

# **ERAWATCH COUNTRY REPORTS 2012: Republic of Moldova**

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**ERAWATCH Network**

**Centre for Social Innovation (ZSI), Austria,  
National Council for Accreditation and Attestation  
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## Executive Summary

The Republic of Moldova is a small country in Eastern Europe, with a population of slightly more than 4 million. It is split into a main territory controlled by the Moldovan Government with the capital Chisinau and in the much smaller breakaway region Transnistria, where a bit more than 0.5 million of the population lives. Moldova is a member of the Commonwealth of Independent States (CIS), a cooperation forum among 11 states having emerged of the former Soviet Union.

Moldova's GDP amounted in 2011 to €5.1b. It is the poorest European country in terms of GDP per capita, which reached only €1,520 in 2011 (World Bank, 2013).<sup>1</sup> The GDP depends highly on remittances from Moldovans abroad. They account for more than a third of the GDP. The World Bank (2010) estimated that more than 25% of the economically active population has left the country. Moldova became independent in 1991 and boasted at that time a well-developed R&D sector. But the ensuing transformation phase from a state controlled to a market economy resulted in a hefty decline of GDP and consequently of R&D funding. Over years the R&D sector was neglected and experienced a massive downsizing. The R&D personnel fell from more than 25,000 to a fifth of this level in 2012. Many skilled young Moldovans as well as qualified researchers emigrated. Investment in equipment and infrastructure was disregarded. Nevertheless, international cooperation helped to keep some R&D capacities continuing.

It is only since 2003 that this downtrend could be reversed and that Gross Domestic Expenditure on R&D (GERD) increased from levels of 0.3% as a share of GDP to around 0.7% in 2008 (SCSTD, 2012). Since then the GERD has declined to 0.4%, in spite of economic growth of more than 6% in the years 2010-2011. As GDP is quite low, these indicators are in absolute figures rather moderate amounts and in 2012 it was equivalent to €22m.

In this recent period several positive policy measures were taken: competitive R&D funding instruments were introduced, support for innovation activities came on the agenda, and international R&D cooperation was expanded. And more measures are on the agenda: the government strategy of 2011 foresees enhanced competitive R&D funding, stimulation of business R&D, decentralisation of the R&D system, etc.

Since the pro-EU government took office in 2009, politics in general and R&D policy too, are focussed on EU integration. A major success in this respect was the association of Moldova to the EU's 7<sup>th</sup> Framework Programme for RTD (FP7) as of 1 January 2012, which the Academy of Sciences negotiated. Some more actions are foreseen in policy documents approved in 2013 (*the Package of reforms in research and innovation of ASM* and *the Strategy of research-development of the Republic of Moldova until 2020*). The reforms aim at adapting the structure of R&D system and science policy to European standards, in particular improving R&D indicators, allocating research funding based on performance indicators, using more foreign experts for project evaluations and other measures.

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<sup>1</sup> Average exchange rates for 2011 of €1=1,2939 and of €1=MDL16 were applied throughout this report.

The R&D system is marked by a centralised structure, whereby the Moldovan Academy of Sciences (ASM) fulfils a role close to that of a ministry of science. At the same time the academy is the main public research organisation in the country: it allocates nearly all governmental R&D funding (institutional and competitive), and it disposes even of an own higher education institution.

It is difficult to paint a clear picture of R&D in Moldova, as proper R&D statistics are lacking. Among several statistical weaknesses, R&D expenditure in private business is not recorded yet. BERD is therefore not available for Moldova and GERD can only be considered an estimate.

Nevertheless, available information indicates that expenditure by the business enterprise sector, as well as R&D performance in this sector is rather weak. This has to do with framework conditions such as limited financial resources available for R&D, lack of adequate personnel, focus on trading and low-tech products, and lack of incentive structures for business R&D.

Knowledge triangle policies in Moldova are still in a nascent phase. Some efforts have been made to build up innovation infrastructure: an Agency for Innovation and Technology Transfer was established in 2004, which runs stimulation and funding instruments. Three technoparks and three incubators are operational for enhancing knowledge circulation. Four more incubators were approved in 2012 and are in the process of being established; and incubators in the regions are envisaged too. In addition, offices were established at some universities for dealing with technology transfer issues. The draft Innovation Strategy focuses on increasing the innovation capacity of firms and on linking them to universities and research centres.

In spite of these efforts the links between public research organisations, universities and business are still weak. Universities are trying to strengthen their research capacities, starting from a low level of research activities. Education is not well targeted at the needs of businesses.

### Knowledge Triangle

	Recent policy changes	Assessment of strengths and weaknesses
Research policy	<ul style="list-style-type: none"> <li>- several competitive funding tools introduced since 2004</li> <li>- new funding agency is established</li> </ul>	<ul style="list-style-type: none"> <li>- competition introduced in the funding system; new funding agency, Centre for Basic and Applied Research Funding has an autonomous status within ASM</li> <li>- very low levels of R&amp;D funding over the past 20 years, limited share of competitive funding (10-15%) versus institutional funding; only few incentives for stimulating science-industry linkages available</li> </ul>
Innovation policy	<ul style="list-style-type: none"> <li>- funding tool 'Innovation and Technology Transfer Projects' introduced in 2006</li> <li>- S&amp;T parks and innovation incubators established or in the process of being established</li> </ul>	<ul style="list-style-type: none"> <li>- efforts to stimulate private investment in R&amp;D and transfer of technology to the business sphere through co-funding requirement within the funding tool 'Innovation and Technology Transfer Projects'</li> <li>- public funding not accessible for private companies; innovation infrastructure (S&amp;T parks, incubators) and policy still in its infancy, low levels of private R&amp;D funding and performance</li> </ul>
Education policy	<ul style="list-style-type: none"> <li>- enrolment rates for universities introduced in 2006</li> <li>- a new mechanism of financing higher education introduced in 2013 to ensure financial and managerial autonomy of HEIs based on a non-profit principle</li> </ul>	<ul style="list-style-type: none"> <li>- high share of young population passes through tertiary education; quotas for state financed study places in ICT and sciences</li> <li>- financial autonomy for HEIs introduced at the price of cuts in public higher education funding</li> <li>- unattractive working conditions for researchers (low salaries, outdated equipment), emigration of skilled and qualified personnel abroad, overload of university staff with teaching duties</li> </ul>
Other policies		

**Assessment of the national policies/measures**

	<b>Objectives</b>	<b>Main national policy changes over the last year</b>	<b>Assessment of strengths and weaknesses</b>
1	Labour market for researchers	New classification of scientific specialities adopted by the Government in 2013 SCSTD signed for the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers (2012)	- pool of well educated young people - low salaries in the R&D sector, low innovation activities of business
2	Research infrastructures	- funding tool for research infrastructure established by ASM	- involvement in infrastructure related FP7 projects (e.g. in ICT – Grid) - Connection to GEANT via RoEduNet - long period of under-investment in infrastructures
3	Strengthening research institutions	- policy goal of strengthening research at universities followed up	- in the period 2004-2008 significant increases of funding for R&D - low share of research performed at universities, are traditionally focussed on education, high teaching workloads
4	Knowledge transfer	- innovation incubators, S&T parks in the process of being established	- Innovation and Technology Transfer projects funded by AITT, innovation infrastructure becomes available - weak links between research and business, no statistics about business R&D available, legal basis for spin-offs lacking
5	International R&D cooperation with EU member states	- association of Moldova to FP7 from 1 January 2012 - new bilateral cooperation scheme with CNRS (France) established - the Science and Technology Office of the Republic of Moldova to the European Union (MOST) established	- strong commitment of policy makers and research community to cooperation with EU member states; scientific diaspora in EU member states - limited financial means
6	International R&D cooperation with non-EU countries		- bilateral cooperation schemes with major research partners of Former Soviet Union established (BY, RU, UA); scientific diaspora in FSU countries - limited financial means

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## 1 INTRODUCTION

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The main objective of the ERAWATCH International Analytical Country Reports 2012 is to characterise and assess the evolution of the national policy mixes of the 21 countries with which the EU has a Science and Technology Agreement. The reports focus on initiatives comparable to the ERA blocks (labour market for researchers; research infrastructures; strengthening research institutions; knowledge transfer; international cooperation). They include an analysis of national R&D investment targets, the efficiency and effectiveness of national policies and investments in R&D, the articulation between research, education and innovation as well as implementation and governance issues. Particular emphasis is given to international research cooperation in each country.



## 2 PERFORMANCE OF THE NATIONAL RESEARCH AND INNOVATION SYSTEM AND ASSESSMENT OF RECENT POLICY CHANGES

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### 2.1 MAIN POLICY OBJECTIVES / PRIORITIES, SOCIAL AND GLOBAL CHALLENGES

According to the Moldovan [Code on Science and Innovation](#), the main R&D policy objective is to contribute to a stable socio-economic and human development. Fundamental and applied research shall be integrated with innovation activities, linkages between education and science shall be consolidated, and resources shall be concentrated on strategic directions of science and innovation. In the Partnership Agreement (2009-2012) between the [Academy of Sciences \(ASM\)](#) and the Moldovan Government these policy objectives are complemented with some more refined objectives: strengthening the infrastructure of science and innovation, improving competitive R&D funding, stimulating the creation of small and medium sized enterprises, attracting direct investments in science and innovation and expanding technology transfer. These goals reflect the main challenges, which the national R&D system faces.

Thematic priorities at the national level and for international cooperation are defined rather broadly in Moldova:

- Consolidation of the State of Law and utilisation of cultural heritage with the perspective of European integration
- Efficient utilisation of human, natural and information resources for sustainable development
- Biomedicine, pharmaceuticals and human health
- Agricultural biotechnology, soil fertility and food security
- Nanotechnology, industrial engineering, new materials and products
- Efficient growth of the energetic complex, assurance of energetic security, including the use of renewable resources.

Because of the strategic orientation for integration in European Research Area (ERA), the thematic priorities defined in the FP are getting increasingly important. [The Strategy of research-development of the Republic of Moldova until 2020](#) foresees measures to align the national research system to developments at the EU level. For example, the national strategic directions in science and innovation for the years 2014-2020 will be synchronised with the research priorities of Horizon-2020; its six societal challenges will be taken over (health, demographic change and wellbeing; food security, sustainable agriculture, marine and maritime research and the bio-economy; secure, clean and efficient energy; smart, green and integrated transport; climate action, resource efficiency and raw materials; inclusive, innovative and secure societies). But thematic priorities depend also on the R&D capacities available in the country, where fields like agriculture, food processing, physics, chemistry, ICT, mathematics and materials may be mentioned. The same holds true

for bilateral funding programmes. Priorities vary slightly in this case, depending on the partner organisation.

In the government programme 2011-2014 the topics energy and natural resources are outlined, which shall be supported specifically and which are set to gain in relevance consequently (Moldovan government, 2011). Topics, the energy supply and usage of natural resources (e.g. through agriculture), are major challenges for Moldova which shall be tackled via R&D.

A financial target had been set by policy makers in 2004. It was foreseen to increase R&D expenditure steadily and to reach a level of 1% GBAORD as a share of GDP by 2008 or 2009. This target was softened later and now reads “up to 1%”. In the partnership agreement between the government and the ASM, the 1% target was set for 2011, but as a result of an amendment it is now fixed annually (at a lower level). In practice GERD as a share of GDP increased to 0.7% in 2008. Since then, however, it has been declining and reached 0.4% in 2012 (SCSTD, 2013). This was due to the economic crisis for the years 2008-2009. In the period 2010-2011 the government did cut back on funding of R&D as a share of GDP, as well as in absolute terms in spite of economic growth. In 2012 the funding of R&D increased slightly in absolute terms, while GDP declined by 0.8%.

In [\*The Strategy of research-development of the Republic of Moldova until 2020: Knowledge Moldova\*](#) five objectives were identified: capacities (building human, institutional and infrastructure capacities); priorities (defining and managing research priorities); linkages (establishing effective interaction with society, implementation of results and disseminating knowledge); internationalization (integration into the European Research Area and increasing the international visibility); and governance (development and implementation of an effective governance model for research, based on performance and excellence). The goal to be achieved is a system capable of creating high-performance scientific knowledge, which will lead to increased competitiveness of the national economy and contribute to the welfare of the population.

