documents were published and they were cited 1.223 times, whereas in 2014 408 documents were published, but cited only 210 times (2008: 307 documents, Cites 3.576). Regional ranking decreased as well from 0,35 % in 1996 to 0,25 %. It seems that Moldovan science is producing a sufficient number of scientific papers, but, in general, quality and recognition on the international level is rather limited.

On the other hand, it has to be seen as positive that from 1996 to 2014 International Collaboration

Cited vs Uncited Documents (in %)		
Year	Cited Documents	Uncited Documents
1996	60	40
2001	69	31
<b>2006</b>	<b>80</b>	<b>20</b>
2010	61	39
2012	43	57
<b>2014</b>	<b>21</b>	<b>79</b>

has increased from 38,93 % to 65,44 %. Despite the general weaknesses of Moldovan sciences, it should be noted that there are some institutes that are well-known on European or even global level, e.g. Physics and Material Sciences (Nanotechnology) [13].

### European Association Process – Public Administration Reform

The *EU – Moldova Association Agreement* [14] was signed by the partners in late June 2014 and a couple of days later Academy of Sciences represented by ASM President Duca and EU officials signed the *HORIZON 2020 Association Agreement of the Republic of Moldova*. In my opinion, both documents and its regulations will have a positive impact on the Moldovan science system in case they are implemented. The Academy of Sciences of Moldova being part of the Moldovan state and public administration system will have to adjust step by step its activities and administrative structures to the content and provisions of the *EU – Moldova Association Agreement*. From my point of view, there are several Articles that will be important in this context, i. e.

- *Efficient and accountable public administration in the Republic of Moldova, with the aim of supporting implementation of the rule of law* (Article 21).

- *Efficient, participatory and transparent decision-making and strategic planning process;... effective delegation of authority, as well as fair and transparent recruitment, training, assessment and remuneration; and the promotion of ethical values in the civil service* (Article 22).

- *Contribute to the promotion of more and better jobs, poverty reduction, enhanced social cohesion, sustainable development and improved quality of life* (Article 31).

- *Contribute to the development of a modern public finance management... compatible with basic EU and international principles of transparency, accountability, economy, efficiency and effectiveness* (Article 47).

- *Internal control, financial inspection and external... including a functionally independent internal audit function* (Article 49).

- *Fight against fraud and corruption* (Article 50).

According to international representatives and observers, e.g. the newly appointed US Ambassador, problem no 1 Moldova is facing is corruption [15]. Due to the scandals, i.e. recently in the banking sector, the credibility on the international level of Moldova in general and public authorities in specific has been reduced tremendously in the last years. International donors ask the Moldovan Government and public authorities to implement real reforms instead of drafting numerous strategies and action plans [16].

In order to improve the public credibility as well as its efficiency in spending public money, the Academy of Sciences of Moldova as part of the public authority system has to be analyzed on this background, too. In 2011, for example, the Moldovan Court of Accounts [17] conducted 10 visits and information was asked from 91 persons. The confidence of the people of Moldova in their national government and public institutions is in decline. In accordance to a survey published on 22 April 2015 [18], reputation and credibility of Moldovan institutions is rather low. Although ASM is ranked fourth, only 39 % trust this institution, what means less than half of population, whereas the Romanian counterpart institution's credibility is much higher (June 2015: 68 %) [19].

### Legal Situation – Education Code and Modification of Code on Science and Innovation

In July 2014, after intensive and partially controversial discussions with the relevant stakeholders, Moldovan Parliament adopted a new *Education Code* [20], including provisions for higher education, e. g. master and doctoral programs (Art. 12, level 8 and 9) as well as postdoc programs (Art. 95). Furthermore, the area of application includes research, development, and innovation [21], what has been regulated so far by the *Code on Science and Innovation*. Ethical issues are addressed, too, by creating a Council for Ethics and Management (Art. 108). This is true for developing state policy in education and research and international cooperation in the fields of education and science. Thus, Ministry of Educations takes over responsibilities for higher education and research issues which have been or are still regulated by the Academy of Sciences based on the *Code on Science and Innovation* (2004). These *Education Code* provisions cannot only be regarded as an attempt to reduce the predominant role of ASM, but as a step of combining science conducted at university und Academy of Sciences institutes' level, too.

