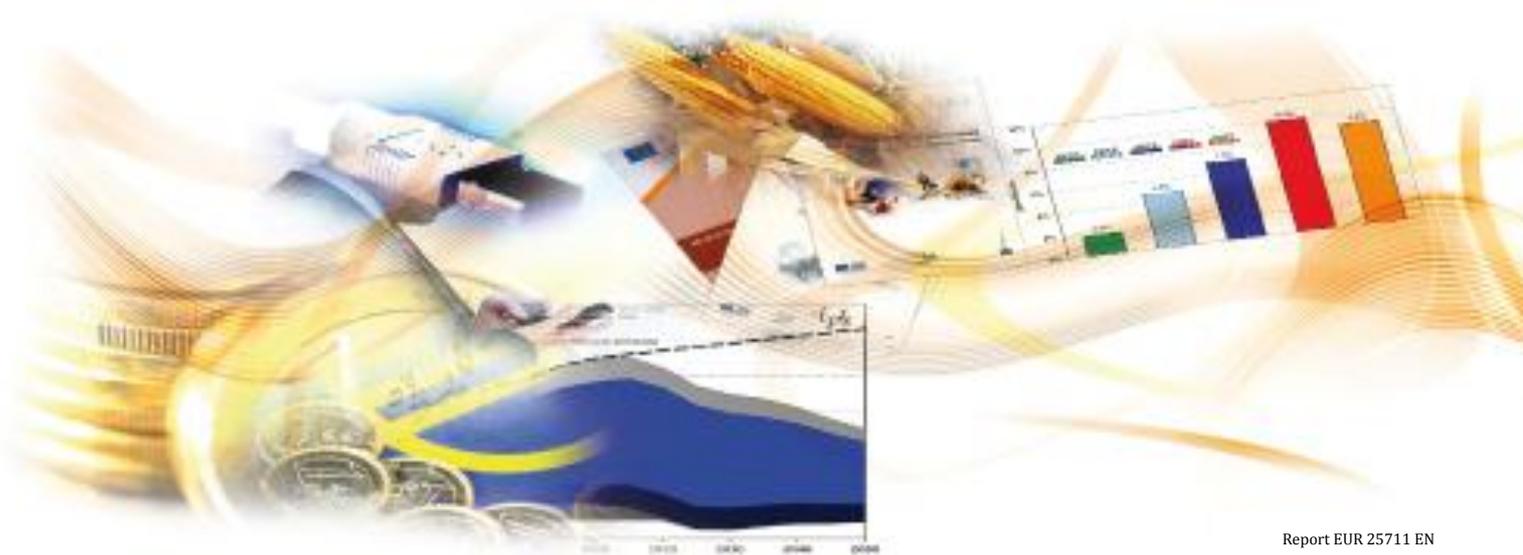


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Executive Summary

Political commitment and administrative capacity were strengthened by the creation in December 2010 of a new Ministry of Science, responsible for policymaking and funding of research activities. In addition, the government established in February 2011 a new Council for Scientific and Research Activity comprising 11 members representing the public and private sectors, research institutes and academics. Montenegro has taken several further measures to implement the National Strategy for Science and Research Activities (2008-2016). A new Law governing scientific research activity was adopted in December 2010. It sets out conditions for State funding for both public and private institutions in 14 research programmes and priority areas in line with FP7.

In January 2011, a strategy for development of SMEs was adopted, covering the period 2011-2015. It focuses on creating better business conditions and entrepreneurship for SMEs and includes several measures to stimulate and monitor research activities of SMEs, which, in turn, will contribute to the Innovation Union.

In March 2011, an Action Plan on Mobility of Scientists was adopted containing measures aiming at strengthening inward, outward and inter-sectoral mobility over the period 2011-2012 and, in doing so, preparing for adoption of the European Charter and Code of Conduct for the recruitment of researchers. By September 2011, two institutions included in Montenegrin's education system had signed the Declaration of Commitment to the Principles of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers (University of Montenegro and University Donja Gorica). EURAXESS, the mobility portal organised by the University of Montenegro, which is the bridgehead organisation, has been fully operational since November 2010.

One of the most important changes in financing research and innovation happened in October 2011 when the Ministry of Science in cooperation with the Ministry of Agriculture and Rural Development, Ministry of Health, Ministry for Information Society and Telecommunications, Ministry of Sustainable Development and Tourism, Ministry of Education and Sport as well as the Ministry of Culture announced a new call for scientific and research projects covering period 2012-2014 with the total budget of €5m. This will be the first time ever budget of that magnitude as well as the first time collaborative national public research funding in Montenegro.

The novelty of the new call is that national research projects will be now available to foreign researchers.

Ministry of Science is preparing a national programme for young researchers' mobility for the period after 2012. The Ministry is also focused at the improvement of bilateral scientific cooperation that sets legal framework for free realisation of mobility.

Montenegro will need to address several structural challenges in order to unleash innovative potential, the most important being: (i) increase scientific output (publications; citations; patenting etc.); (ii) accelerate commercialisation of research and deepen collaboration with the business sector (the impact of public R&D expenditure on economic development depends on the how the scientific results and research capacity are commercialised in the format of licensing; spinoff companies or contract research to the business sector); and (iii) promote higher levels of private R&D investments and facilitate innovative start-up companies (expansion of business R&D).

Multi-annual strategy is spelled out in the Strategy for development of scientific research activity in Montenegro for the period 2008-2016. The strategy's action plan includes a roadmap for increasing investment in science and research, both by the public and private sector, aiming at reaching an investment level of 1.4% of

Montenegro's GDP in research by 2013.

Strategy for Scientific Research Activities 2008-2016, defines:

- objectives and tasks of scientific - research activities;
- harmonisation of scientific - research activities with laws and strategic documents;
- institutional framework for development of scientific - research work;
- research, innovation and technological development;
- international cooperation;
- financing of scientific - research activities and
- realisation of objectives and monitoring of implementation of the Strategy recommendations.

The policy mix in place for promoting private investments in R&D has yet to be developed. The main source of R&D funding is the government. On the whole, the business sector enjoys limited support from government, as evidenced by non-existent data on its shares in R&D funding and in performance. The higher education sector is also largely government-funded. The above structural features indicate a relatively slow transformation of R&D towards enterprise-based R&D systems. Yet, during the transition period and until recently, the trend was towards a stronger higher education sector. With continuing recovery and economic growth, it is expected the business enterprise sector will have its added importance.

When looking to the relevance of the ERA for Montenegro research policy, one needs to consider that Montenegro is not a member of the EU and thus, strategic policy document (see, e.g., Strategy for scientific and research activity of Montenegro 2008-2016) contain very few references to the ERA or the ERA objectives.

Montenegro has started to be involved in EU research policy, mainly through its association to the 7th Research Framework Programme. Montenegro's strategy for research activities is largely in line with the EU research policy and contributes to the targets set at EU level in the context of the ERA. However, close monitoring of these targets and implementation of planned actions will be of key importance. Overall, if it continues its efforts, Montenegro should, in the medium term, have the capacity to comply with the requirements of the *acquis*.

However, it will have to undertake additional efforts in strengthening human capital and infrastructure capacities for its effective participation in research framework programmes and integration into the European Research Area.

Future policy can make use of the following suggestions:

- Monitoring implementation on an annual basis of science and technology policy and an action plan;
- Performing regular evaluation of innovation policy (including the work of institutions which are responsible for policy implementation)

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1 Introduction

Montenegro is a country located in South Eastern Europe covering the area of 13,812 km² with total population of 625,266¹. It has a coast on the Adriatic Sea to the southwest and is bordered by Croatia to the west, Bosnia and Herzegovina to the northwest, Serbia to the northeast and Albania to the southeast.

GDP (million €) in 2010 was 3,104m² and GDP (€ per capita) 5,006, which is 6.1% higher, compared to 2009³. The economy started to recover in 2010 from the effects of the crisis, growing by 2.5%⁴, after a drop by 5.7%⁵ a year earlier. The economy of Montenegro is mostly service-based and is in late transition to a market economy. In 2007, the service sector made up for 72.4% of GDP, with industry and agriculture making up the rest at 17.6% and 10%, respectively⁶. According to Eurostat data, the Montenegrin GDP per capita stood at 41% of the EU average in 2010⁷. Aluminium and steel production and agricultural processing make up for most of the industrial output. Tourism is an important contributor to Montenegrin economy. Approximately one million tourists visited Montenegro in 2007, resulting in €480 million of tourism revenue. Tourism is considered the backbone of future economic growth, and government expenditures on infrastructure improvements are largely target towards that goal.

In the absence of valid statistics (MONSTAT-Statistical office of Montenegro) gathers no data on HERD, BERD, GOVERD), it has not been possible to monitor progress on investment in research, but the level is still very low (estimated at 0.13% of GDP in 2007)⁸ or 11 times less⁹ than the average of the EU-27. The main source of R&D funding is the Government. The higher education sector receives the biggest part while the business sector enjoys limited support from government.