The draft [\*Innovation Strategy of the Republic of Moldova for the period 2013-2020: “Innovations for competitiveness”\*](#), developed by the Ministry of Economy, foresees five general objectives:

- 1) Adoption of an open governance model of research and innovation;
- 2) Empowering people with innovative skills;
- 3) Orientation of companies towards innovation;
- 4) Applying knowledge to solve societal and global problems;
- 5) Stimulation of demand for innovative products and services.

The aim of the Strategy is to ensure consistent horizontal policies, which will help to improve the country's international competitiveness and to build a knowledge-based economy. To this end human capital will be developed and Moldovan firms will be strengthened in absorbing, generating and disseminating innovations and in connecting them better with universities and research centres.

## 2.2 STRUCTURE OF THE NATIONAL RESEARCH AND INNOVATION SYSTEM AND ITS GOVERNANCE

The Republic of Moldova is a small country in Eastern Europe, situated in between two much larger states, Romania and Ukraine. It has an overall population of slightly more than 4 million. In comparison to Moldova the neighbouring countries Romania and Ukraine had 21.4 million and 45.1 million inhabitants respectively in 2011 (UIS, 2013). The country is split into a main territory controlled by the Moldovan Government and the much smaller breakaway region Transnistria. 3.6 million Of the population is living in the area controlled by the Moldovan government, while slightly more than half a million live in Transnistria (including Bender). The latter is governed by a separate local administration.

Moldova is the poorest European country in terms of GDP per capita, which reached only €1,520 in 2011 (World Bank, 2013). The GDP is in absolute figures quite low and depends highly on remittances from Moldovans abroad. Remittances account for more than a third of the GDP. The World Bank (2010) estimates that more than 25% of the economically active population has left the country. In 2009 the economic crisis resulted in a 6% decline of GDP. Growth was back with a strong 6.9% in 2010 and with 6.4% in 2011 (World Bank, 2013). It amounted herewith to Moldovan Lei 87.8 billion (NBS, 2013a) in 2011, which was equivalent to only €5.5b. In 2012 GDP declined again slightly by 0.8%. Moldova spent in 2012 0.40% of GDP on R&D (GERD), which was equivalent to a moderate €22m (SCSTD, 2013).

In its scientific cooperation, Moldova has tried to establish or re-establish cooperation with neighbouring countries (Romania, Ukraine), with major EU countries (Germany, Italy, France) and former main partners (Russia). It has strived over the last years to reinforce cooperation with the EU, especially since a pro-European alliance took over government in 2009. As a result of the efforts of the Academy of Sciences, Moldova is associated to the EU's FP7 as of 1 January 2012. This is an important step for the country towards closer cooperation and integration with the EU.

### **Main actors and institutions in research governance**

Moldova's R&D and innovation system is rather centralised, with the Moldovan Academy of Sciences (ASM) being the key player. It is the main policy-making institution and fulfils a role similar to that of a ministry of science. The president of ASM is a member of the government. The Moldovan Government approves the R&D budget, and the Moldovan Parliament approves laws for R&D and innovation as well as strategic scientific priorities. Some other ministries (e.g. Ministry of Environment) are involved in R&D policy-making and implementation, but with a minor role compared to the ASM.

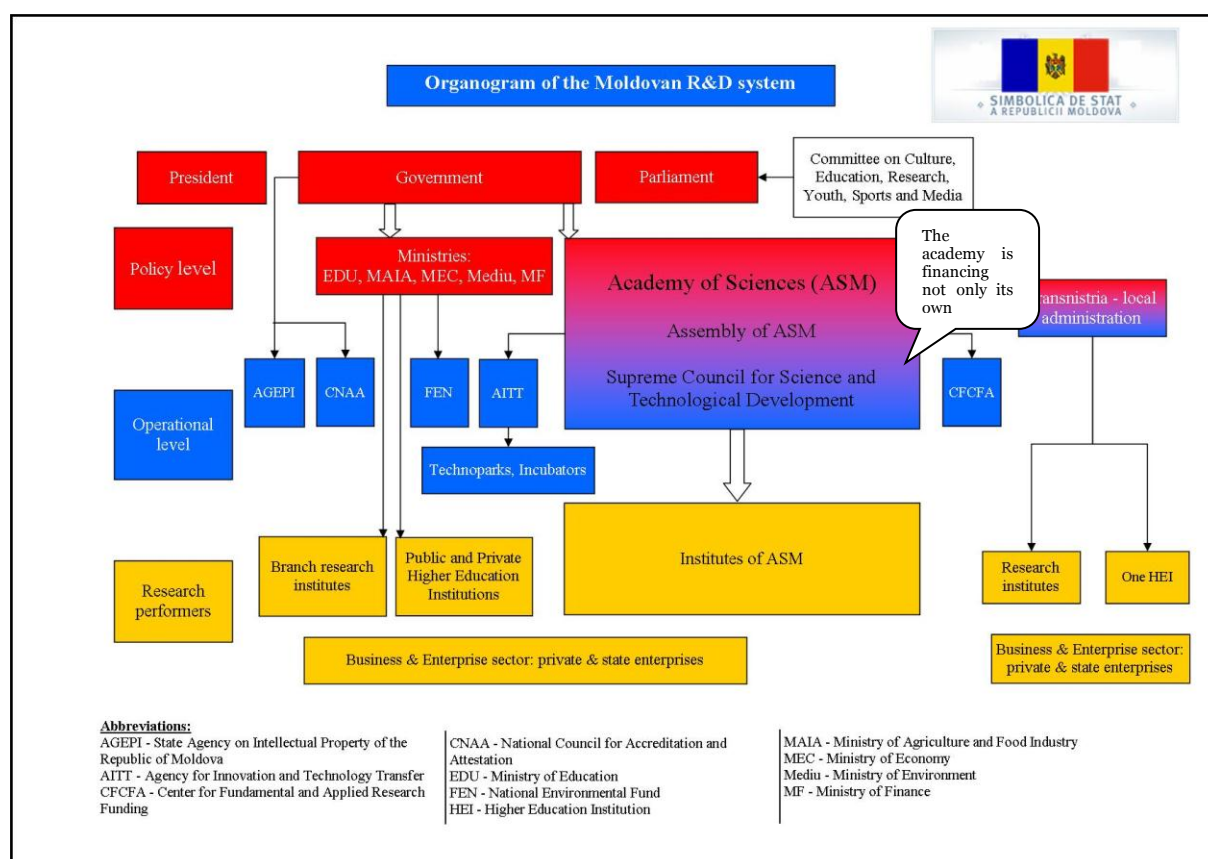
The Academy is also the main policy implementation body. The Academy and its executive body, the Supreme Council for Science and Technological Development (SCSTD), manage nearly all public R&D and innovation funding programmes. In the SCSTD main stakeholders in the S&T field are represented (e.g. representatives from ASM mainly, but also from universities and other players). Two agencies are responsible for managing the funding programmes: the subordinated Agency for Innovation and Technology Transfer (AITT) takes care of innovation funding. In

2012 the Centre for Fundamental and Applied Research Funding (CFCFA) was established as an autonomous subdivision within the ASM with the aim to allocate public funding for fundamental and applied research and to manage the main Moldovan funding programmes. The Academy is with its 19 research institutes also the main research organisation in the country.

An important role has been given to the National Council for Accreditation and Attestation (CNAA), which accredits research organisations in Moldova. Only accredited organisations are eligible for public R&D funding. Intellectual property rights protection is taken care of by the State Agency on Intellectual Property of the Republic of Moldova (AGEPI).

In Transnistria, a Supreme Advisory Council on Science and Technology is responsible for R&D strategy formulation and definition of priorities. The head of the local administration subsequently determines the research policy, which is being implemented by the department for education. The regional legislature approves legal acts for R&D.

**Figure 1: Overview of Moldova’s research system governance structure**



Source: ERAWATCH Moldova Country Fiche, 2013.

### The institutional role of regions in research governance

The Republic of Moldova is according to its constitution a unitary state. It is divided into thirty-two districts (rayons), three municipalities (the capital Chisinau, Balti, and Bender), one autonomous-territorial unit (Gagauzia) and one territorial unit with undefined status (Transnistria).

There is a great difference between Chisinau municipality and the rest of the country's territory in economic activity, in the living standard and the development of infrastructure and production factors. Chisinau is inhabited by 21% of the country's population and generates approximately 50% of the GDP.

In R&D, the exceptional status of Chisinau is also evident. Among the 58 organisations accredited in the years 2005-2012 by the CNAA to carry out research and development activities, only three are situated outside Chisinau, two in Balti, and one in Maximovca (a village near Chisinau). The volume of R&D funding allocated to these three organisations in 2012 from the state budget amounted to 5.3% of total funding for institutional projects (basic funding for R&D organisations). The share of R&D personnel of these organisations of the overall Moldovan R&D personnel was 5.2% (SCSTD, 2013). The location of higher education institutions accredited by the Ministry of Education confirms this concentration of capacities in the capital. Only four of the 27 accredited Moldovan universities are located outside Chisinau: in Balti, Cahul, and Comrat. In addition, limited research activities at institutions in Transnistria, which are not accredited by the Moldovan authorities, have to be considered. This concerns for example the Taras Shevchenko University in Tiraspol.

The Moldovan Code on Science and Innovation stipulates that local authorities may fund regional R&D and innovation programmes and projects from their budget, and that they can set up science and innovation organisations. But de-facto there is only few regional R&D and innovation support ongoing and no special bodies for R&D development have been established at the regional level. Research and innovation activities in the regions are stimulated mainly by the ASM, which has established two innovation incubators in 2012 - in Balti ("NORD", administrator – State University of Balti) and Comrat ("INNOCENTER", administrator – State University of Comrat). Another incubator is planned to be opened in Balti in 2013. Some specific examples of regional support measures for R&D exist nevertheless. In Chisinau annual prizes for young scientists are awarded, and the municipal authorities conclude some contracts with researchers and research institutions for carrying out scientific projects relevant for the capital (in the local energy sector, cultural heritage of the city, etc.). Another case for regional support measures, although a rather special one, is the breakaway region of Transnistria, where research activities are funded from local budgets.

### **Main research performer groups**

Most of R&D - 77.1% of GERD in 2009 - is performed in the governmental sector (institutes of ASM and branch institutes of ministries), while the business enterprise and higher education sectors perform significantly less - 11.3% and 11.6% respectively in 2009 (UIS, 2013).

- The governmental sector is composed mainly by the 19 institutes of the Academy of Sciences, which report administratively and scientifically to ASM. CNAA has accredited 18 institutes as research organisations. R&D institutes subordinated administratively to different ministries (former branch R&D institutes) belong also to the governmental sector. There are also 19 R&D institutes, including eight of them subordinated to the Ministry of Health and eight to the Ministry of



Agriculture. Scientifically they are supervised by ASM and receive public funding also from the academy.

- The higher education sector is composed of 27 universities accredited by the Ministry of Education, including 16 state and 11 private universities. CNAA has accredited 17 universities, including 13 state and four private universities as R&D performing institutions.
- The National Bureau for Statistics (NBS) recorded for the year 2009 the following figures related to the business enterprise sector: eight private R&D organisations (design-investigation organisations and design offices for construction works), four mixed (public and private) R&D organisations (two scientific-research institutions and two organisations falling in the category of design-investigation organisations and design offices for construction works), and one joint venture organisation. Two state enterprises are accredited by CNAA as research organisations. But these figures are far from complete, because they do not take into account fully private companies performing R&D and innovation activities.

In Transnistria more than 50% of the public R&D budget is spent in the governmental sector (research institutes in the field of environment mainly). The local state university in Tiraspol receives around 40% of governmental spending, but performs most of R&D in Transnistria.

