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Abstract

The Analytical Country Reports analyse and assess in a structured manner the evolution of the national policy research and innovation in the perspective of the wider EU strategy and goals, with a particular focus on the performance of the national research and innovation (R&I) system, their broader policy mix and governance. The 2013 edition of the Country Reports highlight national policy and system developments occurring since late 2012 and assess, through dedicated sections:

- national progress in addressing Research and Innovation system challenges;
- national progress in addressing the 5 ERA priorities;
- the progress at Member State level towards achieving the Innovation Union;
- the status and relevant features of Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3);
- as far relevant, country Specific Research and Innovation (R&I) Recommendations.

Detailed annexes in tabular form provide access to country information in a concise and synthetic manner.

The reports were originally produced in December 2013, focusing on policy developments occurring over the preceding twelve months.

ACKNOWLEDGMENTS AND FURTHER INFORMATION

This analytical country report is one of a series of annual ERAWATCH reports produced for EU Member States and Countries Associated to the Seventh Framework Programme for Research of the European Union (FP7). [ERAWATCH](#) is a joint initiative of the European Commission's [Directorate General for Research and Innovation](#) and [Joint Research Centre](#).

The Country Report 2013 builds on and updates the 2012 edition. The report identifies the structural challenges of the national research and innovation system and assesses the match between the national priorities and the structural challenges, highlighting the latest developments, their dynamics and impact in the overall national context.

The first draft of this report was produced in December 2013 and was focused on developments taking place in the previous twelve months. In particular, it has benefitted from the comments and suggestions of Gerard Carat from JRC-IPTS. The contributions and comments from DG-RTD are also gratefully acknowledged.

The report is currently only published in electronic format and is available on the [ERAWATCH website](#). Comments on this report are welcome and should be addressed to jrc-ipts-erawatch-helpdesk@ec.europa.eu.

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EXECUTIVE SUMMARY

Luxembourg is a small, wealthy country and its national research system (NRS) reflects both its size and its economic resources. Funding is multi-annual and programmes are normally thematic. Policies are consistent and coherent. In the 2013 Innovation Union Scoreboard, Luxembourg placed sixth, making it the second Innovation Follower after the Netherlands and representing positive movement from ninth place in 2011.¹

The most significant event both for Luxembourg's NRS and the Grand Duchy as a whole in 2013 was the result of the elections of 20 October, when the ruling Christian Democratic Party lost power for only the second time since 1944 and the Liberal Democrats, Socialists and Greens joined forces to form a coalition. The Liberal Democrats provided the Prime Minister, Xavier Bettel, and the Minister of Higher Education and Research, the third of the year. With a new government and both PRO performance contracts and funding commitments ending in 2013, 2014 holds some uncertainties and, although the Prime Minister has reiterated his commitment to supporting research, across-the-board cuts in budgets are underway .

With GDP growth estimated to recover to +1.9% in 2013, up from a stagnant -0.2% in 2012, GERD might also be expected to increase to meet 2020 objectives of 2.3 to 2.6% of GDP. As a sub-objective for 2020, the government has set an R&D intensity range of between 1.5% and 1.9% for the private sector and 0.7% to 0.8% for the public sector. The government's intermediate objective is an overall intensity rate of 2.0% by 2015. However, as BERD has experienced significant declines, meeting the 2015 target begins to appear unlikely. An additional source of concern is a lack of information on current levels of both GERD and BERD.

Structural Challenges

Four structural challenges have been identified for Luxembourg:

- *Increasing absorptive capacity.* Policies are in place but an increase also depends on economic conditions. Declining levels of BERD are a particular concern.
- *Increasing Luxembourg's research profile through international cooperation.* To gain critical mass in its targeted priorities, Luxembourg needs greater participation in international consortia.
- *Developing human resources in RDI.* Luxembourg relies heavily on foreign researchers to staff its NRS. More native researchers are needed. Luxembourg is also at the bottom ranks of the EU in RDI gender equality and any existing policies have failed to have an impact on effecting change.
- *Promoting a culture of entrepreneurship.* A dearth of entrepreneurial spirit, as well as difficulties in launching a start-up in the Grand Duchy, has long been identified in ERAWATCH and TrendChart reports. While a range of programmes exist, more indirect support measures would be helpful.

¹ The 2014 Innovation Union Scoreboard places Luxembourg fifth, the first of the Innovation Followers.

The extent to which Luxembourg's priorities match its structural challenges varies. Luxembourg does have measures in place to increase its *absorptive capacity* over time, including the law of 5 June 2009 and the requirement that PROs generate revenue from working with the private sector. Performance contracts also mandate revenues from international projects. These should help *increase Luxembourg's research profile*, as should the Fit4Europe (now Fit4Horizon2020) initiative for the private sector. Solutions are being sought on how to deal with the burden of project administration for SMEs.

Luxembourg's extensive support for PhDs and post-docs through the Aid for Research Training (AFR) programme, its PEARL and ATTRACT programmes, and its promoting research as a career will assist in the *development of human resources* in RDI. The issue of gender representation requires a significantly more active approach and effective policies and incentives developed.

Finally, there are some policies in place that support *entrepreneurship*. SMEs especially benefit from provisions in the law of 5 June 2009, the law giving beneficial tax treatment to IP revenue, the availability of business incubators with a range of expert support services and the resources of Luxinnovation. PRO performance contracts also have targets requiring the valorisation of research and the creation of spin-offs. Nonetheless, it remains difficult to be an entrepreneur in Luxembourg and both additional policies and changes in mind-set are needed. The latter is more difficult to address through policy alone.

Progress Towards Innovation Union Commitments

Strengthening the knowledge base and reducing fragmentation is supported by Luxembourg's EU-leading levels of HRST and workers with tertiary education. It is a model for open recruitment and has programmes to bring exceptional researchers to the Grand Duchy. It is also constructing a world-class research facility, the City of Sciences, which will house the University, public research centres and a business incubator. Getting good ideas to market is accomplished by having targets for patents and spin offs in PRO performance contracts, while the private sector is supported by the law of 5 June 2009 which offers subsidies for R&D. Luxinnovation works with companies on ways to fund innovation activities, while the law of 21 December 2007 offers preferential tax treatment to IP revenues.

Luxembourg's RDI strategy is to focus on a limited number of targeted areas and not try to be "all things to all men." Consequently, Luxembourg partners to address societal challenges by participating in the EIPs "Smart Cities and Communities" and "Active and Healthy Aging." The new programme National Centre for Research Excellence of the NRF also assumes transnational participation to address social-economic issues.

While Luxembourg is its own NUTS2 region, initiatives in logistics and ecotechnologies, two of the Grand Duchy's areas of "Smart Specialisation," involve the entire country. In terms of *international scientific cooperation*, Luxembourg has traditionally sought partnerships and collaborations to achieve critical mass. It has therefore established a range of bilateral and multilateral agreements and created the INTER programme to fund Luxembourg researcher participation in international projects. For the private sector, Fit4Europe (now Fit4Horizon2020)

supports SMEs in participating in FP7 consortia, while LuxLaunch prepares them for ESA projects.

Progress Towards the Realisation of ERA

With the exception of gender equality, Luxembourg has made significant progress in realising all aspects of ERA. To establish a *more effective national research system*, performance contracts have been signed between the Ministry of Higher Education and Research and all PROs. Contracts mandate annual evaluations by independent international experts. All funding programmes issue calls for proposals and proposals are evaluated by international peer review. Because of its small size, Luxembourg has always sought *transnational cooperation* and has signed seventeen bilateral and multilateral funding agreements. The NRF also participates in ECRIM, COST, EUROHORCS, and ESF networking programmes as well as in several ERA-Nets. In 2012, lead agency agreements were signed with Germany and Switzerland.

Luxembourg is a model for the *open recruitment of researchers*. All PROs and the NRF are signatories to the Code of Conduct for the Recruitment of Researchers and the European Charter for Researchers. Luxembourg has a Euraxess portal and both the University and PRC Santé have achieved Euraxess awards for HR Excellence. Finally, initiatives supporting the *circulation, access to and transfer of scientific knowledge* are either launched or underway, with the University having established a policy on Open Access and the NRF developing a plan. An EU report roughly estimates OA represents 50% or more of scholarly journal articles published in Luxembourg between 2008–2011. The National Library provides free digital access to all of its resources to all Luxembourg residents, including researchers.

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1 BASIC CHARACTERISATION OF THE RESEARCH AND INNOVATION SYSTEM

With an area of 2,586 sq. km and a population of 579.400,² Luxembourg is small, the smallest EU Member State except for Malta. It is also exceptional in that, of its resident population, 248,900, or 43%, are foreign nationals and that, in addition, each working day 160,964 *frontaliers* cross their national borders to work in Luxembourg. Of these, 40,685 are Belgian, 39,912 are German and 80,417 are French.³ This multinational mix extends to the Grand Duchy's academics, researchers and innovators.

In addition to its size, Luxembourg is also wealthy. As shown in Table 1 below, despite moribund GDP performance, Luxembourg has by far the highest GDP per capita in Europe, ahead of Norway's 193 and Switzerland's 156 for 2012, with 100 being the EU27 average. A unique factor of Luxembourg's GDP is the contribution made by the Services sector, which is the highest of any Member State, as shown in Chart 1 below, and the second highest in the world after Hong Kong.

Table 1. Luxembourg's GDP and GDP per Capita

	2010	2011	2012	2013
GDP Growth %	3.1	1.9	-0.2	1.9e
GDP per Capita	263	266	263	n.a.

Source: Eurostat December 2013. GDP per capita EU27 = 100 e = estimate

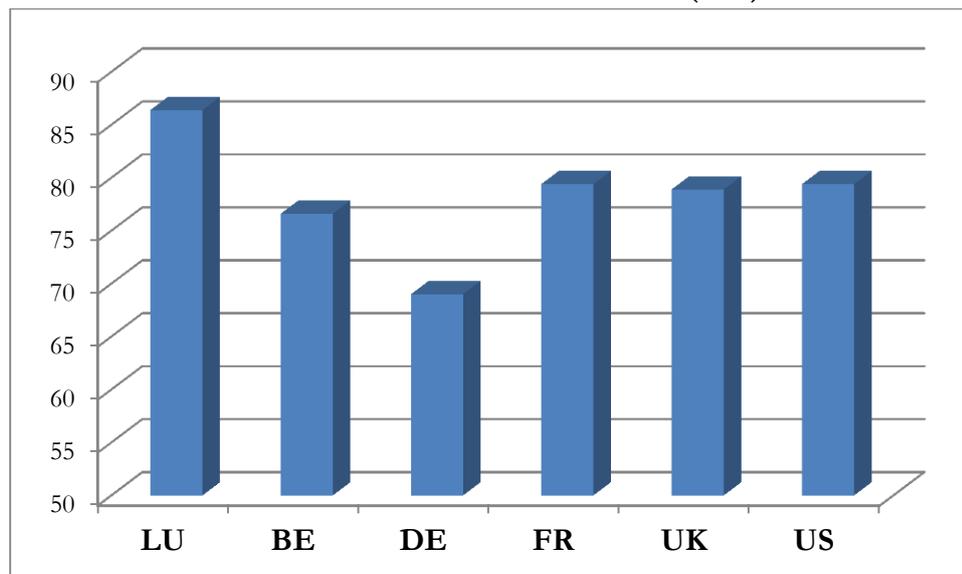
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3

http://www.statistiques.public.lu/stat/TableViewer/tableView.aspx?ReportId=7252&IF_Language=fra&MainTheme=2&FldrName=3&RFPPath=92

Chart 1: Contribution of the Services Sector to GDP % (2013)



Luxembourg's national research system (NRS) is also small, well-funded and well -defined. It can also be characterised by its youth. The Grand Duchy's oldest public research institutions were established in the late 1980's and its sole university was launched as recently as 2003. Consequently, the NRS is still developing absorptive capacity and the preponderance of research has historically been undertaken by private sector companies.

Table 2. Budget credits allocated to public R&D

Year	2008	2009	2010	2011	2012	2013	2014*
Amount	€183.1m	€200.2m	€247.7m	€253.4m	€271.3m	€280.1m	€292,00m
% GDP	0.49	0.56	0.62	0.60	0.62	0.62*	0.63*

Source: *Luxembourg 2020*, 2013. *Estimate

In addition to establishing a [national university](#) in 2003, the government sponsored [a study by the OECD](#) of its NRS in 2006 and a [Foresight Study](#) of its [National Research Fund](#) (NRF) and its programmes in 2006-2007. The former recommended all public research organisations (PROs) establish performance contracts with the Ministry of Higher Education and Research (MESR), that they stress the exploitation of research results and that they encourage the formation of public-private partnerships (PPPs). The Foresight Study identified the research themes which form the basis of the NRF's aptly named [CORE programme](#).