Public budget for R&D increased in nominal value from €0.57m in 2003 to €5m in 2011 (total investment for period of two years, 2012-2014).

Montenegro accounts for extremely low level of R&D inputs and outputs.

Research suffers from large difference in the development of different research units or institutions without setting and following the national priorities as well as from a lack of adequate premises and updated large-scale equipment. However, scientific-research institutions in Montenegro still have some competitive research infrastructure in the

¹ 2011 Census of Population, Households and Dwellings in Montenegro, First Results, Montenegro Statistical Office, Podgorica, 2011

² Annual data, Economy of MNE in 2010: Statistical Office of Montenegro (2011): <http://www.monstat.org/eng/page.php?id=19&pageid=19>

³ Ibid

⁴ Ibid

⁵ Ibid

⁶ Montenegro at glance: available at http://devdata.worldbank.org/AAG/mne_aag.pdf

⁷ GDP per capita in PPS: Eurostat. Retrieved 13 December 2011; Available at: http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/2-13122011-BP/EN/2-13122011-BP-EN.PDF

⁸ Montenegro 2011 Progress Report available at: http://ec.europa.eu/enlargement/pdf/key_documents/2011/package/mn_rapport_2011_en.pdf

⁹ Montenegro in the 21st Century - In the Era of Competitiveness, Montenegrin Academy of Science and Art, 2010

fields of:

- Biomedical and life sciences, which involves the infrastructure in the field of agriculture, public health, facilities for Hydrograph examination, chemistry and microbiology of waters and marine waters, as well as the infrastructure for marine biology research.
- Computation and data treatment, which involves laboratories in the field of power engineering, telecommunications, electronic devices, computer engineering and technologies.
- Materials science, which involves research laboratories and site testing, materials testing (metallic, non-metallic, construction), microscopy.

Human research capacity is very limited. Montenegro counted 781¹⁰ full-time research equivalents (researchers, who together with part-time colleagues and external research associates work in the country's 3 universities, 9 private higher education institutions, government and the private sector) in 2009. This corresponds to about 0.4% of the total workforce in Montenegro.

The current performance of R&D in Montenegro is small and strongly linked to number of scientific publications and scientific papers per million populations. According to the Science Citation Index Expanded, in 2008 they were 93 scientific publications and 149 scientific papers per million populations in Montenegro¹¹.

Science in Southeast Europe in general is dominated by four broad disciplines: physics, engineering/technology, chemistry and clinical medicine. In Montenegro, these four areas account for 73% of all scientific publications. There was no significant evolution in the relative specialisation of published scientific texts between 2002 and 2008, according to Science Citation Index data¹².

With regard to the low level of investments into research and technological development, as well as the weakness of company innovation, Montenegro has not seen any significant improvement in recent years. Furthermore, with the onset of globalisation the economy is susceptible to various threats that may adversely affect future investments into R&D. The weak link between the scientific, research, educational and economic sphere is an obvious weakness that negatively affects human resource development, technological development as well as export competitiveness.

In order to encourage them to invest into research, the Strategy for Scientific Research Activities 2008-2016 states that the state should support industrially oriented projects that produce commercially useful results.

One of the weak points of research in Montenegro is the poor transfer of research outcomes to the market. Montenegro has begun the process of creating the legal and institutional frameworks to help promote innovation, in particular in SMEs, but it still has a long way to go to implement the legal norms and create a national programme for improving innovation performance. Establishment of links between the SMEs and the scientific and research institutions is still at an early stage.

The basic principles and guidelines of science and higher education policy are determined by the Montenegrin Parliament, which regulates them through laws, legal enactments and provisions. The Parliament of Montenegro appoints the Commission for

¹⁰ 2010 Statistical Yearbook, MONSTAT Agency for Statistics, Podgorica

¹¹ Publications in Southeast Europe by major field of science, 2008: Thomson Reuters (Scientific) Inc. Web of Science, (Science Citation Index Expanded), compiled for UNESCO by the Canadian Observatoire des sciences et des technologies

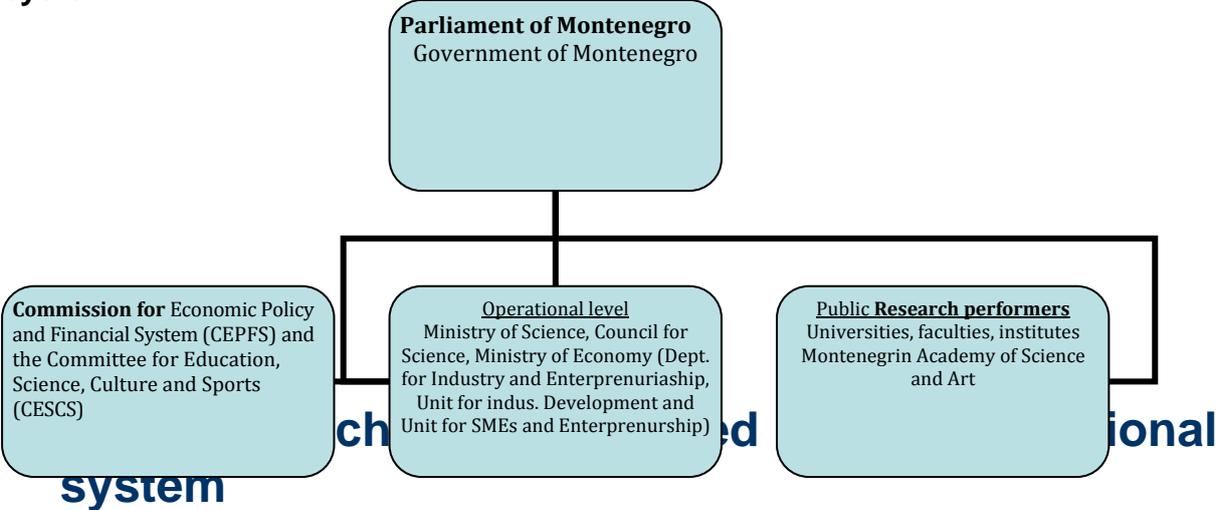
¹² Ibid

Economic Policy and Financial System (CEPFS) and the Committee for Education, Science, Culture and Sports (CESCS). CEPFS considers proposals for a law, other regulations and general acts and other materials referring to science. The commission submits a written report to the government, which contains findings and assessment of the reviewed material and proposals for conclusions within the form which should be adopted by the government. CESCS considers bills, drafts of other regulations and general acts and other issues referring to: pre-school, primary, special and secondary education; higher education; science; scientific - research activities; culture; arts; technical culture; international scientific, educational, cultural and technical cooperation; protection of scientific, cultural, artistic and historical values; sport and physical culture. The Ministry of Science, which was created in December 2010 (formerly Ministry of Education and Science), is the principal administrative body responsible for planning, funding and monitoring the entire science system. The highest advisory body for the entire scientific research system in Montenegro is the Council for Science and Research Activities. It consists of 11 members, four from the government and seven from the research community.

The Department for Industry and Entrepreneurship of the Ministry of Economy is in charge of the organisation, coordination and preparation of draft laws and other regulations in the field of industry and entrepreneurship. The Unit of Industrial Development is responsible for development of national strategies, goals and measures of industrial policy; conducting analysis of the industrial sector and modern technologies, etc. The Unit of Small and Medium Enterprises and Entrepreneurship is focused on the SME sector elaborating corresponding strategies and programmes to support SMEs and foster entrepreneurship in Montenegro. Furthermore, the identification and removal of business barriers, institutional support and encouragement of interconnection operators of SMEs are between the second unit's tasks. Research is primarily conducted in the public sector i.e. at the University of Montenegro, institutes and other public institutions such as the Montenegrin Academy of Science and Art, rather than in the private sector.

The Nomenclature of Territorial Units for Statistics (NUTS) for Montenegro does not exist.

Figure 1: Overview of the governance structure of Montenegrin research system



R&D policy is one of the areas in which Montenegro have achieved slow progress during the transition period. The National Innovation System tended to be neglected and suffers from a legacy of unfinished reforms. Then, aggregate expenditures on R&D are comparatively low, (estimated at 0.13% of GDP in 2007)¹³ or 11 times less¹⁴ than the average of the EU-27. More importantly, these expenditures tend to generate limited scientific and economic results because expenditures are mainly concentrated in the public sector and research results are not commercialised. More broadly, cooperation with the private sector is negligible while in EU, share of private sector is 61.53% of GERD (2010)¹⁵ and public sector, 37.51% of GERD (2010)¹⁶. In sum, knowledge, when created, will very likely remains non-operational from an economic standpoint. To improve the impact of R&D policies, Montenegro needs to improve the quality of public expenditures on R&D.