## 2.3 RESOURCE MOBILISATION

### 2.3.1 Financial resource provision for research activities (national and regional mechanisms)

Provision with financial resources in Moldova is marked by the difficult economic transition phase that the country has been going through since its independence in 1991. Funding for R&D and innovation was for years completely marginalised and the sector had to switch to survival strategies, such as neglecting investment in equipment and material and substantially reducing the R&D personnel. Policy makers succeeded to change the trend and to increase funding only since 2002. GERD as a share of GDP started to rise from levels of 0.2% and reached a peak with 0.7% in 2008. This was equivalent to €24.3m in absolute figures (SCSTD, 2011). Policy makers had foreseen to increase R&D expenditure steadily and to achieve a level of 1% on this indicator by 2011. But due to the international economic crisis, Moldova had to cut back on expenditure in 2009.

In the years 2010/2011 the economy has been growing again, but GERD continued to decrease. In 2012 the funding of R&D increased slightly in absolute terms, but GERD as a share of GDP continued to remain at 0.4%, which is substantially lower than in EU countries. In the analysis of the cited figures, it needs to be considered that only fragmented data on R&D funding and on performance of R&D are available for Moldova. The presented figures rely mostly on data from annual reports of the academy. GERD does include private R&D funding only to a limited extent, as this is not yet recorded exactly in Moldova. It does not give therefore the whole picture of R&D funding and needs to be considered as an estimate. Furthermore, official figures do not include R&D funding in Moldova's breakaway region Transnistria.

Roughly around 65% of public R&D funding is allocated through institutional funding in a semi-competitive mode. Truly competitive funding makes up close to 10% and other funding modes account for approximately 25%. Competitive funding is distributed through various schemes including State Programmes for R&D, Innovation and Technology Transfer Projects, grants for young researchers, grants for procurement of equipment, international programmes, and excellence awards. Competitive funding has to a large extent only been introduced over the last ten years; it is still moderate and its share has even decreased in the last two years.

R&D and innovation funding is dominated by the public sector, while business enterprises contribute only a limited share; exact statistics are, however, not yet collected on the business-enterprise sector.

The distribution of public R&D funding on thematic priorities in 2012 (SCSTD, 2013) shows that most funding was invested in the fields of agriculture & food, nanotechnologies & new materials (physics/chemistry) and in the use of natural resources & environment & ICT.

<i>Priority</i>	<i>% of total financing, 2012</i>
Consolidation of the State of Law and utilisation of cultural heritage with the perspective of European integration	12.8
Efficient utilisation of human, natural and information resources for sustainable development	28.1
Biomedicine, pharmaceuticals and human health	16.7
Agricultural biotechnology, soil fertility and food security	26.9
Nanotechnology, industrial engineering, new materials and products	13.0
Efficient growth of the energy sector, energy security, including the use of renewable resources.	2.5

R&D funding in Transnistria has to be considered in addition to the figures presented above. Governmental R&D funding by the local administration was provided in 2012 in the amount of about €1.4m (21.2 million Transnistrian Roubles) or 0.5% of the budget expenditures of the region. More than 50% of this budget was performed in the governmental sector and in its higher education institution.

The Moldovan Government has envisaged important reforms of the R&D and innovation system in its Action plan for 2012-2015. Research in higher education institutions, as well as the interaction of research with business shall be strengthened. Governmental R&D funding shall be decentralized and opened to all R&D and innovative organisations, beyond the currently accredited research organisations (Moldovan Government, 2012).

A multi-annual strategy for R&D and innovation is fixed mostly in the Partnership Agreement (2009-2012) between the Academy of Sciences and the Moldovan Government. The partnership agreement includes general objectives such as strengthening the science and innovation infrastructure, improving competitive R&D funding, but it included in its initial version of 2009 also funding targets for GBAORD as share of GDP for each year and an annual protocol specifying the planned public R&D expenditure. The agreement stipulated that GBAORD should reach 0.8% of GDP in 2009, 0.9% in 2010 and in the remaining two years 1%. As a consequence of an amendment to the agreement, these targets were removed and now a target is fixed annually, albeit at a lower level (e.g.: 0.40% were specified for

2012). The Strategy of research-development of the Republic of Moldova until 2020 fixed an R&D investment target of 1.5% of GDP by 2020.

Few efforts have been made so far to link R&D and innovation policy to society and to build mutual trust. The ASM undertakes some PR efforts, such as press releases and conferences, participation in public debates, open days of some scientific and educational institutions, the organisation of the national contest "The Most Innovative Pupil of the Year", a special dedicated S&I TV show on national television, and a dissemination module within state research programmes. CNAA accreditation rules reward linkages of research organisations to society: points are granted for the publication of books and popular science articles, for participation in radio and TV emissions devoted to science, for seminars and other events organised for visitors, but also for policy documents which were developed and approved. Informed policy making through involving stakeholders in foresight activities is gaining in importance. A first foresight project was jointly implemented by Romanian and Moldovan partners in 2011-2012. The foresight was strategy oriented; it focused on development perspectives of the R&D sector and how its efficiency could be improved. Priority areas of R&D were also studied. The results of the foresight were used for the Moldova 2020 R&D strategy and for the reform package of ASM, approved in January 2013.

### **2.3.2 Providing qualified human resources**

Human resource policies for research have to deal with several serious challenges in Moldova: a shrinking of the R&D personnel, low remuneration, migration and ageing trends of the population.

The Moldovan R&D personnel declined from 25,200 in 1990 to around a fifth of this level 20 years later. One of the main reasons for this development was a sharp reduction in R&D spending during this period, which led to a very low remuneration of the R&D personnel.

In 2012 the R&D personnel amounted to 5,121, out of which 3,338 were researchers (NBS, 2013b). The data are underestimated though, as official statistics do not consider the R&D personnel in the private enterprise sector. According to UNESCO data in FTE there were 1.93 researchers per thousand labour forces in 2009 and 2.05 researchers per thousand total employments, which was a slight increase in comparison to previous years (UIS, 2013). In addition, the human resources of Transnistria have to be considered, which amounted to 562 R&D personnel in 2012, including 409 researchers.

Migration of skilled people abroad, because of shortage of adequate jobs and low salaries, and an ageing of the R&D personnel are further factors which point to a non-adequate availability of human resources. A lack of qualified researchers can be observed especially in the age bracket 36-45 years. With regard to the future of R&D in Moldova the low number of young people embarking on a scientific career is a major concern. To tackle this issue, several measures have been taken: quotas for young researchers in projects supported under public R&D funding programmes were introduced and competitive support programmes for young researchers up to 35 years established.



Among these challenges it should not be forgotten that in Moldova, as in other countries of the Former Soviet Union, education is valued very highly and consequently a high share of the population graduates from tertiary education. A significant trend in this context is, however, a strong re-orientation to social sciences, while a lack of students and graduates in ICT, sciences and engineering can be observed. During the times of the Soviet Union, a certain oversupply with R&D personnel was generated, and here especially the natural sciences and engineering were favoured. As a result of the economic transformation and reorientation this pattern was changed. In 1990 every second researcher was engaged in technical sciences, while in 2010 only every fifth.

The educational approach in higher education institutions follows still too often traditional avenues and is not sufficiently targeted at the needs of the private sector. Enterprise representatives and economic stakeholders do not have the possibility to intervene in education policies. In consequence, there are significant gaps between the training level of graduates and the expectations of companies. In a national representative survey, about 66.7% of companies pointed out the lack of a skilled labour force, as the main cause for the deficit of human resources in companies (Global Compact Network Moldova, 2007). Creativity, critical thinking and other features of modern education are not yet sufficiently high on the agenda. Entrepreneurship training is becoming more relevant, but not widely available (e.g. the University of the ASM offers special courses on innovation entrepreneurship).

### **2.3.3 Evolution towards the national R&D&I targets**

#### ***Evolution of BERD***

Statistics on R&D funding by the business enterprise sector (BERD) are not available for Moldova. But a reform of the R&D and innovation statistics is underway and it may be expected that BERD will be calculated in the future. In general R&D funding and performance of the business enterprise sector are quite moderate in comparison to EU countries. Data of the UNESCO show that the GERD performed by the business enterprise sector decreased from 17.9% in 2005 to 11.3% in 2009 (UIS, 2013). This has to do with scarce financial resources, reorientation on non-innovative activities during the years of economic transformation, lack of incentives for R&D, etc.

There are obviously some companies performing R&D in Moldova, but their activities are difficult to trace. The National Council for Accreditation and Attestation (CNAA) has accredited only two state enterprises as research organisations, which gives them access to competitive public R&D funding. As for private companies, a few are performing R&D, e.g. "ELIRI" S. A. Research Institute. Companies that do perform R&D are active in fields such as ICT, microelectronics, agriculture, chemistry, and materials.

An explicit national target for BERD has not been fixed. But discussions are ongoing about increasing BERD, and different stakeholders are aware of this necessity. It is difficult, however, to increase the funding from the business sector due to a number of factors:

1. The structure of the economy is not conducive to private R&D investment. When Moldova became independent at the beginning of the 1990s, it disposed of a centralised, state owned economy marked by relatively large enterprises and a well-developed R&D sector. When this system collapsed and was transformed to a market economy, large enterprises lost most of their markets and research partners. Many companies had to be shut down or reoriented to less innovative and low-tech products. Low costs continue to be the main source of competitiveness. Innovation in the industry and in services is based mostly on new equipment and technology acquisitions, since few Moldovan enterprises have any innovative departments.
2. Linkages between public research organisations, universities and enterprises are generally weak. Intermediary organisations, such as technology transfer offices, technoparks and incubators have been established only in recent years or are in the process of being set up. As they are still in their infancy and taking into account the financial limitations in the country, these structures will still need experience and some time to play a significant role.
3. Adequate and qualified human resources are missing to some extent for strengthening business R&D and innovation activities. A lot of skilled and young Moldovan citizens have emigrated; estimates go from 25% of the economically active population.
4. Companies lack financial resources for R&D and the market for their innovative products. They are more focused on achieving profits through trading and production of low-tech products.
5. Only few incentives for stimulating private R&D investment are in place and they exert only a limited impact. Innovation and Technology Transfer Projects, S&T Parks and Innovation Incubators, which are all supported by the AITT, are the available stimulation instruments. They have some limitations, because private companies cannot receive public R&D funding in Moldova – only research organisations accredited by the CNAA can receive public R&D funding. A reform of this situation is envisaged in the governmental programme 2011. Tax incentives have been introduced by law for residents of S&T Parks and Innovation Incubators. They have, however, never been applied in practice because of different interpretations of the law. The legal situation regarding these incentives remains still unclear. A law on venture capital is still under consideration within the Government.

A draft innovation strategy was prepared by the Ministry of Economy in 2012, but it is not approved yet.<sup>2</sup> A certain lack of planning of overall national objectives is characteristic of the situation, but foresight is coming into play since 2011 and will contribute to more coherent strategy formulation. Foresight and its results were used for example as an input for the Moldova R&D strategy 2020 mentioned above, and to a lesser extent for the draft innovation strategy. Procurement policies of technologies have not been used until now for providing R&D related incentives. A favourable legal environment for spin-offs from research organisations and universities and for new start-up firms is missing too.

The distribution of the FDI stock in Moldova is not encouraging for R&D performing activities. Most investment came in the sectors of electricity, gas and water, wholesale

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<sup>2</sup> See for more details on the strategy chapter 2.1 MAIN POLICY OBJECTIVES above.

and retail trade, hotels and restaurants, where it was possible to generate profits in a short-term perspective, especially in situations of monopolistic markets (e.g., companies Gazprom, Union Fenosa, Lafarge) (Moldovan, 2007).

Generally, a weak innovation culture is a barrier for business R&D. The understanding of the importance of R&D for economic and social development is low in the society. On the side of researchers, a poor understanding of the essence of business is given. Among enterprises the knowledge of innovation management is weakly developed and moreover they are reluctant to take risks for own R&D.

### ***Policy Mixes towards increased private R&D investment***

The policy mix is focused on R&D investment in the public sector, while incentives and policies for stimulating private R&D investment are still weakly developed.

The main tool for raising private R&D investment is the funding programme '[Innovation and Technology Transfer Projects](#)', implemented by the Academy's agency AITT. It provides funding to accredited research organisations, but not to private companies involved in such projects. However, it requires the companies to fund 50% of the project cost.