In terms of the private sector, in 2007, the government enacted a law giving preferential tax treatment to revenues from intellectual property (IP) registered in Luxembourg. On 5 June 2009, the government passed a [new law](#) which extended private research subsidies to the predominant services sector, with a special focus on SMEs. It also supported the secondment of public sector researchers to the private sector.

Luxembourg's research policy reflects multi-annual planning and funding and is outlined in [Luxembourg 2020](#), the National Reform Plan (NRF). Because Luxembourg has typically enjoyed an unusually stable political environment, policies have been consistent and carried forward

through the various national plans. Luxembourg's commitment to the Lisbon Agenda and, more recently, to Europe 2020, has been strong and is reflected in efforts to achieve excellence in its NRS. Examples include instituting performance contracts, mandating annual evaluations by independent, international experts and requiring international peer review of all project proposals. Finally, the [law establishing the University](#) specified that its primary focus was to be research rather than simply teaching.

The structure of Luxembourg's national research system is straightforward and remained stable in 2013. At its head is the Superior Committee for Research and Innovation (Comité Supérieur de la Recherche et de l'Innovation), which has as its objective ensuring consistency and coherence in RDI policy. Established in 2008, its co-chairs are the Ministers of the Economy and Foreign Trade and of Higher Education and Research.

The Ministry of Higher Education and Research (MESR) is in charge of public research performers that include the [University of Luxembourg](#), the public research institutions [Gabriel Lippmann](#), [Henri Tudor](#), [Santé](#),⁴ and [CEPS/INSTEAD](#). The [National Research Fund](#) (NRF) is also overseen by the MESR. Founded in 1999, the NRF oversees funding for public sector research programmes and administers the national funding programme for doctorate and post-doctorate studies, Aid for Research Training (AFR).

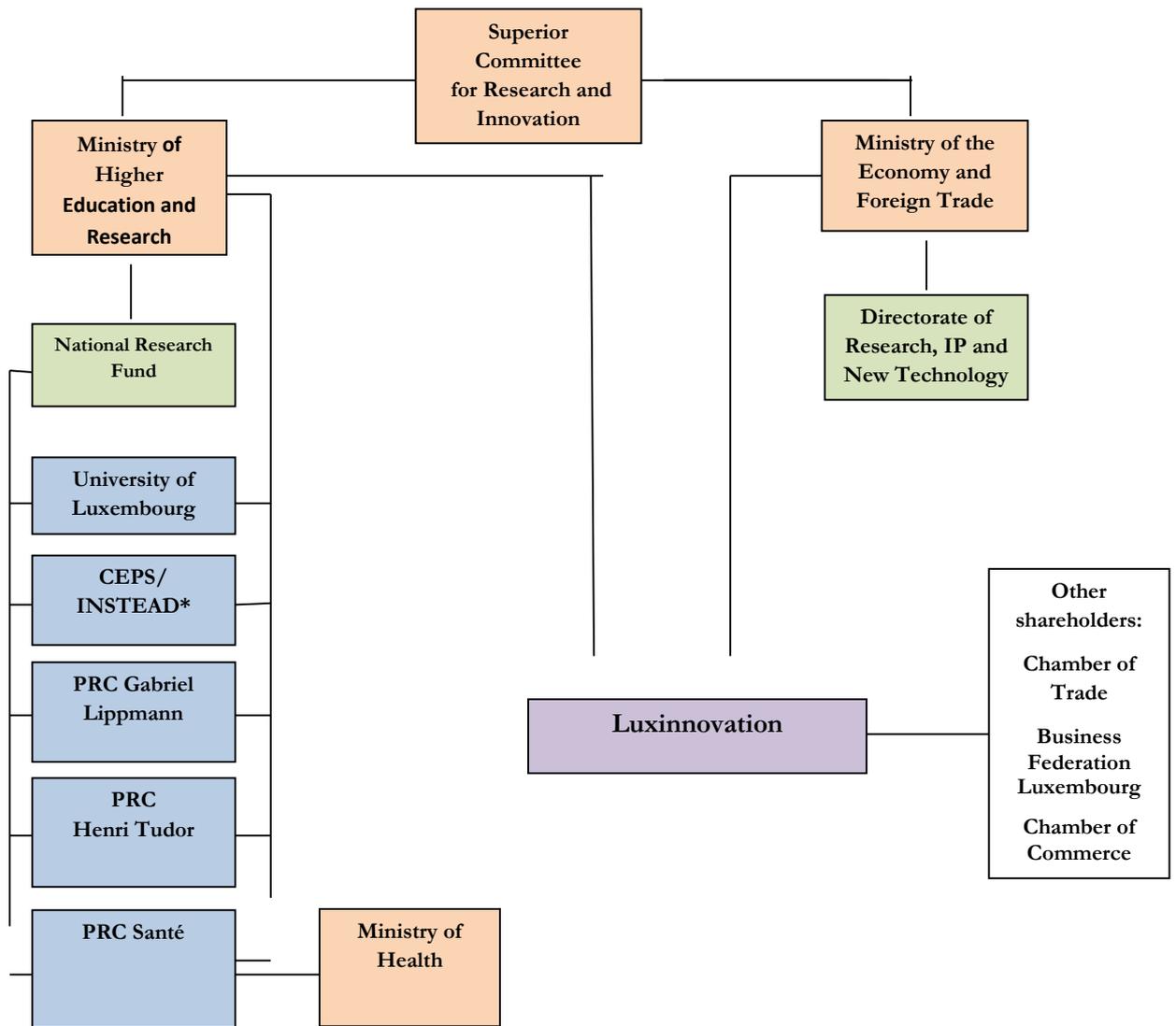
The Ministry of the Economy and Foreign Trade (MECE) manages private sector research programmes under the law of 5 June 2009. Its Directorate of Research, Intellectual Property and New Technology specifically deals with private sector RDI. Bridging the private and public sectors is the national agency [Luxinnovation](#). Established in 1984, Luxinnovation works with companies on identifying sources of funding and possibilities for public-private partnerships (PPPs), organising sectoral clusters and assisting firms with EU and ESA project participation. Most recently, Luxinnovation has also begun to work with the NRF to identify the potential for valorisation of the projects it funds.

Because of its small size, there are no regional RDI policies or bodies. In fact, Luxembourg is its own NUTS2 region.

A diagram of Luxembourg's research and innovation system is included on the following page.

⁴ CRP Santé is also overseen by the Ministry of Health

Figure 1: Luxembourg's R&I System



	Policy makers
	Research funders
	Research performers
	Innovation support agency

*Center for research on population, poverty and socio-economic policy / International Networks for Studies in Technology, Environment, Alternatives, Development

“”PRC – Pubic Research Centre

2 RECENT DEVELOPMENTS OF THE RESEARCH AND INNOVATION POLICY AND SYSTEM

2.1 National economic and political context

Luxembourg's economic performance was lacklustre at best in 2012, with a contracting GDP of -0.2%. While an improvement over the Eurozone 28's 2012 GDP of -0.7%, the Grand Duchy lagged neighbouring Belgium (-0.1%), France (0.0%) and a more robust Germany (+1.6%). GDP estimates for 2013 are for growth of +1.9%.

An additional weight on the economy has been an increase in unemployment, announced by Statec, Luxembourg's statistical agency, to be 7.1% in November 2013, compared to 6.3% in November 2012.⁵ While these figures vary from Eurostat's assessment of unemployment in the Grand Duchy as being 5.4% in December 2012 vs 6.1% in December 2013, and the Eurostat figures for Luxembourg are significantly lower than an EU 28 unemployment rate of 10.7% and a Eurozone rate of 11.9%,⁶ both sets of data indicate the rate is increasing. In addition, the government notes in *Luxembourg 2020* that many of the new jobs created are being filled by *frontaliers*, Luxembourg's cross-border workers, who have the skillsets which are apparently lacking locally.

The most significant national event of 2013 was the result of the early election on 20 October 2013. Elections were originally foreseen for June 2014 but were rescheduled following the announcement on 10 July 2013 by Prime Minister Jean Claude Juncker that he would offer the resignation of his government and call for early elections.

The announcement was a response to a scandal involving the country's secret service which in the late 1990's carried on surveillance of local politicians and business leaders without proper authorization. The results of the investigation prompted the withdrawal of support from the Christian Democrat's coalition partner, the Socialists (LSAP).

Luxembourg is known for its exceptional political stability. Juncker had been Prime Minister since 1995, making him the world's longest serving democratically elected political leader, and head of the eurogroup from 2005 through early 2013. His Christian Democratic party, the CSV, had won every national election in Luxembourg since its establishment in 1944 except for one in 1974.

It was a surprise, therefore, when the CSV lost just enough support in the election that three other parties were able to form a coalition without the Christian Democrats. The new coalition is comprised of the Liberal Democrats (DP), Socialists (LSAP) and the Greens. The Prime Minister is the DP's Xavier Bettel who, at 42, is the youngest head of government in the EU. The

⁵ <http://www.statistiques.public.lu/fr/actualites/population/travail/2013/12/20131220/index.html>

⁶

<http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&language=en&pcode=teilm020&tableSelection=1&plugin=1>

Minister of Commerce and Foreign Trade remains Socialist Etienne Schneider, while the Minister of Higher Education and Research, who is also the Minister of National Education and Youth, is DP Claude Meisch. Meisch is the third minister the MESR has had in 2013. He succeeded CSV member Martine Hansen, who had replaced François Biltgen, who was also a member of the CSV.

One result of the early election and change of government is that many legislative and policy issues have remained on hold. This includes the laws proposing changes to the national research system, which continue to await ratification. Additional uncertainties arise due to the fact that performance contracts between the MESR and the public research organisations terminate at the end of 2013, as well as many programme funding commitments, and contracts and budgets for 2014 and beyond have not yet been specified. Indications, however, are that budgets will be cut, with the recently announced (April 2014) €105m decrease in government funding for the University for the period 2014-2017 an example.⁷

2.2 Funding trends

2.2.1. Funding flows

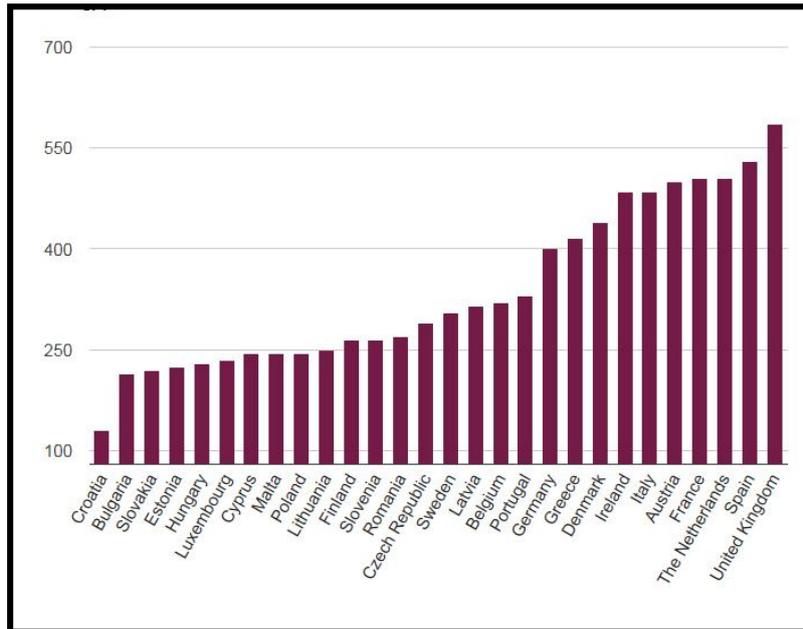
Because Luxembourg's funding programmes are multi-annual, and the current cycle runs through the end of 2013, there have been no disruptions in public funding despite the financial crisis and political transition. As reported in Section 2.1 above, however, across-the-board cuts are being made in public budgets and the RDI sector will be no exception.

Overall, the government has set a range of 2.3 to 2.6% of GDP as a national goal for R&D intensity, under its Europe 2020 strategy. As a sub-objective for 2020, the government has set a range of between 1.5% and 1.9% for the private sector and 0.7% to 0.8% for the public sector. The government's intermediate objective is an overall intensity rate of 2.0% by 2015. However, as the figures indicate in Table 3, it will take significant efforts to reach the intermediate objective of 2.0%, especially considering the continuing low levels of BERD.

