

INNO-Policy TrendChart –
Innovation Policy Progress Report

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PREFACE

Innovation is a priority of all Member States and of the European Commission. Throughout Europe, hundreds of policy measures and support schemes aimed at innovation have been implemented or are under preparation. The diversity of these measures and schemes reflects the diversity of the framework conditions, cultural preferences and political priorities in the Member States.

PRO INNO Europe® is an initiative of the Directorate General Enterprise and Industry (DG ENTR) which aims to become the focal point for innovation policy analysis, learning and development in Europe, with a view to learning from the best and contributing to the development of new and better innovation policies in Europe. Run by the Innovation Policy Directorate of DG ENTR, it pursues the collection, regular updating and analysis of information on innovation policies at national and European level.

INNO-Policy TrendChart serves the 'open method of coordination' approach laid down by the Lisbon Council in March 2000. It supports policymakers and innovation support measure managers in Europe by providing summarised and concise information and statistics on innovation policies, performances and trends. It is also a European forum for benchmarking and the exchange of good practices in the area of innovation policy.

INNO-Policy TrendChart products

INNO-Policy TrendChart, previously the TrendChart on Innovation, has been running since January 2000. It currently tracks innovation policy developments in all 27 EU Member States, plus Brazil, Canada, China, Croatia, Japan, Iceland, India, Israel, Norway, Switzerland, Turkey and the US. The INNO-Policy TrendChart website ⁽¹⁾ provides access to the following services and publications, as they become available:

- a database of innovation policy measures in the 39 countries;
- a news service and related innovation policy information database;
- annual policy monitoring reports for all countries covered;
- the European Innovation Progress Report, an annual synthesis report bringing together key points in the INNO-Policy TrendChart.

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The report covers the period from July 2008 to June 2009.

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¹ See <http://www.proinno-europe.eu/index.cfm?fuseaction=page.display&topicID=52&parentID=52> online.

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Executive Summary: Public support for innovation – a snapshot

1. Main trends in the National Innovation System

After years of growth, the economy of Luxembourg is declining in 2009. The GDP per capita is still the highest in the EU 27 but it is expected that GDP will decrease by 4% in 2009 as a result of the economic crisis. Luxembourg's economy is particularly characterised by a high level of labour productivity, a high level of foreign direct investments, a high rate of employment growth and a positive public balance. Despite the excellent performances of the country for several years, the performance of 2009 could be considered as fairly bad for the whole economy. With an unemployment rate that is expected to reach 7% in 2009, a negative public balance for the first time since 2004, and a government debt that should increase from 6.3% to 14.7% of GDP, the economic and financial crisis will have strongly affected the economy. In addition, the decrease of tax revenues from the finance industry ⁽²⁾ will have consequences on the budget of the government for the next two years. Nevertheless, Luxembourg's innovation system should not expect a decrease of public R&D expenditures as the STI policy is a priority for the government as is the Lisbon objective. On the contrary, the national innovation system might suffer from a collapse of business R&D investments that represented 83.76% of total R&D expenditures in 2007. Finally, the three main challenges it has to face have not changed for several years, and are the following:

- reinforce the collaboration between the public and private sector,
- incite more companies to innovate,
- attract and retain the high skilled workforce in Luxembourg.

2. Main developments in public support for innovation

As noted, the main developments in public support for innovation are threefold. Firstly, the latest developments aim to energise the economic landscape by increasing the number of new companies and supporting more extensively the innovation process of enterprises. To this end, the new law on RDI will be a key instrument as it will target other types of innovation ⁽³⁾ that were not eligible for funding until now, and will be able to finance specific consulting services in innovation. The reinforcement of collaboration between the public organisations – in particular public research centres – and business is the second issue targeted by the new measures. The performance contracts and the new law on RDI should improve the situation. Finally, to attract and retain a high-skilled workforce in Luxembourg is the other challenge faced. A bill on the free movement and immigration was voted to make obtaining of residence permit for third-country nationals easier. Moreover, the University has shown good results, since its creation in 2003 with an increasing number of students who stay in Luxembourg afterwards, including PhD students who are hosted by public research to complete their thesis. In addition, a new scholarship system was introduced in 2007 to attract this valuable workforce.

3. Appraisal of national innovation policy

The numerous objectives that were announced in the different policy documents ⁽⁴⁾ preceding the election of the new government on June 2009 match very precisely the three challenges that were

² Finance industry generates more than 30% of total GDP and 49% of the tax revenues.

³ These two new types of innovations are organisational and process innovations.

⁴ Chambre de Commerce, Luxembourg (2009), *Entreprise Luxembourg 2.0* (<http://www.cc.lu/docdownload.php?id=2802>), Gouvernement du Grand Duché du Luxembourg, *Plan national pour l'innovation et le plein emploi, 2008* (http://www.odc.public.lu/publications/pnr/Report_Plan_national_2008.pdf), Stateg, *L'économie luxembourgeoise en 2008 et évolution conjoncturelle récente*, Mai 2009 (http://www.statistiques.lu/fr/publications/series/noteConjoncture/2009/note_conjonct_01_09/note_conjonct_01_09.pdf)
Gouvernement du Grand Duché du Luxembourg, Ministère des Classes Moyennes, du Tourisme et du Logement, *3^e plan d'action en faveur des PME*, Avril 2008 (http://www.gouvernement.lu/salle_presse/actualite/2008/05-mai/08-boden-pme/plan.pdf), Gouvernement du Grand Duché du Luxembourg, Ministère d'Etat, *Plan de conjoncture du Gouvernement*, mars 2009 (http://www.gouvernement.lu/salle_presse/actualite/2009/03-mars/06-plan/plan-soutien.pdf), Chambre des députés, *Débat d'orientation sur la crise économique et financière*, mars 2009 (http://csv.lu/lb/upload/actualites/4959/RAPPORT_DE_LA_COMMISSION_SPECIALE.pdf).

described previously. Indeed, all the challenges identified in RDI were taken back in the official documents describing the objectives of the government for the new legislature. Moreover, the different RDI measures that were voted and implemented these last two years support these objectives. This shows clearly the ability of the policymakers to identify the right challenges the country has to face in the STI area, and its willingness and capacity to design a relevant innovation policy to tackle these challenges.

Specific measures were designed and implemented in response to each challenge. The adoption of a new law on RDI in June 2009 aims particularly to better support innovative firms, and incite and help non-innovative firms to develop an innovation approach. It also intends to increase the collaboration between public research and the enterprises. It is supported to this end by the implementation of the Performance Contracts since 2007 that target the public organisations of the NIS, and whose objectives are to formalise the objectives to be reached for each organisation and to measure their performances. Finally, the third challenge for Luxembourg to attract and retain its high-skilled workforce is definitely a key topic as the Minister of Culture, Higher Education and Research, Mr. Biltgen, was one of the two leaders of the Gago-Biltgen initiative whose objective is to improve the attractiveness of RTD careers and the conditions for mobility of researchers in Europe. Several measures were taken to answer this issue, like the modification of the law on immigration or the improvement of scholarship funding for researchers.

As a conclusion, there is clear consistency between the STI policy that is defined and implemented by the government and the main challenges the country faces. Financial and legal instruments are used as best as possible to give a relevant answer to these demanding challenges. However, most new measures have been or are about to be implemented soon, with respect to the new law on RDI. Thus, it is too early to assess the effectiveness of this policy and its measures. Finally, one has to keep in mind that it will take time to overcome these challenges as most reflect the lack of an entrepreneurship and risk-taking spirit.

1. Main trends and challenges in the National Innovation System

1.1 Recent economic trends and market developments

Luxembourg faces its most severe recession since the steel crisis in the mid-1970s. After four years of strong growth, the country's economy entered a deep recession during the third quarter of 2008 due to the financial turmoil. As a small open economy strongly dependent on its finance industry, the country is fully exposed to turmoil.

Indeed, the finance industry accounts for more than 30% of GDP and 49% of the incomes of the state. As for the service sector, the manufacturing industry was also affected by the ongoing crisis. The growth of steel, automotive and transportation industries, three major sectors of the country, also came to a sudden halt during the last quarter of 2008.

As a consequence, the GDP was stable in 2008. But expectations for 2009 are bad as the latest available figure published by the national statistic office reports a decline of 5.3% during the second quarter of 2009. A decrease by 4% for the whole year 2009 is expected.

However, a recovery is expected in 2010 with a slight increase of GDP by 1% thanks to the financial and fiscal measures that were taken by the government and the automatic stabilisers that should support the domestic demand and investment. In addition, Luxembourg is still the country with the highest GDP per capita in the EU 27, and performs 2.5 times better than the EU 27 average.

The country is also characterised by a high level of labour productivity, especially compared to the EU 27 average. However, this indicator fell due to the increase of the employment combined with the decline of the GDP. Although the total employment growth increased during the second quarter 2008, bad perspectives are expected. The national statistic office forecasts an unemployment rate at 7% in 2010, the highest figure ever in Luxembourg since this indicator was introduced to the country.

After five years of slight inflation, the rate accelerated strongly since 2005. It reached the highest level ever in July 2008 with an inflation rate of 4.9% due to the rising prices of raw materials and petrol. With the impact of the financial crisis, the inflation rate decreased to 1.1% in December 2008, and a rate of 0.4% is forecasted for 2009.

Although the growth rate of the unit labour cost increased in 2008, a strong slowdown was observed at the end of 2008. In addition, the national statistic office forecasts a 2% increase in 2009 as a decrease of the wages in the finance and construction industries should occur due to the crisis. After three consecutive years of growth, public balance decreased from 3.6% of GDP in 2007 to 2.6% in 2008 as incomes from the finance industry went down. Despite this fall, the country displays a positive balance and is still among the best in class in the EU 27. Nevertheless, the Statec forecasts a deficit of the public balance of 2.3% in 2009 and 4% in 2010 *ceteris paribus*.

After nine years of stability, the public debt of the country increased from 6.3% to 14.7% of GDP in 2008. Finally, foreign direct investments increased sharply as the amount doubled between 2004 and 2007.

Exhibit 1: Comparable indicators of economic performance

Indicator	National performance		EU 27 average	
	2004	2008	2004	2008
GDP per capita in PPS (EU 27=100)	253.4	252.8	100	100
Real GDP growth rate (% change previous year)	4.5	0	2.5	0.9
Labour productivity per person employed (EU 27=100)	170.2	161	100	100
Total employment growth (quarterly % change)	2.6	5.2 (Trim 2)	0.7	0.9
Inflation rate (average annual)	3.2	4.1	2.0	3.7
Unit labour costs (growth rate)	-0.4	5.5	-1.4	0.6
Public balance (net borrowing/lending) as a % of GDP	-1.1	2.6	-2.9	-2.3
General government debt as a % of GDP	6.3	14.7	62.2	61.5
Unemployment rate (as % of active population)	5.0	4.4	9.0	7.0
Foreign direct investment intensity	238.7	435.5 (2007)	0.9	3.4 (2007)
Business investment as a percentage of GDP	17.3	15.6	17.2	18.7 (2007)

Source: Eurostat – Structural Indicators and Long-term Indicators (see <http://epp.eurostat.ec.europa.eu>).