The second tool is tax incentives introduced in 2007 for residents (including companies) of S&T Parks and Innovation Incubators. Exemption from VAT, custom and income tax apply for residents. In addition to these tax breaks, residents enjoy low tariffs on premises leasing and on public utilities, and the State Agency on Intellectual Property (AGEPI) covers 95% of their patenting costs.

The creation of new businesses and enhancing the innovative capacities of SMEs was stimulated through the 'State Programme to support the development of SMEs' for 2009-2011. In 2012 a [Small and Medium Enterprise Sector Development Strategy for 2012-2020](#) was approved. It provides for a number of common actions of AITT and the Ministry of Economy in order to increase innovation activities of SMEs: an online application system for innovation support programmes will be developed; the participation of SMEs in the priority "Research for SME's" of FP7 will be supported; an incentive framework for cluster development will be introduced, etc. Business incubators are considered as a key instrument for establishing new businesses, including R&D intensive ones, and for promoting public-private cooperation. It is planned to set up a network of innovation incubators and consequently four more incubators were approved to be established with support of AITT as of 2012.

### ***Innovation oriented procurement policies***

Procurement policies are not yet specifically innovation oriented in Moldova.

### ***Other policies that affect R&D investment***

The most important "other policies" are implemented by the Ministry of Economy, which tries to facilitate the establishment of businesses and to reduce related bureaucracy.

In 2004 a reform of the regulations for entrepreneurial activities has been launched (Government Decision No.141 of 17.02.2004). The reform aimed at minimising the administrative regulations, as well as reducing the financial expenditures and the time necessary for establishing and running a business. Subsequently two more related laws were approved: the "Law on reviewing and improving the regulatory framework governing business activities" No.424 of 16.12.2004 (called "Guillotine I") and the "Law on the basic regulatory principles of entrepreneurial activities" no.235 of 20.07.2006 (called "Guillotine II"). The Government Action Plan 2012-2015 aims to further improve the regulatory framework, by implementing another reform, the "Guillotine II+" (Moldovan Government, 2012).

Relevant in this context of other policies for R&D investment is also the state policy in the area of ICT, where incentives to companies are provided. Protection of intellectual property is managed by AGEPI. Patenting is relatively cheap in Moldova for local researchers. In 2012, [\*the National Intellectual Property Strategy until 2020\*](#) was approved. It has the aim to strengthen the legal and institutional framework conducive to the creation, protection, management and full use of the intellectual property potential, which should become a fundamental element of developing a sustainable economy based on knowledge and innovation and a source of national wealth for the Republic of Moldova.

#### 2.4 KNOWLEDGE DEMAND

Knowledge demand is driven by public policy makers and academic communities mostly. Business representatives are not included in R&D policy-making bodies. Some efforts are undertaken to steer R&D towards the needs of the economy. The Moldovan government has outlined in its programme for 2011-2014 the two topics energy supply and usage of natural resources as major challenges for Moldova. These fields shall be supported specifically through governmental programmes and in the frame of the RTDI funding programmes. They are set to gain in relevance therefore.

Sustainable development in economic terms and environmental issues are also relevant in this context. Economic development is not so much tackled yet from an R&D policy point of view, but with practical measures to stimulate company development and administrative facilitation of business activities. Sustainable use of resources and environmental research receive a relevant share of public funding. In 2011 this field received the highest share of R&D funding (see above chapter 2.3.1 financial resource provision for research activities). While a National Environmental Fund (FEN) is available in Moldova, it is more focussed on supporting practical measures and infrastructure (wastewater treatment, sewage system, etc.) and makes only few resources available for R&D (about 3% of its budget).

A more advanced sector in demand-side policies is the renewable energy sector. Measures include direct funding of S&T projects in energy and environment in the framework of state research and development programmes. Some actions concern the implementation of international environmental and energy saving standards.

However, the sectoral structure of the economy and FDI are not very favourable to business driven knowledge demand, because of an orientation towards low-tech products and the use of other factors than technology to ensure competition.

## 2.5 KNOWLEDGE PRODUCTION

### 2.5.1 Quality and excellence of knowledge production

The limited available human and financial resources in Moldova have obvious repercussions on the quality and excellence of knowledge production. GERD was for years very low until it started rising in 2004. It reached a peak in 2008 with 0.7% as a share of GDP, or €24.3m in absolute figures. Since then it has been declining again. In 2012 it reached 0.4% of GDP or €22m. These are modest financial resources, taking into account that research equipment and consumables must be purchased at world market prices. The R&D personnel dropped since 1990 drastically from more than 25,000 to slightly more than 5,100. Qualified R&D personnel emigrated or moved to other sectors of the economy. The low R&D investment did not allow significantly upgrading or purchasing of new equipment, let alone funding of more substantial research infrastructure.

In 2012 the Moldovan R&D system produced about 1,410 articles in national journals (compared to 7,800 articles in 2006-2010), over 1,800 articles in journals abroad (4,900 in 2006/2010) and 208 patents (more than 1,000 in 2006-2010) (SCSTD, 2012). However, these results are poorly recognised internationally. Thus, in the Scopus database in the period 1996-2011 only 4,032 documents of Moldovan researchers are listed, which ranks Moldova on the 97<sup>th</sup> place in the world on this criterion (according to the SCImago Journal & Country Rank). In the other major database, Thomson Reuters (ISI) Web of Knowledge, the performance of the national R&D system is also fairly low: 94<sup>th</sup> by the number of articles and 129<sup>th</sup> by the number of citations of an article. According to the number of publications per million inhabitants Moldova ranks 86<sup>th</sup> – the indicator is 6 times lower than the average for new EU members and 15 times lower than the overall EU average (Cuciureanu, 2011). As to scientific fields, in the ISI-Web of Science most articles are published in the following areas (in decreasing order of importance): physics, chemistry, materials science, engineering, mathematics and computer sciences.

The number of patent applications of Moldovan researchers is relatively high compared to the number of population and the size of the economy – over 4,300 patent applications in the period 2006-2011 (WIPO, 2013). Registering and maintaining a patent is relatively cheap at the State Agency on Intellectual Property of the Republic of Moldova. However, at the end of 2009 only 31% of the granted patents were in force and only 24% of them had duration of over 5 years. The small number of renewed patents is explained partially by the remission from taxes for a period of five years, which applies for Moldovan researchers. Other reasons for this situation are the low applicability of registered inventions (determined by the profile of the Moldovan economy), the weak links between business and R&D sectors, and, in general, by a low innovation culture.

The number of patent applications at foreign patent offices is marginal. For example, in 2006-2011, only seven patent applications from Moldova were submitted to the European Patent Office, and only nine patent applications to the United States Patent and Trademark Office (WIPO, 2013). This can be explained by the high cost of



registration and the fact that Moldovan researchers working abroad or in collaboration with foreign partners are rarely listed as first inventor (which is relevant for allocating a patent to a certain country).

### **2.5.2 Policy aiming at improving the quality and excellence of knowledge production**

Procedures for improving the quality and excellence of knowledge production have been introduced in Moldova only since the year 2000. The culture of evaluation, monitoring and international benchmarking is therefore still in a developing phase.

Competitive R&D and innovation funding based on evaluations has been introduced, starting mainly from 2000. The focus of evaluation in Moldova is primarily on research organisations, and on R&D and innovation funding programmes and projects. Evaluations are usually performed by national experts, whereas in only few exceptional cases international experts have been used. However, according to [\*the package of reforms in research and innovation of ASM\*](#), approved on 31.01.2013, the share of foreign experts in evaluations is set to increase, and especially researchers of the Moldovan scientific diaspora shall be used in the future for this purpose. Moldova has concluded several bilateral funding programmes with international partners, which involve some international expertise of these bilateral projects.

The reform package includes also the development of indicators for measuring the performance of researchers and of research institutes. Funding allocation will then be based on the evaluation of these indicators. A special funding programme for establishing a national network of centres and laboratories of excellence is planned to be introduced in 2013. Furthermore, standard indicators for measuring R&D activities (e.g. BERD), which are still missing in Moldova, are planned to be collected according to international standards such as EUROSTAT.

R&D institutions wanting to become eligible for public funding have to undergo an evaluation and accreditation procedure, which is conducted by the National Council for Accreditation and Attestation (CNAA). The CNAA is a governmental body. It applies the same objectives, criteria and methodology for the evaluation and accreditation of different categories of organisations that undertake R&D activities. To be accredited, an organisation has to meet a number of mandatory requirements, such as having a scientific council, having a minimum of 13 doctors and habilitated doctors, allocating at least 20% of its budget for the procurement of equipment and for mobility, and editing a scientific journal.

Evaluation criteria for organisations refer to the scientific level of research results, their applicability and implementation potential, competence of staff, collaboration with similar organisations at home and abroad. The criteria are operationalized as quantitative and qualitative indicators that cover the whole range of R&D activities of an organisation.

Research programmes are mainly evaluated ex-ante and during their implementation. According to the legislation, all competitive R&D and innovation funding programmes and projects supported under these programmes have to be evaluated. The evaluation is performed by the Academy's Consultative Council for

Expertise. For all funding programmes in Moldova (competitive and semi-competitive) the same set of general evaluation criteria for projects applies:

- correspondence of the objectives and results of investigations of programme / project to the strategic directions of science and innovation;
- the scientific level of the proposed project, the competitiveness of planned results;
- scientific objectives;
- applicability and economic potential of the results;
- composition of the project team, including participation of young scientists;
- competence of personnel;
- material and technological basis of the involved organisations;
- project management;
- Social and economic effects of project implementation.

In addition programme specific criteria are used.

A reporting requirement to SCSTD is another measure: researchers, laboratories and institutes have to report annually according to quite complex forms, which include virtually all aspects of their activity. In addition to the reporting requirement, SCSTD organises at the end of each year hearings and discussions on funding programmes and the projects supported under these programmes. The reports and subsequent hearings generally assess the scientific results, but not the overall effectiveness of a certain programme. These evaluation data are used in part in subsequent decision-making. The results of the hearings back-up the decision on the continued funding of particular projects. Reporting to scientific councils of the research organisations and universities is also common in Moldova.

Moldova has limited experience with benchmarking exercises. Research policy-makers generally make use of existing international comparative studies and statistical databases in order to compare the performance of the national R&D system and of researchers in an international context. Reviews of the S&T system were performed by local NGOs (e.g. Popa, Expert Grup, 2011) and by a group of foreign experts in 2012 in the frame of the FP7 funded Inco-Net EECA project. Several recommendations of this latter review and of a Moldovan-Romanian foresight exercise implemented in 2011-2012 were taken up in the mentioned reform package of the ASM, which was approved in January 2013.

## 2.6 KNOWLEDGE CIRCULATION

### **2.6.1 Knowledge circulation between the universities, PROs and business sectors**

Knowledge sharing and circulation between universities, PROs and business is a major challenge in Moldova. Current framework conditions such as strained public budgets, a limited number of innovative companies, low R&D expenditure of business, and migration of qualified personnel abroad are not very conducive to innovation activities. Research in universities is traditionally weaker than in the academy and research institute sector. It is however a policy goal to enhance research

in universities and to improve its linkages. A few actions have been taken to stimulate knowledge circulation in this respect.

In 2004 the Moldovan Agency for Innovation and Technology Transfer (AITT) was established. The approach was to stimulate know-how transfer and implementation of research results generated at HEIs and PROs to the business sector. Its main funding tool is Innovation and Technology Transfer Projects, which has a budget of around €0.5m per year. In this scheme the funding of the research organisations is covered by AITT, while the business partners need to provide co-funding of 50% of the project cost. The impact of the measure is limited by the modest public budget available for the programme and the difficulty of attracting project partners and funding from the private sector for cooperation with research institutions. Co-funding from industry is still rather limited. In addition there is no clear mechanism that regulates how benefits and intellectual property rights of authors are shared, in case of co-financing from the private sector. Other stimulation instruments of the agency concern awards for the best innovations of the year, business plan competitions, and an online virtual market of inventions and technologies.

Further innovation infrastructure, which supports knowledge circulation, has been established only in recent years. There are currently three techno parks and three innovation incubators operational in Moldova. Since mid-2012, four new innovation incubators at Moldovan universities are being established. Only few universities (e.g. Technical University of Moldova) have technology transfer offices integrated in their structure.

