

Strategic Evaluation on Innovation and the Knowledge Based Economy in relation to the Structural and Cohesion Funds, for the programming period 2007-2013

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Executive Summary

In the context of this study Luxembourg is considered a one-region country. It is the recipient of a total of EUR 40 million (in 1999 prices) of ERDF funds for Objective 2, the same amount as it received in the previous period. The funds have been used for zones in the north, east and south part of the country, to (1) complement government funds in the knowledge sectors, and (2) in infrastructure to bring the peripheral parts of the country to the level of development of the area around the city centre of Luxembourg. The northern zone was formerly the agricultural centre of the country and is now dependent on tourism and small farm agriculture. It is underdeveloped in view of its potential and sophistication and experiences higher levels of unemployment than the national average. The eastern areas of the country thrive on the production of Moselle wine, fluvial transport and tourism. The southern zone used to be Luxembourg's economic driver via its steel industry. As the economy has evolved into a more financial services based one, the south has been left with areas of land unfit in its current state for any activity, land that however also carries tremendous opportunities if properly rehabilitated and managed. This region has benefited the longest from regional support funds, and has come the furthest in re-adjusting to become competitive again under today's economic circumstances.

Luxembourg's knowledge and innovation policy is in an early stage. The country has recognized the importance of investments in research, knowledge development and innovative behaviour. As the policymakers await the OECD national review report that has been commissioned, there are at present few policies formulated. The national innovations system was enlarged recently by the addition of a national university (established in 2003).

The country, with a very high GDP per capita compared to the EU average¹, has until recently had invested in very little public R&D. Indicators show a relatively high score on private sector R&D, but further analysis shows that this score is partly a result of the tax incentives in place for patent registration and corporate headquartering in Luxembourg. As the European Financial Services Act and the European Tax Directive stipulate that Luxembourg's exception to the harmonization of European financial regulations will end in 2010, the incentives for Luxembourg to invest in a knowledge economy are even stronger. The Government has shown its commitment to this goal.

The main weaknesses are under investment in public research, unimpressive levels of value added in its industry, and the lack of a strategic framework for ensuring that Luxembourg remains an innovative, competitive economy in the future. The strength is a clear political and financial commitment to remedying the situation. The country's small size facilitates cooperation between the public and private sector. Luxembourg's low score on public research in a European comparison can be, in part, but not fully, explained by the absence of a national university before 2003. All tertiary education has in the past been obtained abroad, a fact that also makes data collection on the number of S&T graduates more difficult.

¹ See comment on GDP versus GDP per capita in Luxembourg in chapter 2.

Luxembourg's relatively important private sector research activity does not translate into high value added enterprises. The reason is again context specific; the small economy has a small number of large enterprises, a skewed tax incentive scheme inviting for large companies to register their headquarters in the country. As a result, the majority of Luxembourg's companies are relatively low tech SMEs.

The lack of national innovation policies and indicators makes it hard to evaluate the situation. It is in the interest of the Luxembourg government to establish an evaluation culture, and promote benchmarking activities. Luxembourg has been able to learn a lot from its neighbours' experiences; most national initiatives are influenced by lessons learned from experiences in the "greater region"².

Luxembourg's R&D spending has increased to almost reach 1% of GDP in 2006. Funds have been allocated to the new university, as well as other RTDI measures. Structural Funds are used to co-finance specific R&D investment projects with contributions of up to 23.40% in average to overall project costs. However, the allocated amount under the ERDF programme is low, and the absorption capacity is limited due to the low RTDI investments in the country.

Luxembourg created a new strategy aimed at establishing an "integrated and interconnected system for sharing knowledge", within the ERDF framework in 2002. The focus of this strategy - has been on (1) a system of clusters and networks of expertise and training; (2) a strategic intelligence system (technology watch); (3) a system of technology parks and relay centres; and (4) a diffusion, communication and networking system based on ICT.