Key: (*) EU25 average, (^) or latest available year (for example: 2005), (:) not available.

1.1.1 The credit crisis and its effect on innovation activity

As a small open economy, the global financial crisis and economic slowdown, as well as the earlier commodity and oil price shocks, have hit the country hard in recent months. All the sectors were impacted, though some more than others. The finance industry can be characterised as a high value-added and low labour intensive industry in Luxembourg. It produces one fourth of the GDP, employs 15% of the active population, and represents 49% of the incomes of the state. The country is thus very dependent on the finance industry. The national statistics office qualified 2008 as 'a chaotic year' for the finance industry. According to the CSSF ⁽⁵⁾, net income before provisions decreased by 10.8%, and profits dropped by 88.1% because of provisions for depreciation.

Despite these results, it seems that the banks were less affected than their peers in Europe. Indeed, as the Statec mentions, the sustained demand for domestic credit activities – at the difference of the trend observed in Europe – enabled them to generate comfortable revenues. However, priority is now to come back to profitability through cost reduction, which means bad times for employment and wages. A worsening of the situation is thus expected for 2009. In March 2009, the loss of jobs was limited with 350 lay-offs representing less than 1% of the workforce. For the next two years, the main consequences of this crisis will mean fewer income taxes for public finance, and a stronger public debt as the forecasts of the Statec confirm. Finally, regarding the debate around future modifications of the regulation framework and financial supervision, it is too early to assess the effects on the mid-term development of the finance industry in Luxembourg.

Despite the quick transition into the service economy these last 25 years, the manufacturing industry is still a key element of the national economy. Its value added only represented 10% of the GDP in 2007 compared to 48% in 1960, but it still employs 37 000 persons. Contrary to the finance sector, the manufacturing industry – particularly the metal and the transportation industries – was strongly affected by the economic crisis. For instance, the automotive industry was particularly impacted during the last quarter 2008 with a decrease by 40% of the demand. Should the crisis last too long, the consequences could strongly impact the national economy, public finance, and employment.

Moreover, as many companies are just subsidiaries of foreign companies and many organisations export, their cost competitiveness should be carefully considered to avoid delocalisation. This situation and the lessons learnt from the past concerning the inability of a state to prevent delocalisation of manufacturing activities from developed countries to emerging countries, necessitates the reshaping of the industrial landscape of a country. Luxembourg is well aware of this and promotes traditional

⁵ Commission de Surveillance du Secteur Financier.

industries when possible, as well as the diversification towards new promising industries such as added-value logistics, green technologies, biomedicine and IT-based services.

After more than twenty years of boom, the immediate future of the construction industry – which accounts for more than three-fourths of the employment in the blue-collar industry – might be less flourishing. Although the impact of the crisis is difficult to evaluate, especially in residential real estate, the decrease of the demand of commercial real estate and the fickle behaviour of the customers do not instil optimism. Thus, the government decided to launch earlier than planned the projects that were supposed to start no earlier than 2010 or 2011. Cities are also incited to accelerate their own investment projects. Finally, grants and tax deduction (e.g. low energy consumption building) are expected to support private demand. Besides these specific measures, a strong consensus was found among all the business authorities around the simplification of the procedures to accelerate the pace of the projects and to reduce their cost.

Finally, commerce, which represents 20% of GDP, is differently affected by the crisis. Whereas B2C activities do not seem to be strongly affected, B2B turnover has decreased dramatically, particularly in the advertisement and communication, logistics and car renting industry. As an answer proposed by the Confederation of Commerce, a communication plan to restore trust in the consumers is the most important measure to be implemented.

These different measures that have been mentioned above to limit the impact of the crisis in the country are actually part of the recovery plan - *Plan de conjoncture* – undertaken by the government which comprises a set of measures which addresses the following 7 axes:

- support of the purchasing power (EUR 600 million),
- support of the activities of the firms through fiscal and other measures,
- creation of an administrative environment favouring business,
- support of the activities of the firms through public investment,
- direct support to firms with difficulties,
- support of employment by supporting part-time employment (EUR 130 million),
- preparation of the exit of the crisis through:
 - investments in the development of new promising industries to diversify the economy (green tech, logistics and biomedicine) and IT (information highways worth EUR 30 million and telecommunications infrastructures worth EUR 74 million).
 - the vote of the new law on RDI: the main changes of this new law are the introduction of new specific regimes towards technical feasibility studies, IPR, and creation of new innovative and young firms, as well as financial support to cover now process and organisational innovations, as well as consulting services in innovation.

Although it is too early to conduct a thorough analysis of the consequences of the crisis on the innovation activity of the most important industries in Luxembourg or on the effects of the recovery plan that has just been implemented, we can already state that the manufacturing industry (particularly the automotive and steel industries) has cut RDI investments drastically. There are many examples of SMEs – but also larger firms – that have laid off a large part of their R&D staff to improve their chances of survival.

Fortunately, the situation is less dramatic in the service sector, and particularly in finance where as explained before only few jobs have been cut yet. As a consequence, and although we might face a decrease of R&D expenses, this fall should be low thanks to the enlarged scope of the new law on RDI and the 30% increase of the budget allocated to finance private R&D.

The stability of the innovation activity will be very much dependent of the evolution of the economic crisis and the impact of the law on RDI. Indeed, there is little expectation towards a sudden increase of creation of firms from unemployed people, not only because the entrepreneurial spirit is low in the country, but also because the compensation system for the unemployed does not encourage them to adopt such behaviour.

1.2 Recent trends in the national innovation performance

Exhibit 2: European Innovation Scoreboard: country pages

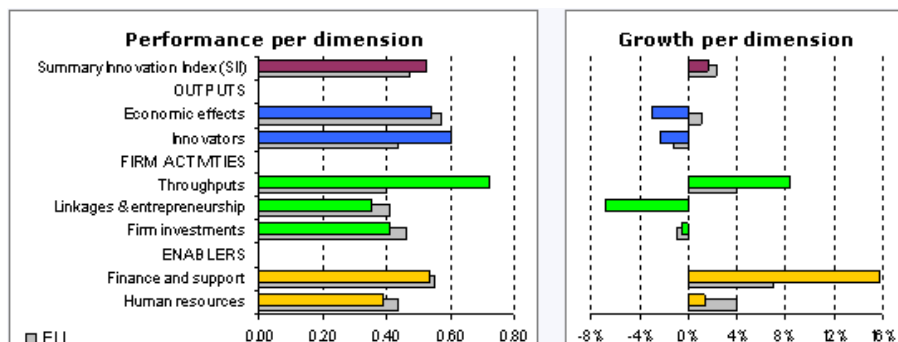


Exhibit 3: European Innovation Scoreboard: innovation growth leaders

TABLE 2: INNOVATION GROWTH LEADERS

Group	Growth rate	Growth leaders	Moderate growers	Slow growers
Innovation leaders	1.6%	Switzerland (CH)	Germany (DE), Finland (FI)	Denmark (DK), Sweden (SE), United Kingdom (UK)
Innovation followers	2.0%	Ireland (IE), Austria (AT)	Belgium (BE)	France (FR), Luxembourg (LU), Netherlands (NL)
Moderate innovators	3.6%	Cyprus (CY), Portugal (PT)	Czech Republic (CZ), Estonia (EE), Greece (GR), Iceland (IS), Slovenia (SI)	Italy (IT), Norway (NO), Spain (ES)
Catching-up countries	4.1%	Bulgaria (BG), Romania (RO)	Latvia (LV), Hungary (HU), Malta (MT), Poland (PL), Slovakia (SK), Turkey (TR)	Croatia (HR), Lithuania (LT)

Average annual growth rates as calculated over a five-year period.

Gross domestic expenditure on R&D (GERD) stood at 1.62% in 2007, a share that is stable since 2003 as the minimum-maximum are between 1.56% in 2005 and 1.66% in 2006. Thus, the commitment of the Government in the NRP in 2005 to reach the Lisbon target of 3% will be hard to achieve.

The business enterprise sector remains the main contributor to R&D expenditures in Luxembourg, with an investment representing 1.36% of GDP in 2007 compared to 1.43% in 2006. This decrease is due to the willingness of the Government to increase sharply the public expenditures in R&D to try to reach the target of 1% of GDP in 2010. Although it is unlikely that this objective be reached on time, the figures show an upward trend of the financial investment of the public sector in R&D. Thus, the share of the government and higher education sectors reached a peak value with 0.27% of GDP in 2007, compared to 0.24% in 2006, 0.21% in 2005, or 0.2% in 2004. Nevertheless, the business sector still contributes to 83.76% of GERD – compared to 89.1% in 2003 – one of the highest rates in the world. Moreover, 91% of Business expenditure on R&D (BERD) is financed by the companies themselves, and only 5.2% by the government (2006). Finally, 90% of business expenditures in R&D in 2006 came from companies with more than 49 employees. This shows one of the weaknesses of the country, i.e. the high concentration of business R&D in the hands of very few big companies.

The European Innovation Scoreboard 2008 (EIS) ranks Luxembourg in the category of Innovation follower with innovation performance above the EU 27 average but with a rate of improvement below

that of the EU. Luxembourg's position on the EIS summary Innovation index has constantly improved since 2004 and lies above the EU 27 average (0.524 in 2008 compared to 0.475 for the EU 27).

When we take a closer look at the different innovation dimensions, Luxembourg demonstrates weak performances in Human resources, and a strong decline in the Linkages & entrepreneurship and Economic effects dimensions.

The poor performance in Human resources is not surprising and can be explained by the lack of data on one hand (the latest data are from 2005 for some indicators), and the weak level of education on the other hand. The unavailability of recent figures for the first two indicators about S&E and SSH graduates and doctorate graduates impacts the mean for the 'Human resources' dimension. In addition, the country needs to pursue its efforts to increase the level of education of the 20-24 and 25-64 year age groups. Nevertheless, one has to put into perspective this situation for two reasons. Firstly, a lot of Luxembourg's students study abroad, and thus are not accounted for in these figures. Secondly, we can easily expect significant progress in the level of education in future years thanks to the presence and the dynamism of the University of Luxembourg.

The Linkages & entrepreneurship dimension is heavily impacted by the decrease of the firm renewal indicator – a situation that can be partly explained by a weak entrepreneurship spirit in the country. The other indicator that explains the poor performance of the country in this dimension is the number of public-private co-publications, a consequence of the historic positioning of the Public Research Centres (PRCs) on innovation and applied development rather than a poor research. However, this situation should change in the next years with the signature by the Public Research Centres of Performance Contracts⁽⁶⁾ featuring a performance indicator which takes into account the minimum number of publications to be published.