An additional concern is the lack of figures for GERD, BERD and related indicators for 2011 and 2012. While the reason for the dearth of information is not clear, Luxemburg is among the lowest ranking of the EU's twenty-eight Member States in the Public Sector Information Scoreboard, as indicated in Chart 2 below.

⁷ <http://www.wort.lu/en/view/105-million-cut-from-university-of-luxembourg-budget-53464c2fe4b012fe7ff666df>

Chart 2: Public Sector Information Scoreboard



Source: The PSI Scoreboard⁸

Table 3. Basic indicators for R&D investments*

	2009	2010	2011	2012	EU28 (2012)
GDP growth rate	5.6	3.1	1.9	-0.2	-0.4
GERD (% of GDP)	1.74	1.51	n.a.	n.a.	2.06e
GERD (euro per capita)	1'256.9	1'178.3	n.a.	n.a.	525.8
GBAORD - Total R&D appropriations (€ million)	202.07	228.274	245.092	267.487	6,309.497
R&D funded by Business Enterprise Sector (% of GDP)	1.23	0.67	n.a.	n.a.	1.12 (2011)
R&D performed by HEIs (% of GERD)	8.0	13.0	n.a.	n.a.	24.0
R&D performed by Government Sector (% of GERD)	16.0	20.0	n.a.	n.a.	12.0
R&D performed by Business Enterprise Sector (% of GERD)	76.0	68.0	n.a.	n.a.	63.0
Share of competitive vs. institutional public funding for R&D %*	12.0 37.2	15.3 34.7	14.5 43.7	14.6 39.1	-
Venture Capital as % of GDP (<i>Eurostat table code tin00141</i>)	0.135	0.110	0.258	0.118	0.025
Employment in high- and medium-high-technology manufacturing sectors as share of total employment (<i>Eurostat table code tin00141</i>)	8.6	7.9	8.1	8.5	5.6 (2011)
Employment in knowledge-intensive service sectors as share of total employment (<i>Eurostat table code tsc00012</i>)	54.2	55.6b	55.0	55.4	38.9

⁸ <http://www.epsiplatform.eu/content/european-psi-scoreboard>

Turnover from Innovation as % of total turnover (<i>Eurostat table code tsdec340</i>)	-15.6 (2004)	12.5 (2008)	8.9 (2008)	88.3	5.0)
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e = estimate; b = break in time series *Figures are for the university then CRPs/EPS

2.2.2. Funding mechanisms

2.2.2.1 Competitive vs. institutional public funding

Based on performance contracts between the Ministry of Higher Education and Research (MESR) and Luxembourg's public research institutions, government funding is tied to increasing amounts of competitive funding, as detailed in Table 4 below.

Table 4: Public And External Funding Of PROs, in millions of euros

	2011	2012	2013	Total
PRC Henri Tudor				
Government	21.40	22.42	23.40	67.22
Contractual	8.93	9.91	11.00	29.84
Competitive	5.30	6.40	7.60	19.3
International*	0.53	0.64	0.76	1.93
PRC Gabriel Lippmann				
Government	15.00	15.30	15.60	45.90
Contractual	3.70	3.80	3.90	8.40
Competitive	6.10	6.20	6.30	18.60
International*	0.54	0.57	0.59	1.70
CEPS/INSTEAD				
Government	9.81	10.15	10.49	31.45
Contractual	2.94	3.31	3.65	9.90
Competitive	3.10	3.50	4.00	10.60
International*	0.20	0.25	0.30	0.75
PRC Santé				
Government	20.10	21.50	23.00	64.60
Contractual	3.92	4.47	5.07	13.46
Competitive	8.64	9.56	10.60	28.80
International*	0.69	0.86	1.06	2.61
University				
Government	106.00	120.20	131.70	357.90
Third Party	18.00	20.00	23.00	61.00

*Note that International funding is a subcategory of Competitive funding. Source: Ministry of Higher Education and Research, 2011

Performance contracts run from 2011 through the end of 2013. At the end of this period, results will be evaluated as new contracts are drawn up to begin in 2014, with it being reasonable to expect continuing increases in the funding coming from competitive sources and decreases in

funding provided by the government. In addition to mandating increasing amounts of competitive funding, the contracts also require annual evaluations of the research institutions.

In *Luxembourg 2020* (2013), the government reported that, while final figures were not available, the Grand Duchy recorded a financial return of €24.28m in 2012 from FP7 participation, compared to €17.47m in 2011. This represents a success rate of 64% of the €65 million established as an objective for the three-year period 2011-2013. Overall, Luxembourg's participation in FP7 is increasing and proposals submitted have nearly doubled between 2007 and 2012.

In terms of participating in projects co-funded by the European Space Agency (ESA), to which Luxembourg is the largest contributor in terms of percent of GDP, over 50 new projects submitted in 2012 were assisted by Luxinnovation. The number of investment contracts by Luxembourg companies signed during the year was 29 and the financial return on those investments amounted to €16.6m.

2.2.2.2 Government direct vs indirect R&D funding⁹

The vast majority of government R&D funding in Luxembourg is direct. For the private sector it takes the form of R&D subsidies under the law of 5 June 2009, as well as the law of 18 February 2010 on the protection of the environment and the rational use of natural resources. The law of 5 June 2009 also provides for the secondment of researchers from the public sector. Between 2011-2013, 240 new applications for subsidies were submitted. Note that the government does not disclose the monetary value of the R&D subsidies it provides to the private sector nor the names of the recipients. This lack of transparency additionally supports Luxembourg's low ranking in the EU's Public Information Scoreboard.¹⁰

While most funding is direct, one exception is the law which went into effect on 1 January 2008 that gives preferential tax treatment to revenue from intellectual property (IP). Under this law, up to 80% of the net income generated by the exploitation of an IP right is exempt from tax, which means the effective average tax rate on IP income is 5.7%. The law covers patents, trademarks, designs, domain names and software copyrights and applies to companies located in Luxembourg.

Although there are no programmes covering the entire value creation scheme, a recent development has been the involvement of Luxinnovation in projects funded by the NRF, so that issues involving the possible valorisation of the work are taken into consideration from the project's inception. No special funding is included, however, beyond what a selected project receives from the CORE programme.

In terms of venture or seed capital, the government did establish a fund, the €150 million Future Fund, which has a stated purpose of investing in innovative SMEs in the ICT sector. Again, the

⁹ ***Government direct R&D funding*** includes grants, loans and procurement. *Government indirect R&D funding* includes tax incentives such as R&D tax credits, R&D allowances, reductions in R&D workers' wage taxes and social security contributions, and accelerated depreciation of R&D capital.

¹⁰ <http://www.epsiplatform.eu/content/european-psi-scoreboard>

government has been criticised in the [media](#) for not providing information on investments made by the fund. The issue of venture capital is further discussed in Section 4.2 below.

2.2.3 Thematic versus generic funding

Because of its small size, Luxembourg has focussed on targeted research priorities. This strategy extends to its research funding. The major funding programme, [CORE](#), has five thematic domains, which are Innovation in Services, Sustainable Resource Management in Luxembourg, New Functional and Intelligent Materials and Surfaces and New Sensing Applications, Biomedical and Health Sciences and Societal Challenges. The programme has a budget of €69m from 2011-2013.

The University was also founded with targeted research priorities that closely correspond to the CORE funding themes. An exception to thematic funding is the [OPEN programme](#), which was launched in 2013 with a budget of €1m. OPEN is intended to support evolving research directions in Luxembourg which are currently not covered by the five CORE priority domains.

2.3 Research and innovation system changes

There were four major RDI system changes in the period surveyed (2013). The first was the follow-up to the announcement that Public Research Centres Henri Tudor and Gabriel Lippmann would be merged in 2015, by the establishment of the [Luxembourg Institute for Science and Technology Economic Interest Group](#) (LIST GIE). LIST will support the process of geographic clustering of teams and boost the strategic coordination within the two PRCs on specific areas and harmonising scientific and technological platforms between the new CRP and the University of Luxembourg.

The second major development was the resignation of François Biltgen and the appointment of Martine Hansen as the Minister for Higher Education and Research. The swearing in of the new minister took place on 30 April 2013. Minister Hansen studied agricultural engineering at the University of Stuttgart-Hohenheim, with a specialisation in "agricultural, social and economic sciences." In 2005, she obtained a master's degree in "school management" at the University of Kaiserslautern. Before her nomination as minister, Martine Hansen taught as a professor at the Lycée technique agricole in Ettelbruck (1993-2006) and had been its director from 2006 to 2013.

The third development was the replacement of Minister Hansen by Claude Meisch in November 2013, following the election of 20 October. Meisch, a Liberal Democrat, has been a member of the Chambre of Deputies since 1999 and the Mayor of Differdange since 2002. Minister Meisch is also the Minister of National Education and Youth.

The fourth development in 2013 was the launch of two new programmes by the NRF- The first, the OPEN programme, is discussed in Section 2.2.2 above. The second is the [National Centre for Excellence in Research](#). (NCER) NCER offers support for a trans-institutional collaborative research centre dedicated to solving a well-defined and relevant socio-economic question by bundling existing competencies, promoting partnerships and supporting networks. The pilot NCER will be "Early diagnosis and stratification of Parkinson disease." Funding is €12m.

2.4 Recent policy developments

In April 2012, legislation modifying the law of 31 May 1999 relating to the NRF was submitted to Parliament. One of the more important changes proposed was the possibility of opening funding not only to public institutions but also to non-profit organisations and foundations undertaking research activities. In December 2012, new legislation concerning the public research centres was also submitted. Provisions in the proposed law cover the mission and organisational basis of the research centres, propose the integration of the Integrated BioBank of Luxembourg (IBBL) with PRC Santé and the merger of PRCs Gabriel Lippmann and Henri Tudor referenced above.. Both laws continue to await final ratification.

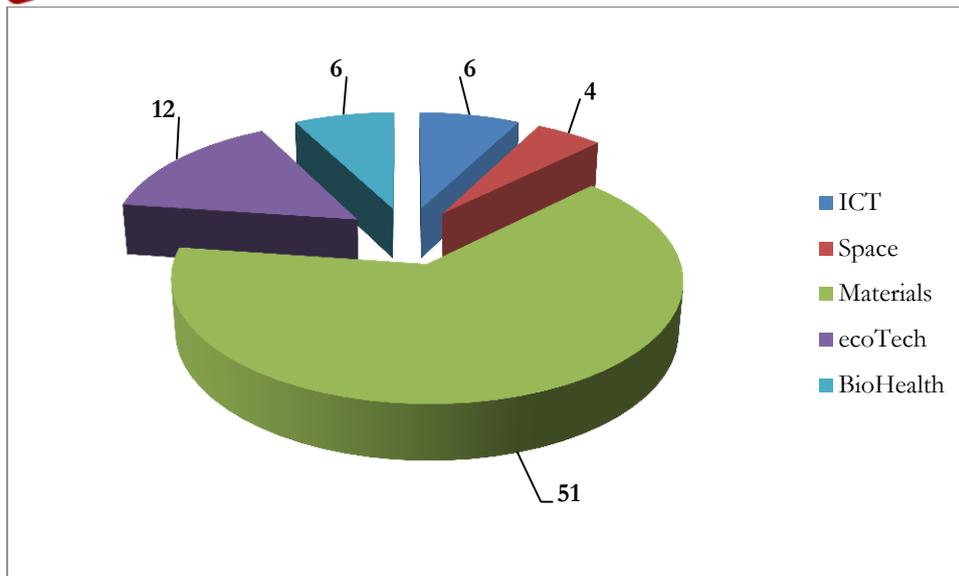
2.5 National Reform Programme 2013 and R&I

Luxembourg 2020 (April 2013) details a range of accomplishments in relation to the Grand Duchy's RDI programmes. In addition to the draft laws mentioned in section 2.4 above, achievements cited included:

- Concentrating on a limited number of research domains, exemplified by the CORE programme which supported 39 projects, representing a sum of €22 million in 2012, complimented by the launch of the OPEN programme, described in section 2.2.2.
- Supporting the development of researchers through the programme Aid for Research-Training (AFR) of the NRF, which supported a total of 94 doctoral candidates and 55 post-doctoral projects in the amount of some €20.8m in 2012
- Initiatives to support the innovation potential of SMEs, including organising an Innovation Master Class
- A fifth edition of “Business Meets Research” to support public-private partnerships
- Increased participation in FP7 and ESA projects
- The Luxembourg Cluster Initiative which supports clusters in Materials, ICT, Space, BioHealth, EcoInnovation and Automotive Components.

