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ERAWATCH COUNTRY REPORTS 2010: Moldova

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Moldova

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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 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 2010. 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 0.6% in 2009. As GDP is quite low, these indicators are in absolute figures rather moderate amounts and in 2009 it was equivalent to €22m. In this recent period several more 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.

The R&D system is marked by a centralised structure, where the Moldovan Academy of Sciences (ASM) fulfils the role 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.

Since a pro-EU government took office in 2009, politics in general and R&D policy too, are focussed on EU integration. Moldova aims at associating to the EU's Framework Programme for RTD (FP7), and the new government strategy of 2011 foresees enhanced competitive R&D funding, stimulation of business R&D, decentralisation of the R&D system, etc.

It appears 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 lets deduct that expenditure by the business enterprise sector, as well as R&D performance in this sector are 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, 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

some stimulation and funding instruments. Three technoparks and one incubator are operational for enhancing knowledge circulation. In addition, few offices were established at universities for dealing with technology transfer issues.

In spite of these efforts the links between public research organisations, universities and business are de-facto 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.

Cross-border knowledge circulation leads Moldovan researchers in first place abroad and emigration of qualified personnel continues to be a problem. Some success was although achieved since 2004 in establishing bilateral and multilateral cooperation programmes, which provide support for research within Moldova and for short term researcher exchange.

Knowledge Triangle

	Recent policy changes	Assessment of strengths and weaknesses
Research policy	- several competitive funding tools introduced since 2004	- competition introduced in the funding system - very low levels of R&D funding over the past 20 years, limited share of competitive funding (close to 15%) versus institutional funding; only few incentives for stimulating science-industry linkages available
Innovation policy	- funding tool 'Innovation and Technology Transfer Projects' introduced in 2006	- efforts to stimulate private investment in R&D and transfer of technology to the business sphere through co-funding requirement within the funding tool 'Innovation and Technology Transfer Projects' - public funding not accessible for private companies; innovation infrastructure and policy still in its infancy, low levels of private R&D funding and performance
Education policy	- enrolment rates for universities introduced in 2006	- high share of young pass through tertiary education - unattractive working conditions for researchers (low salaries, outdated equipment), emigration of skilled and qualified personnel abroad, overload of university staff with teaching duties
Other policies		

European Research Area

Assessment of the national policies/measures which correspond to ERA objectives¹

¹ Of course non-ERA countries do not strive to achieve ERA objectives. This part of the report is simply to allow a comparison with the activities of ERA countries on these issues

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses
1	Ensure an adequate supply of human resources for research and an open, attractive and competitive labour market for male and female researchers	- in 2006 enrolment rates for universities introduced;	- high tertiary graduation rate; possible undersupply for science & engineering - overall rather poor working conditions for researchers: low salaries, outdated infrastructure, migration of skilled people abroad
2	Increase public support for research	- public budget for R&D decreased in nominal value to €22m; also as percentage of GDP to 0.6% in 2009 (from a peak of 0.65% in 2007)	- increases of GERD realised, target of 1% although not reached yet - overall, low levels of R&D expenditure, affected by the crisis
3	Increase coordination and integration of research funding	- increases of GERD to 0.65% of GDP in 2007	- several competitive funding programmes introduced since 2004 - institutional and competitive funding allocation centralised with ASM; low share of close to 15% of competitive funding
4	Enhance research capacity	- enrolment rates for universities introduced in 2006	- high share of young pass through tertiary education - unattractive working conditions for researchers, emigration of skilled and qualified abroad
5	Develop world-class research infrastructures (including e-infrastructures) and ensure access to them	- competitive funding programme for equipment introduced in 2006	- stimulation measures for increasing investment in infrastructure taken since 2006 - over past 20 years very low investment in infrastructure and equipment
6	Strengthen research institutions, including notably universities	- government strategy 2011-2014: strengthening of university research	- university research is getting more important and shall be further strengthened - universities traditionally focussed on education; university staff overloaded with teaching duties
7	Improve framework conditions for private investment in R&D	- funding tool Innovation and Technology Transfer Projects introduced in 2006	- some efforts made to stimulate private investment through AITT - until now rather low private R&D investment as well as R&D performance

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses
8	Promote public-private cooperation and knowledge transfer	- two more incubators approved in 2011	- some efforts made to establish infrastructure for PPC (technoparks, AITT) - PPC and knowledge transfer still in its infancy; rather weak links between PROs, HEIs and business enterprise sectors
9	Enhance knowledge circulation	- AITT, technoparks, incubator established since 2004	- infrastructure and incentives for knowledge circulation established - infrastructure in its infancy still; weak links among HEIs, PROs and business
10	Strengthen international cooperation in science and technology	- a range of bilateral R&D cooperation programmes established since 2004	- success story in developing international cooperation; association negotiations to FP7 - cross-border knowledge circulation is mainly one way from Moldova abroad
11	Jointly design and coordinate policies across policy levels and policy areas, notably within the knowledge triangle	- AITT established in 2004	- some stimulation measures for knowledge triangle established: AITT, technoparks, incubators - quite weak links among education, research, and business R&D
12	Develop and sustain excellence and overall quality of research	- several competitive funding instruments established since 2004	- more competition introduced in R&D system - evaluations only by national experts within a limited researcher community; benchmarking not commonly used for policy making, complicated by lack of proper R&D statistics
13	Promote structural change and specialisation towards a more knowledge - intensive economy	- government strategy 2011-2014: energy and natural resources singled out as priorities	- some focus envisaged on relevant topics: energy, natural resources (agriculture) - knowledge demand from private business poorly to not considered in policy making; niches of excellence not systematically surveyed (e.g. through foresight)
14	Mobilise research to address major societal challenges and contribute to sustainable development	- government strategy 2011-2014: energy and natural resources singled out as priorities	- rather broad approach to scientific fields - limited focus of resources on niches of excellence and relevant fields; diversion of resources

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses
15	Build mutual trust between science and society and strengthen scientific evidence for policy making	- some PR efforts	- some PR efforts for building mutual trust - few usage of scientific evidence for policy making; lack of proper R&D statistics

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1 Introduction

The main objective of the ERAWATCH International Analytical Country Reports 2010 is to characterise and assess the evolution of the national policy mixes for the non EU countries in the perspective of the Lisbon goals and of the 2020, post-Lisbon Strategy even though they do not pursue these policies themselves. The assessment will focus on the national R&D investments targets, the efficiency and effectiveness of national policies and investments into R&D, the articulation between research, education and innovation,. In doing this, the 15 objectives of the ERA 2020 are articulated.

Given the latest developments, the 2010 Country Report has a stronger focus on the link between research and innovation, reflecting the increased focus of innovation in the policy agenda. The report is not aimed to cover innovation per se, but rather the 'interlinkage' between research and innovation, in terms of their wider governance and policy mix.