The Academy is trying to tackle the issue of knowledge circulation through its scientific-educational cluster “UnivER SCIENCE”. For integrating education with research and business, the cluster includes the ASM’s Lyceum for gifted children, the University of the ASM, and the Academy and its research institutes. Furthermore, companies, a techno park and an Innovation Incubator in Chisinau are part of the cluster. The cluster is expected to boost cooperation among research and education institutions, among actors from the public and private sector, commercial associations and other entities. But until now it is a formal structure with limited practical impact. No specific topics have been indicated for the cluster up to now and only one company, the plant TOPAZ SA is member of the cluster. The main purpose of the cluster is to concentrate available material and intellectual resources for training and development of the scientific personnel.

## 2.7 OVERALL ASSESSMENT

The national R&D system is small, with limited financial and human resources, but with a strong education and research tradition inherited from its past in the Soviet Union. Financial input in research and innovation amounts only to slightly more than €20m per year and the R&D personnel is around 5,100 in head count. This low financial input does not allow purchasing major modern research infrastructure.

The Academy of Sciences is the key player in Moldova’s research system: it is responsible for policy-making and funding allocation, and is the biggest research institution. This model has come under pressure from other governmental players



and reforms regarding the allocation of research funding have been envisaged. A new Centre for Basic and Applied Research Funding has been established by the ASM with 1 June 2012 and will be given some autonomy for its funding activities. Moreover the use of foreign experts for project evaluations is under discussion, which is particularly important considering the size of the local scientific community.

Scientific production has been stable over recent years and amounted to annually over 1500 articles in national journals and about 200 patents applications to the national patent office. The internationally recognised scientific production is, however, less significant, both by the number of articles (annually about 200-250 in Thomson ISI and 250-300 in SCOPUS) and the number of patent applications (on average annually one patent application to the European Patent Office and to the United States Patent and Trademark Office). International cooperation is particularly important here, as about 75% of papers in international databases are authored jointly by Moldovan and foreign researchers.

## 3 NATIONAL POLICIES FOR R&D&I

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### 3.1 LABOUR MARKET FOR RESEARCHERS

#### 3.1.1 Stocks of researchers

In 2012 the R&D personnel amounted to 5,121 in head count, out of which 3,338 were researchers (NBS, 2013b). The data are underestimated, because official statistics do not consider R&D personnel in the private enterprise sector. As reported by UNESCO (UIS, 2013) there were 1.93 researchers per thousand labour force in 2009 and 2.05 researchers per thousand total employments (in FTE), which was a slight increase in comparison to previous years. As a result of the economic crisis, which also hit Moldova in the years 2008-2009, the number of researchers has declined slightly (3471 in 2008, 3561 in 2009, 3267 in 2010, 3372 in 2011, and 3338 in 2012). In addition to these data, the human resources of Transnistria have to be considered. These were 562 R&D personnel (in head count), including 409 researchers (data for 2012).

In general, Moldova has the problem that a large number of skilled people have left (and are continuing to leave) the country. The biggest exodus of Moldovan researchers took place in the 1990s. This contributed to the significant reduction of the R&D personnel during this period. At present emigration has become younger and more and more university graduates leave the country.

#### 3.1.2 Providing attractive employment and working conditions

The employment and working environment for researchers is not attractive. Salaries are low and infrastructure and equipment is outdated, except in the leading and internationally well-linked institutes. To put things bluntly, it needs either some enthusiasm and commitment to science, or a lack of alternatives to embark on or follow-up a research career in Moldova.

Although salaries of researchers increased according to ASM annual reports in the period 2004-2008 by a factor of four, the average monthly salary of a scientific collaborator in a public research organisation was only €219 in 2012 (up from € 190 in 2011; SCSTD, 2013). In comparison, the average monthly salary in Moldova in the same year was €217 (up from €200 in 2011; NBS, 2013c). Salaries in several sectors of the economy are much higher than these average levels, and the level of remuneration is hence one of the main factors which discourages talent to stay in research.

Research and education organisations usually have a high degree of flexibility in setting the level of salaries for their academic staff. Individual income can vary significantly depending on the research projects, in which researchers are involved. This makes international cooperation projects with usually higher labour cost levels particularly interesting. Funding from abroad has helped bring the leading research

groups through the difficult times of economic transition in the past 20 years. It provided these groups with more solid salaries and financial resources for equipment upgrades.

The difficult research environment leads to migration of qualified personnel abroad and discourages inward mobility to Moldova. With the current salary rates and infrastructure situation, Moldova is no destination for inward mobility.

As an answer to this precarious situation, the Academy has established several bilateral cooperation schemes to stimulate researcher exchange. These programmes divert more funds to internationally linked groups and provide opportunities for international exchanges and joint publications. As with many bilateral funding programmes between countries, solid impact studies on the results generated by these programmes are missing. ASM is doing however, together with the respective partner organisation, an assessment of the results of each programme before a new call is launched (e.g. joint assessment with the German BMBF). Another action to stimulate inward mobility and support brain circulation is projects for linking researchers of the diaspora to the colleagues in their former home country through short-term stays. The ASM is implementing these projects with international partners.

Gender sensitivity is not an important issue in Moldovan research. The labour code stipulates equal employment opportunities for women and men. But when it comes to the leading positions in Moldova, then these are traditionally male dominated. While women represent 47.1% of doctors of science, their share falls significantly to 17.2% among habilitated doctors (NBS, 2013b). Within the academy, the share of women is very low: in the ASM Assembly elected in 2013, women make up only 7% of members (up from 6% in the previous assembly) and among the members of ASM women count only for 3% (up from 2%). The situation is better among rectors of universities where women represent 23%, and in the supreme council of ASM (SCSTD) with a share of 13% women.

Moldovan researchers working temporarily abroad in R&D on the basis of inter-governmental or interdepartmental agreements and scientists delegated abroad for training keep their employment positions. In addition, social security rights (including pensions) are guaranteed. Social security rights are in general the same for non-nationals as well as for Moldovan citizens; employed persons become liable to social and health insurance taxes and implicitly recipients of such assistance.

### **3.1.3 Open recruitment and portability of grants**

In line with the Code on Science and Innovation any scientific position can be occupied by foreign citizens and stateless persons who meet the requirements for the position on offer. The labour market is, however, in practice protected. Non-nationals can only be hired if the position cannot be filled within 15 days with a local citizen. Moreover, position announcements are published usually only in Romanian at the website of the institution concerned and in a local newspaper. This protection would not be necessary, taking into account the actual framework conditions for researchers.

Transparency of recruitment procedures is limited. Often, position announcements are tuned towards filling a position with a rather specific qualification. Portability of grants is in practice rather difficult and de-facto not feasible. It should be mentioned, however that, in 2012 the European Charter and Code on recruitment was signed by SCSTD and its provisions are being translated into national practice.

### **3.1.4 Enhancing the training, skills and experience of researchers**

The doctoral and postdoctoral (habilitated doctors) education is overseen by the National Council for Accreditation and Attestation. It is implemented in a traditional way. Some institutions have started to develop doctoral schools, but national legislation in this field is still lacking. One of the competitive Moldovan funding programmes for research projects is targeted specifically at young researchers. It launches calls each year and projects implemented in this programme allow gaining experience and improving of research skills.

International contacts and involvement in international research projects is highly relevant in the context of training and enhancing research experience. International cooperation is prestigious in Moldova and advantageous for career development. Moreover, it is financially important for the researchers involved.

## **3.2 RESEARCH INFRASTRUCTURES**

The Republic of Moldova lacks modern research facilities. Given the small size of the economy and the precarious financial situation of R&D in particular, investment in basic equipment and research infrastructure was over the last 20 years very low. As a result, the scientific equipment older than 10 years constitutes about 37% of the total cost of equipment (SCSTD, 2013). Research infrastructure in Moldova is available mainly at leading research institutes of the Academy of Sciences, such as the Institute of Applied Physics or the Institute of Chemistry. Those research groups that are internationally linked also dispose of modern equipment.

Some policy measures have been taken since 2006 to upgrade the infrastructure. Grant competitions for purchase of scientific equipment have been held annually. As a result of the calls 65 projects were approved with a financial volume of more than €1.8m (SCSTD, 2011, 2012). Most of this equipment was purchased within the strategic direction "Nanotechnologies, industrial engineering, new products and materials".

Regulation is also used to stimulate the procurement of equipment: in order to be accredited by CNAA, not less than 20% of the expenditure of a research organisation must be spent for mobility and the purchase of equipment. Since 2006 the import of equipment has been exempt from customs duties for accredited research organisations. Importantly for Moldova, international R&D cooperation programmes facilitate access to modern infrastructure.

Overall, in the period 2006-2012 R&D organisations spent on procurement of scientific equipment about €11.4m (SCSTD, 2011, 2012, 2013). The evolution of these

expenditures, but also of share of GBAORD for procurement of scientific equipment, followed the general trend in spending on science and innovation: an upward trend until 2008, followed by a sharp decline:

	2006	2007	2008	2009	2010	2011	2012
Expenditure on procurement of scientific equipment €, m	0.8	2.5	3.6	1.6	1.0	1.1	0.5
Share of GBAORD for procurement of scientific equipment, %	10.1	19.4	22.8	10.3	6.9	6.6	2.1

Source: SCSTD, 2011, 2012, 2013

As examples of research infrastructure development in the last period, one can mention the National Centre for Materials Study and Testing, the Seismology Centre, and the Test Centre of cells and solar panels. Another highly important infrastructure development concerns the connection to European e-infrastructures (e.g. GEANT, GRID), which was established with EU support.

All national RIs are open to foreign researchers. Access is possible through participation in joint projects and as a result of bilateral agreements.

### 3.3 STRENGTHENING RESEARCH INSTITUTIONS

#### 3.3.1 Quality of National Higher Education System

The Moldovan Ministry of Education lists overall 27 accredited universities in the country, including 16 state and 11 private universities. The number of enrolled students reached 104,000 in the academic year 2011/12, out of which 85,000 students were enrolled in public universities and 19,000 in private ones. There were 292 students per 10,000 inhabitants. In 2011 about 27,800 students graduated from Moldovan universities. The number of doctoral students was about 1,600 (2011). And finally the teaching staff of universities amounted to around 6,100 persons (2011/12) (NBS, 2013d).

The number of students in Moldova increased continuously until 2006/2007 to 128,000 students (NBS, 2012e). Since this peak it has been decreasing, due to the government's introduction of enrolment rates for all universities in 2006. After the introduction of these entrance restrictions, there are around 23% of young people in the age bracket of 18-25 enrolled in higher education. Migration among the young and among students is high; according to the Ministry of Education, 17.7% of young people aged 15-29 migrated abroad in 2010.

The entrance procedures are common for all higher education institutions in Moldova. The government establishes and approves the number of places available for all specialities at each university. The competition for admission is made on the basis of the grades achieved at the end of secondary education. Depending on the score obtained, applicants can be enrolled either for state-funded places or for places with payment.

In addition to data outlined above, there is one public university situated in the breakaway region of Transnistria with around 15,000 students and 85 PhD students.

The universities are in their mission primarily focussed on education, while research and particularly links to business are weakly developed. A model of separating education and R&D has been preserved to some extent from the times of the Soviet Union. In this approach universities are primarily teaching institutions and research activities are undertaken only on a relatively limited scale. Theoretically, all university teachers must carry out R&D, but usually the staff is overwhelmed with teaching duties and only a few conduct substantial research. However, researchers of the ASM also teach at the universities. Even so, the university sector contributes with about one third of Moldovan researchers, who have published in journals included in ISI and about two fifths of patent applications filed. Only few leading Moldovan universities (e.g. Moldova State University, Technical University of Moldova) participate in projects supported under multinational funding programmes.

The National Council for Accreditation and Attestation has accredited 16 universities as R&D performing institutions, including 13 state universities and three private ones. Links to business and commercialisation of research results are underdeveloped; a feature, which the universities share with the public research organisations. Some efforts have been undertaken in recent years to establish technology transfer offices and incubators within or linked to universities, but both tools are still at an early stage of development. In Transnistria the situation is somewhat different as research is performed mainly within its university.