Luxembourg 2020 also provides some information on MECE funding of research under the law of 5 June 2009. Chart 3 shows the funding breakdown by sector. Information on companies receiving funding or the amounts of funding provided was not specified, highlighting another deficit in disclosing public information.

Chart 3: MECE Private Sector Research Funding by Sector, % received



Source: *Luxembourg 2020* (2013)

2.6 Recent evaluations, consultations, foresight exercises

It is a requirement of performance contracts that all public research institutions have annual evaluations by a team of independent, international experts. In 2012, the departments ISC (IT, Systems and Collaboration) at PRC Gabriel Lippmann, SSI (Service Science and Innovation) at PRC Henri Tudor, and Public Health at PRC Santé were evaluated. In addition, a second external evaluation of the University was made in March 2013. Results of the PRC evaluations and the responses of the institution are posted on the website of the [Ministry of Higher Education and Research](#). The University evaluation has also been published on its [website](#).

2.7 Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3)

Luxembourg has targeted three areas for Smart Specialisation. These are BioHealth, EcoTechnologies and Logistics. Note that because of Luxembourg's small size, there are no regional specialisation strategies.

Luxembourg laid out a "road map" for further developing a logistics sector in 2004, based on the presence of the Port of Mertert on the Mosel and logistics companies Cargolux and LuxAirCargo at Findel Airport, as well as having a highway and rail system which is within 350 km of the ports of Antwerp and Rotterdam. Since then, it has developed a "multi-modal" hub at Bettembourg for the transfer of freight between trucks and trains. It has also targeted niches in which to specialise that include a special facility at the airport to handle pharmaceutical products and the construction of a [freeport](#) for the storage of valuable goods.

PRC Henri Tudor is undertaking two Interreg IVB North West Europe (NWE) projects funded by the European Regional Development Fund (ERDF) and offers a Masters in Logistics programme in conjunction with the University of Lorraine, while a Cluster for Logistics that includes participants from all sectors of the knowledge triangle has been formed.¹¹ On the

¹¹ Note that the Cluster for Logistics (<http://www.clusterforlogistics.lu/>) is not included in the national cluster initiative detailed in <http://www.clusters.lu/>

ministerial level, both the Ministry of the Economy and Foreign Trade and the Ministry of Sustainable Development and Infrastructure are closely involved in logistics funding and oversight.

EcoTechnologies are supported by the law of 18 February 2010. Of the projects subsidised by the Ministry of the Economy and Foreign Trade in 2012, 12% related to EcoTechnologies and an EcoInnovation Cluster has been formed. Both PRCs Lippmann and Tudor have units focussed on sustainability and one of the CORE programme themes is Sustainable Resource Management. In addition, one of the University's stated main research areas is Environmental Resources, Technologies and Change.

Biohealth has received significant government investment with the founding of the [Integrated BioBank of Luxembourg](#) (IBBL) and the University's [Luxembourg Centre for Systems Biology](#) (LCSB). In addition, the government has invested €20 million of risk capital in the Advent Venture Partners [Advent Life Sciences Fund](#) (ALSF).¹² One of the CORE themes is Biomedical and H and 6% of projects funded through the law of 5 June 2009 in 2012 related to Biohealth. Unlike Logistics, which built on existing capacities, Biohealth has been a greenfields initiative and has attracted actors from all knowledge triangle sectors. One of the provisions of the draft law on research merges the IBBL with PC Santé.

Interestingly, the report *Research and Innovation Performance in Luxembourg* (2013) identified six areas in which Luxembourg shows significant scientific and technological strengths in a European context. They are space, automobiles, energy, materials, construction and the environment, with the space and automotive¹³ sectors assessed as Luxembourg's most competitive. Of the six, only one, the environment, has been designated by the government as a "smart specialisation" (*Luxembourg 2020*).

In the general report, *Research and Innovation Performance in EU Member States and Associated Countries 2013*, two areas, Space and Automotive, are identified as competitive "Hotspots in key technologies" for Luxembourg. The report is also pessimistic about Luxembourg's being able to meet its RDI Intensity targets for 2020. It calls the research and innovation ecosystem "very weak," its public components not yet able to play any decisive role in fostering innovation-led growth and the economy's over-dependence on the financial sector a "strong structural risk."

Finally, in terms of Smart Specialisation, it is noteworthy that, of the government's investments in private sector RDI funding through the law of 5 June 2009 as shown in Chart 3 in Section 2.5 above, only 12% were in EcoTechnologies and 6% were in BioHealth and none were in Logistics. 51% of subsidies were to companies working in Materials.

¹² ALSF started to invest in February 2011. As of January 2012, three investments had been made. The fund targets around fifteen investments of which approximately ten will focus on the creation of young enterprises and the rest on project funding. 70% of the investments will be made in Europe.

¹³ In Luxembourg's case, automotive means components such as sensors.

2.8 Policy developments related to Council Country Specific Recommendations

On 19 June 2013, Council recommendations relating to Luxembourg's NRF for 2013 and its 2012-2016 stability programme were delivered (Council of the European Union, 2013). Recommendations specific to RDI pointed out Luxembourg's heavy dependency on the financial sector and a subsequent need to develop alternative "competence niches," an undertaking that was perceived to be made more difficult by the weakness of Luxembourg's research and innovation system, as evidenced by the country not being on track to meet its R&D intensity target for 2020.

The principle recommendations were to foster more cooperation between the public and private sectors and to develop a more targeted smart specialisation strategy. The recommendations were the same for both the NRP and the stability programme and are also essentially the same as the assessments made in the *Research and Innovation Performance in EU Member States and Associated Countries 2013* referenced in Section 2.7 above.

While there have been no specific policy responses to date, doubtless reflecting the fact that the time period since the release of the recommendations overlapped with the run up to the early election and the formation of the new government, there is acute national awareness of the dominance of the financial sector and the need to diversify.

There have been a range of initiatives to promote more public-private partnerships, such as the "[Business Meets Research](#)" days organised by Luxinnovation, and targeted projects launched in the areas designated as Luxembourg's smart specialisations, detailed in Section 2.7 above. Examples of the latter specific to logistics are the development of a [freeport](#) and a [pharma and healthcare goods handling centre](#) at Findel airport. Otherwise responses to the recommendations will be contained in the new NRP to be published in April 2014.

3 PERFORMANCE OF THE NATIONAL RESEARCH AND INNOVATION SYSTEM

This chapter is aimed to assess the performance of the national research and innovation system and identify the structural challenges faced by the national innovation system.

3.1 National Research and Innovation policy

In the 2013 Innovation Union Scoreboard, Luxembourg scored sixth, the second of the “innovation followers” after the Netherlands. This is a significant increase in ranking from 2010’s tenth place and 2011’s ninth place. In the Innovation Union Scoreboard for 2014, released in early 2014, Luxembourg had moved up to fifth place, the first of the innovation followers after the quartet of “innovation leaders.”¹⁴

Overall, Luxembourg’s indicators showed marginal country growth of +0.7%, with a significant decrease of -32% in non-R&D innovation expenditures by firms and significant increases in the number of scientific co-publications (+22.4%) and scientific publications among the top 10% most cited (+17%), although the latter indicator was still below the EU average. Particular strengths were identified as “Innovators” and “Open, excellent and attractive research systems,” while weaknesses were noted in “Firm Investments.” Although recent figures on BERD are not available, the scoreboard suggests the earlier trend of decreasing business expenditures in R&D is continuing. At the same time, with services representing 86.4% of GDP, Luxembourg leads the EU in knowledge-intensive services exports as % total service exports, at over 78%.

¹⁴ http://ec.europa.eu/enterprise/policies/innovation/files/ius/ius-2014_en.pdf

Table 5: Innovation Indicators*

Human Resources	
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	53 / 0.79 (2011)
Percentage population aged 25-64 having completed tertiary education	139 / 49.6
Open, excellent and attractive research systems	
International scientific co-publications per million population	478 / 1,318.3 (2011)
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	93 / 10.1 (2008)
Finance and support	
R&D expenditure in the public sector as % of GDP	60 / 0.303% (2010).
Public Funding for innovation (innovation vouchers, venture/seed capital, access to finance granted by the public sector to innovative companies)	- / n.a.
FIRM ACTIVITIES	
R&D expenditure in the business sector as % of GDP	77 / 1.027% (2010).
Venture capital and seed capital as % of GDP	260 / 0.52 (2011)
Linkages & entrepreneurship	
Public-private co-publications per million population	67 / 36 (2011)
Intellectual assets	
PCT patents applications per billion GDP (in PPSE)	42
PCT patents applications in societal challenges per billion GDP (in PPSE) (climate change mitigation; health)	34 / 0.56 (2008)
OUTPUTS	
Economic effects	
Medium and high-tech product exports as % total product exports	85 / 1.7 (2009)
Knowledge-intensive services exports as % total service exports	/ 78.2 (2010)
License and patent revenues from abroad as % of GDP	133 / 0.78 (2011)

*The first figure is Luxembourg's scoreboard listing, the second when available is from Eurostat, December, 2013.

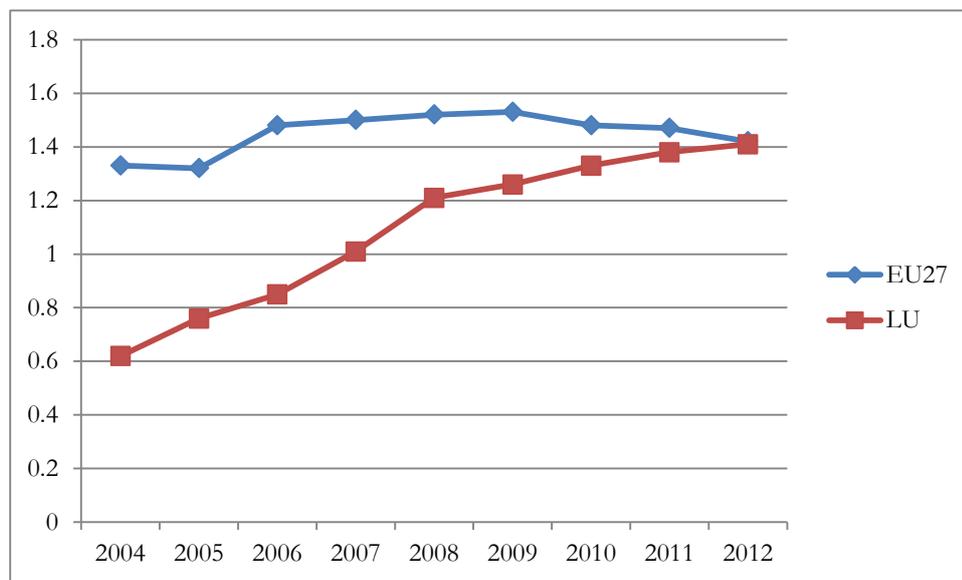
According to the EU Innovation Union Competitiveness Report, Luxembourg is further behind in meeting its target for R&D intensity in 2011 than it was in 2000 and 2007.¹⁵ The same document reports that Luxembourg, along with Croatia, Romania, Spain, Latvia, Portugal, the

¹⁵ http://ec.europa.eu/research/innovation-union/pdf/competitiveness_report_2013.pdf

United Kingdom and Finland, experienced negative annual real growth in total GERD of -4.8% between 2008-2011. On the positive side, Luxembourg’s R&D budget grew faster than GDP during 2008-2011, which means the government was able to protect R&D initiatives despite the financial crisis. In this respect, Luxembourg was second only to Malta.

Luxembourg, along with Estonia, Slovakia, Portugal and Germany, is one of the Member States where the share of R&D in government expenditure has progressed the most since 2007. That being said, Luxembourg’s GBAORD of 1.41% in 2012 is still marginally below the EU 27 average of 1.42%. Chart 4 below indicates the evolution of Luxembourg’s GBAORD vs the EU 27’s.