¹³ Montenegro 2011 Progress Report available at: http://ec.europa.eu/enlargement/pdf/key_documents/2011/package/mn_rapport_2011_en.pdf

¹⁴ Montenegro in the 21st Century - In the Era of Competitiveness, Montenegrin Academy of Science and Art, 2010

¹⁵ ERAWATCH (2010), overview of research policies and systems at European level

¹⁶ Ibid, ERAWATCH, (2010)

Poor scientific outcomes (low level of citations, patent applications, and patents granted) are result of allocation of public resources that is not based on performance but rather on a per headcount basis. Overall productivity of Montenegrin scientists is below the average productivity in the world. According to the [SCImago Journal and Country Ranking](#) of 236 countries, Montenegro was ranked at 155th place by the H-index¹⁷ and at 232nd place by citations per document. Research resources only recently have started to be allocated on a more competitive basis, but “performance contracts” for example have not yet been introduced.

Another factor that determines scientific performance is the availability of R&D personnel and researchers. Montenegro and the EU-27 account for contrasting trends in numbers of researchers and R&D personnel. There were 313¹⁸ researchers full-time equivalents (FTE) employed in the Montenegro in 2009, which rank Montenegro far below the EU-27 average (1.6 million researchers (FTE) employed in the EU-27). Also, Montenegro has been experiencing brain drain in the last two decades.

Availability of modern research equipment is another problem. Infrastructure facilities designed to serve the former Yugoslavia are sometimes too large for the new national market and expensive to be maintained by national budgets. The result is often deterioration. Access to information and communications technologies (ICT) is lagging behind.

The key challenges in the R&D system in Montenegro have been continuing for many years and identified in the key government documents (Strategy for scientific and research activity of Montenegro 2008-2016; Montenegro in the 21st Century - In the Era of Competitiveness) as well as several external reviews (OECD, World Bank) and policy/academic literature on R&D policies of South East Europe (World Bank - SEE regular economic report; OECD-Sector specific sources of Competitiveness of the Western Balkan-Key conclusions and next steps).

Montenegro will need to address several challenges in order to use innovative potential, the most important being: (i) increase scientific output (publications; citations; patenting etc.); (ii) accelerate commercialisation of research and deepen collaboration with the business sector; and (iii) promote higher levels of private R&D investments and facilitate innovative start-up companies.

- i. Increase scientific output. In a context of scarce resources, increasing scientific output will require better management of financial and human resources. One way to achieve this is by introducing performance-based contracts for the allocation of resources to public research organisations. These reform efforts have started in some EU10 countries such as Romania, and Montenegro could learn from these experiences. Another way to promote efficiency is by increasing the fiscal autonomy and the flexibility to manage human resources of public research organisations. This should be accompanied by modernising human resource policies to favour scientific achievement and open opportunities for young researchers. Increasing the allocation of research resources on a competitive basis (as opposed to a headcount basis) is another initiative to encourage results and excellence. All of the above measures could be incorporated into modern laws regulating scientific research.
- ii. Accelerate commercialisation of research and deepen collaboration with the

¹⁷ H-index quantifies both the scientific productivity and the scientific impact of a journals

¹⁸ Data calculated for the publication “Montenegrin Academy of Science and Art (2010): Montenegro in the 21st Century - In the Era of Competitiveness”, Podgorica, 2010.

business sector. The impact of public R&D expenditure on economic development depends on the how the scientific results and research capacity are commercialised in the format of licensing; spinoff companies or contract research to the business sector. The problem is not the existence or not of commercialisation but whether the conditions for a systemic process are in place. Most of the time, commercialisation does not evolve naturally from research. Most discoveries require further development to reach a marketable stage. Researchers often lack capacity to envisage such potential and do not want to deviate from purely academic research that brings better prospects for career development. Another obstacle is the matching between the invention itself and the market demand as well as the format of commercialisation. Enabling commercialisation in the region would require, among other: (a) a legal framework that transfers the role of managing the intellectual property (IP) emerging from publicly funded research to universities; (b) an incentive regime that encourages the researcher to engage in commercialisation, as for instance, establishing a minimum financial compensation from the commercialisation and counting commercialisation results as relevant achievements for career development; and (c) developing organisations specialised in IP management such as technology transfer offices.

- iii. Promote higher levels of private R&D and facilitate innovative start-up companies. Business R&D activity in a country is affected by a number of factors, including the degree of economic specialisation, the level of competition and access to finance. Economic specialisation is a relevant factor because sectors such as biotechnology and IT may be more likely to invest in R&D than says textiles or footwear industries. Meanwhile, higher competition could foster R&D and innovation when it reduces pre-innovation profits by more than it reduces post-innovation profits. With structural reforms still underway, this differential may be relevant, and promoting competition may play an important role in transition economies. Access to external financing is another important factor to the expansion of business R&D. Access to credit for routine activities frees up internal resources to be invested in riskier businesses such as R&D and innovation. In this context, developing a series of direct and indirect support stages for innovation financing, several of which will require enough scale to allow proper risk management may be valuable interventions to promote business R&D. Direct support would involve public programs supporting the different phases of innovation development by SMEs or start-ups from grants to the development of a proof of concept; to matching-grants or conditional loans for prototype development as well as angel and venture capital type of funding for early stage financing and start-ups. Some of those programs have been in place in neighbouring countries such Croatia where initial evaluations indicate a positive impact. Indirect support – in the form of tax breaks for R&D, while more relevant to larger firms – are another common form of public support that has been underutilised in the region.

3 Assessment of the national innovation strategy

3.1 National research and innovation priorities

The multi-annual RDI strategy is spelled out in the Strategy for development of

scientific research activity in Montenegro for the period 2008-2016. Research policy in Montenegro is mainly generic in character while support programmes for specific thematic areas are not common in policy practice.

The basic task of the Strategy for development of scientific research activity in Montenegro 2008-2016 is to stimulate development of science and technology by connecting these factors, and to increase their contribution to the development of society, with application of the new knowledge and creation of proper knowledge and technologies to the largest possible extent. In order to achieve this task, the following objectives, analysed within this Strategy, have been set:

- Emphasise the importance of science and research in the context of further social and economic development and transformation into a modern society based on knowledge;
- Provide to the Government of Montenegro an expert framework, recommendations and support for concrete activities taken with the aim of improving and creating conditions for conducting the scientific and research activities and indicating to the competent ministries the necessity and legitimacy of investment into scientific and research work;
- Encourage allocation of funds for investment into the science and scientific infrastructure in accordance with the Lisbon Strategy recommendations and propose an adequate dynamics of allocation with regard to the GDP;
- Emphasise the irreplaceable role and decisive importance of human resources for development of science and technology, primarily through development of young staff and inclusion into the ERA;
- Stimulate technological development and innovation and draw attention of economic entities to the fact that their market success depends on the acquisition and use of new and better knowledge, successful application and promotion of scientific results and development of new technologies whose products are attractive for the market;
- Give recommendations for optimisation and possible reorganisation of the institutional framework for implementation of scientific and research activity with the view of more efficient action;
- Underline the importance of the system for scientific informing and the role of information and communication technologies (ICT);
- Put emphasis on the importance of defining favourable legal measures (tax policy measures) as well as of adopting adequate regulations (e.g. for intellectual property protection);
- Identify the most important areas of scientific and research work, bearing in mind the comparative natural, technological and human resources related advantages of Montenegro;
- Through an adequate action plan, define priority areas and activities as well as methods for monitoring realisation of adopted tasks. One of the basic reasons for developing the Strategy for development of scientific research activity in Montenegro 2008-2016 is to point out the strategic importance of scientific and research activities as the basic element of economic and general social development. This is especially important in the conditions when the society,

such as the Montenegrin one, still does not recognise the importance and role of science and technological development in achievement of new values, and the academic community suffers from lack of motivation and information, psychological barriers for inclusion into mobility programmes and inadequate valorisation of the results of its own work.

Political commitment and administrative capacity were strengthened by the creation in December 2010 of a new Ministry of Science, responsible for policymaking and funding of research activities. In addition, the government established in February 2011 a new Council for Scientific and Research Activity comprising 11 members representing the public and private sectors, research institutes and academics.

With respect to research cooperation under the Seventh EU Framework Programme (FP7), Montenegro organised several information days, participated regularly in FP7 management meetings and built a good functioning network of national contact points. It has also taken action to stimulate participation by Montenegrin research entities in FP7 by granting financial support to successful applicants. However, in terms of successful projects, progress is moderate.