There are no accurate data available on Higher Education Expenditure on R&D (HERD) in Moldova and on the business share of HERD. Calculations based on the ASM annual report (SCSTD, 2012), show that in 2011 an amount of €2.4m was allocated to 11 universities for research projects from the state budget. This is equal to around 13% of GBAORD. Total R&D funding in the higher education sector is higher, as allocations from general university funds (GUF) and from other sources need to be considered in addition. Estimates show that the business share of HERD is negligible.

### **3.3.2 Academic autonomy**

In principle, the university autonomy is guaranteed by the Law on Education (1995). It states that autonomy refers to areas such as governance, structure and functioning of the institution, teaching and scientific research, management and funding. The autonomy is de facto restricted: the government decides on enrolment rates for each university and on the teaching load of university teachers. The Ministry of Education defines the employment conditions of university teachers and approves the conferring of the titles docent and professor. CNAA awards then these titles and also approves the award of scientific degrees to researchers from universities.

Salaries of teaching staff at public universities are specified according to the Law on the public sector wage system (2005). In addition to the salary from state sources, public universities determine wage increases according to the number of students, who pay for their studies. At private universities the salaries are determined exclusively by the governing bodies of those universities.

In the Strategy of Education Development for 2011-2015 (Ministry of Education, 2010) it is recognised that there is a low degree of autonomy of higher education



institutions. This concerns a centralised management of financial resources and a diminishing relevance of performance criteria in the allocation of funds for state universities. The document provides for extending the autonomy and increasing the accountability of universities over the next years up to 2015. With a major reform already approved, financial autonomy has been introduced for public universities with the beginning of the year 2013.

The governance of universities follows a rather traditional approach. A higher education institution in Moldova is headed by the senate, which is chaired by the rector. The faculty is the next lower layer, which is headed by the faculty council and which is chaired by the dean. The operative management of a university is provided by the university senate office (Administrative Council).

The university senate is composed of representatives of the didactic and scientific staff - 75%; students and PhD students - 15%; and support staff - 10% (Law on Education, 1995). Rectors of state higher education institutions are selected on a competitive basis by the senate. Rectors of all state higher education institutions are confirmed in their function by the government. Pro-rectors of institutions are appointed and dismissed by the rector, with agreement of the Ministry of Education. The remaining management positions (deans, heads of department etc.) and functions for researchers and lecturers are selected and confirmed at the university.

To apply for any leadership position, the requirements are citizenship of Moldova and holding a scientific degree and university title. The rectors and other governing functions of private higher education institutions are chosen by its founders.

### **3.3.3 Academic funding**

The state budget for education in 2012 provided for higher education an amount of €65m and for post-university education € 5.6m (Law on state budget for 2013, 2012). These financial resources are allocated only to state universities. In the allocation of funding to single universities, the expenditure for university staff and for scholarships of students and doctoral students is taken into account. These general university funds for state universities are not split in separate funding lines for training and research. They represent between 12-21% of the whole budget of public universities (Ciurea/Litra, 2009). The main share of the university budget comes from tuition fees paid by students. As a result, state HEIs are interested in attracting more students with private funding. These resources are usually not spent on scientific research, even if the universities have the right to do so. They may in principle use these funds to support research, which they consider a priority.

Financial autonomy of universities has been introduced in 2013 and this will lead to important changes in financing. The allocation of funding to public universities will be based on the number of students on state financed study places (slightly more than 20,000 students for Moldova overall). While the public universities will be able to plan their expenditure independently, this flexibility will come at the price of significant cuts in the public higher education expenditure. The budget will plunge from €65m in 2012 to a projected €37m in 2013 (Law on state budget 2013, 2012). The number of students has been decreasing over the last years due to enrolment rates for universities, but the public higher education expenditure continued to

increase. The planned budgetary cuts will mean increases in tuition fees, which students have to pay.

Lifelong learning and vocational training will however gain in importance, and the funding for these educational fields will be increased over the coming years.

Universities are also funded from the state budget for science; they received a little more than 13% of this funding in 2011 (SCSTD, 2011). However, only 11 of the 16 universities accredited for R&D activities have benefited in 2011 from this funding source. Private universities are self-funded, mainly through tuition fees of students. They do not receive public funding directly from the budget. Private universities accredited as research organisations with the CNAA, may receive public funding through competitive funding programmes of the ASM. Grant funding from the state budget is based more on expert assessments than on the use of bibliometric indicators. The major share of funding from the state budget for science is institutional. The share of funding received as result of competitions is higher in universities than in institutes of ASM. Financial resources solicited in competitive programmes can be spent only in accordance with the terms of contracts for research projects.

Finally, participation in international research programmes constitutes a significant contribution to the budget of the most competitive teams of universities. For the future, the Strategy of Education Development for 2011-2015 (Ministry of Education, 2010) envisages some important changes related to the financing of the HEIs with repercussion on knowledge triangle policies:

- increasing the share of public funding of university research to at least 30% of the total funds allocated to the R&D sector by 2015;
- establishing a National Fund to support scientific research;
- Developing partnerships between higher education, R&D sphere and the business enterprise sector, including related research funding.

### 3.4 KNOWLEDGE TRANSFER

#### 3.4.1 Intellectual Property (IP) Policies

Knowledge transfer from PROs and universities to business in Moldova is still in a nascent phase. The same holds true for management of Intellectual Property Rights.

The Moldovan Academy of Sciences (ASM), as the main research institution in the country, tries to stimulate knowledge transfer between education, research and business through its cluster project UnivER SCIENCE. It includes the ASM's Lyceum for gifted children, the University of the ASM, and the Academy and its research institutes. Furthermore, companies, a technopark and the Innovation Incubator Inovatorul are part of the cluster too. The cluster aims to improve cooperation among research and education institutes, state and private sector, commercial associations and other entities. Overall in 2012, there were three technoparks and seven innovation incubators operational or in the process of being established in Moldova.



They are linked to the ASM or to universities and support knowledge transfer (SCSTD, 2013). One more incubator is planned to be established in Balti in 2013.

There are only few Knowledge Transfer Offices (KTOs) operating in Moldova, in particular at leading universities. These KTO's do not yet manage actively IPR or operate, as would be understood in the context of EU countries. For example the Technical University of Moldova has established the sub-division Technical-Scientific Center of Advanced Technologies Implementation "Etalon". The centre was created on the basis of a former factory within the military-industrial complex of the Soviet Union. The State Agricultural University of Moldova has started establishing an Innovation Park for Applied Research and Business Cooperation (PIECA) in 2010.

The State Agency on Intellectual Property (AGEPI) deals with IPR protection. Registering a patent is relatively cheap with AGEPI and this stimulates the patenting activity. Another stimulus for patenting is that patents are used as quantitative indicators for measuring scientific output. A qualitative assessment would be necessary here too, as only a limited number of patents is maintained after a five year tax remission period ends.

### **3.4.2 Other policy measures aiming to promote public-private knowledge transfer**

The main support for public-private knowledge transfer and stimulation of innovation activities is provided by the Agency for Innovation and Technology Transfer and its various stimulation instruments. Above all the main funding programmes 'Innovation and Technology Transfer Projects' needs to be mentioned. Besides, AITT organises business plan competitions, runs a virtual innovation marketplace, etc.

#### **Spinoffs**

Three Technoparks, seven Incubators and few Knowledge Transfer Offices at leading universities are the other major tools and infrastructure for promoting public-private knowledge transfer, spin offs, inter-sectoral mobility and interactions between research institutions and SMEs.

#### **Inter-sectoral mobility**

Inter-sectoral mobility from public to private sectors has to be seen in the context of the difficult framework conditions under which researchers have to work. This mobility means usually not a continuation of research in the private sector, but a movement to better paid positions in the economy or migration abroad.

### **Promoting research institutions - SME interactions**

Interactions between research organisations and SMEs are specifically stimulated. The support tools of AITT, the Innovation and Technology Transfer Projects, S&T Parks and Innovation Incubators also have to take care of it.

### **Involvement of private sector in the governance bodies of HEIs and PROs**

Involvement of the private sector in the governance of PROs is non-existent. The same situation is given for HEIs, except for private universities. Venture capital and business angels are de-facto missing in Moldova.

### **Regional Development policy**

Regional development measures are gaining in importance in Moldova, but it remains to be seen, whether they will contribute to knowledge transfer and support of R&D activities. In 2010 three regional development agencies and a National Fund for Regional Development were set up. Their focus lies on stimulation of economic activities, which shall in turn contribute to poverty reduction. Two innovation incubators were opened in the regions (Balti and Comrat) and one more incubator is planned for Balti in 2013.

## **3.5 ASSESSMENT**

Innovation stimulation tools have been established by AITT through the main funding programme “Innovation and Technology Transfer Projects” and the infrastructure measures “S&T Parks” and “Innovation Incubators”. But this infrastructure is still in a developing phase and needs to become more efficient. The links between PROs, HEIs and the business enterprise sector remain weak.

In the training of human resources it can be mentioned that a high share of the young pass through tertiary education. Overall, the working conditions for researchers are poor and marked by low salaries, outdated infrastructure, and migration of skilled people abroad. Universities traditionally are focussed on education and their staff is overloaded with teaching duties. Financial autonomy has been introduced for universities in 2013; the effects of this measure remain to be seen. While universities will dispose of more flexibility, they will have to manage with less public funding. An increase in tuition fees may be expected accordingly

## 4 INTERNATIONAL R&D&I COOPERATION

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### 4.1 MAIN FEATURES OF INTERNATIONAL COOPERATION POLICY

International R&D cooperation is a success story of Moldovan S&T policy-making. It was highly important for Moldova since its independence at the beginning of the 1990s. It helped increase financial resources for leading teams, allowed building linkages with foreign researchers and access to modern infrastructure. In the 1990s international cooperation was implemented in a support mode for Moldova through organisations such as the US based CRDF or the European INTAS programme. Since 2004 it has switched more to a jointly funded approach, where also Moldova raises some financial resources. In the last 10 years these activities have been developed significantly, especially through bilateral and multilateral funding programmes.

The priority in multilateral cooperation is clearly the EU, and Moldova succeeded in becoming associated to the Framework Programme 7 (FP7) as of 1 June 2012. On the bilateral level, cooperation is focussed on some of the EU member states (Bulgaria, Estonia, France, Germany, Italy, Romania, Poland, etc.). Another regional focus has been put on major partner countries within the region of the former Soviet Union: Belarus, Russia, and Ukraine. Long-standing cooperation is in place with the USA. Partners of interest are also China and Turkey.

Scientific fields in the international cooperation are defined broadly in the majority of cases. Since Moldova's association to the FP7, the priorities of the framework programme as well as the societal challenges of the upcoming EU funding programme, the Horizon 2020, are becoming ever more important as R&D priorities at the national level and in its international RTDI cooperation.

What concerns Transnistria, its limited R&D capacities are focused on cooperation with Russia. This orientation is due to the overall political situation with Transnistria; this breakaway region is collaborating closely with and depending on Russia. The Transnistrian University takes part in the Russian higher education system and has cooperation agreements with Moscow State University and other Russian universities.

### 4.2 NATIONAL PARTICIPATION IN INTERGOVERNMENTAL ORGANISATIONS AND SCHEMES

Moldova participates in the intergovernmental organisation Science and Technology Center in Ukraine (STCU). It joined the organisation at the end of 2004. The STCU is dedicated to the prevention of the proliferation of expertise related to weapons of mass destruction. It tries to assist former military researchers in the transition to self-supporting, peaceful activities in the international science and business communities. The STCU channels financing from governmental and private sources from the EU, the USA and Canada to research and innovation activities in five countries of the Former Soviet Union, including Moldova

Moldova launches joint calls with the STCU, which are co-financed by the partners. In the period 2012-2013 the partners have jointly funded 11 projects. The projects were supported in the following fields: nanotechnologies and new materials (4 projects), energy (4), and in agriculture and biotechnology (3). The last call was launched in April 2012.