Following a Government Decision from July 2013, Academy of Sciences has recently submitted a *Draft Law on the Amendment and Completion of the Code of Science and Innovation of the Republic of Moldova* [22] as well as an *Information Note* [23] on the proposed amendments. At present, ASM decision makers and subordinated institutions are asked to discuss the future of the Academy of Sciences in regard to the Code of Science and Innovation amendments. The latest ASM draft of modifications intends a *National Council for Research and Development* as advisory body to the RM Government and a *National Agency for Research and Development*, responsible for the implementation of the national science and innovation policy. From my point

of view, this Agency, in case it will be really independent from external influences and conducted by scholars and science managers, having gained international experience, will have the chance to coordinate and monitor successfully research in two areas, within the Academy of Sciences as well as Moldova universities.

Furthermore, I am convinced that bodies dealing with project funding, project evaluation, evaluation and attesting of research institutes, and fostering international activities should become really independent from the Academy of Sciences and be connected directly to the National Agency for Research and Development [24].

Regarding the role of the Academy, I am not in favor of separating Moldovan fundamental and applied research. Nowadays, fundamental research is obviously complex, time consuming and expensive, especially for a small country like Moldova. However, without fundamental research there will be very often no valuable results in applied sciences. From my point of view, the idea to create national centers of excellence in certain academic fields, e. g. nanotechnology and the other national priority areas, is a step in the right direction. In these cases, close links between fundamental and applied sciences are recommended.

Being aware of the limited and insufficient financial resources which society and Government allocate to Moldovan science [25], it could be an idea for institutes dealing with applied research to have access to results of state-of-the art fundamental research through international cooperation and active participation in international projects. In addition, I would rather prefer intensifying the links between ASM and university institutes, Moldovan ministries and civil society as well as business in order to increase scientific results and impact on society and business in general.

### Recommendations

All in all, the current situation in the Moldovan science in general and in the Academy of Sciences in specific should be analyzed carefully and critically. The following recommendations are made:

- Conducting SWOT analyzes (strengths, weaknesses, opportunities, threats) at all levels - ASM leadership, ASM sections, ASM institutes, and research systems in universities.
- All groups represented in the scientific working process should be integrated into the discussion: distinguished scientists having gained experience as well as young researchers. Moreover, positive experiences gained in the European Research Area or globally should be taken into account, too. However, analyzes and recommendations themselves are not sufficient, real changes and concrete measures are necessary. A culture of regular reporting and monitoring should be imple-

mented. The positive experience and successful results of the Baltic Countries should be taken into account.

- Cooperative leadership and management style on all levels. Reduction of top-down approaches, and elimination of authoritarian behavior. Delegation of decision power. Respectful treatment of scientist and employees. Respecting academic ethical values and state regulations for public servants.

- Implementation of a round table culture in order to attract and integrate all groups in the discussion, decision, and working process, especially young researchers. Connecting ASM institutes to universities, public authorities (Ministries), business and society by installing Round Tables.

- Creating an own ASM Human Resources Department: Organizational and individual continuous education action plans, i. e. increase of courses in English, project management as well as communication and START up training activities for scientists.

- Administrative and financial autonomy and independence of CEE and CFDFI in order to guarantee independent selection of best project proposals. Increase and qualitative improvement of evaluation processes (especially interim and final reports; impact of research results on society and business). Public database including past and present research projects, including project summaries in English and results (websites etc.).

- Creating a totally independent internal audit unit, supported by independent national and international external evaluators. Publication of a detailed annual budget on ASM website. Increasing transparency regarding transfer of ASM premises.

- Increasing the role of the General Assembly as highest democratic body by installing sub-committees in order to support and control the ASM leadership in its activities.

- Fostering international visibility through increasing scientific articles and reports published in English on ASM website, ASM institutes, and publications.

- Further development of positive HORIZON 2020 activities by the Center for International Projects (CPI): info days, project writing seminars, support by network of local contact points. However, orientation not only on Horizon 2020, but on other EU projects, too (i. e. ERASMUS +, COST, and COSME).

- Substantial increase of salaries for scientists and administrative personnel in order to allow them and their families a decent living and to avoid further brain drain. Providing family allowances in accordance to European *Acquis Communautaire*. Reduce the role of seniority and increase the role of scientific quality indicators (i. e. HIRSCH Index) [26].

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12. Cf. <http://www.scimagojr.com/countrysearch.php?country=MD>
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23. Cf. Nota Informativa la proiectul Legii pentru modificarea și completarea Codului cu privire la știință și inovare. Author and translation cf. ref. 31).

24. Furthermore, detailed comments on the planned Code on Sciences and Innovation amendments have been made in an additional document: Draft Law on the amendment and completion of the Code on science and innovation. Comments by Heinrich Pingel-Rollmann, Chisinau, 4 June 2015 (unpublished manuscript).

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