2 Performance of the national research and innovation system and assessment of recent policy changes

The aim of this chapter is to assess the performance of the national research system, the 'interlinkages' between research and innovation systems, in terms of their wider governance and policy as well as the most recent changes that have occurred in national policy mixes in the perspective of the Lisbon goals. Each section identifies the main societal challenges addressed by the national research and innovation system and assesses the policy measures that address these challenges. The relevant objectives derived from ERA 2020 Vision are articulated in the assessment for comparison reasons.

2.1 Structure of the national research and innovation system and its governance

This section gives the main characteristics of the structure of the national research and innovation systems, in terms of their wider governance.

The Republic of Moldova is a small country in Eastern Europe, situated between the much bigger Romania and Ukraine. It has an overall population of slightly more than 4 million. In comparison to Moldova the neighbouring countries Romania and Ukraine have 21.9 million and 45.1 million inhabitants (data for 2010). The country is split into a main territory controlled by the Moldovan Government and the much smaller breakaway region Transnistria. In the area controlled by the government are living 3.6 million of the population and slightly more than half a million live in Transnistria (including Bender). The latter one is governed by a separate local administration.

In the past 20 years Moldova has lost an important share of its research potential. Before independence in 1991 it had, as a part of the Soviet Union, a well-developed R&D sector. But the economic transition phase led to a marginalisation of R&D funding and a reduction in R&D personnel to a fifth of previous levels (from more than 25,000 to slightly more than 5000 in 2010).

Moldova is the poorest European country in terms of GDP per capita, which reached only 1,631\$ in 2010 (World Bank, 2011). 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. The economic crisis resulted in a 6% decline of GDP in 2009. But in 2010 the economy was back on a growth path and GDP was expanding strongly by 6.9%. It amounted herewith to Moldovan Lei 71.8 billion, which is equivalent to only €4.5b. Moldova spent in 2009 0.59% of GDP on R&D (GERD), which was equivalent to a moderate €22m.

Moldova has strived over the last years to reinforce cooperation with the EU, especially since a pro-European alliance took over government in 2009. Moldova is cooperating closely with the EU in the frame of the Eastern Partnership, which focuses on economic integration but covers among several other issues also cooperation on R&D and innovation. Moldova is trying to get associated to the EU's FP7, although participation in FP7 funded projects is in spite of increasing application

rates still very low. In its bilateral scientific cooperation, Moldova has tried to establish or re-establish cooperation with neighbouring countries (Romania, Ukraine), with major EU countries (Germany, Italy) and former main partners (Russia).

Main actors and institutions in research governance

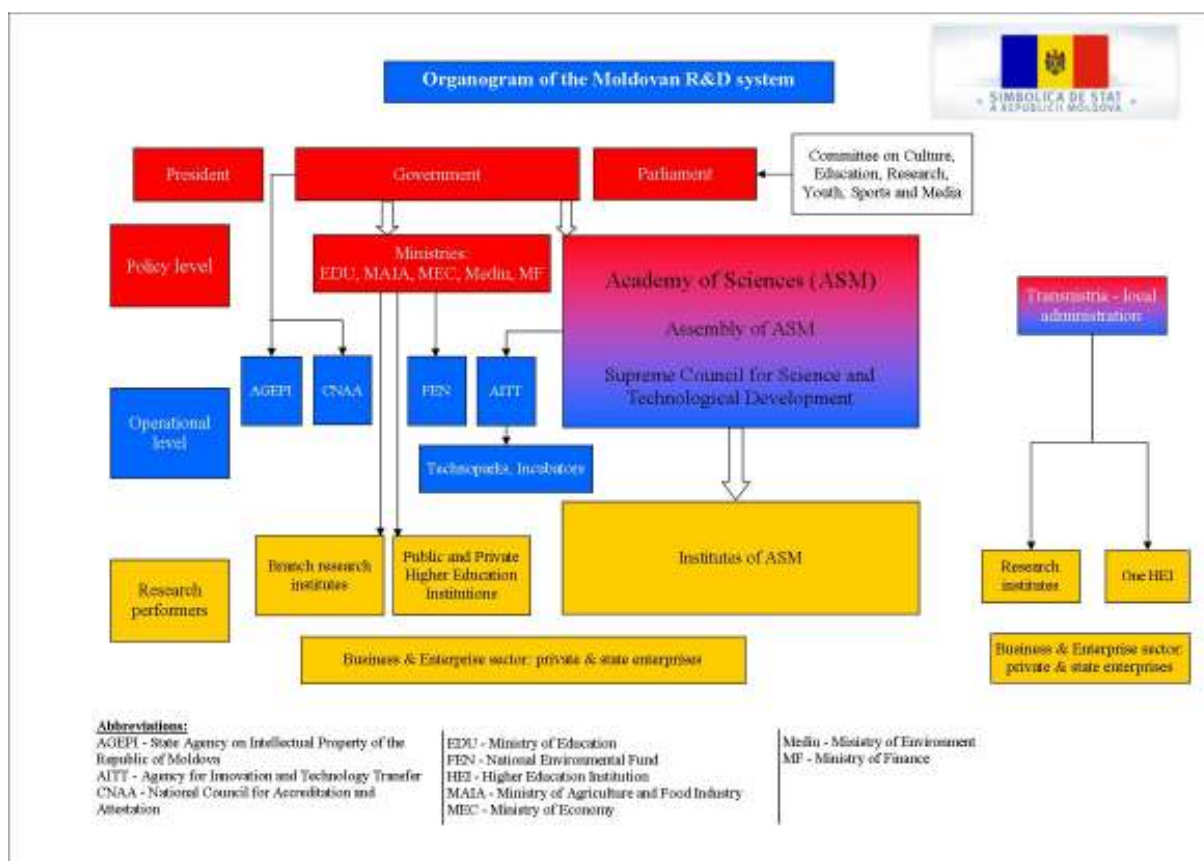
Moldova's R&D and innovation system is rather centralised, with the Moldovan Academy of Sciences (ASM) being the key player. It is the main policy-making institution and fulfils the role of a ministry of science. The president of ASM is a member of the government. The Moldovan Government approves the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

The academy is also the main policy implementation body; nearly all public R&D and innovation funding programmes are managed by the academy through its executive body, the Supreme Council for Science and Technological Development (SCSTD), or its subordinated agency, the Agency for Innovation and Technology Transfer (AITT). The academy is with its 19 research institutes also the main research organisation in the country.

An important role fulfils the National Council for Accreditation and Attestation (CNAA), which accredits research organisations in Moldova. Only accredited organisations are eligible for public R&D funding. The State Agency on Intellectual Property of the Republic of Moldova (AGEPI) takes care of protection of intellectual property.