The growth of the Economic effects dimension dropped because of the impact of the crisis on the employment and the decrease of exports in the medium-high and high-tech manufacturing industries. Like all Innovation followers, Luxembourg performs above the EU average in the Innovators dimension. This is due to the high capacity of the SMEs to innovate as Business R&D intensity is one of the highest in the world. Finally, the country is well ahead its peers in the Throughputs dimension, and is showing the fastest rate of improvement across the EU in the Finance and support dimension.

On another front, excellence of Luxembourg in IPR is not new. However, one has to remember that these figures cannot be explained only by the IPR activity of indigenous firms, but also by the opportunity given by the competitive fiscal policy that offers an 80% tax cut on IP profits since January 2008. Regarding the financing of R&D, the government has been aware for several years that an increase of public R&D expenses is needed. The increase of the R&D budget in percentage for 2008 is one of the biggest in the EU (23% compared to 2007), and this trend should continue in the future as the government still intends to reach the Lisbon objective of 3% of the GDP invested in R&D.

In addition, private credit has boomed, and broadband access is one of the highest rates in the EU. This results from the big investments made in IT these last ten years, and the ongoing projects in land-based and mobile telecommunication networks and infrastructures.

Looking back the past five years, Finance and support and Throughputs have been the main drivers of of the comparative level of Luxembourg's innovation performance, in particular through the strong growth in Private credit (16.8%), Broadband access by firms (20.0%) and Community designs (13.5%). One should not forget as well the tremendous increase of Public R&D expenditures. In practical terms, the annual budget for 2009 is expected to amount to EUR 215 million, that is three times more than in 2004 (EUR 72 million), and around eight times more than in 2000 (EUR 28 million).

Lastly, performance in Firm investments, Linkages & entrepreneurship, Innovators and Economic effects has worsened, in particular due to a decrease in Public-private co-publications (-14.3%), Employment in medium-high & high-tech manufacturing (-6.4%) and New-to-firm sales (-8.0%).

⁶ These Performance contracts were launched in 2008.

Exhibit 4: European Innovation Scoreboard: country pages

	2001	2002	2003	2004	2005	2006	2007	2008	growth
SII				0.486	0.486	0.513	0.497	0.524	1.6%
ENABLERS									8.3%
Human resources									1.4%
1.1.1 S&E and SSH graduates	--	--	--	--	--	--	--	--	--
1.2.2 S&E and SSH doctorate graduates	--	--	--	--	--	--	--	--	--
1.1.3 Tertiary education	--	--	--	23.7	26.6	24.0	26.5		2.9%
1.1.4 Life-long learning	--	--	6.5	9.8	8.5	8.2	7.0		1.9%
1.1.5 Youth education	--	--	72.7	72.5	71.1	69.3	70.9		-0.6%
Finance and support									15.8%
1.2.1 Public R&D expenditures	0.15	--	0.18	0.20	0.21	0.24	0.27		10.7%
1.2.2 Venture capital (3-year average)	--	--	--	--	--	--	--		--
1.2.3 Private credit	1.29	1.04	1.03	1.06	1.30	1.55	1.92		16.8%
1.2.4 Broadband access by firms	--	--	39.0	48.0	64.0	76.0	81.0		20.0%
FIRM ACTIVITIES									1.1%
Firm investments									-0.5%
2.1.1 Business R&D expenditures	--	--	1.47	1.43	1.35	1.43	1.36		-1.9%
2.1.2 IT expenditures	--	--	--	--	--	--	--		--
2.1.3 Non-R&D innovation expenditures	--	--	--	0.87	--	0.90	--		0.9%
Linkages & entrepreneurship									-6.8%
2.2.1 SMEs innovating in-house	--	--	--	--	--	--	--		--
2.2.2 Innovative SMEs collaborating with others	--	--	--	14.8	--	15.1	--		0.6%
2.2.3 Firm renewal (SMEs entries + exits)	4.4	3.6	3.3	3.5	--	--	--		-6.0%
2.2.4 Public-private co-publications (2-year avg.)	--	14.6	11.2	7.7	5.4	4.2	--		-14.3%
Throughputs									8.4%
2.3.1 EPO patents	169.7	135.9	197.4	248.8	194.9	--	--		1.7%
2.3.2 Community trademarks	631.9	522.2	573.5	561.0	632.0	880.2	1220.0		10.2%
2.3.3 Community designs	--	--	134.5	143.9	397.3	94.6	1018.6		13.5%
2.3.4 Technology Balance of Payments flows	--	0.95	0.82	1.01	1.17	1.31	--		8.4%
OUTPUTS									-2.2%
Innovators									-2.3%
3.1.1 Product/process innovators (SMEs)	--	--	--	49.1	--	44.7	--		-2.3%
3.1.2 Marketing/organisational innovators (SMEs)	--	--	--	62.8	--	60.2	--		
3.1.3 Resource efficiency innovators									
3.1.3a Reduced labour costs	--	--	--	16.2	--	12.9	--		
3.1.3b Reduced use of materials and energy	--	--	--	7.6	--	6.8	--		
Economic effects									-3.0%
3.2.1 Employment in medium-high/high-tech manuf	1.19	1.22	1.41	1.21	1.38	1.26	1.08		-6.4%
3.2.2 Employment in knowledge-intensive service	20.59	22.13	22.63	22.83	23.60	24.06	23.94		1.4%
3.2.3 Medium/high-tech manufacturing exports	--	36.2	35.8	34.1	32.9	32.7	--		-2.5%
3.2.4 Knowledge-intensive services exports	--	81.2	77.5	76.7	80.0	82.4	--		0.4%
3.2.5 New-to-market sales	--	--	--	6.4	--	5.9	--		-2.1%
3.2.6 New-to-firm sales	--	--	--	9.1	--	6.5	--		-8.0%

1.3 Identified Challenges

Exhibit 5: Main innovation policy challenges

Description of challenge	Relevant indicators and trends
1. Increase collaborations between public research and private companies	Public-private co-publications Research contracts between public research and private companies (turnover)
2. Attract and keep high skilled workers in Luxembourg	S&E and SSH graduates (evolution in %) S&S and SSH doctorate graduates (evolution in %) Tertiary education (evolution in %)
3. Create and develop new innovative companies	Firm renewal SMEs innovating in-house Number of Spin-offs

The main challenges for Luxembourg competitiveness are the same as those presented in the previous TrendChart report.

As indicated in most official documents like the NRP for the 2008-10 period (⁷), the recommendations from the Chamber of Commerce (⁸) to the new government, or the *Plan de conjoncture* (⁹) from the government, three of the main challenges for the country in the field of innovation are:

- to increase collaboration between public research and private companies, and particularly SMEs,
- to attract and keep high skilled workers in Luxembourg,
- to favour the creation and development of new innovative companies.

A high level of Research in key future areas and the promotion of such competences and capacities has become mandatory for any country that wishes to be recognised internationally in the field of Research and Development. However, it is certainly not sufficient to be competitive. Indeed, in this promising era of open innovation, the key success factor for small countries will probably lie less in R&D than in their capacity to market research. This capacity that is partly based on the quantity and the quality of collaboration existing between the research and business spheres is precisely one of the most important weaknesses of Luxembourg. The reasons for this situation lie mainly in the lack of communication between these two worlds and the feeling shared by both parties who do not speak the same language and do not have the same objective. Thus, a set of actions and measures was defined and implemented to improve this situation.

The most important measure is the signature of the three-year performance contracts between the PRCs, the university and the government. These documents include several quantitative objectives to be reached by the parties. It stimulates collaborations between public research and private companies by setting a specific number of cooperation initiatives that have to be undertaken. Another major initiative is the possibility given to the public research organisations to participate in the ongoing cluster initiative in the fields of logistics, renewable energies, IT, biomedicine, aerospace and materials. Finally, the creation of the multi-annual event called 'Business meets research' aims to help the business and research spheres meet and better know their competences and needs.

With fewer than 500 000 inhabitants and one of the highest GDP per capita in the world, Luxembourg is very dependent on the workforce coming from the three neighbouring regions located in three different countries: Belgium, France and Germany. Moreover, as its sole University is fairly recent (¹⁰), the economy cannot expect this unique source to fully feed its needs in high skilled workforce. As a consequence, Luxembourg is one of the countries whose growth depends most on its capacity to attract and retain talent.

To this end, several measures targeting different publics were voted and implemented in recent years. In such a way to attract the best future researchers, a major modification of the scholarships was implemented in 2007 with the replacement of the Research Training Grants (BFR) by the Luxembourg Post-doctoral Funding (AFR). The new scheme now offers better social security to the beneficiaries as the scholarships are given, provided that the student has signed an employment contract.

Another change was the adoption of a new law on immigration in July 2008 that made it easier for highly skilled people from third countries to move to Luxembourg and work there. Finally, the country actively promotes its main assets abroad, i.e. a high level of wages and security, associated with a low level of tax and performing IT infrastructures.

The last challenge for the country, and undoubtedly one of the most difficult, is to increase the creation and development of innovative enterprises. To this end, the country has developed a set of programmes and measures to render it more attractive, to encourage people to create their own company, particularly innovative firms, and to support them in the development of their firm. To fulfil

⁷ See http://www.odc.public.lu/publications/pnr/Report_Plan_national_2008.pdf online.

⁸ See <http://www.cc.lu/docdownload.php?id=2802> online.

⁹ See http://www.gouvernement.lu/salle_presse/actualite/2009/03-mars/06-plan/plan-soutien.pdf online.

¹⁰ The university was set up in 2003.

the first objective, the legal framework facilitating the establishment of foreigners, the competitive tax rate, and the efforts to make the creation of a company as easy and fast as possible through the simplification of the administrative process are some of the answers to this challenge.

In a country where finance and public sectors offer low-risk high-wage job opportunities, it is a real challenge to incite people to create their own companies. Thus, intense efforts are made to promote and strengthen entrepreneurship to a large public. Several public events were organised to this end in 2008. One of them was The Woman Business Manager of the Year 2008 award, whose aim is to promote female entrepreneurship. The strengthening of relations between the university and the business sphere is another way to address the issue of entrepreneurship.

COURAGE I and II are cross regional initiatives that gather six universities and schools from Luxembourg and Germany. The objective of this programme is to promote entrepreneurship in the Greater Region through continuing and initial trainings. With the same purpose of encouraging students to create their own company, the university and the Chamber of Commerce launched in 2007 a Master of Science in Entrepreneurship & Innovation. But the demand for such profiles from companies is so strong that graduates end up joining the companies instead of creating their own business. The 1,2,3 Go initiative also plays a key role through its mission to help entrepreneurs prepare their business plan. This initiative was included in the ranking of the ten best initiatives at the conference on Small Enterprise Charter that was organised by the European Commission in Berlin in June 2007. 1,2,3 Go also launched in 2007 the *Primes de lancement*, a 100% guarantee surety, and a sponsorship contract. Furthermore, the beneficiary gets access to a reduced interest rate loan with banks that are partners of the initiative, as well as the support of a specialist in business development all along the duration of the reimbursement.