Chart 4: Evolution of GBAORD as a % of total government expenditure

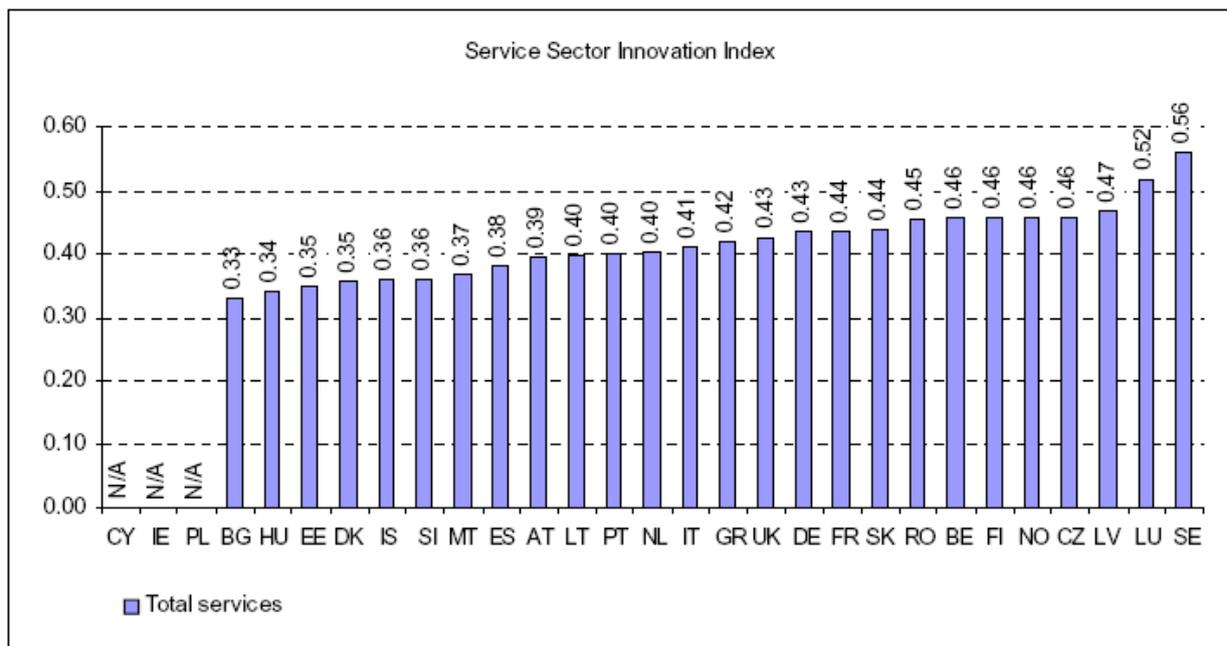


Source: Eurostat 12/2013¹⁶

In Luxembourg’s case, however, it is helpful to put its innovation performance in the context of the contribution made by Services to GDP, as shown in Chart 1, and the dominance of the financial services sector, which contributes 38% of GDP. A paper by Kanerva et al. (2006) suggests that countries that have “service economies” need to be assessed by different criteria than those traditionally used when evaluating innovation. Kanerva then contrasts the results of the 2006 Community Innovation Survey (CIS) rankings with his Service Sector Innovation Index (SSII), as shown in Table 6 below.

¹⁶ http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gba_nabste&lang=en

Chart 5: Services Sector Innovation Index (2006)



Source. Kanerva et al. 2006

Table 6: CIS/SSII Results Comparison

Country	CIS Rank	SSII Rank	Country	CIS Rank	SSII Rank
AT	13	18	IS	10	22
BE	14	7	IT	21	14
BG	32	26	LT	25	17
CY	23	NA	LU	8	2
CZ	19	4	LV	29	3
DE	6	11	MT	24	20
DK	4	6	NL	11	15
EE	20	24	NO	17	5
ES	22	19	PL	30	NA
FI	3	6	PT	28	16
FR	12	10	RO	33	8
GR	-	13	SE	1	1
HU	26	25	SK	27	9
IE	15	NA	SL	18	21
-	-	-	UK	9	12

Source Kanerva et al. (2006)

Certainly the Innovation Indicators used in the Innovation Union Scoreboard do not include all of the criteria laid out in the OECD's Oslo Manual (2003) for measuring innovation in services, which comprise product innovation, process innovation, organisational innovation and marketing innovation.

Finally, the characteristics of Luxembourg's corporate ecosystem should also be taken into account when evaluating the Grand Duchy's innovation performance and potential. The vast

majority of Luxembourg companies—76%—consist of fewer than five persons, as shown in Chart 6. In addition, 87% of all companies are in services. Only 3% are industrial and the remaining 10% are in construction, as indicated in Chart 7 Luxembourg’s largest private sector employer, steel giant ArcelorMittal, had only 4,810 employees in 2013.¹⁷

Chart 6: Companies by no. of employees

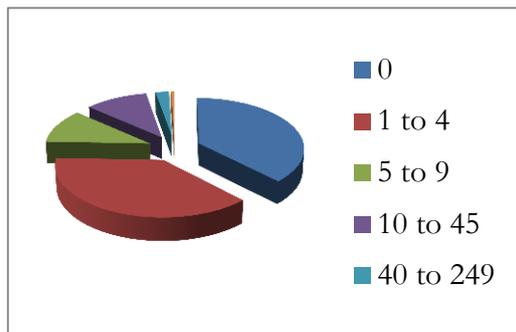
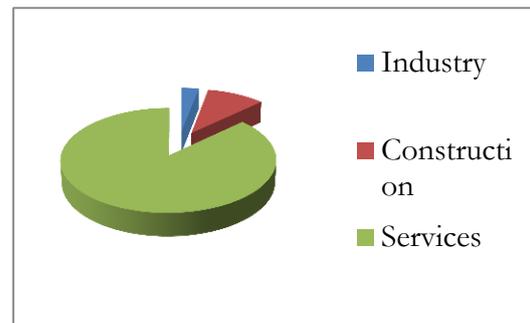


Chart 7: Companies by NACE categories



Source: Statec

3.2 Structural challenges of the national R&I system

Previous Country and Policy Mix Reports, the April 2011 Self-Assessment for DG RTD, the Innovation Union Competitiveness Report, the Innovation Union Scoreboard and other materials suggest the following key structural—as opposed to policy—challenges for Luxembourg’s RDI system.

Increasing absorptive capacity. At 1.43% in 2011, compared to an EU-27 average of 2.03%, Luxembourg’s GERD remains low. The reasons traditionally given for this underperformance are the youth of Luxembourg’s public research system and the consequent need to develop absorptive capacity. While time will take care of the first limitation, developing absorptive capacity is dependent not only on effective RDI policies, many of which are in place, but also on such factors as the economic environment and a successful diversification away from the dominant financial services sector.

The law of 5 June 2009 on State Aid for Research¹⁸ is intended to encourage public-private partnerships, innovation in services and increased SME participation in research, including the secondment of public sector researchers. All of these provisions are expected to positively impact the development of greater RDI absorptive capacity, but the challenge remains.

A concern in increasing absorptive capacity is the decrease in BERD, from 1.31% of GDP in 2009 to 0.98% in 2011. The Innovation Union Competitiveness Report 2013 measures Luxembourg’s growth rate in BERD at a negative -4.2% between 2007-2011. This would

¹⁷http://www.statistiques.public.lu/stat/TableViewer/tableView.aspx?ReportId=2979&IF_Language=fr&MainTheme=4&FldrName=1

¹⁸<http://www.innovation.public.lu/catalogue-publications/financements/rdi-entreprise/aides-publiques-rdi-EN.pdf>

indicate that increasing absorptive capacity is an even greater structural challenge than it was previously.

Increasing Luxembourg’s research profile through international cooperation. The NRF recognises the need for “international cooperation, particularly with a view to giving research in Luxembourg a higher profile in other countries and to achieving a critical mass within research that cannot be sought if the research context is limited to Luxembourg.”¹⁹ In addition, the same need is identified in the NRP for 2011, *Luxembourg 2020*, and is stated as “creating awareness of public R&D players to get them to participate more systematically in prospecting and economic promotion activities for Luxembourg abroad, in an effort to create closer links and more partnerships on joint projects.”²⁰

The Innovation Union Competitiveness Report 2013²¹ indicates that Luxembourg received FP7 funding that represented only 5.7% of GERD—an EU low in 2011. Its success rate of 13.1% is in the low mid-range.

In addition, despite the Fit4Europe (now Fit4Horizon2020) initiative that provides support to SMEs applying to European programmes.²² SME applicants also had a lower success rate than the EU-27 average. These rates imply the existence of ongoing roadblocks to raising Luxembourg’s international research profile. [LuxLaunch](#) which prepares SMEs to undertake projects with ESA has had more success.

Developing human resources in RDI. Luxembourg is a poster child for researcher mobility, open recruitment, equitable work contracts and fair compensation. Despite this, developing human resources in RDI remains a challenge. Like increasing absorptive capacity, addressing this challenge may be only a matter of time. A university was only created in 2003 and its programmes for PhDs are still evolving. The AFR programme, which funds PhD and post-doc work and is administered by the NRF, is currently supporting around 600 researchers. The ATTRACT and PEARL programmes “import” outstanding researchers and the NRF’s “Promotion of Scientific Culture” and related activities aim to make a career as a researcher interesting to students.

Improving gender equality as a component of developing RDI human resources is a greater challenge. In the EU study SheFigures 2012,²³ Luxembourg continues to rank at the bottom of the EU in such measures of gender equality as the proportion of female researchers, the proportion of women in Grade A academic positions (9%) and the proportion of Women on Boards. Only 21% of researchers are female, compared to an EU-27 average of 30%. The European Commission’s SheFigures report for 2009 states that the presence of women on boards “is absolutely essential to promote the cause of women in science; avoid a discriminatory

¹⁹ <http://www.fnr.lu/en/Research-Programmes/Research-Programmes/INTER-Programme>

²⁰ http://ec.europa.eu/europe2020/pdf/nrp/nrp_luxembourg_en.pdf

²¹ http://ec.europa.eu/research/innovation-union/pdf/competitiveness_report_2013.pdf

²² <http://www.innovation.public.lu/en/financer-projets/programmes-europeens/fit4europe/index.html>

²³ http://ec.europa.eu/research/science-society/document_library/pdf_06/she_figures_2012_en.pdf

snowball effect; and ensure better chances for diversity and excellence in research objectives and strategies.²⁴

Promoting a culture of entrepreneurship. Also identified as a challenge in the Self-Assessment done for DG RTD in April 2011, as well as previous ERAWATCH and TrendChart reports, a culture of entrepreneurship still needs additional development in Luxembourg.

While the creation of spin-offs using IP from research activities are included in several PRO performance contracts, the number achieved in 2011 was 1 (one), with a goal for 2011-2013 of 6.²⁵ Similarly, PRO performance contracts anticipated 23 patents would be registered during 2011-2013. In fact, only four patents were filed in 2011.²⁶ It can also be noted that although the law of 5 June 2009 has special provisions for SMEs, there are no specific policies, laws or incentives for entrepreneurs or start-ups, while in 2013, of the 22 students in the University's Masters in Entrepreneurship and Innovation, only one was a Luxembourg citizen.²⁷

Given the difficulties facing entrepreneurs, it is interesting that several private sector initiatives have developed to support start-ups. These include The Impactory (www.impactory.lu), the Lux Future Lab which is sponsored by the bank BGL BNP Paribas (<http://www.luxfuturelab.lu/>) and the Accelerator programme of PwC (<http://www.pwcaccelerator.com/pwccaccelerator/index.html>).

3.3 Meeting structural challenges

Table 7. Meeting Structural Challenges

Challenge	Policy measures/actions addressing the challenge ²⁸	Assessment in terms of appropriateness, efficiency and effectiveness
1. Increasing absorptive capacity	Law of 5 June 2009. Law on EcoTechnologies. IP Law of 21 December 2007. Cluster initiative. Business Meets Research and IP events. Fit4Europe/Fit4Horizon2020	Given continuing decreases in BERD and concerns that R&D intensity targets will not be met, additional measures are necessary.
2. Increasing Luxembourg's research profile through international cooperation	Fit4Europe/Fit4Horizon2020 LuxLaunch, National Centre for Research Excellence programme, NRF bilateral and multilateral funding agreements, performance contract targets	FP7 success rates are slowly increasing; a more accurate assessment can be made when performance contract results are known.

²⁴ http://ec.europa.eu/research/science-society/document_library/pdf_06/she_figures_2009_en.pdf

²⁵ The 2011 figure represents the most recent information available as of March 2013 and which is included in the MESR 2012 Annual Report http://www.mesr.public.lu/ministere/rapports/min_recher/rapport_2012.pdf. A more current assessment is expected in the 2013 report.