Montenegro is actively pursuing research opportunities with other international partners and has concluded several bilateral science and technology agreements with neighbouring countries and international partners such as COST, EUREKA and NATO. Montenegro has taken several further measures to implement the Strategy for Science and Research Activities 2008-2016. A new Law governing scientific research activity was adopted in December 2010. It sets out conditions for State funding for both public and private institutions in 14 research programmes and priority areas in line with FP7. Montenegro has also taken several decisions to increase use of information technology for research purposes. The government has set up an electronic information system on scientific and research activities, which aims at processing automatically all information of interest to scientific activities in Montenegro and abroad. It has also adopted an information and communications technology (ICT) development plan to assess use of ICT for scientific research activities, review the legislation adopted in the ICT field and analyse the networking between ICT companies and scientific research institutes. In January 2011, a strategy for development of SMEs was adopted, covering the period 2011-2015. It focuses on creating better business conditions and entrepreneurship for SMEs and includes several measures to stimulate and monitor research activities of SMEs that, in turn, will contribute to the Innovation Union. In March 2011, an Action Plan on Mobility of Scientists was adopted containing measures aiming at strengthening inward, outward and inter-sectoral mobility over the period 2011-2012 and, in doing so, preparing for adoption of the European Charter and Code of Conduct for the recruitment of researchers. By September 2011, two institutions included in Montenegro's education system had signed the Declaration of Commitment to the Principles of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers (University of Montenegro and University Donja Gorica).

EURAXESS, the mobility portal organised by the University of Montenegro which is the bridgehead organisation, has been fully operational since November 2010. Montenegro launched a feasibility study on establishing science parks and centres of excellence. In October 2011, the Ministry of Science in cooperation with the Ministry of Agriculture and Rural Development, Ministry of Health, Ministry for Information Society and Telecommunications, Ministry of Sustainable Development and Tourism, Ministry of Education and Sport as well as the Ministry of Culture has announced a new call for scientific and research projects covering period 2012-2014 with the total budget of

€5m¹⁹. This will be the first time ever collaborative national public research funding in Montenegro and would help increase the scientific input as one of the major challenges Montenegro faces at present. The deadline for the submission of project proposal was 4 Nov. 2011. At the time when this report has been completed (Nov. 2011), Ministry of Science of Montenegro has reported that 198 project proposals were submitted, 51 in the area of ICT, energy, transport, new materials and services, 40 in health, 37 in science and education and competitiveness, 29 in agriculture and food, 25 in national identity, 10 in sustainable development and tourism, and 4 interdisciplinary projects²⁰. The final results on funded project will be communicated by the Ministry of Science most probably in March 2012 (at the time this report is drafted, Feb. 2012, no results have been announced, yet).

Montenegro is not eligible for the EU Structural Funds that play an important role for co-funding R&D in Europe. There has been so far no support provided through different forms of funding: venture capital, subsidised loans, tax incentives, guarantees, public-private partnerships in leveraging additional funding etc.

The evaluation culture in Montenegrin science and research system is weak. All kinds of evaluation usually serve the administrative purposes of the responsible ministries. The tradition of evaluation is mainly evident in the evaluation of research projects financed through the support measures "programme for financing of scientific and research activities". These programmes are the basic instruments of the responsible entity ministries for financing research activities through competition-based research grants. The evaluation of projects includes ex-post evaluation. Ex-post evaluations are mainly targeting the achievement of project results. Large research programmes based on scientific themes do not exist in Montenegro and there therefore there is no system for their evaluation. There is a lack of systematic and comprehensive evaluation of the research supporting programmes administered by the relevant entity ministries. So far, the ministries publish the information on the number of submitted and selected projects as well as the budget spent in the given call. More comprehensive evaluation is absent that, as a consequence has no significant impact on science policy.

3.2 Trends in R&D funding

A major characteristic of research funding in Montenegro are: the only source of R&D funding is the Government, the higher education sectors receives the biggest part, the business sector enjoys limited support from government and there is no thematic focus and non-oriented research. These trends relate to marginal spending in research where the estimated gross expenditure on R&D (GERD) in last 10 years accounted for 0.04% to 0.13%. Public budget for R&D increased in nominal value from €0.57m in 2003 to €1.67m in 2008 (total investment for period of two years, 2008-2011). This is 13 times less²¹ than the EU-27 average. MONSTAT (Statistical office of Montenegro) has no data on HERD, BERD. In fact, none of the institutions (MONSTAT, Ministry of Finance, Ministry of Economy, Agency for the Promotion of

¹⁹ Konkurs za sufinansiranje nacionalnih naučnoistraživačkih projekata počev od 2012. godine, Ministarstvo nauke Crne Gore, 2011; <http://www.mna.gov.me/rubrike/konkursi/108820/K-O-N-K-U-R-S.html>

²⁰ Ministarstvo nauke: <http://www.gov.me/vijesti/109732/Na-Konkurs-za-sufinansiranje-naucno-istrazivackih-projekata-pristiglo-198-prijava.html>

²¹ Montenegro in the 21st Century - In the Era of Competitiveness, Montenegrin Academy of Science and Art, 2010

Foreign Investments and Central Bank of Montenegro) implements a continued and systematic collection of data on R&D activities.

The public investments in education, research and innovation is not prioritised and budgeted in the framework of multi-annual plans to ensure predictability and long-term impact. However, it is based on an annual basis. Montenegro does not have an action plan on investment in research. However, the Action Plan of the Strategy sets the aim of increasing the investment in scientific and research activities up to 1.4% of the GDP by 2013. The progress towards R&D investment target of 1.4% is not yet achievable. The Strategy for Scientific - Research Activities 2008-2016 make proposal for the dynamics of increase of investments in research, technological development and innovations for the five-year period (2009-2013) as a % of GDP. The public/private split in R&D investment foresees the following figures: 2009 (0.3/0.1), 2010 (0.6/0.2), 2011 (0.8/0.2), 2012 (0.9/0.3), 2013 (0.8/ 0.6).

There were significant increases in public investment in research in 2011. Total public support more than doubled in nominal terms. In October 2011, the Ministry of Science in cooperation with the Ministry of Agriculture and Rural Development, Ministry of Health, Ministry for Information Society and Telecommunications, Ministry of Sustainable Development and Tourism, Ministry of Education and Sport as well as the Ministry of Culture has announced a new call for scientific and research projects covering period 2012-2014 with the total budget of €5m. A new Law governing scientific research activity was adopted in December 2010. It sets out conditions for State funding for both public and private institutions in 14 research programmes and priority areas in line with FP7 which will alter the non-thematic focus of R&D funding.

Table 1: Basic indicators for R&D investments in Montenegro

	2008	2009	2010	EU average 2010
GDP growth rate	6.9	-5.7	2.5	2.0
GERD as % of GDP	0.09	N/A	0.13	2.0
GERD per capita	N/A	N/A	N/A	490
GBAORD (€ million)	1.67	N/A	N/A	92,729
GBAORD as % of GDP	N/A	N/A	N/A	0.76
BERD (€ million)	N/A	N/A	N/A	151,125.56
BERD as % of GDP	N/A	N/A	N/A	1.23
GERD financed by abroad as % of total GERD	N/A	N/A	N/A	N/A ²²
R&D performed by HEIs (% of GERD)	N/A	N/A	N/A	24.2
R&D performed by PROs (% of GERD)	N/A	N/A	N/A	13.2
R&D performed by Business Enterprise sector (as % of GERD)	N/A	N/A	N/A	61.5

The current funding mechanisms include both subsidies (competitive research grants, institutional funding). The institutional funding including salaries for researchers makes the substantial part of R&D funding while the share of competitive grants is much lower.

²² 8.4 (2009), 9.04 (2005)

The balance between these funding mechanisms has changed in 2011 where the total amount for competitive research grants increased.

Public-private partnerships still have no significant effect on R&D funding in Montenegro. However, this form of financing is gradually becoming more relevant. Ministry of Science e.g. launched in May 2011 a feasibility study on establishing science parks and centres of excellence.

3.3 Evolution and analysis of the policy mixes

Promotion of research, technological development and innovation in industry is the work of the Ministry of the Economy, the Ministry of Science, the Directorate for Development of Small and Medium Sized Enterprises, the Chamber of Commerce of Montenegro and the Montenegrin Employers Federation, as well as through activities of international organisations and NGOs. The main instrument of the Ministry of Science is the call for co-financing of scientific and research and developmental projects, in which industrial teams are allowed to apply in partnership with research institutions.

At the end of 2007, the Directorate for Development of Small and Medium Size Enterprises formed a consortium with the Chamber of Commerce of Montenegro, the Faculty of Mechanical Engineering of the University of Montenegro and the Business Start-up Centre from the city of Bar for the purpose of preparation of the project for setting up the Centre for Promotion of Innovation in the business sector. The project proposal was submitted for the call within the CIP programme and after positive evaluation the European Information and Innovation Centre Montenegro (EIICM) was formed. It started to work in November 2008. EIICM is a member of the Enterprise Europe Network. The target groups for the services of EIICM are: small and medium enterprises, institutions which carry out research and development, innovators, government bodies, professional organisations, educational institutions. EIICM, among other things, provides services for fostering innovation, the transfer of technologies and knowledge, as well as services which encourage the participation of small and medium sized enterprises in Community Framework Programmes for Research and Technological Development.