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

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 54 organisations accredited in the years 2005-2010 by the CNAA to carry out research and development activities, only two were situated outside Chisinau, namely in Balti. The volume of R&D funding allocated to these two organisations from the state budget amounted in 2009 to about 3.5% of total funding for research projects and the share of R&D personnel of these organisations of the overall Moldovan R&D personnel was similar (ASM Annual Report, 2009). The location of higher education institutions accredited by the Ministry of Education confirms this concentration of capacities in the capital. Only six of the 30 accredited Moldovan universities are located outside Chisinau: in Balti, Cahul, Comrat, Taraclia. 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.

According to the Moldovan Code on Science and Innovation, local authorities may fund regional R&D and innovation programmes and projects from their budget and can create 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.

Nevertheless, some specific examples of regional support measures for R&D exist. 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 - 73.4% of GERD in 2007 - 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 - 15.5% and 11.1% respectively in 2007 (UIS, 2011).

- The governmental sector is composed mainly of 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 9 of them subordinated to the Ministry of Health and six 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 30 universities accredited by the Ministry of Education, including 17 state and 13 private universities. CNAA has accredited 15 universities, including 12 state and three private universities as R&D performing institutions.
- The National Bureau for Statistics (NBS) recorded for the year 2008 the following figures related to the business enterprise sector: six 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 official figures are far from complete.

Recent trends show a strengthening of the role of R&D in higher education institutions, improvements of the innovation infrastructure (e.g. via recently established technoparks) and measures to enhance business R&D.

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

2.2 Resource mobilisation

This section will assess the progress towards national R&D targets, with particular focus on private R&D and of recent policy measures and governance changes and the status of key existing measures, taking into account recent government budget data. The assessment will include also the human resources for R&D. Main assessment criteria are the degree of compliance with national targets and the coherence of policy objectives and policy instruments.

2.2.1 Resource provision for research activities

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 have succeeded to change the trend and to increase funding only as of 2003, when GERD as a share of GDP started to rise from levels of 0.3%.

GERD reached a peak with €24.3m in absolute figures in 2008, which was equivalent to 0.6% of GDP. As a share of GDP it had attained the peak already in the previous year 2007 with a value of 0.65%. 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 and GERD decreased in 2009 reaching an amount of €22m. GERD as a share of GDP was hence equivalent to 0.59%, which is substantially lower than in EU countries. The budgetary cuts can be illustrated with the planned budgetary expenditures for R&D in 2009: the government had approved €30.3m for R&D activities, but allocated only €19.9m (Moldovan Ministry of Finance, 2010).

In the analysis of the cited figures, it needs to be considered that for Moldova only fragmented data on R&D funding and on performance of R&D are available. 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 80% of public R&D funding is allocated through block funding/institutional funding in a non-competitive mode. Competitive funding makes up close to 15% and other funding modes around 5%. 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, but its share shows an upward trend.

R&D and innovation funding is dominated by the public sector, while business-enterprises contribute only a limited share; exact statistics are although not yet collected on the business-enterprise sector. Co-funding from the business sector is stimulated through the AITT funding instrument "Innovation and Technology Transfer Projects", where usually a contribution of 50% of the project budget from private sources is required.

The distribution of public R&D funding on thematic priorities in 2008 (ASM annual report) shows that most funding was invested in the fields of agriculture & food, nanotechnologies & new materials (physics/chemistry) and in use of natural resources & environment & ICT.

<i>Priority</i>	<i>% of total financing, 2008</i>
Consolidation of the State of Law and utilisation of cultural heritage with the perspective of European integration	9.9
Efficient utilisation of human, natural and information resources for sustainable development	21.8
Biomedicine, pharmaceuticals and human health	16.2
Agricultural biotechnology, soil fertility and food security	26.3
Nanotechnology, industrial engineering, new materials and products	22.5
Efficient development of the energy sector, assurance of energy security, including the use of renewable resources.	3.3

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 2009 in the amount of about €0.95m (13.4 million Transnistrian Roubles) or 0.8% of the budget expenditures of the region. More than 50% of this budget was performed in the governmental sector and around 40% in the single higher education institution.

The Moldovan Government (2011), which took office in January 2011, has envisaged important reforms of the R&D and innovation system in its government programme. Research in higher education institutions, as well as the interaction of research with business shall be strengthened. Governmental R&D funding shall be decentralised and opened to all R&D and innovative organisations, beyond the currently accredited research organisations. The research fields energy and natural resources are grand challenges in Moldova and have been singled out for specific stimulation with funding instruments.

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.: 0.53% were specified for 2010).

For linking R&D and innovation policy to society and to build mutual trust, few efforts have been made so far. ASM undertakes some PR efforts, such as press releases and conferences, participation in public debates, open days of some scientific and educational institutions, etc. 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 still in a planning phase.

2.2.2 Evolution of national policy mix geared towards the national R&D investment targets

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 it can be estimated that R&D funding and performance of the business enterprise sector is quite moderate in comparison to EU countries. Data of the UNESCO Institute for Statistics (2011) show that the business enterprise sector performs slightly more than 15% of R&D (15.5% in 2007). There are several reasons for this situation: During the years of economic transformation, companies reoriented on non-innovative activities. Now they are still in a situation of scarce financial resources for R&D and innovation, but they are furthermore lacking adequate personnel. And the state is not in a position to provide substantial incentives for business R&D.

There are obviously some companies performing R&D in Moldova, but their activities are difficult to trace. The National Council for Accreditation and Attestation has accredited only two state enterprises as research organisations, which gives them access to competitive public R&D funding. What concerns 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.

Main barriers and risks to private investment in R&D

Available data indicate that R&D and innovation are overwhelmingly funded from public resources, while the private sector contributes only a very limited share.

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.

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.

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.

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.

Only few incentives for stimulating private R&D investment are in place and they exert only a limited impact. Tax incentives are one stimulation instrument, but which applies only to few companies situated in technoparks and one incubator. Another instrument is Innovation and Technology Transfer Projects supported by AITT. These projects provide a certain incentive to involve and raise private funding. But private companies cannot receive public R&D funding in Moldova, as they would have to be accredited with CNAA. None is accredited yet, but a reform of this situation is at least envisaged in the governmental programme 2011.

A coherent national R&D and innovation strategy is not yet available; moreover a lack of foresight and planning of overall national objectives is characteristic of the situation. Procurement policies of technologies are not yet used for providing R&D related incentives and a favourable legal environment 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 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. It requires though the companies to fund 50% of the project cost.

The second tool is tax incentives introduced in 2007 for residents (including companies) of technoparks and one incubator. The following tax incentives apply for residents:

- exemption from payment of VAT (20%) on goods and services imported from abroad and on those bought in the Republic of Moldova;
- exemption from payment of customs taxes (5%) on imported goods and services;
- exemption from payment of income tax.