Regional cooperation forums relevant for Moldova are the Black Sea Economic Cooperation (BSEC) and the Central European Initiative (CEI). The country participates in the BSEC Working Group on S&T, and in research related initiatives of the CEI.

Until 2010 R&D cooperation between EU countries, countries associated to the FP6 and Moldova was supported through the European INTAS programme (International Association for the cooperation with scientists of the Former Soviet Union). INTAS supported small scale multilateral research projects, grants for young scientists, summer schools, and innovation and conference grants. The Moldovan Academy of Sciences implemented in 2005 a jointly funded call for research projects and Young Scientists Grants with INTAS. INTAS was wound up in 2010.

In research infrastructures, Moldova has been connected to GEANT, the European data network for research and education. Moreover it participates in some GRID and high-performance computing infrastructure projects funded under FP7.<sup>3</sup> These connections are highly relevant for the country and facilitate the exchange and cooperation with the European and international research communities.

Long standing cross-border knowledge circulation goes on with Russia in the frame of the major infrastructure Joint Institute for Nuclear Research, in Dubna. Moldova is a member (co-founder) of the infrastructure and takes part in its activities. Moldovan researchers are either constantly working on projects there, or have regular trips (including students) to Dubna in the frame of short-term projects. Some cooperation of Moldovan organisations with CERN was funded previously in the frame of the European INTAS programme.

### 4.3 COOPERATION WITH THE EU

#### 4.3.1 Participation in EU Framework Programmes

Institutions from Moldova participate in the EU's 7th Framework Programme for RTD (FP7) and in actions supported under the European COST programme. Moldovan institutions are not yet involved in the EUREKA programme or in the EUROSTARS programme (managed by EUREKA).

Since 1 January 2012 Moldova is associated to the FP7, which was a major political success for Moldovan S&T policy makers. A functioning NCP network has been put in place, which is linked internationally. A representation and liaison office has also been established in Brussels, the Moldovan Office for Science and Technology (MOST).

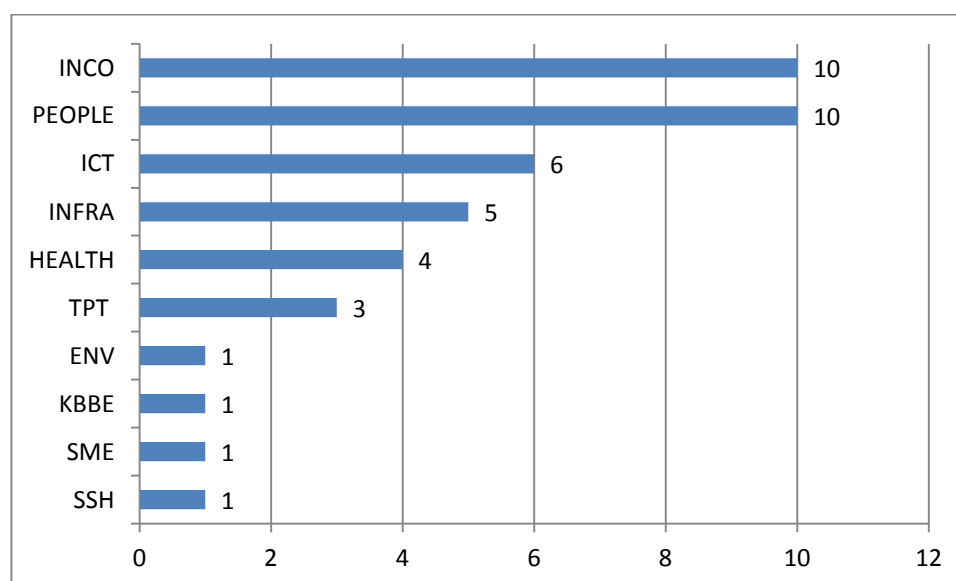
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<sup>3</sup> See for example: <http://www.see-grid.eu/> and <http://www.seera-ei.eu/>

With status May 2013 Moldovan teams were involved in 249 FP7 proposals. 296 Moldovan applicants participated in these proposals (see Table 1 below under *All submitted*). Out of this population 42 FP7 grant agreements were signed, involving 52 Moldovan research organisations (see Table 1 below under *Main listed*). This gives a success rate of 17.6% (EU average 20%).

The highest number of applications was recorded in the people programme, international cooperation, social sciences, ICT and environment research. The highest success (in terms of number of proposals funded) was achieved in the People and International Cooperation programmes (10 proposals with Moldovan participants each), followed by ICT (6), research infrastructures (5). The other funded Moldovan FP7 project participations are in health (4), transport (TPT - 3), environment (ENV - 1), knowledge based bio-economy (KBBE - 1), the SME programme (1), and in social sciences and humanities (SSH - 1), (data provided by the European Commission in June 2012 and May 2013; see Figure 2 and the detailed Table 1 below).

**Figure 2: Number of FP7 funded projects with Moldovan participants per FP7 sub-programme**



The success rates per FP7 sub-programme show that they were highest in transport, with 75%; and in infrastructure with 67%, whereby the low number of applications in these programmes biases these rates. In TPT three out of four applicants were selected for funding. The lowest success rate (2.78%) was achieved in social and humanities, where only one applicant out of 36 applicants received funding.

The total cost of the overall 42 projects selected for funding amounts to €1.7b. The Moldovan organisations have received more than €3 million in EU funding in these projects.

**Table 1: Moldova (Republic of) participations in FP7**

Proposal SP Description <sup>2</sup>	Proposal Program	All submitted		Mainlisted			Success Rate:
		Number of Proposals	Number of Applicants	Number of Proposals	Number of Applicants	Proposal Total Cost	
Not_Available	N/A	2	2				
SP1-Cooperation	ENERGY	2	2				
SP1-Cooperation	ENV	19	20	1	1	961.467	5,00%
SP1-Cooperation	HEALTH	17	18	4	4	19.850.827	22,22%
SP1-Cooperation	ICT	33	36	6	6	8.636.126	16,67%
SP1-Cooperation	KBBE	16	22	1	1	2.518.903	4,55%
SP1-Cooperation	NMP	9	9				
SP1-Cooperation	SEC	2	2				
SP1-Cooperation	SSH	33	36	1	1	3.185.000	2,78%
SP1-Cooperation	TPT	4	4	3	3	4.338.145	75,00%
SP2-Ideas	ERC	3	9				
SP3-People	PEOPLE	49	61	10	14	89.880	22,95%
SP4-Capacities	INCO	41	52	10	14	1.464.623.790	26,92%
SP4-Capacities	INFRA	8	9	5	6	163.907.383	66,67%
SP4-Capacities	REGIONS	1	1				
SP4-Capacities	REGPOT	2	2				
SP4-Capacities	SiS	4	5				
SP4-Capacities	SME	4	6	1	2	1.444.000	33,33%
	<b>Sum:</b>	<b>249</b>	<b>296</b>	<b>42</b>	<b>52</b>	<b>1.669.555.521</b>	<b>17,57%</b>

A weakness of Moldovan participation is its limited involvement in research projects. Most of Moldovan teams are involved in supporting and coordination actions within FP7. Out of 42 successful projects with Moldovan participants, 20 are coordinating and support actions (see Table 2 below). Another nine projects provide support for researcher mobility, including one International Incoming Fellowship and eight projects under the International Research Staff Exchange Scheme (IRSES). Dedicated research projects are eight, including three collaborative projects (SICA & generic), one research project for SMEs, and four small or medium-scale focused research projects. The success rate for the research projects is lower than the overall success rate for Moldova, and reaches around 10%. For example out of 42 submitted small or medium-scale focused research project proposals; only 4 were selected for funding.

**Table 2: Moldova (Republic of) Contract type of the FP7 projects with country's participation**

Proposal Sub Funding Description	Number of Proposals submitted	Number of Proposals main listed
Collaborative project for specific cooperation actions dedicated to international cooperation partner countries (SICA)	19	2
Collaborative project (generic)	8	1
Coordinating action	28	8
ERANETplus	1	1
Integrating Activities / e-Infrastructures	5	4
International Incoming Fellowships (IIF)	9	1
International Research Staff Exchange Scheme (IRSES)	27	8
Research for SMEs	4	1
Small or medium-scale focused research project	42	4
Supporting action	55	12
Other	51	
<b>Sum:</b>	<b>249</b>	<b>42</b>

Moldova is involved in FP7 funded international networking projects for the Eastern European region: this concerns the S&T International Cooperation Network for Eastern European and Central Asian Countries (IncoNet EECA) and the S&T International Cooperation Network for Central Asian and South Caucasus Countries (IncoNet CA/SC). This will continue over the coming years, as the country has been involved in several INCO-NET and Research2Innovation projects, as well as an ERA-NET funded under the FP7 calls 2013, such as the INCO-NET for the Danube region and the Eastern Partnership countries (Danube-INCO.NET and IncoNet EaP).



In addition, the ERA-WIDE funding line within the FP7 international cooperation activities is relevant for Moldova. ERA-WIDE aims at contributing to research capacity building in countries included in the European Neighbourhood Policy (ENP). One project – MOLD-ERA - has been funded in the call 2010 and another one in the call 2011 – MOLDNANONET. The projects help improving the capacities of leading nanotechnology research groups (at the Academy of Sciences, the Technical University of Moldova, the ELIRI SA Company and the University in Balti)<sup>4</sup>.

What concerns the European Cooperation in Science and Technology - COST, three Moldovan organisations participated in COST actions with reference date September 2012.

#### 4.3.2 Bi- and multilateral agreements with EU countries<sup>5</sup>

As with Moldova's multilateral S&T cooperation, also the bilateral one is implemented through the Academy of Sciences. Moldova has signed about 50 bilateral agreements, which foresee scientific cooperation (mostly in the frame of a broader cooperation approach covering fields such as economic cooperation, etc.). At the intergovernmental level there are 21 such agreements, all signed in the period up to 2003 by ministries. Most of them do not have a practical impact and remain at the level of cooperation intentions. The rest of the agreements were signed by the ASM, the majority after 2004.

On the basis of such agreements the academy has established joint R&D funding programmes with the EU Member States France, Germany, Italy and Romania. Estonia introduced a unilaterally funded mobility programme for R&D cooperation with Moldova in 2013. Cooperation agreements are in place with a range of partner academies of sciences, which include exchange of researchers in all different scientific fields. The academy has concluded such agreements with the academies of sciences of Austria, Bulgaria, Czech Republic, Hungary, and Poland. An agreement was also concluded with the Royal Society of the UK.

Bilateral RTDI cooperation with Germany and Romania is the most important in terms of funding activities in the most recent years.

Cooperation with Romania started in 2008. Competitions are held usually every three years, whereby the first call was launched in 2009. It operates as a jointly funded programme for research projects. The funding partner on the Romanian side is the National Authority for Scientific Research. In the period 2010-2012, Moldova invested €150,000 in 24 research projects. The budget per one project amounted to €6,250. Beneficiaries in Moldova were above all institutes of ASM (14 institutes), participants from universities (6 participants) and the rest from research institutes under line ministries. In terms of topics, most projects were funded in efficient utilisation of human, natural and information resources for sustainable development (including ICT, mathematics, environment – 7 projects), and in nanotechnologies

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<sup>4</sup> See <http://mold-era.eu/> and <http://www.mold-nanonet.eu/>

<sup>5</sup> See for details: <http://international.asm.md/bilateral.html> Additional information the authors have received from the ASM.



and new materials (7). The rest of the projects were supported in biomedicine and pharmaceuticals (5), and in agriculture and biotechnology (5).

Bilateral RTDI cooperation with Germany has started in 2008 and three competitions were held so far in 2009, 2010 and in 2012. It operates as a jointly funded programme for mobility projects. The funding partner on the German side is the German Federal Ministry of Education and Research and its International Bureau. In each of the first two competitions 10 joint projects were selected for funding and a budget of €187,500 invested by Moldova. The projects were supported in the following fields: nanotechnologies and new materials (7 projects), human, natural and information resources (5), biomedicine and pharmaceuticals (4), agriculture and biotechnology (3), and in rule of law and cultural heritage (1),

Bilateral RTDI cooperation with Italy has been established as of 2011. The funding partner on the Italian side is the Italian National Research Council (CNR). It operates as a jointly funded programme. In the period 2011-2012, Moldova invested €20,000 in 4 research projects. The budget per one project amounted to €5,000. Beneficiaries in Moldova were 3 institutes of ASM (14 institutes), and one participant from the Technical University of Moldova. In terms of topics, most projects were funded in efficient utilisation of human, natural and information resources for sustainable development (including chemistry, environment, and nanotechnologies – 3 projects). The fourth project was supported in humanities. Another call for mobility projects was implemented in 2012.