The EIICM work plan sets out the following support services:

Module B: Services for innovation, transfer of knowledge and technology

Important contribution to reducing the “Innovative gap“, creation of new jobs, and sustainable development is expected from:

- distribution of information knowledge on policies for innovation, new legislation and support programmes;
- dissemination and take up of research results;
- providing services for technology and knowledge transfer and building up of partnership between all innovation stakeholders
- stimulating of private sector innovation.

The coordinator of EIICM activity in this module is the Chamber of Commerce of Montenegro

Module C: Services which encourage participation of small and medium sized enterprises in Community Framework Programmes for research and technological development:

- increase level of knowledge of small and medium sized enterprises about Community Framework Programmes for research and technological

development;

- supporting small and medium enterprises to identify their needs for research and technological development and to find relevant partners and
- supporting small and medium sized enterprises in preparation and coordination of project proposals for participation in Community Framework Programmes for research and technological development.

The coordinator of EIICM activity within this module is the Faculty of Mechanical Engineering of the University of Montenegro.

Technology centres and science and research parks have not been set up yet in Montenegro. Currently, a project proposal is being prepared for development of a technology park with which the Directorate for Development of Small and Medium Sized Enterprises in cooperation with partners will apply under the IPA - Adriatic Cross-Border Cooperation Programme 2007-2013.

There are two business incubators in Montenegro, in the cities of Bar and Podgorica, developed in the partnership between local authorities and international organisations.

The business incubator in **Bar** offers young entrepreneurs the following services:

- Business Skills Training - 4/5 day training sessions on topics like marketing,
- financial management, management skills, legal and tax issues, exporting to the
- EU, product development and innovation etc.
- Business Plan Competition - young potential entrepreneurs are supported
- to write a professional business plan in 2 phases (business concept, business plan)
- Business Support Services - the best business plans/entrepreneurs resulting from the BPC are supported through personal coaching, consultancy, micro-loans, incubation space & services and free registration of their business training, consultancy, working space and access to micro-credit which will lead to the establishment of new and innovative small and medium enterprises.

Podgorica is focused on innovative information technologies. Entrepreneurs with feasible projects joining the incubator get the following support:

- Physical space and equipment (office space, computers, printer, internet, meeting room, etc.)
- Management coaching and training;
- Support in creating an effective business plan;
- Administrative services;
- Transfer of knowledge and technology
- Technical support;
- Business networking;
- Presentation at trade fairs and exhibitions
- Advice on intellectual property; and
- Sources of financing.

Specialised agencies for technology transfer have not been established yet.

3.4 Assessment of the policy mix

With regard to the scope of investments into research and technological development, as well as the degree of companies' innovations, Montenegro maintains the existing state, which, from the viewpoint of dynamic changes in the world, does not allow for stimulation of development. The weak link between the scientific, research, educational and economic sphere is also an obvious deficiency that negatively affects the human resources development, technological development as well as export competitiveness.

What is of vital importance at this stage of innovation "culture" in Montenegro is to comprehend the current state of research in the country as a whole, and act accordingly, setting the goals as realistic as possible. First of all, it is evident that the academic community is currently lacking good research groups, not to mention interdisciplinary ones. Also, the connections with industry have decreased over years, and the joint activities that exist are more focused on provision of different types of services than on "real" research. It is a consequence of the general situation in the region over the past two decades (conflicts, transition, and privatisation). As for the international scientific cooperation, its intensity was also reduced because of the isolation of the country in the past.

To improve innovative potential, Montenegro will need to address several challenges, the most important being: (i) increase scientific output (publications; citations; patenting etc.); (ii) accelerate commercialisation of research and deepen collaboration with the business sector; and (iii) promote higher levels of private R&D investments and facilitate innovative start-up companies.

Table 2: Policy measures and assessments

Challenges	Policy measures/actions ²³	Assessment in terms of appropriateness, efficiency and effectiveness
Increase scientific output	A new Law governing scientific research activity was adopted in December 2010. It sets out conditions for State funding for both public and private institutions in 14 research programmes and priority areas in line with FP7.	In a context of scarce resources, increasing scientific output will require better management of financial and human resources. One way to achieve this is by introducing performance-based contracts for the allocation of resources to public research organisations. These reform efforts have started in some EU-10 countries such as Romania, and Montenegro could learn from these experiences.
Accelerate commercialisation of research and deepen collaboration with the business sector	Ministry of Science launched in May 2011 a feasibility study on establishing science parks and centres of excellence.	<ul style="list-style-type: none"> • a legal framework that transfers the role of managing the intellectual property (IP) emerging from publicly funded research to universities; • an incentive regime that encourages the researcher to engage in commercialisation, as for instance, establishing a minimum financial compensation from the commercialisation and counting commercialisation results as relevant achievements for career development; and • developing organisations specialised in IP management such as technology transfer offices.

²³ Changes in the legislation and other initiatives not necessarily related with funding are also included.

Challenges	Policy measures/actions ²³	Assessment in terms of appropriateness, efficiency and effectiveness
Promote higher levels of private R&D investments and facilitate innovative start-up companies	Strategy of development of SMEs 2011 – 2015	Low levels of the technology, the innovative and absorptive capabilities of the companies as well as their financial restrictions

4 National policy and the European perspective

The national mix of the research and innovation policies should address challenges related to the weak scientific output, commercialisation of research and promote private R&D investments and facilitate innovative start-up companies.

Possible directions include policies aimed at (i) better management of financial and human resources, (ii) incentive regime that encourages the researcher to engage in commercialisation, and (iii) promoting technology, the innovative and absorptive capabilities of the Montenegrin companies.

National policy mix is gradually adapting to the ERA pillars and objectives. More efforts need to be taken in order to address the strategic challenges outlined above and achieve further alignment with the ERA. Some of the key challenges include increasing inward and outward mobility of researchers, increasing the proportion of researchers in the private sector, developing research infrastructures and securing their efficient utilisation, reforming research and higher education (through improved funding mechanisms, quality assurance, and accountability), developing science - industry collaboration and internationalisation.

Table 3: Assessment of the national policies/measures supporting the strategic ERA objectives (derived from ERA 2020 Vision)

	ERA dimension	Main challenges at national level	Recent policy changes
1	Labour Market for Researchers	<p>(-) Overall highly unattractive working conditions for researchers.</p> <p>(-) Strong brain-drain of tertiary students and young researchers.</p>	<p>In March 2011, an Action Plan on Mobility of Scientists was adopted containing measures aiming at strengthening inward, outward and inter-sectoral mobility over the period 2011-2012 and, in doing so, preparing for adoption of the European Charter and Code of Conduct for the recruitment of researchers. By September 2011, two institutions had signed the Declaration and Charter for Researchers (University of Montenegro and University Donja Gorica).</p>
2	Cross-border cooperation	<p>(-) So far National programmes were closed to foreign participants.</p> <p>(-) Low mobility within the Western Balkan region</p>	<p>Changes in design of national programmes (Call for scientific and research projects covering period 2012-2014); open for foreign participants.</p> <p>Bilateral R&D cooperation agreement intensified with countries from the region, most notably with Slovenia, BiH.</p>
3	World class research infrastructures	<p>(-) No country research infrastructure (RI) planning.</p>	<p>Montenegro has taken several decisions to increase use of information technology for research purposes. The government has set up an electronic information system on scientific and research activities. Adopted an information and communications technology (ICT) development plan to assess use of ICT for scientific research activities.</p>
4	Research institutions	<p>(-) Private research institutions are not eligible for funding</p>	<p>A new Law governing scientific research activity was adopted in December 2010. It sets out conditions for State funding for both public and private institutions in 14 research programmes and priority areas in line with FP7</p>
5	Public-private partnerships	<p>(-) Non-existent science parks and centres</p>	<p>Ministry of Science e.g. launched in May 2011 a feasibility study on establishing science parks and centres of excellence.</p>

	ERA dimension	Main challenges at national level	Recent policy changes
6	Knowledge circulation across Europe	(-) Low participation rates in European research initiatives.	In March 2011, an Action Plan on Mobility of Scientists was adopted containing measures aiming at strengthening inward, outward and inter-sectoral mobility over the period 2011-2012 and, in doing so, preparing for adoption of the European Charter and Code of Conduct for the recruitment of researchers.
7	International Cooperation	(-) Moderate participation in the FP, EUREKA and COST programme. (-) Overall, very low resources provided for international co-operation in science and technology.	There have been no recent policy changes

Annex: Alignment of national policies with ERA pillars / objectives

1. Ensure an adequate supply of human resources for research and an open, attractive and competitive single European labour market for male and female researchers

1.1 Supply of human resources for research

Official statistic for human resources in science and technology in Montenegro for R&D employees and researchers do not equate to Full Time Equivalents (FTE) as defined in the OECD's Frascati manual.