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 is stimulated through the “State Programme to support the development of SMEs” for 2009-2011. Business incubators are considered a key instrument for establishing new businesses, including R&D intensive ones, and for promoting public-private cooperation. A network of business incubators is planned, and consequently two more incubators shall be set up with support of AITT as of 2011.

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 establishing 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"). As result of its implementation, the following was achieved:

- the system of authorisations for initiating entrepreneurial activities was optimised and so-called “one-stop shops” established - the duration of registering a company was herewith reduced from 28 days in 2004 to five days at present;
- the financial and statistical activity reports were simplified;
- the list of business types subject to licensing was reduced.

In 2007 the Moldovan Parliament approved a set of amendments to several laws relevant for economic activities. Among other measures a zero income tax was introduced that applies for company profits, which are not distributed in the form of dividends.

2.2.3 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.

The Moldovan R&D personnel has declined from 25,200 in 1990 to around a fifth of this level 20 years later. This was caused by a sharp reduction in R&D spending during this period, which led, as a consequence, to a very low remuneration of the R&D personnel.

In 2009 the R&D personnel amounted to 5,424 in head count (National Bureau of Statistics, 2011b), out of which 3,561 were researchers. This was a slight increase on previous years and showed a certain reversal of the shrinking trend. The data are underestimated though, as official statistics do not consider R&D personnel in the private enterprise sector. According to UNESCO (2011) data there were 1.83 researchers per thousand labour force in 2007 and 1.92 researchers per thousand

total employments. In addition, the human resources of Transnistria have to be considered, which amounted to 545 R&D personnel, including 380 researchers.

Migration of skilled people abroad, because of shortage of adequate jobs and low salaries, and an ageing of the R&D personnel are 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. In regard of 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 education is valued very high in Moldova, which is similar to other countries of the Former Soviet Union. Consequently, a high share of the population graduates from tertiary education. A significant trend in this context is though a strong re-orientation on social sciences. 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 changed. While in 1990 every second researcher was engaged in technical sciences, in 2010 it was only every fifth.

The educational approach in higher education institutions is still rather traditional and not sufficiently targeted at the needs of the private sector. Enterprise representatives and economic stakeholders do in reality 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).

2.3 Knowledge demand

This section focuses on structure of knowledge demand drivers and analysis of recent policy changes.

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. A certain thematic focus has been put therefore on agriculture, energy, nanotechnology and materials. The Moldovan government has outlined the topics energy and natural resources in its programme of January 2011, which shall be supported specifically and which are set to gain in relevance consequently. Both 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.

Sustainable development in economic terms and environmental issues are also relevant. Economic development is not so much tackled yet from an R&D point of view, but with practical measures to stimulate company development and administrative facilitation of business activities. Sustainable use of resources and environmental research receives a relevant share of funding (see section 2.2.1 Resource provision for research activities). The National Environmental Fund (FEN) 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).

2.4 Knowledge production

The production of scientific and technological knowledge is the core function that a research system must fulfil. While different aspects may be included in the analysis of this function, the assessment provided in this section focuses on the following dimensions: quality of the knowledge production, the exploitability of the knowledge creation and policy measures aiming to improve the knowledge creation.

2.4.1 Quality and excellence of knowledge production

The limited available resources in Moldova have obviously repercussions on the quality and excellence of knowledge production. When Moldova became independent some 20 years ago, GERD dropped strongly and only in the recent years up to 2009 it was rising to levels of around 0.6% as a share of GDP. In absolute figures these are modest financial resources, e.g. in 2008 this was equivalent to an amount of €24.3m, which was already the double of 2006. The R&D personnel declined in the period since 1990 drastically from 25,200 to around a fifth of this level 20 years later. Qualified R&D personnel emigrated abroad or moved to other sectors of the economy. The low R&D investment did not allow to significantly upgrade existing research infrastructure, let alone funding of more substantial new equipment or research infrastructure.

In the period 2006-2010, the Moldovan R&D system has produced about 7800 articles in national journals, 4900 articles in journals abroad and more than 1000 patents (SCSTD, 2010). However, these results are poorly recognised internationally. Thus, in the Scopus database in the period 1996-2009 only 3347 documents of Moldovan researchers are listed, which ranks Moldova on 93 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 not high: 94th place by the number of articles and 129th by the number of citations of an article. According to the number of publications per million inhabitants Moldova ranks 86, 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, most articles published by Moldovan authors or co-authors in the ISI-Web of Science are in the following areas (in decreasing order): physics, chemistry, materials science, engineering, mathematics and computer sciences. Another important research field is agricultural sciences, where the country disposes of several specialised research institutes. Furthermore significant shares of the national R&D budget are spent on research in the fields environment and health.

The number of patent applications of Moldovan researchers is relatively high as compared to the size of the population and the economy. This can be explained by the relatively low costs for registering a patent with 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 a 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 researchers. The main explication of this situation seems to be, though, the low applicability of registered inventions,

determined by the profile of the Moldovan economy, 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 2007, only three patent applications from Moldova were submitted to the European Patent Office, and only two patent applications to the United States Patent and Trademark Office. This can be explained by the high costs of registration and by the fact that Moldovan researchers working abroad or in collaboration with foreign partners are rarely listed as first inventor (but which is relevant for the country allocation).

2.4.2 Policy aiming at improving the quality and excellence of knowledge production

Procedures for improving the quality and excellence of knowledge production were introduced in Moldova only in the last years. The culture of evaluation, monitoring and international benchmarking is therefore still weakly developed, but is in the process of being strengthened.

Competitive R&D and innovation funding based on evaluations has been introduced, starting mainly from 2004. 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 were used. Moldova has though concluded several bilateral funding programmes with international partners, which involves some international expertise of projects submitted in these programmes.

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 doctors², allocating at least 20% of its budget for the procurement of equipment and for mobility, and editing a scientific journal. Criteria applied for evaluating research 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 operationalised as quantitative and qualitative indicators that cover the whole range of R&D activities of an organisation.

Moldovan research programmes are mainly evaluated ex-ante and during their implementation. According to the legislation, all competitive R&D and innovation funding programmes, as well as 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 pseudo-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;

² Habilitated doctor is a scientific degree at postdoctoral level used within Moldova.

- 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 for verifying the quality of knowledge production: 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. The reports and subsequent hearings generally assess the scientific results, but not the overall effectiveness of a certain programme. These generated evaluation data are underutilised however in subsequent decision-making.

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.

2.5 Knowledge circulation

This section provides an assessment of the actions at national level aiming to allow an efficient flow of knowledge between different R&D actors and across borders.