²⁶ Note that 2011 was the most recent year for which figures were available. A more current assessment is expected in the 2013 report.

²⁷ Programme Director communication.

²⁸ Changes in the legislation and other initiatives not necessarily related with funding are also included.

<p>3. Developing human resources in RDI</p>	<p>AFR PhD and post-doc programme; PEARL and ATTRACT programmes, NRF “Why not a researcher?” and Science Night programmes</p>	<p>Demand for researchers continues to remain higher than supply. Balanced gender representation remains a serious issue and effective and efficient policies/incentives/schemes/main-streaming programmes are needed.</p>
<p>4. Promoting a culture of entrepreneurship</p>	<p>Master in Entrepreneurship and Innovation; Innovation Master Classes, Luxinnovation, business incubators (Technoport, FutureLab, Impactory), Chambre of Commerce Espace d’Entreprise, IP Law of 21 December 2007.</p>	<p>Despite the measures of support for entrepreneurs, more efficient and effective measures are needed. Company start-up costs are high and funding and capital are scarce, especially for non-high tech ventures. Indirect funding such as tax incentives or credits would improve success rate. New initiatives are being developed by the private sector.</p>

4 NATIONAL PROGRESS IN INNOVATION UNION KEY POLICY ACTIONS

4.1 Strengthening the knowledge base and reducing fragmentation

Promoting excellence in education and skills development

Luxembourg has the EU's highest level of human resources in science and technologies (HRST): 56.5% as a percentage of total employment versus an EU 27 average of 42.7% in 2011 and 58.3% in 2012 (EU 28 figure not available). In terms of 30-34 year olds with tertiary education, Luxembourg's level was 48.7% in 2012, compared to an EU-27 average of 35.8%. Researchers and personnel in R&D are calculated by Eurostat at 1.27% of the active population in 2010, but comparative statistics are not available.

Luxembourg provides an excellent labour market for researchers and embodies open, transparent and merit-based (OTM) recruitment practices. All research institutions are signatories of the Charter for Researchers and both the University and PRC Santé have received the Euxaxess award of HR Excellence.

The NRF has two programmes to bring external researchers to work in Luxembourg. The [ATTRACT programme](#) is targeted at outstanding younger researchers from abroad two-to-eight years beyond their doctorates. Candidates submit research proposals with a host PRO. Funding is up to €1.5m for up to five years for the researcher and research team. Host institutions offer a candidate the prospect of building up and integrating their project into the PRO's activities. The [PEARL programme](#) offers PROs the means to recruit senior researchers in areas of strategic importance to Luxembourg. Funding of €3-5m is available for the best candidates with one or two awards made per year.

Luxembourg is a member of the [Euraxess](#) initiative and has its own Euraxess web site. The [Luxembourg Portal for Innovation and Research](#) has links to researcher job openings and internships and all PROs also list openings for researchers, including PhD and post-doc positions.

Supporting PhDs and post-docs is the Aid for Research Training ([AFR grant programme](#)) which funds researchers in doctoral and post-doctoral work. Research may be done in Luxembourg or abroad and recipients may be Luxembourg nationals or foreigners, including non-residents. Since October 2008, €54 million has been committed to fund the work of 670 PhD and post-doc researchers. The programme ensures recipients enjoy work contracts with the host institution that include social benefits.

An indication of the inward flow of researchers to Luxembourg is the number of non-Luxembourg nationals in the Grand Duchy's public research institutions as shown in Table 8 below.

Table 8: Nationalities in Luxembourg’s PROs 2011-2012

	Luxembourg		EU		Non-EU		Total	
	2011	2012	2011	2012	2011	2012	2011	2012
PRC Gabriel Lippmann	28	20	192*	197	-	15	218	232
PRC Henri Tudor	49	45	352	344	40	42	441	431
PRC Santé	57	50	174	207	21	33	252	290
CEPS/Instead	29	14	87	89	12	15	128	118

*Includes both EU and Non-EU. Source: MESR Annual Report, 2012²⁹

A requirement of each performance contract 2011-2013 is that the research organisation develop a “career path” for researchers.

In terms of curricula addressing innovation skills, programmes range from the Masters in Logistics programme at PRC Henri Tudor, that aims to develop skilled resources in one of Luxembourg’s smart specialisation areas, to a Masters in Entrepreneurship and Innovation offered by the University. Luxinnovation also offers Innovation Master Classes.

Research Infrastructures

Luxembourg’s major research infrastructure project is the City of Sciences (Cité des sciences) which is nearing completion. Funded with €565 million from 2008-2015, the Esch-Belval site will provide facilities for the University, PRCs Henri Tudor and Gabriel Lippmann (in the future to be combined in the “New PRC”), CEPS/INSTEAD, quarters for public-private partnerships and the Technoport business incubator. For 2007-2013, the FEDER Regional Competitiveness and Employment programme has allocated €15 million to co-finance the incubator and the building for the Luxembourg Centre for Systems Biomedicine (LCSB).

However, it should be noted that as of December 2013, there was no European Strategy Forum on Research Infrastructures (ESFRI) roadmap for Luxembourg nor are there many RI facilities which are considered as providing transnational access to researchers. That being noted, as the majority of researchers in Luxembourg are foreign, de facto access to the facilities of the City of Sciences is a given.

An interesting assessment of the impact of the City of Sciences RI project is provided by a paper written by Dautel and Walther (2011) that examined the “local determinants” of innovative businesses in Luxembourg. In a study of five municipal “units” in the Grand Duchy, they found that geographic space was a significant determinant of firm innovation as well as accessibility to the “mean centre,” in this case Luxembourg City. Thus the most innovative firms were clustered in the capital and, to a lesser extent, the surrounding suburban areas. The study suggests that the City of Sciences, with its location near Esch, may not be optimally located as far as innovative

²⁹. http://www.mesr.public.lu/ministere/rappports/min_recher/rapport_2012.pdf

companies are concerned and may, in fact, increase rather than reduce RDI system fragmentation.

Because of Luxembourg's small size, and generally targeted approach to research, it does not participate in large-scale, intergovernmental RI projects. This is not considered to be an issue or detrimental to its NRS.

There are also the research infrastructures the [CVCE](#) (Centre Virtuel de la Connaissance sur l'Europe) which is open to foreign researchers, the University's European Studies Library of the European Investment Bank, which is also open and the [LIS Cross-National Data Center](#)- The Data Center makes available information from the Luxembourg Income Study (LIS) and its team was recently joined by Dr Paul Krugman, winner of the 2008 Nobel Prize in economics.³⁰

4.2 Getting good ideas to market

Improving access to finance

A dearth of venture capital has long been an issue in Luxembourg and cited as one of the main innovation challenges in previous country reports. The grass-roots resurrection of the [Luxembourg Business Angels Network](#) (LBAN), headed by two veteran entrepreneurs, has been a positive development. LBAN is partnered with the Chambre of Commerce, Luxinnovation, Seed4Start and the Technoport business incubator to work with start-ups and provide seed capital. It offers coaching and organises "pitching days." It is also focussed on social innovation and is part of the European Business Angel Network (EBAN.) In 2012, LBAN members invested €2.3 million in nineteen companies.

A second grassroots initiative is the "111" movement, which advocates the establishment of a simplified procedure for starting an S.à.r.l.—one person, one day, one euro.³¹ While a study by DG Enterprise and Industry on a Member State's meeting three criteria for ease of starting a company—"one stop shop," days to incorporate and cost—gave Luxembourg two green lights, the assessment is questionable. The Guichet for Business (www.guichet.lu) has some information but is not complete, the three days cited to start a business is a gross underestimation if a business license is required, and which is needed in most cases, and the cost given of €1,100 is also considerably too low. It also overlooks the capital requirements of €12,500 for an S.à.r.l. and €32,000 for an S.A.

Another development which should have been positive, the formation of a €150m Future Fund, co-managed by the European Investment Fund (EIF) and the National Society for Credit and Investment ([SNCI](#)) has been less happy. With a stated purpose of making investments in innovative SMEs, there has been little reporting of its investments since its establishment in January 2012 to the point it has been criticised in the [press](#). A similar lack of transparency has also been characteristic of the Ministry of the Economy and Foreign Trade, which discloses neither the recipients of subsidies under the law of 4 June 2009 nor the amounts they receive. In

³⁰ <http://www.lisdatacenter.org/news-and-events/paul-krugman-to-join-lis-team/>

³¹ <http://www.change.org/en-GB/petitions/etienne-schneider-launch-the-111-company-simplified-s%C3%A0rl-and-make-luxembourg-the-place-to-be-for-start-ups-and-entrepreneurs>

addition, the application procedures for the subsidies are heavy for an SME and the selection criteria for awards being made or withheld lacking in transparency.

Luxinnovation is helpful in assisting companies in identifying sources of funding and in explaining the various programmes available. However, Luxinnovation also tends to be targeted towards specific sectors (space, materials, ICT, biohealth, ecotechnologies, automotive) and many innovative companies fall outside of these domains. It should be noted that the Clusters that are supported are also space, materials, ICT, biohealth, ecotechnologies and automotive and that the subsidies awarded under the law of 5 June 2009 were also to companies in the traditional areas of ICT (27%), space (4%), materials (51%), ecotechnologies (12%) and biohealth (6%). The majority of the support going to the materials sector is also noteworthy, as the law was supposed to be targeted at the services sector which represents 86.4% of Luxembourg's GDP and 87% of its companies. Also noteworthy is that only 18% went to ecotechnologies and biohealth, while nothing went to logistics, which are the areas designated as "Smart Specialisation."

Protect and enhance the value of intellectual property and boosting creativity

Luxembourg's law of 21 December 2007 gives up to an 80% tax exemption on income derived from intellectual property such as patents, licenses and trademarks and encourages the registration of IP in the Grand Duchy. To further encourage awareness of IP, the "Boost IP" project, financed by FEDER and supported by the MECE, was directed at SMEs in the ecotechnology and artisan sectors. Diagnostics of intellectual property practices were offered by means of an individual and personalized interview. In 2012, around 33% of companies contacted were granted a personalised interview. In addition, 14% of SMEs who had a personalised interview expressed an interest in carrying out a financial evaluation of patents.

The Ministry of the Economy and Foreign Trade has an Office of Intellectual Property. In addition to supporting the law on IP, the [Law of 5 June 2009](#) on the promotion of research, development and innovation takes into account the costs of obtaining title to intellectual property. A website, www.brevet.lu, provides information on IP and "Intellectual Property Days" are organised annually to raise IP awareness.

Public procurement

Currently there are no significant activities directed towards the public procurement of innovative goods and services. This mostly reflects the small size of the Grand Duchy. All requests for proposals are listed on the government's main website and the Chambre of Trades has an application that sends emails when new opportunities are announced. Thus the situation is assessed as being primarily positive.

4.3 Working in partnership to address societal challenges

Given the Grand Duchy's targeted approach to research, Luxembourg participates in EIPs which reflect two of its specific societal concerns. These are "Smart Cities and Communities" and "Active and Healthy Aging."

The new National Centre for Research Excellence programme of the NRF, described in Section 2.3 above, was launched to support for a trans-institutional collaborative research centre

dedicated to solving a well-defined and relevant socio-economic question. The first pilot National Centre of Research Excellence will focus on the topic of “Early diagnosis and stratification of Parkinson’s disease” and address a significant problem for the ageing populations of Western societies. An initial call was launched in January 2014.

4.4 Maximising social and territorial cohesion

Due to Luxembourg’s small size, territorial cohesion is not a significant issue. This may also be the reason Luxembourg has only been slated to receive €56m in post-2013 structural funds, the least amount of any national recipient.

That being noted, two of Luxembourg’s three chosen areas for smart specialisation do involve the entire country. While the biohealth initiative will essentially be undertaken in the City of Luxembourg and at the City of the Sciences in Esch Belval in the south, both the logistics and ecotechnologies specialisations will involve actors throughout the Grand Duchy. Logistics, for example, encompasses the port of Mertert and the rivers that border Luxembourg on the east, the more centrally located airport, the southerly multimodal hub at Bettembourg and the highway system that transects the country.

4.5 International Scientific Cooperation

Luxembourg has long recognised the need to be involved in international scientific cooperation. As stated on the NRF website, “The FNR actively encourages research collaboration between researchers in Luxembourg and abroad. Indeed, Luxembourg does not possess a critical mass of researchers that would allow the creation of high-performance research teams in all scientific domains and, in order to achieve international excellence, it is paramount for researchers cross national borders. In order to optimise the visibility of Luxembourg as an attractive site for research activities within Europe, the FNR plans to reinforce collaborations with selected countries as well as its own international cooperation instruments.”