There is a considerable structural change in the R&D system, which can be seen when looking at R&D sector performance. The higher education sector receives the biggest part while the business sector enjoys limited support from government. This situation also reflects the distribution of human resources in the respective R&D institutions. As there is no official data available, the publication "Montenegro in the 21st Century - In the Era of Competitiveness" states that today almost all share of researchers are within the higher education (90%) sector while the number of researchers in public or private institutes as well as in the industrial sector is marginal.

Montenegro and the EU-27 accounted for contrasting trends in numbers of researchers and R&D personnel. There were 313²⁴ researchers full-time equivalents (FTE) employed in the Montenegro in 2009, which rank Montenegro far below the EU-27 average (1.6 million researchers (FTE) employed in the EU-27). Demise of central planning and immediate introduction of a market economy were reflected in fall in GERD however, stocks of human resources in R&D remained stable. In 2000, numbers of R&D workers were 1,217 and researchers were 642. By 2005 there were some 1,246 R&D workers (of which 633 researchers) in headcounts in Montenegro. There were some 1,512 R&D workers (of which 781 researchers) in headcounts in 2009 (last available data from MONSTAT²⁵), which represents 0.88% of total workforce.

Publication "Montenegro in the 21st Century - In the Era of Competitiveness" states additional data on human resources. There are around 1.7 FTE researchers per 1,000 employees or 0.44 FTE researchers per 1,000 inhabitants.

Around 300 students, out of which 40% studying social, 37% medical, 15% engineering and 4% natural sciences, presently attend doctoral studies. There are no postdoctoral studies. Annually 0.16 PhD thesis per 1,000 inhabitants aged 25-34 are awarded in Montenegro. The average in EU rates around 1.5.

The share of inhabitants with tertiary education in the population aged 25 to 64 rates approximately 9.5% (in EU-27 is 22.5%).

Data on the levels of inward versus outward flow of researchers is not available, but brain drain is considered a serious problem for the development of human resources in Montenegro. Specific actions taken at national level to enhance transnational mobility was the adoption (March 2011) of the "Action Plan on Mobility of Researchers (2011-2012)". The Action Plan foresees measures that the Ministry of Science will take in order to remove barriers to mobility, as well as strengthening financial instruments for mobility support. The main changes are in relation to national research projects that are now available to foreign researchers, and planning of a national programme for young researchers' mobility for the period after 2012. The Ministry is also focused at the improvement of bilateral scientific cooperation that sets legal framework for free realisation of mobility.

Bilateral interstate scientific-technological cooperation is a very efficient mechanism for mobility support according to the principle of reciprocity, for research teams from partner countries working on similar topics

²⁴ Data calculated for the publication "Montenegrin Academy of Science and Art (2010): Montenegro in the 21st Century - In the Era of Competitiveness", Podgorica, 2010.

²⁵ Montenegro Statistical Office (2011): Annual data, Economy of Montenegro in 2010. Available at: <http://www.monstat.org/eng/page.php?id=19&pageid=19>

of research that are financed from state budget of two countries. Since the Declaration of Independence of Montenegro (2006), eight agreements have been signed (Austria, Albania, Bosnia and Herzegovina, Slovenia, Croatia, Serbia, Bulgaria and China), through which three calls for mobility of researchers have been realised within bilateral agreements for a two years period (Slovenia, Croatia and Austria). Mobility is considered to be a short-term stay (up to 3 months) depending on the dynamics of visits.

The Ministry of Science supports research via national programme “scientific research projects” which, represents the most important instrument of national policy. Participation of research teams in this programme is also available to foreign researchers who could be part of the team taking part in activities foreseen by the project. Making national programmes available to foreign researchers with whom local research team cooperates is a good practice presented within the strategic document “European Partnership for Researchers”. Mobility financing through national project has already been practiced but at smaller scale, and with the new Action Plan on Mobility of Researchers (2011-2012) this mechanism will be improved, as main transitional instrument until bilateral cooperation is established with larger number of states. Through participation in national projects, foreign researchers have the possibility to come to Montenegro to perform research, mentorship in preparation of dissertations, knowledge transfer etc. Montenegrin researchers could use financial resources for realisation of project also to perform research in large research centres and laboratories abroad, participation in scientific congresses etc.

1.2 Ensure that researchers across the EU benefit from open recruitment, adequate training, attractive career prospects and working conditions and barriers to cross-border mobility are removed

Employees in public sector are considered as civil servants. Salaries in public research organisations are regulated through a Decree on Compensations and other Income of Government Employees and Civil Servants (Official Gazette of Montenegro No. 24/05, 42/05 and 70/06). These are based on education level, type of jobs and length of experience. Salaries are determined by the amount of funds provided from the state budget. Salaries are below the average of most EU countries, which significantly reduces the demand for inflow of researchers in the country. The faculties can introduce additional stimulus in addition to the monthly salaries due to the scholarships.

In September 2011 two institutions (University of Montenegro and University Donja Gorica) included in Montenegrin’s education system had signed the Declaration of Commitment to the Principles of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers.

Recruitment procedures in place do not hinder the openness of the vacancies towards non-nationals. Foreign researchers are allowed to work in the private and public research and education institutions without the obligation to have a work permit in accordance with the Law on Employment and Work of Foreigners (Official Gazette of the Republic of Montenegro, No. 22/08). The goal of this is to increase the number of researchers thus creating a sound basis for enhancing competitiveness and fostering economic growth, as well as to encourage further cooperation of Montenegrin researchers with their international colleagues. The research grants are not portable i.e., awarded grants does not allow candidate to pursue his/her research other than at the home institution.

1.3 Improve young people's scientific education and increase interest in research careers

Currently, the number of people with scientific degrees who are employed in science and research, as well as the total number, especially of young researchers, in Montenegro is far below the average in the countries of the EU as well as those of Eastern Europe. By targeting usage, the renewal and increase in scientific potential, active involvement in research and economic activities in Europe, by stimulating the return of our established researchers from abroad, by paying special attention to the scientific youth, it is possible for Montenegro to gain both experience and expertise in the scientific and technological sectors, that can precipitates its full development. Undoubtedly, in such processes it is of great importance to create conditions for the circulation of, and not the drain of scientists, especially young personnel, as well as to pay special attention to young talented people. Investing in future generations, primarily by the acquisition of knowledge throughout their education and training, and modernising their skills through research, is increasingly becoming accepted as the most important condition for long-term social growth and the

increase of competitiveness. Equally important in that process is to provide the capacities needed to constantly innovate knowledge, in applying existing and new knowledge, as well as new ideas, and thus secure the more successful and efficient progress of Montenegro.

The current status of science, technology, engineering and mathematics in Montenegro is maybe best explained in the publication "Montenegro in the 21st Century – in the Era of Competitiveness", prepared by the Montenegrin Academy of Sciences and Arts (MASA).

The publication states that there is no a defined strategy of detecting and observing talent from the earliest stages. Nevertheless, there are some examples of good practice aimed to increase interest of secondary school students in science (summer schools of physics, biology and chemistry, knowledge competitions at the municipality and country level, group visits to the Large Hadron Collider at CERN for the students with the best results at the country's physics competition).

PISA and domestic testings show that the average results of Montenegrin students in the field of scientific literacy are significantly below the OECD average.

After the educational reform, there are less compulsory lectures in natural sciences, and elective courses are not popular among the students because of the weaknesses in their organisation and old-fashioned way of teaching.

General decline of students' interest in natural and technical subjects is also influenced by the Montenegrin transitional economy and labour market, which strongly favour management, commerce and services.

Equipment of teaching classrooms for natural sciences most frequently lacks or it is pronouncedly poor.

There is a great disproportion between the number of university students in the social and humanities groups and the group of natural sciences, mathematics and engineering, with a tendency of a decrease in interest by graduates for the latter.

There are not enough programmes for the promoting and popularisation of science. Nevertheless, there are examples of good practice - Science Festival in Montenegro, held each year in September.

Established Young Researchers' Centre of the Montenegrin Academy of Sciences and Arts.

The publication further provides directions to the Government on how to develop and improve the current situation.