2.5.1 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 are not very conducive to innovation activities. Moldova has only a limited number of innovative companies. R&D expenditure of business is rather low and strained public budgets leave not much room for stimulation measures. Migration of qualified personnel abroad poses another problem in this context. Research in universities is traditionally weaker than in the academy and research institute sector, however, it is a policy goal to enhance research in universities and to improve its linkages. Policy makers have strived to improve the situation over the last years and a few actions have been taken to stimulate knowledge circulation.

In 2004 the Moldovan Agency for Innovation and Technology Transfer (AITT) was established. Its approach is to stimulate know-how transfer and to support the implementation of research results generated at HEIs and PROs in the business sector. AITT's main funding tool is "Innovation and Technology Transfer Projects", for which it makes a budget of around €0.5m per year available. 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 by problems to attract project partners and co-funding from the private sector. Moreover, 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 technoparks and one innovation incubator operating in Moldova. In early 2011, two additional incubators were selected for support by AITT and will be set up over the coming years. Only few universities (e.g. Technical University of Moldova) have yet 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, the "TOPAZ" company, a technopark and the only already operational Moldovan Innovation Incubator are part of the cluster. Companies situated in the technopark and incubator are not defined as members of the cluster, but may participate in its activities. The cluster is thematically open. It shall allow for cooperation among research and education institutes, state and private sector, commercial associations and other entities, and contribute herewith to the training and development of the scientific personnel. But until now it is more a formal structure with limited practical impact.

2.5.2 Cross-border knowledge circulation

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, Germany, Romania, Russia, Ukraine, USA). With a few other countries (e.g. Austria, Poland, etc.) researcher mobility is facilitated at the level of Academies of Sciences through bilateral agreements.

At the multilateral level, Moldova tries to intensify cooperation with the EU through an association to the Framework Programme for RTD. Negotiations on a Memorandum of Understanding (MoU) on this possible association have been successfully concluded and it is expected that, following ratification of the MoU, Moldova will be associated to FP7 from 1 January 2012. But it needs to be stated that participation of Moldovan researchers in research projects within the FP7 is in spite of increasing application rates still very low. Moldova uses also other EU related multilateral cooperation schemes for cross-border knowledge circulation: this concerns the Black-Sea ERA.Net or participation in EU funding programmes under the Structural Funds and the European Neighbourhood and Partnership Instrument (ENPI). Previously, up until 2010, mobility of Moldovan researchers and young researchers was supported through projects funded under the European INTAS³ programme.

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 FP7.⁴ These

³ INTAS stood for International Association for the promotion of co-operation with scientists from the New Independent States of the Former Soviet Union. It was part of the FP6 and of previous EU framework programmes for RTD. INTAS was wound up in 2010.

⁴ See for example: <http://www.see-grid.eu/> and <http://www.seera-ei.eu/>

connections are highly relevant for the country and facilitate obviously 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.

Mobility of researchers is mainly a one-way pattern of Moldovan scientists moving and emigrating abroad. To make use of this Moldovan scientific potential abroad, two internationally funded projects try to link it up with the scientific community in their former home country, for example through funding of short-term research stays in Moldova. Researchers working in Moldova get support for mobility above all within the bilateral funding programmes mentioned above.

2.5.3 Main societal challenges

Thematic priorities at the national level and for international cooperation are defined rather broadly in Moldova. Because of the aspirations to become associated to the FP7, the thematic priorities of the FP are getting increasingly important. But priorities depend also on the R&D capacities available in the country, where especially the fields agriculture, food processing, physics, chemistry, ICT, mathematics and materials may be mentioned.

The Moldovan government has outlined the topics energy and natural resources in its programme of January 2011, which shall be supported specifically and which are set to gain in relevance consequently. Both topics are major challenges for Moldova, which shall be tackled via R&D. Regarding energy, Moldova aims at reducing dependence on energy supply from Russia, and usage of natural resources shall be supported to better use the agricultural potential of the country for economic development. Environment is also a relevant issue in this context, but is dealt with mainly from a practical point of view (see section 2.3 Knowledge demand).

2.6 Overall assessment

Table 1: Summary of main policy related opportunities and risks

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	<ul style="list-style-type: none"> - increase of public R&D funding in the period 2006-2010 - enhancing of support for business R&D foreseen in government programme 2011-2014. 	<ul style="list-style-type: none"> - persisting low R&D funding by private sector - limited incentives for private investments in R&D; - missing of 1% target GERD as a share of GDP by 2011 - insufficient efforts for preventing 'brain drain' of highly skilled labour - ageing of scientific personnel and diminishing of the number of

		researchers in some research fields
Knowledge demand	<ul style="list-style-type: none"> - increasing awareness towards the importance of R&D and innovation for competitiveness and welfare - government programme 2011-2014 defines energy and natural resources as priority - measures of AITT to identify business community requirements - national foresight exercise envisaged 	<ul style="list-style-type: none"> - lack of clear strategic research priorities of research system, developed with the participation of all relevant actors involved in the country's innovation system - private demand for R&D is constrained by an orientation on low-tech production - insufficient orientation of the research organisations to the economic and social needs of the country - lack of adequate human resources to meet goals of applied research and innovation activities
Knowledge production	<ul style="list-style-type: none"> - various financial schemes to increase quality of the scientific production introduced (grants, awards, projects for upgrading research infrastructure etc.) - efforts for improving the system of quality assessment of knowledge production. 	<ul style="list-style-type: none"> - low level of allocation of public funding for R&D projects on a competitive basis (close to 15%) - Restricted access to public R&D funding for universities and private enterprises - limited international relevance of Moldovan research results - evaluations usually by national experts in competitive programmes is problematic considering the small size of the scientific community
Knowledge circulation	<ul style="list-style-type: none"> - development of schemes and infrastructure to connect academic and business communities foreseen - perspective of association of Moldova to the EU's 7th Framework Programme for RTD (FP7) - bilateral and multilateral programmes for cross border knowledge circulation established - attracting emigrated Moldovan scientists to 	<ul style="list-style-type: none"> - focusing of the Moldovan universities on education and less on research - weak linkages between universities, public research organisations and business - low absorption capacity of R&D results by the enterprise sector - intermediary instruments to facilitate knowledge circulation between the universities, PROs and business sectors still in its infancy - low mobility of human

	work with colleagues in their former home country	resources between public R&D sector and companies combined with migration of qualified personnel abroad
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Table 2: Main barriers to R&D investments and respective policy opportunities and risks