In order to support the entrepreneurs in the development of their firm, the country relies on three incubators, the cluster initiative that grows and targets new industries, and services dealing with technology transfer, strengthening and funding. The new law on Research Development and Innovation that was voted on June 2009 should play a key role in the near future. The main change compared to the former law lies in the new types of projects and services it will finance, i.e. process and organisational innovations, but also consulting services in innovation.

2. Public Support to Innovation

2.1 Main objectives for innovation policy

The main policy documents (see Exhibit 5 below) dealing with innovation have defined the following objectives as key for the future of the country:

- increasing public R&D expenditures up to 1% of GDP,
- increasing the quality of research,
- concentrating investments in R&D in the following fields ⁽¹¹⁾ identified by the government on the basis of the foresight study led in 2006-07 by the National Research Fund:
 - development and performance of the financial systems,
 - high quality and efficient business services,
 - security of information,
 - sustainable management of water resources,
 - labour market, education and social protection,
 - languages, diversity, and integration,
 - functional and intelligent surfaces and materials,
 - diseases linked to ageing population,
- improving governance of public organisations that compose the national innovation system through the implementation of Performance Contracts,
- increasing the supply of high skilled workforce through:
 - raising the level of the trainings offered by the University and the other education institutes,
 - promoting initial and continuing education,
 - facilitating the establishment of third countries researchers and highly educated people
 - modifying the law for the attribution of residence permits and the development of the new scholarship system (AFR)
- developing collaboration between public research and business, both at the domestic level and at the international level,
- developing the quality of IT infrastructures
- developing an entrepreneurial spirit and favour the creation of firms, particularly through a competitive fiscal framework and a simplification of the administrative procedures,
- supporting the development of the firms, as well as innovation and R&D development in the SMEs. The new law on RDI is a central element in the expected increase of the RDI efforts of the SMEs.
- diversifying the economy by:
 - developing high value added industries – through the cluster policy – such as renewable energies, biomedicine, logistics, IT based services, aerospace, e-commerce and intellectual property,
 - innovating in the key industries of the country (banking, automobile, steel and construction).

¹¹ See http://www.gouvernement.lu/salle_presse/conseils_de_gouvernement/2007/10/31-conseil/index.html online.

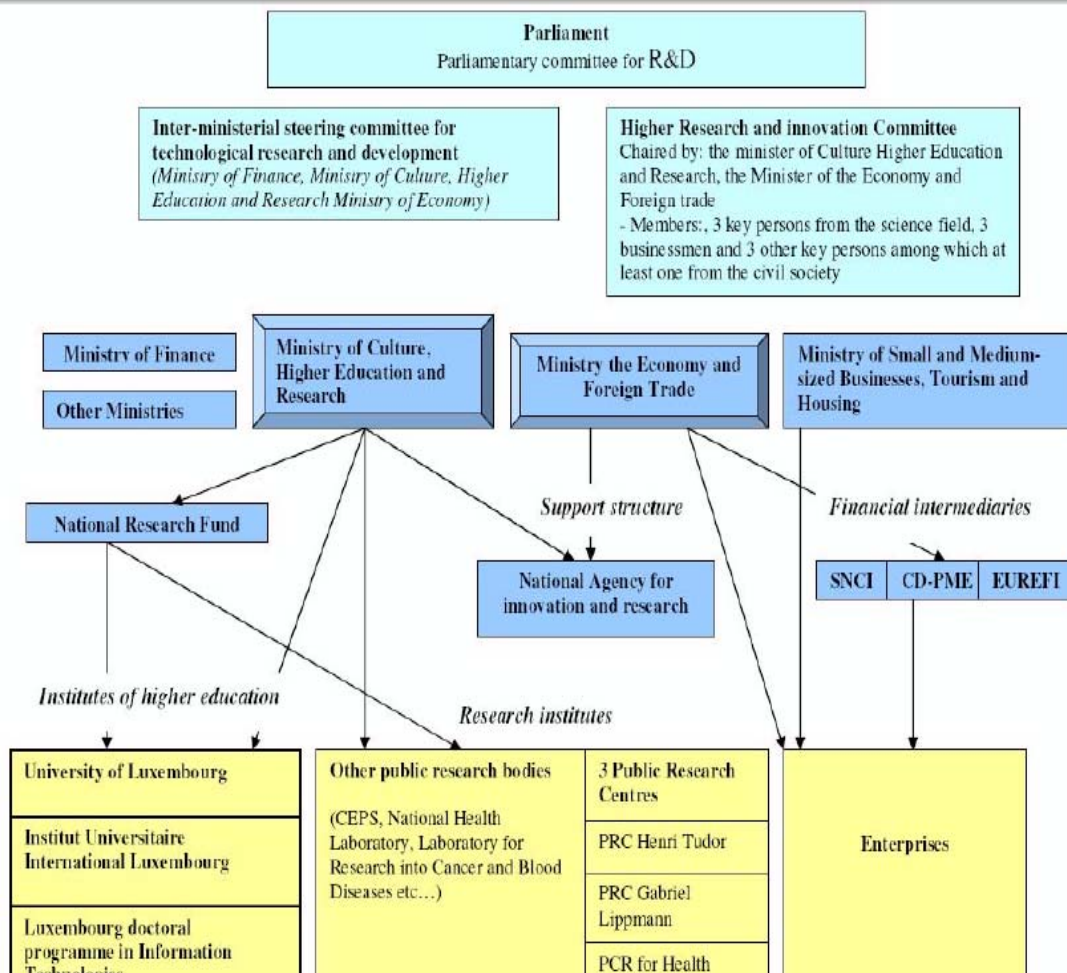
Exhibit 6: Main innovation policy documents

The main policy documents dealing with innovation are:

- the NRP 2008 ⁽¹²⁾,
- the *Plan de conjoncture* of the Government ⁽¹³⁾,
- the Economic bulletin from the Chamber of Commerce: *Entreprise 2.0* ⁽¹⁴⁾,
- the report from the special commission of the Chamber of Deputies called Economic and financial crisis ⁽¹⁵⁾,
- the declaration of the government on the economic, social and financial situation of the country 2009 ⁽¹⁶⁾.

2.2 Innovation governance system

Exhibit 7: Innovation governance system



¹² See http://www.odc.public.lu/publications/pnr/Report_Plan_national_2008.pdf online.

¹³ See http://www.gouvernement.lu/salle_presse/actualite/2009/03-mars/06-plan/plan-soutien.pdf online.

¹⁴ See <http://www.cc.lu/docdownload.php?id=2802> online.

¹⁵ See <http://www.chd.lu/wps/portal/public/RoleEtendu?action=doDocpaDetails&id=5977#> online.

¹⁶ See <http://www.gouvernement.lu/gouvernement/etat-nation-2009/etat-nation-2009-traduction-FR/index.html> online.

2.2.1 Governmental bodies

The main ministries with innovation policy responsibilities are the Ministry of the Economy and Foreign Trade and the Ministry of Culture, Higher Education and Research. The Ministry of the Economy and Foreign Trade is composed of four General Directorates:

- general directorate of business, economic development and foreign trade,
- general directorate of domestic market, consumption, regional policy and general affairs,
- general directorate of energy, ecommerce and computer security,
- general directorate of economic studies.

Within the general directorate of business, economic development and foreign trade, there are four sub-directorates:

- directorate of enterprise policy,
- directorate of research and innovation,
- directorate of development and economic diversification,
- directorate of foreign trade.

The Ministry of the Economy and Foreign Trade is primarily responsible for policy regarding Luxembourg's economic competitiveness. Its priorities include the following four areas: enterprise, technology and competitiveness; regional economic development; research and technological development, technology transfer and innovation; and industrial and intellectual property rights.

Within the General Directorate of Business, Economic Development and Foreign Commerce of the Ministry of the Economy and Foreign Commerce, the Department of Research and Innovation is in charge of technology and innovation policy. It has a staff of four (plus one administrative staff). Generally, technology and innovation policy aims to encourage Luxembourg companies to increase their R&D and innovation efforts, in close coordination with activities to promote entrepreneurship and firm creation. The following activities of the ministry address business enterprises directly:

- awareness activities for industrial research and innovation,
- information about national and European measures and programmes and instruments,
- promotion of individual technological competences and aggregate 'poles of competence',
- national and international networking of companies, research centres and universities to facilitate exchange of technologies and cooperation,
- financial encouragement of individual or cooperative R&D projects,
- a business innovation centre called ECOSTART recently created as an incubator for companies in the start-up, providing office space for companies in their development phase and for foreign companies seeking to establish themselves in Luxembourg.

These activities are provided through the ministry and related external institutions such as Luxinnovation (whose board is currently chaired by the Ministry of the Economy and Foreign Trade), the National Portal of Innovation and Research and ECOSTART, the cluster programme or Information Society initiatives.

Financial support for innovation projects can be provided on the basis of the new framework law on development and economic diversification of June 2009 that addresses stimulation of business R&D. Both innovation projects and projects aimed at creating or widening research capacities are eligible for funding. Public funding is expected to provide an incentive to take the risk inherent in technological development. Applications must be submitted prior to undertaking research activities. Funding takes the form of subsidies which can be complemented by innovation credits provided on favourable terms by the SNCI, the national company for credit and investment.

The Ministry of Culture, Higher Education and Research contains the following three departments:

- department of Culture
- department of Higher Education
- department of Research

The organisational units responsible for research and higher education are the Department of Research and the Department of Higher Education. The Department for Research is the main actor for research and covers the following areas:

- public research policy in the fields of scientific and applied research: related inter-ministerial coordination,
- scientific and technological cooperation at inter-regional, international and European level: coordination and implementation,
- Fonds National de la Recherche (FNR),
- commissariat of the public research centres (Gabriel Lippmann, Henri Tudor, Santé), as well as of CEPS/INSTEAD and the Virtual Centre for Knowledge in Europe (CVCE),
- technology transfer and innovation: promotion of entrepreneurship, promotion of technology and innovation-based firm start-up,
- human resources: scholarships for training and research, mobility,
- coordination of Luxembourg's policy with respect to the European Space Agency (ESA).

The department of Higher Education is responsible for the development and continuity of Luxembourg's higher education sector. It has raised awareness of Luxembourg's higher education sector among Luxembourg society and of its development potential at national, European and international levels. The department was heavily involved in preparing draft legislation for the creation of the University of Luxembourg and in introducing post-graduate training. The department is also responsible for documentation on national and international higher education and manages public financial support for higher education through its Centre for Documentation and Information on Higher Education (CEDIES).