The absorption capacity for Structural Funds in RTDI interventions has been characterized by an important reallocation of funds after the mid-term review: 49 % of the original budget was thus re-affected to other axes and measures. Absorption capacity when calculated on the original financial matrix is low ($\pm 28\%$ as of late 2005)³ Project funding has overwhelmingly been directed at public owned and managed infrastructures and the two measures that were geared at private and public research institutes, have seen their means stalled at the level of what had been committed at mid-term. Both these measures have encountered very little success. Reasons for this outcome include the zoning used for the Objective 2 programme, but also the design of the measures and the overall implementation and management procedures of the programme.

Impacts and results from these public RTDI projects (mainly implemented by one beneficiary the Public Research Centre (PRC) Henri Tudor) are difficult to evaluate at this point, since investments did not get under way until late 2003 and they are aimed at longer-term services to the economy as a whole.

² Composed of Lorraine in France, Saar and Rheinland Pfalz in Germany and the Luxembourg province and German speaking areas of Belgium.

³ If calculated according to the latest amended financial matrix, absorption capacity as of late 2005, reaches 55 %.

Recommendations for Structural Fund investments in innovation and knowledge for the next programme period are the following:

- Luxembourg's small dimension is an asset and a threat at the same time. There is a need to establish a permanent trans-border platform to address and co-manage a series of specific RTDI issues, as has been done in neighbouring areas (for example: Lille Métropole and the Dutch-German-Belgian Euroregion).
- Added value of structural funds in relation to RTDI has been disappointing and an opportunity has been missed. A comprehensive overall RTDI policy framework needs to be urgently developed and a specific coordination unit for RTDI related interventions established.
- There is a major mismatch between labour force educational levels (and innovation management capacities) and the more sophisticated technological requirements of the business sector. Improvement can be initiated through specific training actions and increasing work force mobility in specific sectors. These activities should be inspired by a greater region perspective, as has occurred through INTERREG programmes.
- Support for enterprise level innovation may be most efficiently focused on knowledge intensive services and most notably on the financial sector. Interventions in this field require a continued effort towards regulatory innovation as a driver of sustained growth.

1 Introduction

In March 2000, the EU Heads of State and government launched an ambitious political initiative for the European Union to become “the most competitive, dynamic, knowledge-based economy by year 2010”. The agenda, which has become known as the ‘Lisbon Strategy’, has included a broad range of policies and regulatory measures to achieve this goal.

At the 2005 Spring Council of European Union, Heads of State and government concluded that all appropriate national and Community resources, including those of Cohesion Policy, should be mobilized in order to renew the basis of Europe’s competitiveness, increase its growth potential and its productivity and strengthen social cohesion, placing the main emphasis on knowledge, innovation and the optimisation of human capital. In short, the Council recognized that while some progress has been made since 2000 in moving towards the goals enshrined in the Lisbon Strategy there remains a need to create “a new partnership for growth and jobs”⁴.

In launching the discussion on the priorities for the new generation of cohesion policy programmes, the Commission published on 6 July 2005 draft Community Strategic Guidelines entitled “Cohesion Policy in Support of Growth and Jobs: Community Strategic Guidelines, 2007-2013”. One of the specific guideline is to improve the knowledge and innovation for growth. More specific areas of interventions, which are proposed by the Commission, include: improve and increase investment in RTD, facilitate innovation and promote entrepreneurship, promote the information society for all, and improve access to finance.⁵

Innovation is an important factor in releasing the potential of the Lisbon agenda. The knowledge captured in new technologies and processes can drive growth and competitiveness and create new jobs. But knowledge must be treated as part of a wider framework in which business grow and operate. Developing knowledge-based economy requires adequate levels of investment in R&D, education, and ICT as well as creating a favourable environment for innovation.

Less developed areas of the Union are also confronted with this new competitiveness challenge. Increasing cohesion leads to improvements in living standards and the reduction of economic and social disparities, which depend to an important extent on increases in productivity. Increasing competitiveness implies economic change through the introduction of new technologies and new methods of production as well as the development of new skills. Innovation is at the heart of this process. Technological and organizational change and new demands generated by rising income levels and factors which create new economic opportunities and therefore, contribute to the growth potential of these countries.