Barriers to R&D investment	Opportunities and Risks generated by the policy mix
Lack of a coherent national research strategy with clear priorities to focus resources on	<p>O: Planned foresight exercises should help to develop a national R&D strategy</p> <p>R: Diversion of funds on a broad range of scientific fields</p>
Lack of an incentive framework for private investments in R&D	<p>O: Private co-funding for Innovation and Technology Transfer Projects of AITT; fiscal incentives for residents of science and technology parks; exemption from customs duties for research organisations; measures announced by the government, including decentralisation of research funding;</p> <p>R: Poor response to these initiatives from the side of the private sector; slow administrative system; lack of public support of R&D activities carried out in enterprises</p>
Structure of economy and FDI distribution	<p>O: Government actions in compliance with the European Charter for Small Enterprises, such as the State Programme to support the development of SMEs for 2009-2011</p> <p>R: Lack of qualified personnel, due to inadequate education and training; migration of skilled abroad; lack of important foreign companies conducting R&D activities in the Republic of Moldova</p>
Weak cooperation between research organisations, universities and business	<p>O: Efforts to establish and strengthen cooperation between R&D institutions and business companies (technoparks, etc.)</p> <p>R: Low knowledge absorption capacity of industry, focus on trading and low-tech products; support tools to stimulate cooperation still in a nascent phase; lack of procedures, which would favour public procurement of innovative goods and services; rather limited support tools for start-ups and spin-offs</p>
Low innovation culture	<p>O: Pro-European reforms envisaged by the government and take over of good practice during an EU rapprochement process; increased awareness among policy makers of importance of R&D for economic and social development</p> <p>R: Low orientation of the R&D organisations towards the needs of society and the application of knowledge;</p>

	weak knowledge of innovation management in companies; reluctance of companies to take risks for R&D
Economic and financial crisis	<p>O: Orientation of some public organisations and companies towards new scientific solutions</p> <p>R: Missing the goal of 1% of GDP for R&D</p>

3 National policies which correspond to ERA objectives

3.1 Labour market for researchers

3.1.1 Stocks and mobility flows of researchers

In 2009 the R&D personnel amounted to 5,424 in head count, out of which 3,561 were researchers (National Bureau of Statistics, 2011b). This was a slight increase on previous years. The data are underestimated though, as official statistics do not consider R&D personnel in the private enterprise sector. According to UNESCO data (2011) there were 1.83 researchers per thousand labour force in 2007 and 1.92 researchers per thousand total employments. In addition, the human resources of Transnistria have to be considered. These were 545 R&D personnel (in head count), including 380 researchers. During the economic crisis, which also hit Moldova in the years 2008-2010, the number of researchers has remained relatively stable.

With regard to mobility no precise data on flows of researchers are available. In general, Moldova has the problem that skilled people have left and still leave the country. Most important migration flows of Moldovan researchers were registered in the 1990s, which 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.

Mobility of researchers is stimulated mainly through international projects, especially through the bilateral R&D funding and exchange schemes, which have been put in place by the academy with certain countries. Moldova has lifted in 2007 visa procedures for EU citizens to facilitate exchanges, including researcher mobility.

3.1.2 Providing attractive employment and working conditions

The employment and working environment for researchers is not very attractive. It is marked by low salaries, as well as outdated infrastructure and equipment. In fact, it needs either quite 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 in the period 2004-2008 about four times (ASM Annual Reports), the average monthly salary of a scientific collaborator in a public research organisation was a moderate €190 in 2009 (ASM Annual Report, 2009). In comparison, the average monthly salary in Moldova was in the same year €170 (National Bureau of Statistics, 2011a). 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 have usually a rather high degree of flexibility in setting the level of salaries for their academic staff. Thus, 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 obviously helped bring the leading research groups through the difficult times of economic transition in the past 20 years, with providing 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. 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, solid impact studies on the results generated by these programmes are missing.

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 44.5% of doctors of science, their share falls significantly to 15.5% among habilitated doctors. Within the academy, the share of women is quite low: in the ASM Assembly women make up only 6% of members and among the members of ASM women count only for 2%. The situation is better among rectors of universities and in the supreme council of ASM (SCSTD), where women represent 23%.

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, although, in practice protected, as 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 anyway not be necessary, taking into account the barely tempting 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.

3.1.4 Meeting the social security and supplementary pension needs of mobile researchers

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.

3.1.5 Enhancing the training, skills and experience of researchers

The doctoral and postdoctoral (habilitated doctors) education is overseen in Moldova by the National Council for Accreditation and Attestation. It is implemented in a traditional way and no specific doctoral schools or training programmes are available. But a competitive funding programme 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 as well as it is financially important.

3.2 Research infrastructures

Research infrastructures (RIs) are a key instrument in the creation of new knowledge and, by implication, innovation, in bringing together a wide diversity of stakeholders, helping to create a new research environment in which researchers have shared access to scientific facilities.

3.2.1 National Research Infrastructures roadmap

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. 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 56 projects were approved with a financial volume of more than €1.5m (SCSTD, 2011). 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 for mobility and the purchase of equipment. And since 2006 for accredited research organisations the import of equipment has been exempt from customs duties. Furthermore, international R&D cooperation programmes facilitate access to modern infrastructure.

Overall, in the period 2006-2010 €6.7m of governmental funding were spent on procurement of scientific equipment (SCSTD, 2011). Because of the actions implemented, the spending volume for the purchase of scientific equipment increased during 2006-2010 almost seven times as compared to the years 2001-2005. The evolution of these expenditures 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
€	578,025	1,700,488	2,351,100	996,056	1,117,544
share of GBAORD (estimate), %	5.2	9.7	10.5	5.0	5.7

Source: SCSTD, 2011

As examples of research infrastructure development in the last period can serve 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

This section gives an overview of the main features of the national higher education system, assessing its research performance, the level of academic autonomy achieved so far, dominant governing and funding models.

3.3.1 Quality of National Higher Education System

The Moldovan Ministry of Education lists overall 30 accredited universities in the country, including 17 state and 13 private universities. The number of enrolled students reached around 108,000 in the academic year 2010/11, out of which 89,000 students are enrolled in public universities and 19,000 in private ones. There are 303 students per 10,000 inhabitants. In 2010 about 28,000 students graduated from Moldovan universities. The number of doctoral students is about 1600 (2009). And finally the teaching staff of universities is around 6,500 persons (2010/11).

The number of students in Moldova increased continuously until 2006/2007 to 128,000 students (Data: National Bureau of Statistics, 2010a). Since this peak it has been decreasing, because in 2006 the government introduced enrolment rates for all universities. 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.

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 13,000 students and 75 PhD students.

The universities are in its mission quite 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. Even so, the university sector contributes about one third of Moldovan researchers, who have published in journals included in ISI and about two fifths of patent applications filed. Only few Moldovan universities participate in projects supported under multinational funding programmes. In 15 projects with Moldovan partners, which were supported under FP7, there are only two teams from the Technical University of Moldova represented. But the share of university teams is more important in projects supported under COST and under EU structural funds programmes. (See section 3.5.1 National participation in intergovernmental organisations and schemes).