To support international cooperation, the NRF has entered into seventeen bilateral and multilateral agreements for the joint funding of research projects with other EU nations as well as the US’ NSF. In addition, the INTER programme funds the participation of Luxembourg researchers in international projects, while the ATTRACT programme funds projects that bring young researchers to Luxembourg and the PEARL programme is designed to fund senior researchers’ coming to Luxembourg. The NRF also participates in ICSU, EUROHORCS, COST, ERCIM, ESF networking programmes and a range of ERA-Nets.

Meanwhile the AFE programme that funds PhDs and post-docs is available to any nationality doing research inside or outside of Luxembourg.

Luxembourg’s biohealth projects, such as the IBBL and the Luxembourg Centre for Systems Biology (LCSB), have also been able to attract to researchers from abroad, in particular from the US.

5 NATIONAL PROGRESS TOWARDS REALISATION OF ERA

5.1 More effective national research systems

Through its performance contracts with the University and PROs, the MESR mandates increasing amounts of competitive funding, as noted in Table 4 in Section 2.2.2.1 above. All NRF funding programmes have calls for proposals which are either regular or annual, except for the PEARL programme, calls for which are open all year.

Proposals submitted in response to NRF calls are all subject to peer review by independent, international experts through a process that is open and transparent. Generally proposals are reviewed by three experts, who provide feedback. Proposals selected for further consideration are reviewed by a panel which has one of the three experts as well as members of the NRF Scientific Council, which also has international experts as members.

Performance contracts also mandate annual evaluations of departments of PROs by international peer review, while regular evaluations of the University are required by the law of 12 August 2003 through which it was established. Results of the evaluations are published on the websites of the MESR and the University.

5.2 Optimal transnational co-operation and competition

Because of its small size, Luxembourg has always been committed to transnational co-operation and the NRF has established widespread [bilateral and multilateral agreements](#) with other international research performers and consortia. These include participation in seven ERA-Nets as well European Cooperation in Science and Technology (COST), European Research Consortium in Informatics and Mathematics (ERCIM) and ESF Research Networking Programmes. As an agency, the NRF participates in European Heads of Research Councils (EUROHORCs), the European Science Foundation (ESF) and the International Council for Science (ICSU). The NRF is also a member of Science Europe. As of 2012, proposals under the bilateral agreements with Germany's DFG and Switzerland's SNF with Luxembourg as the Lead Agency are submitted under the NRF's CORE programme. As noted above, all proposals submitted to the NRF are subject to independent, international peer review.

5.3 An open labour market for researchers

As indicated in Table 8 in Section 4.1 above, the majority of researchers working in Luxembourg are foreign. To support researcher mobility, Luxembourg has its own Euraxess portal and all open positions are posted on the University and PRO websites. A booklet, "Foreign Researcher's Guide to Luxembourg," is available that provides comprehensive information about doing research in Luxembourg. All PROs as well as the NRF are signatories to the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers and their principles are supported by the Human Resources policies of the MESR. PRC Santé and the University have received Euraxess awards for HR Excellence. Finally, to simplify the entry of researchers from third countries to the Grand Duchy, [the law on the free movement of](#)

[persons and immigration](#) allows public research institutions to receive a license to enable them to employ researchers from outside of the EU without the need for a separate work permit filing.

5.4 Gender equality and gender mainstreaming in research

This is the priority in which Luxembourg needs the most improvement, as indicated by Luxembourg's rankings in the 2012 [SheFigures](#) report. While there are ostensibly policies supporting gender equality, they are not effective. An example is the NRF's recommendation that PROs submitting proposals for the ATTRACT and PEARL programmes give special consideration to female candidates. Despite this, of eight [ATTRACT fellows](#), two are women and, of four [PEARL grant recipients](#), none are female.³² One factor is there are no policies that provide incentives to improve gender equality or consequences for the lack thereof.

To present a broader picture that is less focussed on the RDI landscape, Table 9 below gives Luxembourg's relative rankings by indicator in the World Economic Forum's 2013 Global Gender Gap Report. The report places Luxembourg 21 overall of 60 nations ranked, which leaves out the nations with the largest gaps (e.g. Chad). Luxembourg is also missing some key indicators. However, the report does give a somewhat more positive picture of overall equality than SheFigures.

Table 9: Luxembourg's Gender Gap Rankings by Indicator (out of 126 countries)

Indicator	Highest	Lowest	Luxembourg	Country Ranking
Overall rating	.8731	.6912	.7410	21 of 69
Participation in labour force F to M ratio	1.06	0.18	0.79	67 of 126
Wage equality F to M ratio	0.81	0.43	0.70	32 of 140
Legislators, senior officials and managers, F to M ratio	1.46	0.02	N.A.	-- of 114
Professional and technical workers F to M ratio	2.24	0.10	N.A.	-- of 113
Literacy rate F to M ratio	1.30	0.46	1.00	22 of 135
Enrolment in primary education F to M ratio	1.09	0.59	1.02	13 of 126
Enrolment in secondary education F to M ratio	1.62	0.38	1.08	38 of 120
Enrolment in tertiary education F to M ratio	5.60	0.24	1.12	91 of 131
Healthy life expectancy F to M ratio	1.18	0.07	1.06	59 of 136
Women in parliament F to M ratio	0.96	0.00	0.28	58 of 132
Women in ministerial positions F to M ratio	1.11	0.00	0.36	36 of 126
Years with female head of state	0.72	0.00	0.00	60 of 60

Source: WEF Gender Gap Report 2013

³² Note that this does not preclude that excellence should prevail upon gender quotas

5.5 Optimal circulation, access to and transfer of scientific knowledge including via digital ERA

Initiatives in this priority are being implemented or are underway, with one achievement being that digital access to the resources of the Luxembourg National Library are freely available to all Luxembourg residents, including researchers.

In May 2013, the University of Luxembourg organized an information session on Open Access, based on a cooperation agreement to be signed with the University of Liège (ULg) that includes the establishment of a strategy and a policy on Open Access (OA) at the University of Luxembourg and the creation of an Institutional Repository ORBi based on the model developed successfully at ULg. In addition, the NRF is also working to develop a policy on Open Access. As a member of ScienceEurope, the NRF endorsed a statement of principles that “advocate that research publications should either be published in an Open Access journal or made available or be deposited as soon as possible in a repository.”³³

In light of the initiatives of the University and the NRF, the report on Open Access Strategies (Caruso et al., 2013) that does not identify any movement in the Grand Duchy on this issue appears to be incorrect. It does state that, “All in all, the number of policies alone is a weak indicator of commitment to OA in a given country.” The report also estimates that, “if the precision and recall of the harvesting instrument is taken into account,” 50% of journal articles in Luxembourg are being published in OA journals.

PRO CEPS/Instead publishes a full text selection of its research work on its website that is not published in “commercial” journals. PRC Lippmann provides bibliographic information on its publications but no links to the publications themselves. PRC Santé publishes information on its publications, abstracts and, when possible, provides Open Access versions of the full text. PRC Henri Tudor provides a catalogue of its publications, but without access to articles. Finally, like PRC Henri Tudor, the University of Luxembourg provides a listing of publications but with limited information or links to the articles themselves.

³³ <http://www.fnr.lu/en/Press/Press-Releases>

Annex 1. Performance the national and regional research and innovation system

Feature	Assessment	Latest developments
1. Importance of the research and innovation policy	<p>(+) Policies have been consistent and coherent and allow multi-annual planning and funding.</p> <p>(+) Policies reflect commitment to fostering excellence in the national research system-</p> <p>(+) Policies that are realised in funding programmes reflect national challenges,, such as the aging of the population.</p>	Appointment of new Minister of Research following elections on 20 October 2013.
2. Design and implementation of research and innovation policies	<p>(+) Policy-forming bodies are central and stable. Multi-annual planning is the norm.</p> <p>(+) Stakeholder interests are included in planning, as in the NRF Foresight Study which included representatives from industry and the civil society as well as the NRS.</p> <p>(+) Research priorities are targeted and thematic.</p> <p>(+) Funding is committed for multi-annual periods.</p> <p>(+) Projects are monitored ex- and post-ante with milestones set throughout the project life-cycle.</p> <p>(+) The NRF has many bilateral and multi-lateral funding agreements.</p> <p>(+) Recommendations of an OECD review of the national research system were implemented. A Foresight Study formed the basis of the thematic CORE programme.</p>	Pending new laws on research which increase NRS efficiency.
3. Innovation policy	<p>(+) The concept of innovation is promoted through Luxinnovation, the Luxembourg Portal for Innovation and Research, a range of electronic newsletter and the magazine FOCUS.</p> <p>(+) Supply and demand side policies are somewhat coordinated, with PROs encouraged to form public-private partnerships and generate spin-offs. The secondment of public sector researchers is included in the provisions of the law of 5 June 2009 for private sector research subsidies.</p> <p>(+) Business meets Research events attempt match making between supply and demand sides.</p>	
4. Intensity and predictability of the public investment in research and innovation	<p>(+) Investment in public sector RDI has been highly predictable. Budgets are set multi-annually and are disclosed for both funding programmes and block funding of PROs.</p> <p>(-) Government investments in private sector RDI lack transparency as to the amounts of subsidies and recipients.</p>	

<p>5. Excellence as a key criterion for research and education policy</p>	<p>(+) Increasingly high standards set for NRF project funding based on review by international experts.</p> <p>(+) Annual evaluations of PROs by international experts.</p> <p>(+) Performance contracts with explicit expectations and goals for all PROs.</p>	<p>Launch of the programme “National Centres for Excellence in Research.”</p>
<p>6. Education and training systems</p>	<p>(+) “Lifelong learning” training reimbursement scheme to develop and update skills, including requirement for employee training days.</p> <p>(+) Masters degree in Entrepreneurship and Innovation offered by the University, as well as Innovation Master Classes.</p> <p>(-) Mediocre showings in PISA Study results highlight need for educational system reform.</p>	<p>Claude Meisch, the new Minister for Higher Education and Research is also the Minister for National Education and Youth which should assist continuity between lower and higher educational systems as reforms are introduced.</p>
<p>7. Partnerships between higher education institutes, research centres and businesses, at regional, national and international level</p>	<p>(+) Luxembourg Cluster initiative attracts participants representing all knowledge triangle actors.</p> <p>(+) New City of Sciences in Esch Belval has purpose-built facilities for public-private partnerships and a business incubator.</p> <p>(+) Law of 5 June 2009 supports secondment of public sector researchers to the private sector.</p>	<p>New “National Centre for Research Excellence” programme designed to promote and fund trans-national partnerships.</p>
<p>8. Framework conditions promote business investment in R&D, entrepreneurship and innovation</p>	<p>(+) Law of 21 December 2007 gives preferential tax treatment to IP revenues.</p> <p>(+) Law of 5 June 2009 provides subsidies for private sector innovation.</p> <p>(-) Early stage investments from business angel networks rather than the government.</p>	<p>Reforming of LBAN, the Luxembourg Business Angel Network.</p>
<p>9. Public support to research and innovation in businesses is simple, easy to access, and high quality</p>	<p>(+) Luxinnovation acts as a “one stop shop” for information about programmes and assistance in applying.</p> <p>(-) Applying for subsidies under the law of 5 June 2009 is bureaucratic, lacking in transparency and administratively heavy.</p> <p>(-) Fit4Europe whose aim is to offset the costs of SME FP7 project proposal submission is bureaucratic and slow-to-pay.</p>	<p>Launch of an Automotive Cluster by Luxinnovation.</p>
<p>10. The public sector itself is a driver of innovation</p>	<p>(+) Performance contracts mandate patents and spin offs.</p> <p>(+) The University has active IP policies and a vice rector who is responsible for the valorisation of research</p>	<p>Luxinnovation is now consulting with the NRF on the commercial possibilities of projects at their inception.</p> <p>The OPEN programme has been launched to support</p>

		research projects not covered by the thematic CORE programme.
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Annex 2. National Progress on Innovation Union commitments

		Main changes	Brief assessment of progress / achievements
1	Member State Strategies for Researchers' Training and Employment Conditions	HR Awards of Excellence to University and PRC Santé (2012-13). Framework for researcher career paths mandated in performance contracts (2013). All researchers have full 1 rights and benefits, including PhD candidates. Euraxess website.	All research organisations in Luxembourg are signatories to the Charter for Researchers. Conditions for researchers are excellent and the same as for a bank employee, for example.
4	ERA Framework		
5	Priority European Research Infrastructures	City of the Sciences nearing completion /2014-2015). OTM researcher recruitment means multi-national researcher access	Massive RI project of €565m for University, research institutes, business incubator, labs,
7	SME Involvement	Law of 5 June 2009 focuses on SMEs. Business Meets Research event to support public private partnerships (2011-2013), Fit4Europe programme supports SME participation in FP7 (2011-2013). LuxLaunch prepares SMEs for ESA projects.	Events and programmes target SMEs for research funding, public private partnership participation, secondment of researchers, FP7 and ESA project participation. Note most SMEs in Luxembourg are not only small but “micro”-sized (less than 5 employees) and thus unlikely to undertake research or participate in EU projects.
11	Venture Capital Funds	Inactivity of €150m Luxembourg Future Fund (2012), managed by EIF and SNCI. Reforming of LBAN (Luxembourg Business Angel Network) (2013)	Initiatives generally grass roots. Lack of transparency. No targeted policies or incentives.
13	Review of the State Aid Framework	Law of 5 June 2009 for State Aid for R&D	Law meets Guideline requirements and is active
14	EU Patent	Signatory	Ratified agreement
15	Screening of Regulatory Framework	Framework for Freeport (2013) New business status for social entrepreneurship (pending (2013)	Luxembourg has an accessible and responsive regulatory environment that adapts to support innovation, the new rules that enable a Freeport in Luxembourg being the most recent example.