- It is essential to provide a larger number of human resources educated in the natural and technological sciences and medicine, as the basic disciplines that generate new knowledge and values. This is why Montenegro needs a larger number, than is currently available, of masters and doctors of the sciences and philosophy, as well as specialists. There is an urgent need to improve the quality and the efficiency of education in the research system.
- The next decade is expected to bring with it new transformative technologies with the potential to change our lifestyle, which imposes the necessity of raising the level of national education in STEM areas (Science, Technology, Engineering, Mathematics). It is essential to stop the decrease in interest of the young for STEM areas, through stimulating measures at the level of the state, the popularisation of those areas and an improvement in the quality and integrity of teaching.
- Elaborate, adopt and implement in stages the Strategy for the natural sciences subjects in pre-university education in Montenegro.
- In the modern world imagination and creativity hold a special place, and therefore should be especially encouraged. Children should be taught to think freely, in an unconventional, creative and critical way.
- The problems of everyday life will more and more require wider visions and multidisciplinary knowledge, while formal education curricula are still organized through courses, which are not well interconnected. The important task is to remove those barriers and help the students take a holistic approach to the various phenomena and problems and gain integrated knowledge.
- Reducing the still too extensive curricula, in order to relieve the students from memorizing facts in

favour of the acquisition of functional knowledge. Diversification of the sources of learning and the practice of the type of teaching that encourages curiosity develops the ability of observation and introduces students to an experimental and research approach to learning.

- The introduction of certain courses in grammar schools at two levels, basic and higher, in order to enable the better students to gain a deeper and more profound knowledge in certain areas.
- Removing weaknesses in organisation of elective science courses in primary schools and high schools and increase the quality of education offered by those courses.
- Creating better working conditions in schools, reducing the number of students in classes, adequately equipping the schools with teaching aids, especially in classrooms for experimental teaching.
- Establishing elite schools. Building an efficient system of discovering gifted children and creating special – individual programs for them, which would allow adequate development of their talent. The engagement of experts for specific teaching areas, who would work with particularly talented students on the principle of a master class.
- Carry out campaigns of science popularisation; support the work of the media, institutions and events promoting science; encourage the participation of the young in excellence centres.
- Build the Museum of Science and support its operation.

1.4 Promote equal treatment for women and men in research

Promotion of women in science is not specifically articulated in the policy formulation. Specific arrangements exist for young researchers in case of maternity leave, where their status can be extended for the period of their absence from work. It applies also for women working at higher education: their status is maintained and the leave does not count into re-election time frame. There are no national policy level regulations, which would in any way discriminate on the basis of gender. Statistics show that there is an equal representation of women in science. Namely, in 2009, out of 781 researches in Montenegro, 361²⁶ are women. Also, among research programme group leaders or heads of research project proposals, approved by Strategy for Science and Research Activities 2008-2016, there is no gender discrepancy.

2. Facilitate cross-border cooperation, enhance merit-based competition and increase European coordination and integration of research funding²⁷

Specific actions taken at national level to enhance transnational mobility was the adoption (March 2011) of the “Action Plan on Mobility of Researchers (2011-2012)”. The Action Plan foresees measures that the Ministry of Science will take in order to remove barriers to mobility, as well as strengthening financial instruments for mobility support. The main changes are in relation to national research projects that are now available to foreign researchers, and planning of a national programme for young researchers’ mobility for the period after 2012. Namely, in October 2011, the Ministry of Science has announced a new Call for scientific and research projects covering period 2012-2014 to which foreign researchers will be eligible to take part. The total budget is €5m.

However, before the new call for scientific and research projects 2012-2014, there were no instruments particularly targeting researchers from third countries. Law on Scientific and Research Activity in theory enabled participation of foreign researchers in Montenegrin research programmes, but there was little

²⁶ Montenegro Statistical Office (2011): Annual data, Economy of Montenegro in 2010. Available at: <http://www.monstat.org/eng/page.php?id=19&pageid=19>

²⁷ Promote more critical mass and more strategic, focussed, efficient and effective European research via improved cooperation and coordination between public research funding authorities across Europe, including joint programming, jointly funded activities and common foresight.

- Ensure the development of research systems and programmes across the Union in a more simple and coherent manner.
- Promote increased European-wide competition and access of cross-border projects to national projects funding

experience with this issue, given limited interest by foreign researchers in working in Montenegro. Low salary and poor R&D equipment are major barriers for attractiveness of research careers in Montenegro both by the Montenegrin and foreign nationals.

Concerning the scientific and educational cooperation with other countries from the region as well as with other European countries, it can be said that Montenegro have an active on going bilateral programme in scientific research with eight countries (Austria, Albania, Bosnia and Herzegovina, Slovenia, Croatia, Serbia, Bulgaria and China), through which three calls for mobility of researchers have been realised within bilateral agreements for a two year period (Slovenia, Croatia and Austria). Mobility is considered to be a short-term stay (up to 3 months) depending on the dynamics of visits.

Montenegrin academic community signed numerous bilateral agreements on international cooperation with foreign institutions (mutual agreements between faculties/colleges, universities, institutes etc.) that also cover the field of science and research, as well as joint projects. This type of cooperation agreements mainly is reflected in individual participation of researchers in research activities. Bilateral cooperation was well developed with Slovenia and Greece.

For the period 2004/2007 Montenegro and Slovenia realised 15 common scientific and research projects from the following research areas: environmental protection; biology; biotechnology; agriculture; physics; mechanic, mechanical engineering; metallurgy; medicine, protection of cultural heritage and linguistics (see Table 3).

Table 4: Overview of number of realised bilateral projects of Montenegro with the Republic Slovenia

Scientific Area	2004/2005	2005/2006	2006/2007	Total
Natural Sciences and Mathematics	3	-	1	4
Technical and Technological Sciences	1	-	3	4
Biotechnological Sciences	-	1	1	2
Medical Sciences	1	1	1	3
Social Sciences and Humanities	1	-	1	2
Total financed	6	2	7	15

14

Within the period 2006/2008 bilateral cooperation between Montenegro and Greece was realised through 14 common scientific and research projects from the following research area: environment protection, marine biology, biotechnology, agriculture, information and communication technology and new materials (Table 4).

Table 5: Overview of number of realised bilateral projects of Montenegro with the Republic of Greece

Scientific Area	2006/2008
Natural Sciences and Mathematics	6
Technical and Technological Sciences	6
Biotechnological Sciences	2
Medical Sciences	-
Social Sciences and Humanities	-
Total financed	14

Montenegro participates in the FP7 (Capacities) [WBC.INCO-NET](#) project, a regional consortium project with the aim of supporting research and innovation cooperation and enhanced integration of the Western Balkan Countries (WBCs) in the ERA.

3. Develop world-class research infrastructures (including e-infrastructures) and ensure access to them

Montenegro has its ESFRI Delegate. No National roadmap has been made yet.

The research infrastructure is primarily national in character. The public research (technological) organisation and the higher education institutions have a large autonomy within the Universities in Montenegro, with significant fragmentation of resources including present research infrastructure and equipment. As a result of this process, small research units with research infrastructure tools dominate. In such situation, duplication of equipment and unnecessary waste of already scarce resources is eminent. To avoid and enable networking and integration, the Register of equipment should be established which is still not the case.

The government has set up an electronic information system on scientific and research activities that aims at processing automatically all information of interest to scientific activities in Montenegro and abroad. It has also adopted an information and communications technology (ICT) development plan to assess use of ICT for scientific research activities, review the legislation adopted in the ICT field and analyse the networking between ICT companies and scientific research institutes.

4. Strengthen research institutions, including notably universities

Universities and their faculties as educational and scientific legal entities within universities have a large degree of autonomy.

Employment is the responsibility of the faculties. The faculties select and employ professors and other personnel and design their education programs. However the faculties cannot set the basic salary for their employees who receive income from the Ministry of Science directly. Instead, the salary represents a part of the block grant, as financial incentives and also a source of revenue for the scientific institutions. Research institutes are the university units. Similar to faculties, the institutes select and employ scientists and other personnel and design their scientific activities. The faculties are responsible for the design of educational and scientific programmes, finances and applications for international projects. The autonomy is tightly connected with obligations of the university towards the students, ensuring the provision of quality education as well as obligation of accountability towards the public, society and the local community.

No important change has occurred in the last three years in relation to the HEI landscape. There are currently 3 HEIs in Montenegro:

- The University of Montenegro, the only public university. Founded in 1974, comprising 19 faculties and 3 scientific research institutes. Currently, the University provides 77 (57 academic and 20 applied) study programmes.
- University Mediterranean (private). Founded in 2006, comprising 6 faculties (10 academic and 2 applied study programmes). Faculty of Tourism Bar–MTS– “Montenegro Tourism School” organises PhD studies Management in Tourism with the duration of three years.
- University of Donja Gorica (UDG) recently founded private university accredited in 2010.

There is no effective national monitoring/evaluation mechanism in place of the research performance in HEIs/PROs. The only evaluation of the research performance in HEIs was done within FP7/REGPOT project “EVOLUNIMONT (Evaluation of Research Activities and Strategic Planning of Research at the University of Montenegro)”.