The National Council for Accreditation and Assessment has accredited 15 universities as R&D performing institutions, including 12 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. According to calculations based on the ASM annual report (2009), seven universities received an amount of €2.1m for research projects from the state budget. This is equal to around 10% of Gross Domestic Expenditure on R&D (GERD). 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), which states that autonomy refers to areas such as governing, structure and functioning of the institution, teaching and scientific research, management and funding. De-facto the autonomy is 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 the 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.

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 shall be composed of representatives of the didactic and scientific staff - 75%; students and PhD students - 15%, 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 2010 provided for higher education an amount of €58.3m and for post-university education € 5.1m (Law on state budget for 2010, 2009). 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 though from tuition fees paid by students. Thus, 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.

Universities are also funded from the state budget for science (the universities receive a little more than 10% of this funding - €2.1m, in 2009 (ASM report, 2009). However, only seven of the 15 universities accredited for R&D activities have benefited in 2009 from this funding. 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 CNAA, may receive public funding through competitive funding programmes of 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 (institutional funding for these institutes is around 90%). 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;
- establishment of the National Fund to support scientific research;
- development of partnerships between higher education, R&D sphere and the business enterprise sector, including related research funding.

3.4 Knowledge transfer

This section will assess the national policy efforts aimed to promote the national and trans-national public-private knowledge transfer.

3.4.1 Intellectual Property 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.

There are only few Knowledge Transfer Offices (KTOs) operating in Moldova, in particular at leading universities. These offices are not yet full-fledged KTO's, and do not manage actively IPR, 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 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. (See for more details regarding this cluster in section 2.5.1 Knowledge circulation between the universities, PROs and business sectors).

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 here be necessary too, as only a limited number of patents is maintained after a five year tax remission period ends. (See also section 2.4.1 Quality and excellence of knowledge production.)

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 programme "Innovation and Technology Transfer Projects" needs to be mentioned. Besides, AITT organises business plan competitions, runs a virtual innovation marketplace, etc.

Three Technoparks, one Incubator 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. Two more incubators shall be established as of 2011.

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

Involvement of private sectors 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 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.

Cohesion policy

EU Structural Funds are a cooperation tool with some R&D and innovation related funding activities relevant for Moldova. The country participates in the EU's transnational regional support programme South-East Europe. Moldovan institutions (e.g. Moldova Technical University) participate in 5 projects out of 40 overall supported projects within this programme. The projects with Moldovan participation are mostly environment related and provide for some linkages between research organisations and companies.

Two more EU cross-border cooperation programmes with neighbouring countries are relevant for Moldova: the Romania-Ukraine-Republic of Moldova Cross Border Cooperation and the Black Sea Cross Border Cooperation. These programmes are managed under the European Neighbourhood and Partnership Instrument (ENPI), but follow an approach quite similar to programmes under the structural funds.⁵ Only little information on projects supported under these cross-border programmes has been published until now (July 2011). Roughly 10-20% of projects seem to have relevance for R&D and innovation and involve research organisations. It remains to be seen, how far these two programmes will provide support to R&D and innovation in Moldova.

3.5 Cooperation, coordination and opening up of national research programmes with the EU

3.5.1 National participation in intergovernmental organisations and schemes

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.

Moldova has expressed its interest in the association to the FP7 and negotiations on this association have been ongoing since 2010. Provided an already agreed Memorandum of Understanding will be ratified, Moldova will be associated to FP7 from 1 January 2012. Currently, Moldovan researchers and research teams can participate in FP7 projects as so-called "third country" partners and receive EU funding. Since the FP7 was launched, 109 project proposals with participation of Moldovan research groups were submitted and 20 accepted for funding. Project participants include research institutions, higher education institutions, SMEs and NGOs. The breakdown of funded projects by specific programme was as follows: Health – 2; ICT – 1; Transport – 1; Environment – 1; Research Infrastructures (INFRA) – 4; SMEs – 1; International Cooperation (INCO) – 4; People Programme (Marie Curie) – 6 (data of July 2011, European Commission).

The COST annual report 2009 listed five actions with Moldovan partners: the State Agricultural University of Moldova participated in three actions on forestry, the

⁵ Project participants from EU Member States are funded by structural funds and participants from Moldova by ENPI.

Technical University of Moldova participated in one action on Materials and Nanosciences, and the Public Association “Our Home - Chisinau” was involved in an action on media transformation.

Moldova is involved in FP7 funded international networking projects for the 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). 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 so far in the call 2010. The project helps improving the capacities of leading nanotechnology research groups (at the Academy of Sciences and the Technical University of Moldova),⁶

Another relevant multilateral forum for R&D cooperation is the Science and Technology Center in Ukraine (STCU). This international organisation operates with resources provided by the EU (via Europeaid), the USA and other international partners and supports R&D projects in Ukraine, Moldova and other countries of the former Soviet Union.

Until 2010 substantial R&D cooperation between EU countries, countries associated to the FP6 and Moldova was supported through the European INTAS programme. INTAS supported small scale multilateral research projects, grants for young scientists, summer schools, etc. and implemented in 2005 a jointly funded call with the Academy of Sciences. INTAS was winded-up in 2010.

3.5.2 Bi- and multilateral RDI agreements with EU countries

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. Most of them do not have though 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 Germany and Romania, and a new programme is envisaged with the Italian National Research Council (CNR). 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 Austria, Bulgaria, Czech Republic, Hungary, and Poland. An agreement was also concluded with the Royal Society of the UK.

Joint R&D funding programmes with countries of the former Soviet Union were established by the Academy with Russia, Belarus and Ukraine. These programmes for support of R&D projects are implemented with the Russian Foundation for Basic Research, with the Russian Foundation for Humanities, the Belarusian Republican Foundation for Fundamental Research, and the Ukrainian Ministry of Education and

⁶ See <http://mold-era.eu/>

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 is since the beginning of the 1990s actively supported through local offices of American R&D support funds. Projects are jointly funded with the US Civilian Research and Development Fund (CRDF) and its local representation, the Moldovan Research and Development Association (MRDA).

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

3.5.3 Other instruments of cooperation and coordination between national R&D programmes

Regarding participation in ERA.Nets, Moldova is involved in the regional Black Sea ERA.Net. Moldova cooperates here with partners, which are mainly R&D and innovation funding organisations from Armenia, Azerbaijan, France, Georgia, Germany, Italy, Romania, Turkey, and Ukraine. The partner from Moldova is the Academy of Sciences, which participates with a funding contribution in a pilot joint call for R&D projects of this ERA.Net. The pilot call was closed on 14 January 2011 and 56 project proposals were found eligible. Only one of these project proposals is coordinated by Moldova, whereas the majority of coordinators are from Romania (23), Germany (10) and Greece (9). The evaluation of the project proposals shall be concluded until end of May 2011 and implementation of projects selected for funding start in autumn 2011.