The most recent cooperation schemes have been established with the French CNRS and with Estonia. A competition for mobility projects was implemented with CNRS in 2012 and a competition by the Estonian Ministry of Foreign Affairs was launched in 2013.

#### 4.4 COOPERATION WITH NON EU COUNTRIES OR REGIONS

##### 4.4.1 Main Countries

Joint R&D funding programmes with countries of the former Soviet Union were established by the ASM with Russia, Belarus and Ukraine. These programmes for support of R&D projects are implemented with the Russian Foundation for Basic Research (RFBR), with the Russian Foundation for Humanities (RFH), the Belarusian Republican Foundation for Fundamental Research (BFBR), and the Ukrainian Ministry of Education and Science. At the same time cooperation agreements with partner academies of these countries have been concluded, and in addition with the Academy of Sciences of Azerbaijan.

Moldovan R&D cooperation with the USA was since the beginning of the 1990s actively supported through local offices of American R&D support funds. Projects were jointly funded with the US Civilian Research and Development Fund (CRDF) and its local representation, the Moldovan Research and Development Association (MRDA). But since 2010 no new activities were supported.

Further bilateral cooperation agreements are in place with academies of science of China, Montenegro and Turkey.

#### 4.4.2 Main instruments<sup>6</sup>

The main instruments for cooperation with Belarus, Russia and Ukraine are jointly funded competitions for projects. The partner funding organisation is in Belarus the Republican Fund for Fundamental Research, in Russia the Russian Foundation for Basic Research (RFBR) and the Russian Foundation for Humanities, and in Ukraine the Ministry of Education and Science.

Bilateral RTDI cooperation with Russia is the longest lasting and has been the most important among non-EU countries. The cooperation with the RFBR was established already in 2005 and operates as a jointly funded programme. It exceeds the cooperation with single EU countries in terms of financial resources invested and number of projects supported. In 2005-2007 as a result of a joint competition 44 projects were supported. Another agreement between ASM and RFBR was concluded in 2008 and a call launched the same year. No further call was launched so far with RFBR (until June 2013). Research projects were implemented in 2009-2010 and supported in the following fields: nanotechnologies and new materials (32 projects), human, natural and information resources (27), biotechnology and agriculture (15), biomedicine and pharmaceuticals (6), energy (5), rule of law and cultural heritage (3). Another funding cooperation with Russia has been established with the Russian Foundation for Humanities. In 2009 a call was implemented in this programme, but no further calls were launched so far (until June 2013). It operates as a jointly funded programme. The research projects selected for funding were implemented in the period 2009-2010, and Moldova invested €28,125 in 9 projects in the humanities and social sciences.

Bilateral RTDI cooperation with Belarus is the most important among non-EU countries in terms of frequency of funding activities. It has started in 2008 and competitions are held usually every two years. It operates as a jointly funded programme. The funding partner on the Belarusian side is the Belarusian Foundation for Basic Research. The first joint call was launched in 2008 and 16 projects were selected for funding. They were implemented over the years 2009-2010. The second call was launched in 2009 and 20 projects were selected for funding. Over the implementation period 2010-2011, Moldova invested €89,063 in research projects in the following fields: nanotechnologies and new materials (8 projects), human, natural and information resources (7), agriculture and biotechnology (4), and in biomedicine and pharmaceuticals (1). Another call with BFBR was implemented in 2012.

In the bilateral RTDI cooperation with Ukraine a call for research projects was launched in 2009. The funding partner on the Ukrainian side is the Ministry of Education and Science; the partners have established a jointly funded programme. As a result of the joint call 17 projects were selected for funding. They were implemented over the years 2010-2011. Moldova invested €62,500 in research projects in the following fields: nanotechnologies and new materials (6 projects), agriculture and biotechnology (3), rule of law and cultural heritage (3), biomedicine and pharmaceuticals (2), human, natural and information resources (2), and in energy (1). Another call with Ukraine was launched in spring 2013.

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<sup>6</sup> See for details: <http://international.asm.md/bilateral.html> (In addition, the authors have received information directly from the ASM.).

#### 4.5 OPENING UP OF NATIONAL R&D PROGRAMMES

Moldovan research programmes are open for participation of foreign researchers, but foreign researchers cannot receive funding within these programmes. They may participate in projects with own resources. Competitive funding programmes are open only to research organisations accredited within Moldova.

There are, de-facto, no foreign researchers working in Moldova and it will be difficult in the near future for Moldova to attract foreign researchers, because of the dire conditions such as low salaries, outdated equipment, and teaching overload in universities under which research has to be performed.

The main barrier for developing a policy here is the limited financial resources available for R&D and innovation in Moldova and the resulting low salaries. There are, however, ongoing efforts to strengthen links to Moldovan researchers working abroad.

#### 4.6 RESEARCHER MOBILITY

##### 4.6.1 Mobility schemes for researchers from abroad

Moldova has concluded several bilateral funding programmes with international partners, and cooperation agreements at the level of Academies of Sciences. By way of these schemes foreign researchers come for short term stays to the country. They have definitely helped to increase short term inward mobility of foreign researchers to the country and to counterbalance to a limited extent the usual mobility pattern, where only Moldovan researchers move abroad.

Efforts are ongoing to strengthen links to Moldovan researchers working abroad (scientific diaspora). A project funded by the Swiss National Science Foundation and another one funded by the EU and implemented by the International Organisation of Migration (IOM) try to link up emigrated scientists to colleagues in their former home country and facilitate short-term stays in the country.

##### 4.6.2 Mobility schemes for national researchers

Developing international cooperation and supporting cross-border knowledge circulation is one of the success stories of R&D policy making in the last years. Several bilateral funding schemes for support of R&D cooperation have been established since 2004 with relevant partner countries (Belarus, France, Germany, Italy, Romania, Russia, Ukraine, USA). In principle in these bilateral schemes, research projects are supported. But these do of course include support for mobility. With a few other countries (e.g. Austria, Poland, etc.) researcher mobility is facilitated at the level of Academies of Sciences through bilateral agreements.

## 5 CONCLUSIONS

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Research funding was marked by stagnation in 2012. The economy shrank 0.8% and R&D funding (GERD) stagnated at 0.4% as a share of GDP. In absolute figures GERD amounted to €22m as reported by the SCSTD. This constitutes a rather moderate investment in R&D activities.

However, in the year 2012 important reforms of the S&T sector were initiated. A new Centre for Fundamental and Applied Research Funding (CFCFA) became operational as an autonomous unit within ASM in spring 2012. It is an effort to separate research funding from policy-making and research performance, which is still concentrated in the ASM.

A reform package of the public S&T sector was proposed by the ASM in autumn 2012 and approved at government level in January 2013. Its key elements include improved project selection and evaluation: international experts will be more strongly involved in project evaluations for Moldovan funding programmes. Allocation of funding to research institutions will be based on performance criteria.

In the higher education sector, financial autonomy of universities was introduced with the beginning of 2013. The flexibility of finances comes at the price of cuts in public higher education funding. Priorities have been moved to lifelong learning and vocational training, for which public funding will be increased. A revised law on education is also under preparation under the auspices of the Ministry of Education. It is expected to contribute to strengthening research activities at the universities, which are traditionally focussed on education. Research performed at universities in Moldova remains low (11.6% of GERD in 2009), but it is increasing.

A draft innovation strategy was prepared by the Ministry of Economy, but has not yet been approved by the government. It is expected to contribute to stimulating the linkages between research organisations and business, which is indeed much needed. Measures were taken in this respect during 2012. New innovation incubators continue to be established with support of AITT and their number was brought to seven overall. Another incubator is planned for the town of Balti for 2013.

A problem in this context is that standard indicators for private sector R&D and innovation activities are not measured in Moldova (e.g. BERD). It is therefore difficult to assess the relevance and volume of research and innovation activities in business. Most observers state that it is in reality quite low. A discussion process has however started on bringing the Moldovan R&D indicators in line with standard indicators of EUROSTAT and the OECD.

A major success for S&T policy makers was the association of Moldova to the EU's Framework Programme 7 on 1 January 2012. This is not only relevant for the research sector, but also politically. It means the integration of Moldova in an important policy field at the EU level and underpins the Europe-friendly policy of the current coalition government, the "Alliance for European Integration". Moldovan representatives participate now in the relevant FP7 management committees and are

in regular contact with their colleagues from EU member states and other countries associated to FP7. A liaison office for fostering EU-Moldova S&T cooperation, the Moldovan Office of Science and Technology (MOST) was established in Brussels. New bilateral funding schemes for researcher mobility were launched with France, and in early 2013 with Estonia. Internationalisation policies are consequently followed-up in Moldova to integrate the scientific community in international networks and to give them access to up to date scientific infrastructure.

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## 7 LIST OF ABBREVIATIONS

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AEI	Alliance for European Integration
AGEPI	State Agency on Intellectual Property of the Republic of Moldova
AITT	Agency for Innovation and Technology Transfer
ASM	Academy of Sciences of Moldova
BERD	Business Expenditures for Research and Development
CERN	European Organisation for Nuclear Research
CFCFA	Center for Fundamental and Applied Research Funding
CIS	Commonwealth of Independent States
CNAA	National Council for Accreditation and Attestation
CNR	Italian National Research Council
COST	European Cooperation in Science and Technology
CRDF	US Civilian Research and Development Fund
EDU	Ministry of Education
ENPI	European Neighbourhood and Partnership Instrument
ERA	European Research Area
ERA-NET	European Research Area Network
ERDF	European regional development fund
ERP Fund	European Recovery Programme Fund
ESA	European Space Agency
ESFRI	European Strategy Forum on Research Infrastructures
EU	European Union
EU-27	European Union including 27 Member States
FDI	Foreign Direct Investments
FEN	National Environmental Fund
FP	European Framework Programme for Research and Technology Development
FP	Framework Programme
FP7	7th Framework Programme
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
GUF	General University Funds
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
ICT	Information and Communication Technologies
INCO	International Cooperation
IncoNet	S&T International Cooperation Network for Central Asian and South
CA/SC	Caucasus Countries

IncoNet	S&T International Cooperation Network for Eastern European and Central Asian Countries
EECA	
INFRA	Infrastructures
INTAS	International Association for the Promotion of Co-operation with Scientists from the New Independent States (NIS) of the Former Soviet Union
IOM	International Organisation of Migration
IP	Intellectual Property
IRSES	International Research Staff Exchange Scheme
MAIA	Ministry of Agriculture and Food Industry
MEC	Ministry of Economy
MEDIU	Ministry of Environment
MF	Ministry of Finance
MoU	Memorandum of Understanding
MRDA	Moldovan Research and Development Association
NATO	North Atlantic Treaty Organisation
NBS	National Bureau of Statistics
OECD	Organisation for Economic Co-operation and Development
PD	Democratic Party
PIECA	Innovation Park for Applied Research and Business Cooperation
PL	Liberal Party
PLDM	Liberal Democratic Party
PRO	Public Research Organisations
R&D	Research and development
RI	Research Infrastructures
RTDI	Research Technological Development and Innovation
S&T	Science and technology
SCOPES	Scientific co-operation between Eastern Europe and Switzerland
SCSTD	Supreme Council for Science and Technological Development
SEE-GRID	South East European GRID
SEERA-EI	South East European Research Area for eInfrastructures
SF	Structural Funds
SME	Small and Medium Sized Enterprise
SNF	Swiss National Science Foundation
STCU	Science and Technology Center in Ukraine
UIS	UNESCO Institute of Statistics
UNESCO	United Nations Educational, Scientific and Cultural Organization
VC	Venture Capital