⁴ Communication to the Spring European Council (2005) “Working together for growth and jobs: A new start for the Lisbon Strategy”, COM(2005) 141. Available at: http://www.europa.eu.int/growthandjobs/key/index_en.htm.

⁵ Communication from the Commission (2005) “Cohesion Policy in Support of Growth and Jobs: Community Strategic Guidelines, 2007-2013”, COM(2005) 0299. Available at: http://www.europa.eu.int/comm/regional_policy/sources/docoffic/2007/osc/index_en.htm.

Structural Funds are the main Community instruments to promote economic and social cohesion. In the past and current programmes, they have contributed to enhance the research potential and innovation in businesses and to develop the information society, particularly in the less developed areas. Cohesion policy has also promoted the development of regional innovation strategies and other similar initiatives in the field of the information society.

The overall objective of the strategic evaluation study, as set out in the terms of reference, is that the study should provide conclusions and recommendations for the future of Structural Fund and Cohesion policy. In particular, the Strategic Evaluation will be used to prepare the negotiations with the Member States for 2007-13, to prepare the next operational programmes and to provide input into the 4th Economic and Social Cohesion Report.

In line with the tender specifications, this country report addresses the following issues:

1. An analysis of the current situation in the field of innovation and the knowledge-based economy at national and regional level. For the national level, performance is compared to the average performance for the EU25 Member States plus Romania and Bulgaria; and at regional level, where possible given available statistics, compared to a typology of EU regions;
2. Lessons from the past and current experience of implementing innovation and knowledge economy measures in the Structural Funds, both in terms of priorities and strategic approaches; as well as in terms of operational implementation;
3. Main needs and potential for innovation in the eligible regions drawing on available studies, strategy development and future and foresight studies; and
4. Recommendations on main investment priorities for Structural Funds over the programming period 2007-2013 and their implications for regional development.

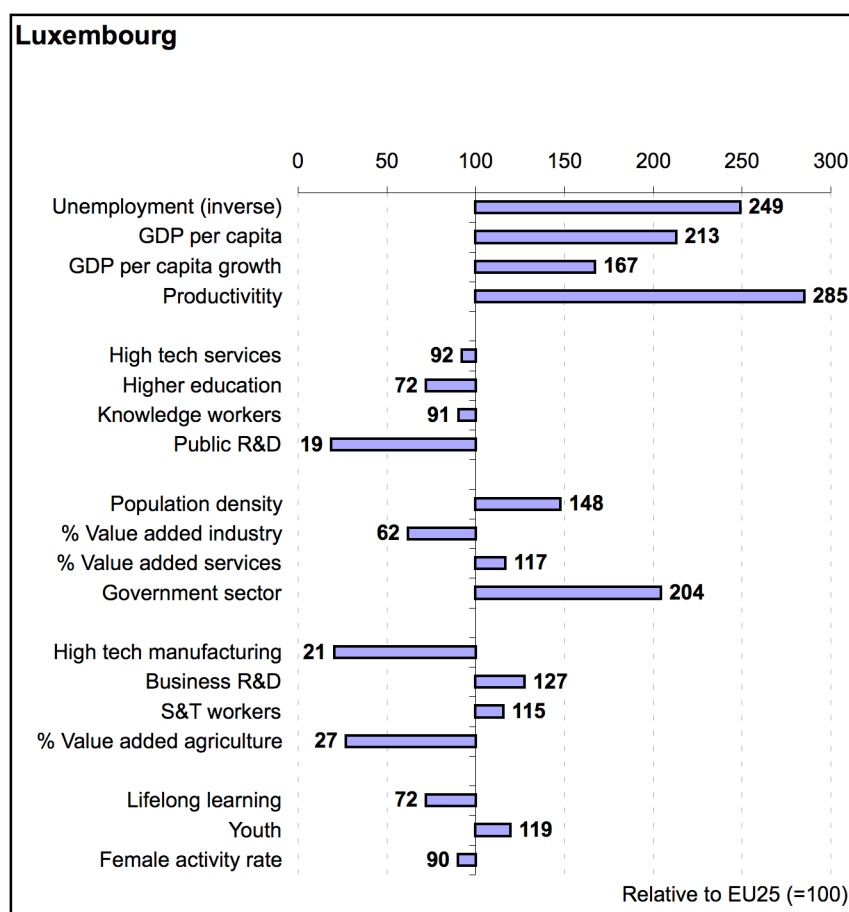
2 Investing in innovation and knowledge: a comparative overview of regional performance