Aside from these two Ministries, one has to mention the Inter-ministerial coordination committee for research and technological development, which was set up in 1987. It is composed of representatives from the Ministry of Culture, Higher Education and Research, the Ministry of the Economy and Foreign Trade, the Ministry of Finance, the Ministry of State and the Ministry of Health. It has the following tasks:

- preparing a report on R&D-related activities financed directly by the various ministries,
- submitting a proposal for the annual or multi-annual R&D programme,
- submitting a coordinated proposal regarding budget allocations and expenditures of the PRCs,
- submitting a budget proposal concerning the budget allocation for the 'training through research' fellowships,
- giving its opinion on any other question concerning inter-ministerial co-ordination as regards R&D.

The committee has some influence on the research and innovation strategy, notably owing to its task of formulating a coordinated proposal on R&D budget allocations in the public sector. Moreover, representatives of the ministries in the committee are directly involved in the implementation of research and innovation policy.

Another important body created in 2007 is the Higher Research and Innovation Committee. Its aims are on one hand to contribute to the development and to the formulation of a coherent and efficient national R&D policy, and on the other hand to advise the government on the implementation of this policy (elaboration of strategic objectives, national priorities, and instruments).

The committee is composed of the Minister of Culture Higher Education and Research and the Minister of the Economy and Foreign Trade (who jointly chair the committee), as well as three key

persons from the science field, three businessmen and three other key persons among which at least one from the civil society.

2.2.2 Main bodies managing implementation of policies

Created in 1984, Luxinnovation is the National Agency for Innovation and Research. It became part of the *Groupement d'intérêt économique* (GIE) in 1998. It is currently composed of six shareholders: the Ministry of the Economy and Foreign Trade, the Ministry of Culture Higher Education and Research, the Ministry of the Middle Classes, Tourism and Housing, the Business Federation of Luxembourg (FEDIL), the Chamber of Commerce and the Chamber of Skilled Crafts.

Luxinnovation is the first one-stop shop for innovation and research in Luxembourg. Its services are provided to companies, research centres, entrepreneurs, and researchers. The missions of the agency are:

- providing strategic information to firms and research centres on all aspects of innovation and R&D, national and European innovation financing, technology transfer and business start-ups,
- giving firms and research centres tailor-made advice/assistance on research and innovation,
- assisting organisations in their innovation project.

Luxinnovation also devises and manages programmes and tools such as the clusters programme and the Luxembourg Portal for Innovation and Research. It also has the mission to facilitate dialogue and strengthen cooperation between private and public bodies in R&D and innovation. Luxinnovation offers four main services:

1. National & international R&D programmes. The national programmes provide information and assistance to companies and research centres on state aids for co-financing research and innovation activities. International programmes include the following:
 - 7th Framework Programme (FP7). As the National Contact Point (NCP) for Luxembourg, Luxinnovation gives information and assistance to public and private organisations.
 - European Space Agency (ESA): As NCP Luxinnovation provides information on how the ESA operates as well as assistance.
 - Intergovernmental initiative EUREKA: Luxinnovation is the EUREKA national Coordination Secretary in Luxembourg. As such it provides information and assistance to companies that want to participate in this program.
2. Technology & cluster services:
 - Enterprise Europe Network (EEN). Luxinnovation coordinates the Luxembourg-Trier-Saarland transnational EEN. Companies can search for the specific technologies they need to innovate or promote their own expertise and meet potential partners.
 - The Clusters programme. Luxinnovation runs clusters that aim to encourage partnerships and collaboration between different technological sectors. Since its creation, six clusters were created in the following areas: Aeronautics and aerospace technologies (AeroSpace technology cluster), Information and communication technologies (InfoCom technology cluster), Surface treatment and new materials (SurfMat technology cluster), Biohealth, EcoDev and Logistics.
3. Services for innovative start-ups:
 - setting-up of projects for starting innovative businesses: advice on financing, administrative formalities, accommodation, partner search,
 - network for entrepreneurship 1, 2, 3 Go: Luxinnovation supports the Chamber of Commerce in the running of this network,

- promotion and animation of the Ecostart enterprise and innovation centre: support to companies hosted at Ecostart and promotion of the incubator,
- intellectual property: advice and organisation of seminars.

4. Services for SMEs

- encouragement of innovation in skilled craft companies: proactive visits, organisation of seminars, publications, technology transfer offers, promotion of the innovation incentive scheme,
- promotion of Innovation Management Techniques (IMT): five-day training course,
- financial supports and grants: advice on financing,
- InnoNet innovation diagnostic tool: questionnaire evaluating the strengths and weaknesses of companies with regard to innovation,
- ProInno DeLux: inter-regional project for fostering potential for innovation in skilled-craft companies in the metal working and processing sector.

Luxinnovation is also composed of a communication department and a documentation and studies department involved in several studies projects (TrendChart, Erawatch).

The Chamber of Commerce and the Chamber of Skilled Crafts are both business organisations but they target different clients. The two organisations are shareholders of the National Innovation Agency, and act alternatively as advisers, partners or customers concerning the activities that are being led by Luxinnovation. Thus, several events and programmes are organised every year in partnership between Luxinnovation and these two business organisations.

The Business Federation Luxembourg (FEDIL) is a federation of companies from several industries such as construction, services, and manufacturing (steel, automobile, transformation of materials particularly). The members of the FEDIL represent 25% of GDP, 30% of the domestic employment, and more than EUR 8 billion of exports. The main objective of the FEDIL is to defend the professional interests of its members as well as to analyse the key issues in the field of economy, society, or industry. Through regular contacts at the local and international level with politicians, representatives of the economy and trade unions, the FEDIL tries to influence the political and administrative decisions with a view to preserving the interests of the free enterprise. As one of the shareholders of Luxinnovation, and through its organisation that comprises a working group in the field of research, development and innovation, the FEDIL plays an important role in the definition of actions to be taken in RDI, as well as in the support of specific events and actions that are organised towards its members.

2.3 Public funding to innovation

2.3.1 Review of the current range of support measures for innovation

Luxembourg has a fairly complete set of measures as all the five categories of the TrendChart are addressed. As in most countries measures in the areas of Research & Technologies and Innovative Enterprises are amongst the most important in Luxembourg. However, numerous measures also target the field of Markets and Innovation Culture.

This concentration on three out of the five categories is not surprising. On the contrary, it demonstrates the relevance of the STI policy of the country. Indeed, these three categories include measures that deal with the three challenges Luxembourg faces:

- increasing collaboration between public research and private companies,
- attracting and keeping high skilled workers in Luxembourg,
- increase the creation and development of new innovative companies.

1. Increasing the creation and development of new innovative companies, and developing an innovation culture. The two most important measures aim to promote entrepreneurship/start-up, including incubators, and support innovation management and advisory services. In a country where risk aversion is widely developed with the structural lack of high skilled workforce and the pre-eminence of high-wage industries, it is difficult to develop an entrepreneurial spirit. Nevertheless, huge efforts are made to incite people to make this professional choice. Thus, through the organisation of the annual open days of the incubators and specific events at the spring annual fair, Luxinnovation intends to target and motivate potential future firm founders to go one step further. The Chamber of Commerce and the University share the same objective with the creation and the operation of a Masters program in Entrepreneurship and Innovation since 2007. As noted in the previous pages, the 1,2,3 Go initiative, through its support to the writing of business plans and the *Primes de lancement* plays a key role in this quest of the entrepreneur. The support of the growth of innovative firms is fulfilled by the latest law on RDI of the Ministry of the Economy and Foreign Trade that was adopted in June 2009 and the law from the Ministry of the Middle Classes, Tourism and Housing. The incubators are also a very important instrument to promote the creation of enterprises and sustain their growth. Luxembourg offers three incubators, and another one is being built and will be located in the City of Sciences in Esch-Belval hopefully in 2010.

To give firms and especially SMEs the opportunity to offer technologies and/or to have access to available technologies, Luxinnovation, as the National contact point of the EEN actively contributes to support SMEs in their innovation process. Finally, as a major instrument to support the growth of innovative enterprises, the cluster initiative is allocated more financial resources year after year. The trend will continue as two new clusters were created in the fields of green techs and logistics since last year. Another one in the field of automotive should be initiated in the next months.

Amongst the other measures that aim to support the creation of a favourable innovation climate, IPR is given a special attention by the government. For several years, Luxembourg has been running a policy to strengthen its position as an attractive place for Intellectual Property. The latest measure from December 2007 confirms this objective. It is a new tax regime that allows an 80% exemption of net income derived from Intellectual Property.

From a financial point of view, figures are either confidential or are not available. The reason of this unavailability lies in the modification of the way public organisations are now financed by their Ministries. Whereas the government allocated funding to public organisations on a project-basis, the new funding approach based on the performance contracts makes the access to the figures 'difficult'. Indeed, in the framework of the performance contracts, public organisations receive funding for three years that it can invest as they wish, provided that the objectives defined with the government will be reached.

2. Attracting and retaining high skilled workers in Luxembourg. In order to further attract high skilled PhD candidates and post doctorates, Luxembourg replaced its former scholarship system called BFR, by a new one entitled: AFR (*Aide à la Formation Recherche*). The new system now offers better social protection to the beneficiaries as the scholarship is given provided that the student signed an employment contract. This 'new' measure started in 2008 with a budget amounting to EUR 7.7 million for the fiscal year 2008.
3. Increasing collaboration between private and public sectors and strengthen public R&D. To achieve this, the government relies on its measures to finance R&D and Innovation. Two financial instruments are available for companies that would wish to start or develop a RDI project: grants and loans. Both instruments are generic in that they do not take into consideration the field of research as a criterion of eligibility.

Grants are mainly offered through the R&D incentive scheme by the Ministry of the Economy and Foreign Trade (MECE) which finances indifferently basic, industrial or applied research,

and pre-competitive development. In 2008, R&D projects amounting to EUR 22 million were financed, compared to EUR 24.94 million in 2007 and EUR 26.93 million in 2006. With the new law on RDI, the budget will increase by 30% to EUR 30 million in 2009. All companies are eligible for this type of funding. However, the percentage of funding is higher for SMEs than for big companies and varies according to the nature of the project based on whether it is a pre-competitive or a fundamental research project. Moreover, the rate of funding is higher if the company collaborates with a public research organisation.

The second type of financial instrument is the innovation loan that is offered by the *Société Nationale de Crédit et d'Investissement* (SNCI). 'Innovation loans' co-finance expenses directly related to R&D projects involving the launch of a new product or service or the development of new production or marketing processes (provided these expenses lead to the creation of assets depreciable over a period of more than one year). Five loans amounting to EUR 1.3 million were offered in 2008, compared to seven loans amounting to EUR 1.6 million in 2007.