17	Public Procurement	N.A	Due to Luxembourg's small size, innovation-linked procurement has not been addressed.
20	Open Access	University and National Library (BNL) main actors in Open Access and launching initiatives (2013); BNL offers all residents e access to research resources The NRF is in process of formulating policies and has adopted ScienceEurope principles.	Initiatives are being undertaken and progress is good.
21	Knowledge Transfer	Performance contracts have targets for patents and spin offs and promote public-private partnerships (2011-2013). Law of 5 June 2009 supports secondment of researchers to SMEs, draft research law includes foundations for public research funding (2012), LuxLaunch funds exploratory and feasibility studies in space sector. Business Meets Research days promote public-private KT (2011.2013). University has official policy on IP and valorisation of research. Luxinnovation national agency promotes private sector innovation.	Extensive resources and programmes for KT from law providing SME R&D support to a range of business incubators and "Living labs."
22	European Knowledge Market for Patents and Licensing	Law on IP revenues, IP Office in Ministry of the Economy, IP Days (2011-2013), performance contract targets for patents, conferences on IP (2012)	Major initiatives to raise awareness of IP for SMEs and support of patent applications. Preferential tax treatment for IP revenues. Lack of trading platform, etc. issue of small size.
23	Safeguarding Intellectual Property Rights	NRF follows lead agency principles in its bilateral R&D agreements. University Guidelines on Valorisation of Research.	Luxembourg supports the Guidelines on Horizontal Cooperation Agreements, as evidenced by its IP initiatives.
24	Structural Funds and Smart Specialisation	Focus on logistics, biotechnologies and ecoinnovation (Luxembourg 2020)	Strategies and development of all three areas is well advanced.
25	Post 2013 Structural Fund Programmes	Luxembourg has been allocated €56m, the lowest amount of any MS (2013).	Allocation reflects nation's size and relative wealth.

26	European Innovation pilot	Social	Living Lab at Technoport incubator (2013), pending legislation providing legal status to corporate social innovation (2013), Business angels for social innovation, Impactory coworking and collaborative workspace with focus on social innovation (2012)	Luxembourg has legislation pending giving legal form to companies engaged in social innovation. It supports various platforms such as living labs at the Technoport. Note social innovation initiatives are also a very grass roots phenomenon in Luxembourg.
27	Public Innovation	Sector	No prizes and government-owned data is generally unavailable, for example amounts and identifies of recipients of subsidies under the law of 5 June 2009.	Although PRC Henri Tudor has more efficiently engineered the work processes of some public agencies, on the whole little has been done in this area.
29	European Innovation Partnerships		Active and healthy aging, Smart cities and communities,	Luxembourg fully participates in relevant groups
30	Integrated Policies to Attract the Best Researchers		ATTRACT and PEARL programmes, funded University chairs, researcher visa programme	Most researchers in Luxembourg at all levels are non-nationals and many from third countries
31	Scientific Cooperation with Third Countries		INTER programme funds Luxembourg researcher participation in international projects. NRF is a party to twelve bilateral agreements and participates in COST, ERCIM and ESF, collaborates with EUROHOCS, ICSU and the US NSF and is a member of ERA-Nets and JRPs.	Luxembourg acknowledges the need to cooperate with third countries to achieve critical mass and has agreements and a programme to accomplish this..
32	Global Research Infrastructures		N.A.	While Luxembourg is developing the City of Sciences, a national RI; it is not directly involved in any global RI.
33	National Reform Programmes		Luxembourg 2020 (2013) covers targets for GERD and BERD, funding of research institutions, private sector support activities, participation in FP7 and ESA projects, etc.	Luxembourg 2020 includes a comprehensive section on RDI policy, goals and accomplishments.

Annex 3. NATIONAL PROGRESS TOWARDS REALISATION OF ERA

ERA Priority	ERA Action	Recent changes	Assessment of progress in delivering ERA
1. More effective national research systems	Action 1: Introduce or enhance competitive funding through calls for proposals and institutional assessments	None	(+) All funding programmes issue calls for proposals and institutional assessments. (+) Feedback is provided.
	Action 2: Ensure that all public bodies responsible for allocating research funds apply the core principles of international peer review	None	(+) All funding programmes submit proposals for international peer review.
2. Optimal transnational co-operation and competition	Action 1: Step up efforts to implement joint research agendas addressing grand challenges, sharing information about activities in agreed priority areas, ensuring that adequate national funding is committed and strategically aligned at European level in these areas	None	(+) Luxembourg policies actively support joint activities, as shown in numerous bilateral and multi-lateral agreements and participation in COST, ERCIM, EUROHORCS, etc.
	Action 2: Ensure mutual recognition of evaluations that conform to international peer-review standards as a basis for national funding decisions	Lead agency agreements with Germany's DFG and Switzerland's SNF.	(+) NRF mandates international peer review for all programme funding decisions.
	Action 3: Remove legal and other barriers to the interoperability of national programmes to permit joint financing of actions including cooperation with non-EU	Launch of transnational "National Centre of Excellence in Research".	(+) While Luxembourg has multiple bilateral agreements, they follow the Lead Agency principle in which the rules and evaluation procedures of the agency to whom the proposal is submitted apply.

	countries where relevant		When not itself the Lead Agent, Luxembourg accepts the decision of the Lead Agent as the basis for its funding decision and funds the research activities carried out in Luxembourg.
	Action 4: Confirm financial commitments for the construction and operation of ESFRI, global, national and regional RIs of pan-European interest, particularly when developing national roadmaps and the next SF programmes	For 2007-2013, the FEDER Regional Competitiveness and Employment programme has allocated €15 million to co-finance the incubator and the building for the Luxembourg Centre for Systems Biomedicine.	(-) There is no European Strategy Forum on Research Infrastructures (ESFRI) roadmap for Luxembourg nor are there any RI facilities which are considered as providing transnational access to researchers.
	Action 5: Remove legal and other barriers to cross-border access to RIs	None.	(+) The completion of the City of Sciences will provide a national infrastructure of very high quality. While access will be primarily limited to Luxemburg researchers, as is noted in the section on ERA Priority 3 below, most researchers in Luxembourg are foreign nationals. (+) There are also the research infrastructures the CVCE (Centre Virtuel de la Connaissance sur l'Europe) which is open to foreign researchers and the University's European Studies Library of the European Investment Bank, which is also open.
ERA priority 3: An open labour market for researchers	Action 1: Remove legal and other barriers to the application of open, transparent and merit based recruitment of researchers	-None..	(+) There are no legal barriers to OTM recruitment. Most researchers in Luxembourg are foreign. (+) All Luxembourg PROs are signatories to the European Charter for Researchers and the Code of Conduct for the

			Recruitment of Researchers. PRC Santé and the University of Luxembourg have both received a Euraxess award for HR Excellence.
	Action 2: Remove legal and other barriers which hamper cross-border access to and portability of national grants	None-	(-) Grants are awarded on a project basis and not to the researcher. Therefore they are not portable.
	Action 3: Support implementation of the Declaration of Commitment to provide coordinated personalised information and services to researchers through the pan-European EURAXESS3 network	Publication of brochure, “Foreign Researcher’s Guide to Luxembourg”	(+) All openings are posted on Luxembourg’s Euraxess portal. (+) The Euraxess portal contains complete information for a researcher working in Luxembourg.
	Action 4: Support the setting up and running of structured innovative doctoral training programmes applying the Principles for Innovative Doctoral Training.	None.	(+) AFR programme funds PhDs and post-docs doing their research in Luxembourg or abroad whether they are Luxembourg citizens or foreign nationals.
	Action 5: Create an enabling framework for the implementation of the HR Strategy for Researchers incorporating the Charter & Code	None.	(+) All Luxembourg PROs are signatories. (+) PRC Santé and the University of Luxembourg have both received a Euraxess award for HR Excellence.
ERA priority 4: Gender equality and gender mainstreaming in research	Action 1: Create a legal and policy environment and provide incentives	None	(-) There are no policies or incentives that specifically promote gender equality.
	Action 2: Engage in partnerships with funding agencies, research organisations and universities to foster cultural and institutional change on gender	None	(+) NRF requests gender be taken into consideration when candidates are proposed for ATTRACT and PEARL grants.

	Action 3: Ensure that at least 40% of the under-represented sex participate in committees involved in recruitment/career progression and in establishing and evaluating	None	(.) No progress.
ERA priority 5: Optimal circulation, access to and transfer of scientific knowledge including via digital ERA	Action 1: Define and coordinate their policies on access to and preservation of scientific information	University launches “Green road” to open access. University Library is in the process of becoming Luxembourg’s National Open Access Desk (NOAD) for the European Commission’s Opener project.	(+) National Library Digital Humanities initiative preserves content.
	Action 2: Ensure that public research contributes to Open Innovation and foster knowledge transfer between public and private sectors through national knowledge transfer strategies	Opening of new Technoport business incubator in the City of Sciences.	(+) All performance contracts mandate patents and spin offs and encourage public private partnerships. (+) The City of Sciences has purpose built facilities for public-private projects. (+) The law of 5 June 2009 supports the secondment of public sector researchers to private sector companies.
	Action 3: Harmonise access and usage policies for research and education-related public e-infrastructures and for associated digital research services enabling consortia of different types of public and private partners	None	(-) There is no federated electronic identity for Luxembourg researchers. However, all Luxembourg residents, including researchers and private sector employees, may obtain online access to the National Library’s digital resources.
	Action 4: Adopt and implement national strategies for electronic identity for researchers giving them transnational access to digital research services	-None.	(+) National Library provides digital access to research resources to all Luxembourg residents. (+) The University library (BUL) has an e-resource, www.fndit.lu , that provides online access to e-books

			and journals to the university community, as well as links to the National Library's digital services.
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LIST OF ABBREVIATIONS

AFR	Aid for Research Training PhD and post-doc funding
BERD	Business Expenditures for Research and Development
COST	European Cooperation in Science and Technology
CVCE	Centre for the Virtual Knowledge of Europe
ERA	European Research Area
ERA-NET	European Research Area Network
ESA	European Space Agency
ESFRI	European Strategy Forum on Research Infrastructures
EU	European Union
EU-27	European Union including 27 Member States
EU-28	European Union including 28 Member States
FDI	Foreign Direct Investments
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
IBBL	Integrated Biobank of Luxembourg
IP	Intellectual Property
MECE	Ministry of the Economy and Foreign Trade
MESR	Ministry of Higher Education and Research
NRF	National Research Fund

NRP	National Reform Plan
NRS	National research system
OECD	Organisation for Economic Co-operation and Development
PPP	Public-private partnership
PRC	Public Research Centre
PRO	Public Research Organisation
R&D	Research and development
RDI	Research, development and innovation
RI	Research Infrastructures
RIS3	Research and Innovation Strategies for Smart Specialisation
RTDI	Research Technological Development and Innovation
SME	Small and Medium Sized Enterprise
S&T	Science and technology
VC	Venture Capital

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