This section provides a synthetic overview of the relative performance of the country, and where relevant main regions, with respect to the EU25 average for a number of selected key structural indicators of innovation and knowledge. The analysis aims to identify **main disparities and needs** at national, and wherever possible, regional level with a view to supporting the definition of priorities for future Structural Funds interventions (see sections 5 and 6 of this report).

2.1 Country overview: innovation and the knowledge economy

Exhibit 1 below provides a snapshot picture of the relative position of Luxembourg compared to the EU-25 average for a series of key knowledge economy indicators.

Exhibit 1: Relative country performance for key knowledge economy indicators



Source: calculations of MERIT based on available Eurostat and national data from 2002-2003 depending on indicator. Detailed definitions and data for each indicator are provided in Appendix B.

Luxembourg is a small country surrounded by three larger countries France, Germany and Belgium. After macro-economic difficulties in early 2000 the country is still experiencing higher than normal inflation and an increasing budget deficit due to fiscal spending. The economy originally developed from an agricultural economy to an industrialized, notably steel industry-based economy. Luxembourg's wealth originated within this sector that still accounts for roughly a quarter of the country's exports.

In the late 1970s the importance of the steel industry declined and the financial services and banking sector emerged as the driver of an economy that currently boasts one of Europe's highest levels of GDP per capita. However, the effect of the large number of foreign workers in the country on this GDP measure should be taken into account. When adjusted for foreigners representing 50% of the workforce, Luxembourg's GDP becomes less impressive.

In this context economic reform becomes more urgent, not only to sustain the level of GDP but also to increase Luxembourg's GDP on the aggregate level⁶. Moreover, the unemployment rate has increased by approximately 0.5 % every year since 2002; reaching 5.2% in 2006⁷. Luxembourg's unemployment level remains relatively low compared to the EU average, but it is unevenly spread across the country, with the areas outside of the centre (in the north in particular) suffering disproportionately.

The country can be divided into two geographical areas, the Bon Pays (Gutland) in the south and central part of the country, and the hilly north, part of the Ardennes-Eiffel. The south is the former home to heavy industry and mining. The north and the east remain highly dependent on agri-and viticulture, as well as tourism. Population density is relatively low, particularly so in the north. The more densely populated areas are in the southern former industrial and mining zones. The value added to the national economy in agriculture is based on small family owned farms that represent about 0.5 % of GNP, with the number of farms declining rapidly.

Luxembourg's economy is characterized by a high prevalence of international institutions and a high participation rate of foreign labour. The private sector is made up of three large corporations; several international companies headquartered in Luxembourg for tax reasons (but without operations on any larger scale) and is otherwise largely made up of small and family based companies and farms. The service sector is to a large extent driven by banking and taxation laws. With the EU tax directive⁸ removing some of the basis for Luxembourg's financial services sector competitiveness after 2010, national actors see reason to be prudent.

Luxembourg's innovation policy is rather recent and dates back to the very late 1980s, with funding for public research since 1987. Luxembourg has a Minister for research only since 1999, a year that marked the beginning of increased focus and budget allocations in RTDI policy such as public research and higher education.

Luxembourg boasts one of Europe's highest GDP per capita, but scores 15th worst on knowledge based economy indicators. Against this backdrop the government began in

⁶ GDP grew at around 3 % in 2005.

⁷ International Monetary Fund, World Economic Outlook Database, September 2005

⁸ For details see the Luxembourg exception until 2010 under the European Tax Directive

1999 to adjust its policies to increase its scores in public research and private sector innovation. Consultants such as Michael Porter and European wide comparative reviews all state that two of the major weaknesses of the Luxembourg economy are the average skills level and the lack of a world-class university. Another weakness is the lack of a detailed RTDI and innovation strategy, and the lack of an evaluation culture to follow up on measures put in place.