Aside from private R&D, the other key issue for the government is to strengthen public R&D. Firstly to get closer to the Lisbon objective that is far from being reached despite the outstanding financial efforts that were made by the government these last two years. Secondly to make public research more attractive and thus increase potential collaborations with the private sector on one side, and attract new companies and investments in Luxembourg on the other side. In order to reach this objective, the government uses the only public financial instrument available: grants. However, these grants can take two forms: competitive grants or three-year direct grants. Competitive grants are used in the multi-annual thematic research programmes that are offered in Luxembourg. All are managed by the National Research Fund and financed by the MCESR. The CORE programme is one of the existing multi-annual thematic research programmes. It concentrates on the six following fields:

- innovation in services,
- sustainable resource management,
- identities, diversity, and integration,
- labour market, educational requirements and social protection,
- new functional and intelligent materials and surfaces, and new sensing equipment,
- biomedical research/regulation of chronic, degenerative and infectious diseases.

The amount of money available for the 2008-10 period from the CORE programme amounts to EUR 81 million. There are also nine other multi-annual research programmes whose budget for the 2000-12 period amounts to EUR 78.9 million. The other public financing instruments are three-year direct grants allocated – in the framework of the performance contracts - by the Ministry of Culture, Education, and Higher Education (MCSER) to the Public Research Centres (PRC) and the University of Luxembourg. The latest available figures indicate that the University will be allocated EUR 220 million, whereas the three PRCs will receive EUR 147 million for the 2008-10 period.

2.3.2 New or modified support measures

The latest key measure that was taken in the field of Research and Technologies is the adoption of the new law on Research, Development and Innovation on June 5th, 2009. This law that replaces the former one from 1993 bringing significant changes that enlarge its scope of application. Whereas the law of 1993 aimed to finance mainly product projects based on R&D, this new law widens the financing to other types of innovation, i.e. process and organisational innovations. Moreover, new activities will now be eligible for funding, such as:

- consulting and support activities as long as they support the innovation process of the eligible organisation,
- temporary appointment of high skilled personnel to a SME under specific conditions,

- expenses aiming to protect its intellectual property.

This substantial evolution is expected to boost innovation activities in SMEs, as these organisations should be the most receptive to this new law.

In addition, because awareness and development of Intellectual Property within SMEs is one of the challenges to address, the Ministry of the Economy and Foreign Trade, the Technological Watch Centre (CVT), and Luxinnovation decided in 2008 to participate in the project IP Awareness and Enforcement Modular Based Actions for SMEs. This is part of the IP-BASE project which is financed by the CIP Programme, DG Enterprise and Industry of the European Commission. The main objective of the project is to raise awareness of and knowledge of IPR in particular for SMEs, with a view to:

- raise SMEs' understanding of the need to integrate IP in their innovation strategies and their business planning,
- improve the protection of SMEs' IP rights through the increased registration of rights EU-wide and also internationally and increase the use of non-registered protection methods through the effective promotion of these methods,
- improve protection and enforcement by SMEs of their IP rights from infringement whether this originates from within or outside the EU,
- raise SMEs ability to fight counterfeiting and increase knowledge on the methodologies available to detect it,
- develop actions to promote awareness on IPR protection to educate the fashion and design industries (textiles, leather, footwear and furniture) on the risks counterfeiting poses and on the existing means and procedures to combat it,
- promote and support the use of IP rights in international research, development and technology transfer activities, providing an IP rights support service to actual and potential beneficiaries of CIP and Research Framework Programme actions, especially high-tech SMEs and Public Research Organisations.

Exhibit 8: New Innovation Policy Support Measures (since the last report)

IPM No	Title	Innovation policy framework category	Organisation responsible
LU 33	New law on RDI	2.3.1 Direct support of business R&D (grants and loans)	Ministry of the Economy and Foreign Trade
LU 34	IP Europe Awareness	5.3.1 Measures to raise awareness and provide general information on IPR	Technology Watch Centre (PRC Henri Tudor)

2.3.3 Strengths and weaknesses in the innovation policy support system

One of the main weaknesses of the innovation policy measures lied mainly in the concentration of the former law on RDI on R&D projects based on innovation of product. As a consequence, all the other types of innovation such as organisational, process and service innovation were left apart whereas the potential target sectors dealing with these types of innovation represent more than 70% of GDP. Fortunately, the new law brings a solution to this situation as it enlarges the potential types of innovation that will be able to be financed.

Another weakness is the complexity and slowness of the administrative process of the funding of a R&D project. Although big companies are not too much affected by this problem, SMEs are. The same problem exists concerning the creation of enterprises that would need to be simplified and accelerated. Yet another weakness is the lack of efficacy of the support system to incite collaboration between the public research centres and the private sector, particularly SMEs.

Despite its recent enhancement, the application of the new law on free movement and immigration – whose aim is to make easier the move of high qualified foreign citizens to Luxembourg – is still complicated and time consuming.

The two existing measures to finance start-ups and spin offs could also be improved or accompanied by new fiscal and financial measures to attract business angels and VCs and finance start-ups at the very early stage.

The innovation policy support system also has its strengths, such as the introduction of the Performance Contracts. These performance contracts represent three-year agreements signed between the government and each public organisation of the national innovation system, which set clear objectives and results to be achieved with a specific budget allocated. For example, all the Public Research Centres included as an objective in their performance contract to be reached a certain number of research contracts with the private sector. Likewise, a specific number of scientific publications and patents to be registered were defined for each organisation.

With the help of other existing measures such as the clusters that are now open to the research organisations, the attractiveness of the new law on RDI or the new public thematic research programme (¹⁷) performance contracts are expected to shift the trend and to develop collaboration between the private and public sectors or to strengthen the quality of public research, among other positive effects.

Another strength of the innovation policy support system is its flexibility. It can be fast to modify and/or create measures as the size of the country is small. There are also positive developments concerning the new law on RDI. Although the law has just been adopted and has not been applied yet, its broadened scope should incite and help a lot of companies, and SMEs particularly, to develop innovative projects.

For two decades, Luxembourg showed an outstanding ability to identify and concentrate its efforts on key industries, and to succeed. Although Finance is the best and easiest example to demonstrate this ability, the competitive position of the country in e-commerce is another good illustration. The interest of Luxembourg in IP might be one of the new scenarios for the future. The country is already the best performer in the EU 27 for several years, as shows the EIS. In addition, the sizeable investments that were made in recent years in key technologies such as biotechnology are another example of the capacity of the country to identify new opportunities to concentrate on.

Lastly, as a small country, all the public stakeholders of the innovation ecosystem know each other very well. It is therefore much easier and faster for the information to be exchanged, and the decisions to be made.

¹⁷ CORE programme run by the National Research Fund.

3. Innovation policy and competitiveness: an appraisal

3.1 The ability of policy to address challenges

3.1.1 How well does policy respond to innovation challenges?

The numerous objectives that were announced in the different policy documents ⁽¹⁸⁾ preceding the election of the new government on June 2009 match very precisely the challenges that were described previously. Indeed, all the challenges identified in RDI were addressed in the official documents describing the objectives of the Government for the new legislature. Moreover, the different RDI measures that were voted for and implemented these last two years support these objectives.

Thus, the creation and development of new innovative companies is included in the 3rd Action plan for SMEs that was written and published by the Ministry of the Middle Classes, Tourism and Housing on April 2008 ⁽¹⁹⁾. Among the measures that were (or will be) taken towards this objective, more than 76 measures have been implemented since 2008. One can mention particularly the creation of real and virtual 'one-stop shops' for firms, the abrogation of the *droit d'attribution*, or the implementation of software to optimise the delivery of the permit to set up a firm.

The recovery plan or *Plan de conjoncture* that was undertaken by the government in March 2009 included a set of measures comprising the vote of a new law on RDI. This new law voted for on June 2009 will be the most important instrument to better support innovative firms and incite and help non-innovative firms to develop an innovation approach. Indeed, the new law now offers nine new regimes – instead of one previously – to arouse and support the development of RDI within companies and SMEs particularly. The eligibility for funding of technical feasibility studies, young innovative companies, consulting services in innovation and organisational and process innovation in services is expected to have a strong positive impact.

The lack of collaboration between public research and enterprises is a well-known challenge that is pinpointed in the publications of private and public organisations like the Chamber of Commerce or the Ministry of the Economy and Foreign Trade. The main responses to this issue were of legal nature through the implementation of the law on RDI and the Performance Contracts. A set of indicators measuring the collaborations in volume and value between the Public Research Centres and firms are included in these contracts. As these indicators are objectives to be reached by the PRC, they are considered a measure to foster collaboration between public research organisations and SMEs. The new law on RDI – as well as the former one – shares the same objective as it offers an additional percentage of financial support when collaboration is concluded between an SME and a Public Research Organisation. Finally, the creation of the future City of Sciences in 2012 that will gather all

¹⁸ Chambre de Commerce, Luxembourg (2009), *Entreprise Luxembourg 2.0* (<http://www.cc.lu/docdownload.php?id=2802>).

Gouvernement du Grand Duché du Luxembourg, *Plan national pour l'innovation et le plein emploi*, 2008 (http://www.odc.public.lu/publications/pnr/Report_Plan_national_2008.pdf)

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(http://csv.lu/lb/upload/actualites/4959/RAPPORT_DE_LA_COMMISSION_SPECIALE.pdf)

¹⁹ See http://www.mcm.public.lu/fr/actualite/2008/05/Communique/3i_me_Plan_d_action_en_faveur_des_PME_.pdf online.

the main actors of the National Innovation System in one place is expected to facilitate public-private partnership.

Finally, the third challenge is for Luxembourg to attract and retain its high-skilled workforce. This issue is definitely a key topic as the Minister of Culture, Higher Education and Research, Mr. Biltgen, was one of the two leaders of the 'Gago-Biltgen' initiative whose objective is to improve the attractiveness of RTD careers and the conditions for mobility of researchers in Europe. Several measures were taken to answer this issue like the modification of the law on immigration and the upgrade of the scholarships for researchers.

As a conclusion, there is a clear consistency between the STI policy defined and implemented by the government and the main challenges the country faces. Financial and legal instruments are used as best as possible to address these demanding challenges. Despite these efforts, it is still too early to assess the relevance and efficacy of the policy as the first results that will be obtained from the implementation of the performance contracts will not be known before early 2011.

3.2 Effectiveness of policy design

The audit of the national innovation system conducted by the OECD in 2006 was given a lot of attention by all the stakeholders of the RDI system. Amongst the criticisms that were formulated, governance problems were particularly pinpointed and the following recommendations were suggested for improving governance:

1. Clarify the role of actors: To build an effective innovation system, the role of the actors in Luxembourg's research and innovation system needs to be adapted to the tasks. This requires clear separation of the functions of policy formulation and implementation and periodical assessment of the role of actors involved in the governance of innovation policy.

This recommendation was carefully applied with the redefinition of the missions of Luxinnovation, the national innovation agency, and the National Research Fund. And as proof of this clarification of their respective mission and the spectrum of the nature of the future collaborations that should be concluded, a convention of collaboration is expected to be signed by the end of 2009. Nevertheless, this signature is not a prerequisite for collaboration, and several events have been co-organised by the two organisations, for example in the framework of the FP7 calls.