Objectives of the project:

- Attain an evidence based and widely recognised profile of the existing research quality and capability of UoM and its prospects
- Acquire sufficient knowledge for responsible decision-making in the process of evaluation and Strategic planning of research at the UoM
- Set strategic goals for the research function of the University of Montenegro, as support to national and regional economic development
- Raise awareness of the importance of evaluation and strategic planning of research among the research community and wider public.

The Final Report of the project is still not available to the public.

5. Facilitate partnerships and productive interactions between research institutions and the private sector

Five years after gaining independence from Serbia in May 2006, Montenegro is in the process of establishing its own science system and science policy. Legal and institutional framework for stimulating innovations is yet to be established. So far, Montenegro adopted three strategic documents reflecting future national strategy for innovation: strategy for science and research activities (2008-2016), strategy for development of SMEs (2011-2015) and strategy for promotion of competitiveness at the micro level (2011-2015).

In July 2008, the government adopted a [Strategy for Scientific Research Activities 2008-2016](#) (including an action plan). Two key priorities were identified in order to facilitate integration into the European Research Area: the increase in research cooperation with the EU and the reform of the national scientific community. Thus, in practice, there are no thematic R&D and innovation programmes or regulations that aim to foster innovation.

In January 2011, a [Strategy for development of SMEs](#) was adopted, covering the period 2011-2015. It focuses on creating better business conditions and entrepreneurship for SMEs and includes several measures to stimulate and monitor research activities of SMEs, which, in turn, will contribute to the Innovation Union.

In June 2011, the Government adopted a similar strategy that is focused on [Promotion of competitiveness at the micro level in the period 2011-2015](#), previously adopted by the Council for Promotion of Competitiveness. The primary goal is to contribute to the improvement of support for SMEs through its activities, which will increase competitiveness and valorise innovative and export potentials.

A new, knowledge based economy has just begun to emerge in Montenegro and the country's technological and export aspirations are still at a low level, policymakers and managers are not fully aware of competitiveness as key to their survival, and thus they under invest in development and innovation. On the other hand, foreign companies' owners bring their "know-how", without any interest whatsoever in establishing R&D units in Montenegro or of using local knowledge and nor do the competitive grants financed by the Ministry of Science sufficiently promote knowledge transfer.

Government-owned research results are not made freely available. Moreover, they are not adequately monitored. There are no special legal regulations covering the field of intellectual property rights (IPR) on the Montenegrin universities. It is likely that many opportunities for commercialisation of research results are not utilised.

The special mobility schemes allowing R&D students/PhDs/ to conduct innovation projects in firms are not present.

Involvement of private sectors in the governance bodies of HEIs and PROs is marginal, usually one representative from private sector within a body of 10 to 15 appointed members, with low impact on the development of an institution in question.

6. Enhance knowledge circulation across Europe and beyond

The main instrument is the Component 2 of the IPA focused on the cross-border cooperation between Montenegro and non-EU countries (Serbia, BiH) as well as IPA ADRIATIC CBC. With the exception of the Priority 1 of the IPA ADRIATIC CBC (<http://www.adriaticpacbc.org/>) that includes Measure 1.1. Research and innovation, other programmes are mostly aimed at the development of economic and social cross-border activities, solving common infrastructural or communal problems, cultural cooperation, tourism, etc.

The SEE-ERA.NET PLUS programme could be considered as a sort of cross border cooperation since it is aimed at enhancing the integration of the Western Balkan countries by a Joint call for European research projects.

There are no recent measures that support the development of a sustainable, efficient and effective European scientific information system.

There are no recent measures that support open circulation of knowledge across national borders and open access to research outputs (publications and data) by researchers and society at large.

7. Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world

At present, there is no special strategy for the conduct of international cooperation on research.

However, the Strategy on Scientific and Research Activity contains a specific chapter referring to the international cooperation, which provides the list of the following conclusions and recommendations:

- The measures referring to the exchange of information in a decision-making process, technology transfer and the exchange of results can have a positive effect on the internationalisation of national programmes. These effects would stimulate the international cooperation through the contacts within the financed projects in different countries, as well as mobility of researchers as an essential condition for creating a successful international cooperation.
- In order to stimulate an international cooperation of a larger scale in Montenegro, it is necessary to undertake a series of specific measures in order to form the infrastructure necessary for fostering of international cooperation and taking part in the European Research Area.
- Participation of researchers in the relevant European and international programmes should be strongly encouraged through the increase of funds designated for their mobility.
- The system of financing, control and flow of information on international cooperation should be unified at the national level within a single legal entity that must keep a neat data base on all participants in international cooperation activities. It is necessary to complete contact point network for different thematic fields within the Seventh Framework Programme, as well as in other international programmes.
- Researchers should be timely and systematically informed about all the calls and the requirements for the applications, and above all, for all the calls regarding the Framework Programme, through national contact points.
- The entrance of Montenegro in the EUREKA programme should be accelerated, since at the international level this programme encourages involvement of industry and private sector in the system of financing scientific and research activities.
- The participation in the COST programme should be promoted through the suitable administrative mechanisms, which are not yet developed in Montenegro, as well as through more widely spread informing of academic circles at large about the possibilities offered by the COST.
- The existing bilateral cooperation should be extended, being one of the most popular experiences in the exchange of scientific and research results. Also, the intensive activities on establishing a more extensive multilateral cooperation should be initiated.
- Regional cooperation should be intensified, since it offers numerous possibilities for joint research projects relevant for the whole region, with a comparatively equal level of scientific and research activities.
- It is necessary to create a better and more strongly connected network between Montenegrin scientific and research organisations and other national and European agencies that promote science and research, as well as their financial organisations, in order to foster and improve cross-border activities.

Most of these recommendations are part of the Action Plan of the Strategy.

Concerning the scientific and educational cooperation with other countries from the region as well as with other European countries, it can be said that Montenegro have an active on going bilateral programme in scientific research with eight countries (Austria, Albania, Bosnia and Herzegovina, Slovenia, Croatia, Serbia, Bulgaria and China), through which three calls for mobility of researchers have been realised within bilateral agreements for a two year period (Slovenia, Croatia and Austria). Mobility is considered to be a short-term stay (up to 3 months) depending on the dynamics of visits.

The cooperation usually involves the establishment of the joint committee that decides about common research priorities, common funds, funding/evaluation research projects, scholarships, exchange of doctoral students, post-doctoral studies in the scientific institutions, etc. The mobility schemes for researchers from third countries are part of the bilateral research and educational agreements and usually include scholarships, exchange of doctoral students and post-doctoral studies in the scientific institutions. There are

no specific rules regulating the national collaborations with third countries.

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List of Abbreviations

BERD	Business Expenditures for Research and Development
BiH	Bosnia and Herzegovina
CEPFS	Commission for Economic Policy and Financial System
CERN	European Organisation for Nuclear Research
CESCS	Committee for Education, Science, Culture and Sports
COST	European Cooperation in Science and Technology
EIICM	European Information and Innovation Centre Montenegro
ERA	European Research Area
ERA-NET	European Research Area Network
ESFRI	European Strategy Forum on Research Infrastructures
EVOLUNIMONT	Evaluation of Research Activities and Strategic Planning of Research at the University of Montenegro
EU	European Union
EU-27	European Union including 27 Member States
FP	European Framework Programme for Research and Technology Development
FP7	7th Framework Programme
FTE	Full time equivalent
GCR	Global Competitiveness Report
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HRST	Human Resources in Science and Technology
ICT	Information and communications technologies
IMF	International Monetary Fund
IP	Intellectual Property
IPA	Instrument for Pre Accession
MASA	Montenegrin Academy of Sciences and Arts
MONSTAT	Montenegro Statistical Office
NGO	Non governmental organisation
NUTS	Nomenclature of territorial units for statistics
OECD	Organisation for Economic Co-operation and Development
PRO	Public Research Organisations
R&D	Research and development
RDI	Research development and Innovation
RI	Research Infrastructures
SMEs	Small Business Enterprises
STME	Science Technology Engineering and Mathematics
UDG	University if Donja Gorica
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UoM	University of Montenegro

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Abstract

The main objective of the ERAWATCH Annual Country Reports is to characterise and assess the performance of national research systems and related policies in a structured manner that is comparable across countries. EW Country Reports 2011 identify the structural challenges faced by national innovation systems. They further analyse and assess the ability of the policy mix in place to consistently and efficiently tackle these challenges. The annex of the reports gives an overview of the latest national policy efforts towards the enhancement of European Research Area and further assess their efficiency to achieve the targets.

These reports were originally produced in November - December 2011, focusing on policy developments over the previous twelve months. The reports were produced by the ERAWATCH Network under contract to JRC-IPTS. The analytical framework and the structure of the reports have been developed by the Institute for Prospective Technological Studies of the Joint Research Centre (JRC-IPTS) and Directorate General for Research and Innovation with contributions from ERAWATCH Network Asbl.

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.