3.5.4 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.

De-facto there are 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, teaching overload in universities, etc. 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 low salaries that result of it. There are although efforts ongoing to strengthen links to Moldovan researchers working abroad.

3.6 International science and technology cooperation

3.6.1 International cooperation (beyond EU)

International R&D cooperation 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. While international cooperation was implemented in the 1990s in a support mode for Moldova through organisations such as the US based CRDF or the European INTAS programme, then since 2004 it has switched more to a jointly funded approach, where also Moldova raises some financial resources. Since 2004

these activities have been developed significantly, especially through bilateral funding programmes, and it is one of the success stories of Moldovan R&D policy making of the last years.

The priority on cooperation is multilaterally clearly on the EU, and on the bilateral level with some of its member states (Bulgaria, Germany, Romania, Poland, etc.). Another regional focus has been put on major partner countries within the former Soviet Union: Belarus, Russia, and Ukraine. Long-standing cooperation is in place with the USA. China and Turkey are also partners of interest.

Scientific fields in the international cooperation are defined mostly broadly.

What concerns Transnistria, its limited R&D capacities are focused on cooperation with Russia. The Transnistrian university takes part in the Russian higher education system and has cooperation agreements with Moscow State University and other Russian universities.

3.6.2 Mobility schemes for researchers from third countries

There are no funding schemes in place to attract foreign researchers to work in Moldova. Through bilateral funding programmes, which Moldova has concluded, foreign researchers come for short term stays to the country.

Nevertheless, there are ongoing efforts to strengthen links to Moldovan researchers working abroad. A project funded by Switzerland and another one funded by the EU try to link up emigrated scientists to colleagues in their former home country and facilitate short-term stays in the country.

4 CONCLUSIONS

4.1 Effectiveness of the knowledge triangle

Table 3: Effectiveness of knowledge triangle policies

	Recent policy changes	Assessment of strengths and weaknesses
Research policy	- several competitive funding tools introduced since 2004	- competition introduced in the funding system - very low levels of R&D funding over the past 20 years, limited share of competitive funding (close to 15%) versus institutional funding; only few incentives for stimulating science-industry linkages available
Innovation policy	- funding tool Innovation and Technology Transfer Projects introduced in 2006	- efforts to stimulate private investment in R&D and transfer of technology to the business sphere through co-funding requirement within the funding tool Innovation and Technology Transfer Projects - public funding not accessible for private companies; innovation infrastructure and policy still in its infancy, low levels of private R&D funding and performance
Education policy	- enrolment rates for universities introduced in 2006	- high share of young pass through tertiary education - unattractive working conditions for researchers (low salaries, outdated equipment), emigration of skilled and qualified personnel abroad, overload of university staff with teaching duties
Other policies		

4.2 Comparison with ERA 2020 objectives - a summary

Table 4: Assessment of the national policies/measures which correspond to ERA objectives

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses
1	Ensure an adequate supply of human resources for research and an open, attractive and competitive labour market for male and female researchers	- in 2006 enrolment rates for universities introduced;	- high tertiary graduation rate; possibly undersupply for science & engineering - overall rather poor working conditions for researchers: low salaries, outdated infrastructure, migration of skilled people abroad
2	Increase public support for research	- public budget for R&D decreased in nominal value to €22m; also as percentage of GDP to 0.6% in 2009 (from a peak of 0.65% in 2007)	- increases of GERD realised, target of 1% although not reached yet - overall, low levels of R&D expenditure, affected by the crisis

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses
3	Increase coordination and integration of research funding	- increases of GERD to 0.65% of GDP in 2007	- several competitive funding programmes introduced since 2004 - institutional and competitive funding allocation centralised with ASM; low share of close to 15% of competitive funding
4	Enhance research capacity	- enrolment rates for universities introduced in 2006	- high share of young pass through tertiary education - unattractive working conditions for researchers, emigration of skilled and qualified abroad
5	Develop world-class research infrastructures (including e-infrastructures) and ensure access to them	- competitive funding programme for equipment introduced in 2006	- Stimulation measures for increasing investment in infrastructure taken since 2006 - very low investment in infrastructure and equipment over the past 20 years
6	Strengthen research institutions, including notably universities	- government strategy 2011-2014: strengthening of university research	- university research is getting more important and shall be further strengthened - universities traditionally focussed on education; university staff overloaded with teaching duties
7	Improve framework conditions for private investment in R&D	- funding tool Innovation and Technology Transfer Projects introduced in 2006	- some efforts made to stimulate private investment through AITT - until now rather low private R&D investment as well as R&D performance
8	Promote public-private cooperation and knowledge transfer	- two more incubators approved in 2011	- some efforts made to establish infrastructure for PPC (technoparks, AITT) - PPC and knowledge transfer still in its infancy; rather weak links between PROs, HEIs and business enterprise sectors
9	Enhance knowledge circulation	- AITT, technoparks, incubator established since 2004	- infrastructure and incentives for knowledge circulation established - infrastructure in its infancy still; weak links among HEIs, PROs and business
10	Strengthen international cooperation in science and technology	- a range of bilateral R&D cooperation programmes established since 2004	- success story in developing international cooperation; association negotiations to FP7 - cross border knowledge circulation is mainly one

	ERA objectives	Main policy changes	Assessment of national strengths and weaknesses
			way from Moldova abroad
11	Jointly design and coordinate policies across policy levels and policy areas, notably within the knowledge triangle	- AITT established in 2004	- some stimulation measures for knowledge triangle established: AITT, technoparks, incubators - quite weak links among education, research, and business R&D
12	Develop and sustain excellence and overall quality of research	- several competitive funding instruments established since 2004	- more competition introduced in R&D system - evaluations only by national experts within a limited researcher community; benchmarking not commonly used for policy making, complicated by lack of proper R&D statistics
13	Promote structural change and specialisation towards a more knowledge - intensive economy	- government strategy 2011-2014: energy and natural resources singled out as priorities	- some focus envisaged on relevant topics: energy, natural resources (agriculture) - knowledge demand from private business poorly to not considered in policy making; niches of excellence not systematically surveyed (e.g. through foresight)
14	Mobilise research to address major societal challenges and contribute to sustainable development	- government strategy 2011-2014: energy and natural resources singled out as priorities	- rather broad approach to scientific fields - limited focus of resources on niches of excellence and relevant fields; diversion of resources
15	Build mutual trust between science and society and strengthen scientific evidence for policy making	- some PR efforts	- some PR efforts for building mutual trust - few usage of scientific evidence for policy making; lack of proper R&D statistics

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List of Abbreviations

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
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
EECA	Central Asian Countries

INFRA	Infrastructures
INTAS	International Association for the Promotion of Co-operation with Scientists from the New Independent States (NIS) of the Former Soviet Union
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