2. Improve coordination: To ensure efficient use of increased public investment in research and innovation, the government will need to improve co-ordination among policy actors, including among the major ministries in charge of R&D policies (MCESR and MECE), and aim at better horizontal coordination of sectoral policies.
3. Establish an Advisory Board on S&T Policy: In view of the tasks to be accomplished to build up Luxembourg's innovation system over the coming years, consider the establishment of a temporary Advisory Board on Science and Technology Policy to be chaired either by the prime minister or by one or several ministers. Its main task would be to monitor progress towards the implementation of the government's agenda for strengthening Luxembourg's research base, advising the government and initiating complementary studies and evaluations. The Board's members should have a strong background in business, science and innovation policy. A sufficient number should be non-residents who can bring experience from outside Luxembourg. In view of limited resources, an existing body, such as the Inter-ministerial Coordination Committee for Research and Technological Development, could provide the secretariat for the Advisory Board.

To address this recommendation, the government created in June 2008 the Higher Committee for Research and Innovation. This committee contributes to the formulation and the development of a consistent and efficient national RDI policy, advising the government on the

implementation of this policy in the short, mid and long term. The Committee elaborates proposals of strategic objectives, national research priorities, and the right instruments and measures for the consistent implementation of the policy mix. This Committee can initiate studies and appraisals of the implemented instruments as well as the actors of the NIS. It advises the government on the evolution of the public investments in RDI.

4. Set science and technology priorities: Build up the research base in Luxembourg requires a number of discretionary investment decisions which make a purely bottom-up approach insufficient. The ongoing foresight study should be used to derive priorities for such decisions. In the meantime, consultations with end-users of research, in preparation for the launch of competence centres (see below), could provide useful information for sharpening priorities for research in the university and the CRPs.

The Foresight that was led by the National Research Fund appeared very useful and was exploited for the following two purposes. First, it defines the research priorities of the new thematic research programme entitled CORE run by the National Research Fund and created in 2008 around six research themes for 2008-10 with a EUR 81 million budget. Second, it helps the government define the eight research priorities on which to concentrate public R&D in the future.

There were also several recommendations emerging from the OECD audit for improving complementarity between public research organisations and agencies. These included:

1. Steering of public research institutions: Enhancing accountability and ultimately efficiency requires a clear mission statement for each public research institution and agency. These mission statements should be derived from strategic audits of the respective institutions. The current contractual arrangements between the government and public research institutions (e.g. the multi-annual programmes of CRPs) should be replaced by state-of-the-art performance contracts.

As stated before, such Performance Contracts are being implemented since 2007 and signatures of such contracts between all public actors of RDI and government were set out.

2. A new role for Luxinnovation: Luxinnovation plays an important role in Luxembourg's innovation system, especially for linking business enterprises and public sector research and ensuring greater participation of small firms in innovation. To maintain quality of services in an environment of growing demand, Luxinnovation's current portfolio of activities should be streamlined and its organisational capabilities strengthened. Luxinnovation should play a key role in extending the reach of innovation policy to the services sector (e.g. in the area of financial services) and to other activities in which innovation is not directly based on R&D (see the example of the proposed centres of competence below).

Following the report, the services offered by Luxinnovation were streamlined and structured along four lines of services and specific segments to target. At the same time, Luxinnovation actively worked on the definition of its first Performance Contract for the 2008-10 period. It was finalised and implemented during the first semester 2008.

3. Entrusting the National Research Fund with all project and programme-based funding: The FNR currently has difficulty to fulfil a very broad mandate that mixes strategic and implementation functions. At the same time, FNR has developed competences that should be used in any restructured governance system. Accordingly, the government should consider focusing the role of FNR on funding research via programmes and projects. This means that all project-based research funding of the PRCs and the University of Luxembourg would be transferred to the FNR to make better use of the FNR's expertise in evaluating research projects. This will help to increase scientific quality and to contribute in aligning public research with overall goals and strategies. The FNR should also play an important role in evaluating and funding the proposed centres of competence (see below).

Not all project-based research fundings of the PRCs and the University of Luxembourg were transferred to the FNR, but only a part of it. Indeed, only the R&D projects that are submitted by the University or the PRCs in the framework of the Calls of the CORE programme ⁽²⁰⁾ or the multi-annual research programmes run by the NRF – and provided that they pass the criteria selections – are now funded by the NRF.

4. Linking research to education: This is a fundamental task of the University of Luxembourg which should be facilitated by the establishment of research schools able to attract talented doctoral and post-doctoral students. However, the PRCs should play a complementary role by emphasising doctoral and post-doctoral training in their research units and ensuring mobility of a highly skilled and trained workforce to the business sector.

This recommendation is the one where there has been less progress. No research school was implemented until now at the university. Regarding the PRCs, a strong emphasis on the training of PhDs and Postdoctorals is noticeable. An increasing number of students have done their PhD studies and passed their doctorate these last years. One explanation among others is undoubtedly the integration of the following key performance indicator – PhD thesis – in their respective Performance Contract.

Although the PRCs participate more actively in training researchers, this has not resulted in an increase of the number of researchers joining the private sector. The reasons for this are twofold. First, public research needs a high skilled workforce and often experiences difficulties to find the right profiles. As a consequence, it is not easy to let go of such rare resources, especially when time was invested to train them. In addition, the high-wage/low-risk research jobs in the public research do not incite researchers to join the business sector. As noted before, the private sector and the public sector do not know each other very well, and even share prejudices sometimes.

5. Promoting a coherent internationalisation strategy: Internationalisation, both in the *Grande Région* and beyond, is of central importance for the performance of Luxembourg research institutions. Internationalisation should be a key evaluation criterion for measuring the performance of public research institutions. At the same time, performance contracts should ensure that the internationalisation strategy of public research institutions is in line with their mission.

PRCs had been collaborating with several other institutions abroad for several years. However, the main difference lies now in that international collaboration has become more important than before, and it is one of the key performance indicators included in the Performance Contracts that were signed by the PRCs with the Government.

3.2.1 Process of delivery

One of the most important policy measures regarding the RDI policy is undoubtedly the law on Research, Development and Innovation. Despite its good results, its main weaknesses are a too long delivery process and an application form to complete that is too time consuming. Regarding the development of the clusters in IT and aerospace, the main barrier to their faster development is a lack of human resources. Otherwise, the presence of many public organisations within the steering committees of each cluster slows down the selection and implementation of certain actions. Finally, as for the law on RDI, the administrative process of firm creation – be they innovative or not – is too long and slow.

However, the situation is slightly different for other measures such as the 1,2,3 Go initiative or the incubators. One of the main reasons of their better delivery process lies particularly in the size of the organisation that runs them and the relative autonomy of the management.

²⁰ The CORE programme is a thematic research programme run by the NRF since 2008.

In the end, one can qualify the landscape of innovation as being contrasted with inefficiencies and ineffectiveness in the delivery process of some measures due to a long and/or collaborative decision-making process. An overweight of public bodies over private actors in the steering committees of specific measures, and a lack of human resources seem to be two major discriminating points. On the other hand, some measures appear efficient, particularly when they are run by small structures, and when the decision-making process and the steering committee are limited to a small number of persons and organisations.

3.3 Impact of public support for innovation

The first group of indicators entitled Human resources that is part of the first dimension Enablers in the EIS 2009 is the sole category for which we can identify quiet accurately links between specific policy measures and their impact on the innovation scoreboard.

Thus, the creation of the university in 2003 has definitely had an impact on the first two indicators, namely S&E and SSH graduates per 1000 population aged 20-29 and S&E and SSH doctorate graduates per 1000 population aged 25-34. Indeed, the number of graduates has boomed from 1 130 in 2005 to 3 276 in 2008, an increase of 189%. The number of doctorates increased from 148 in 2006 to 250 in 2008. It is also important to mention the percentage represented by nationals as it can give us an idea of the number of people who stay in Luxembourg. Indeed, although we lack statistics on the number of foreign students who stay in the country after their studies, we know that nationals who study in Luxembourg rarely leave the country to go working abroad. The nationals who graduated with a Bachelor and a Master in 2008 represented 63.6% and 28.7% of all the graduates. Regarding the Doctorates, 19.6% of the students were nationals. This proportion has not changed since 2006.

Finally, we should not forget that the Public Research Centres welcome and train PhD students too, and that the number of successful theses since the introduction of the Performance Contracts is one of their key performance indicator to be reached. Although it is too early to make any appraisal, the fact that the training of PhD students has become an objective that is scrutinised will undoubtedly have a positive impact on the statistics.

Regarding the group of indicators Finance and support, and aside from the Public R&D expenditures for which the link with the increase of the budget of the government is obvious, there is no specific policy measure aiming to increase any of the indicator. The only thing that can be pinpointed is the low level of venture capital in the country – despite the existence of two financial measures to support start ups and spin offs – which could be explained by the low number of new promising projects.

In the Firm activities dimension, the level of Business R&D expenditures can be explained by the low level of Public R&D expenditures, and the strong concentration of investments within very few big companies. Fewer than ten companies represent more than 80% of the total business R&D expenditures.

Otherwise, it is difficult to link any of the policy measures and the performances of most indicators of the 'Linkage & entrepreneurship' group. Indeed, despite the law on RDI of the Ministry of the Economy and Foreign Trade that incites private firms to do R&D, and particularly to collaborate, there is no study that indicates whether the law explains the investment of the firms in R&D, or whether it is an opportunity cost.

Finally, the dynamism of Luxembourg in the field of IP is not new. However, one can expect that the new law that was implemented from January 2008 that offers an 80% tax cut of IPR revenues should have a noticeable impact in the near future.

3.3.1 Conclusions: possible future actions and opportunities for innovation policy

It is a fact that the main challenges Luxembourg will have to face in the future have been clearly identified. As a consequence, a lot of policy measures were taken or modified to this end. The

missions of key organisations in the field of RDI were reviewed, and new governance rules were defined and introduced. Nevertheless, there are still several issues to deal with that will determine the future of RDI in Luxembourg.

The first challenge is undoubtedly the necessity for the country to incite more companies to innovate. The idea is not only to motivate SMEs to undertake an innovation approach, but also to target other industries such as the service sector and support other types of innovation such as organisational and process innovation. In this perspective, the new law on RDI of the Ministry of Economy and Foreign Trade should be an effective answer to this challenge. Indeed, by taking into account these two other types of innovation on one side, and financing specific consulting services in innovation on the other, a lot of new SMEs from different industries should be targeted and motivated to undertake innovation projects. They will be encouraged by the law that will finance in certain circumstances a large part of the project.

The second challenge is to increase the number of innovative enterprises. The problem does not lie in the capacity of the structures to welcome projects, but on the contrary to a low flow of projects. This can be explained mainly by the lack of entrepreneurship spirit in the country, the lack of success stories to talk about, the high level of wages offered in specific industries and the lack of high skilled workforce in some sectors. To overcome this situation, stronger simplification of setting up a business than what was already introduced and the enhancement of the fiscal policy could be helpful. A more appealing fiscal law on stock options and IP could be useful. It should motivate researchers to create their spin-offs and thus to value their research. But above all, it is the capacity of the country to create centres of excellence through the Public Research Centres and the university that will make the country an attractive place for the creation of innovative firms, be they indigenous or from abroad.

The other challenge is to increase the collaboration between public and private organisations. We already said that the performance contracts should have an impact to this end. However, we think that the cluster initiative is probably one of the best measures to favour such collaborations as clusters are ideal places for organisations to better know each other, share, and hopefully work together. This is why clusters were opened in 2008 to research organisations. The first results are encouraging, as ten collaborative projects started since this date. Finally, the last challenge is to attract and retain a high skilled workforce in the country. Although the law on free movement of people and immigration was a step beyond compared to the former one, it is still constraining and would benefit from modification.

There are three key areas for Luxembourg to develop in the future: Innovation in services, diversification into promising key technological areas, and IP. As a consequence of the foresight study that was led by the National Research Fund from 2006 to 2007, Innovation in services has become officially one of the six research priorities of the country since 2008. Even if the service sector represents more than 80% of the GDP of the country, such a decision was never formulated before. And although research efforts should concentrate on finance, the NRF suggested that 'research should lend momentum to the development of new high-value added services - for both business and the general public – and the improvement of Luxembourg's innovation capacity. The challenge here is to develop the best framework for innovation and to improve the ICT infrastructure, as well as information security and trust management in e-applications to provide a good basis for developing new niches for economic development'.

With more than 30% of GDP, the finance industry is one of the pillars of the national economy. But as the current financial crisis demonstrates, such a high concentration of wealth in one industry can be very risky. As a consequence, the government has undertaken an acceleration of the diversification of the economy into specific key technologies such as biotechnologies and green technologies. Two clusters were created to develop the country's economy in these two fields in 2008 and 2009.

Finally, Luxembourg might concentrate in the near future on another promising area: IP. The country boasts the best results in the whole EU in this field for several years. This performance is mainly due to its competitive fiscal policy in IP, and not to an outstanding capacity of the domestic companies to register patents. As a consequence, and because the size of the country will hardly enable it to develop more than two or three worldwide centres of excellence, Luxembourg may decide in the near

future to capitalise on its competitive fiscal policy in IP through the development of open innovation activities and strengthening of research.

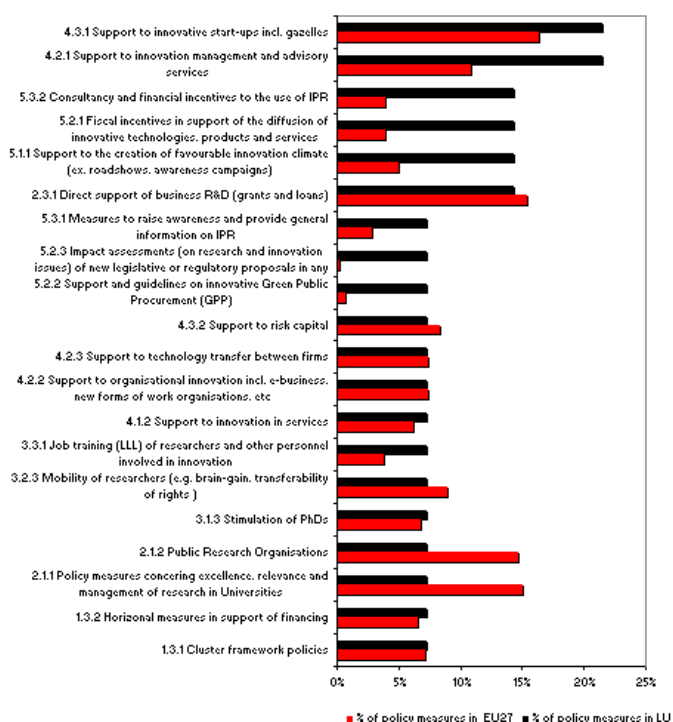
Annexes

Annex 1: Luxembourg– Innovation Policy Support factsheet

GENERAL OVERVIEW

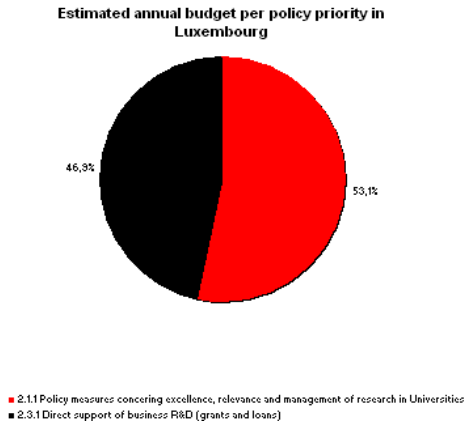
1. Main policy priorities addressed by the support measures

Figure 1. Main priorities addressed by the support measures in Luxembourg in a comparative perspective



2. Main policy priorities and their estimated budget (CHART)

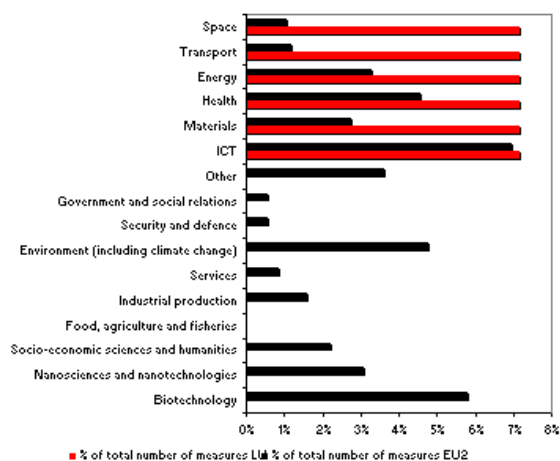
Figure 2. Estimated annual budget allocations per policy priority in Luxembourg



PROFILE OF PUBLIC INTERVENTION IN INNOVATION

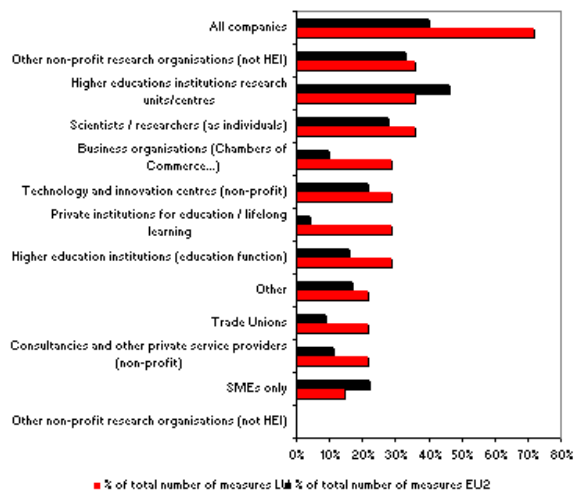
3. Targeted research and technology fields (CHART)

Targeted R&T fields by support measures in Luxembourg compared to EU27

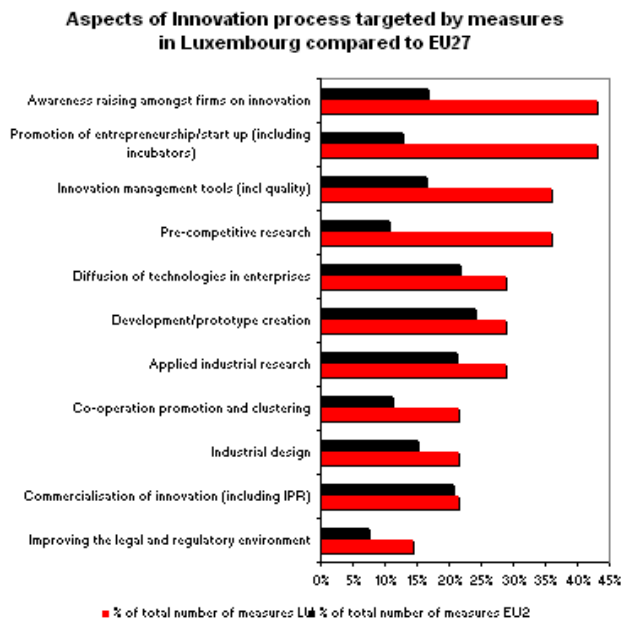


4. Target groups of support measures (CHART)

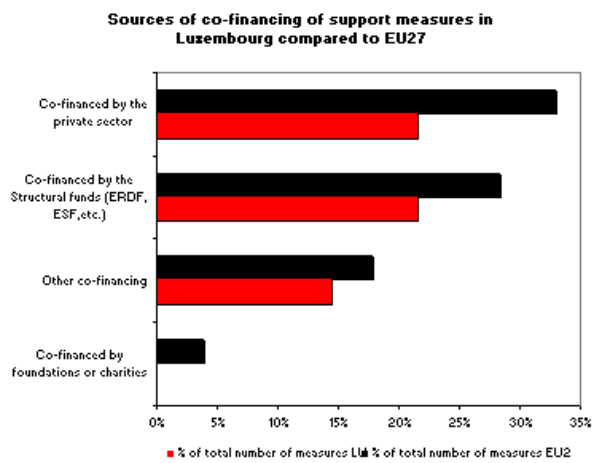
Target groups of support measures in Luxembourg compared to EU27



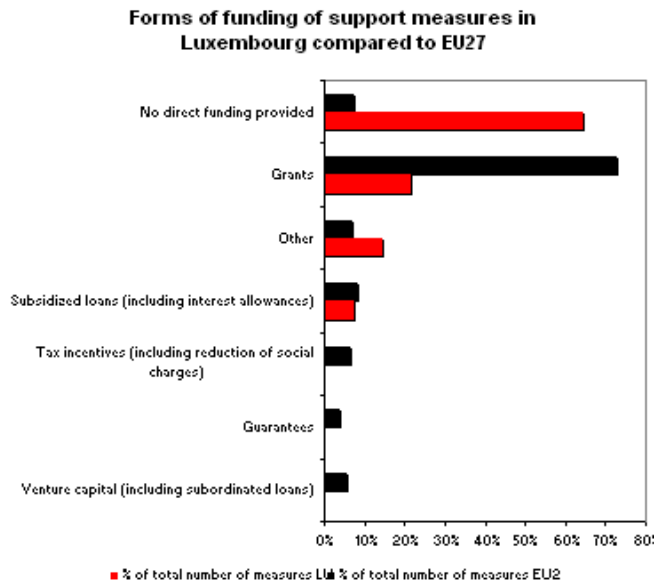
5. Aspects of innovation process targeted by measures (CHART)



6. Sources of co-financing of support measures (CHART)



7. Forms of funding of support measures (CHART)



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