Luxembourg R&D expenditure almost reached the intended target of 1% of GDP in 2005, (it accounted for 0.8% of GDP). The Government is committed to fulfil the 3% objective in 2010, of which one third is to come from the public spending, and two-thirds from the private sector, which will require a doubling of private sector R&D spending.

Luxembourg's own weaknesses in public research are now being addressed through ambitious increases in public spending towards public research through the National Research Fund and the new University of Luxembourg. However, the government has run fiscal deficits since 2004, with an increasing deficit trend foreseen to continue in 2006 and this hampers the effective implementation of these increases.

Due to its small size and its particular regulatory incentives, Luxembourg scores relatively high on private sector research. The actual research is however carried out by a few large companies employing 1800⁹ researchers. The larger share of the private business, particularly in the north of the country, is made up of small and medium sized companies, who lack both financial and human resources to carry out research in house. Analysing private R&D indicators for Luxembourg, one may query the amount of research effectively being carried out in each company. Many international companies have filed quite a number of patents in Luxembourg, but not all the R&D leading to these patents is taking place within the country. With the new EU tax directive coming into force by 2010, the number of patents filed is likely to decline.

The apparent paradox of Luxembourg's relatively high aggregate GDP and low R&D score can be explained by its unique geographical context. Many out of the 50% of the workforce that are commuting in and out of Luxembourg are knowledge workers, attracted by the higher salaries comparative to neighbouring France, Germany and Belgium. Luxembourg's high level of trans-regional integration with its neighbours is an important asset even though it complicates international comparison.

⁹ Goodyear alone employed 450 full-time research staff in 2003, with 900 employees in total at the technical centre in Colmar-Berg

2.2 Regional disparities and recent trends

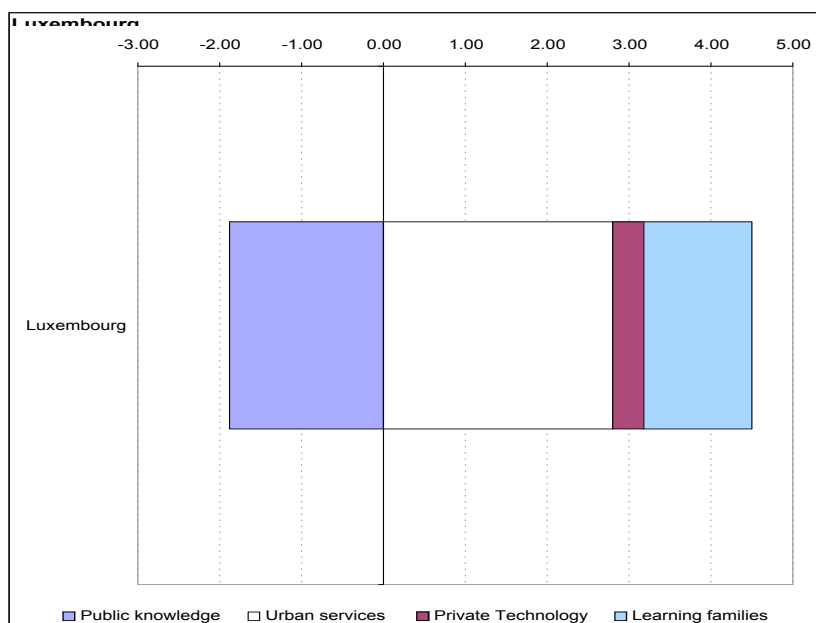
In order to analyze and describe the knowledge economies at regional level in the EU, the approach adopted was to reduce and condense all relevant statistical information available for a majority of regions. The approach involved firstly reducing the information from a list of selected variables into a small number of factors by means of factor analysis. These factors are:

- Public Knowledge (F1): human resources in science and technology combined with public R&D expenditures and employment in knowledge intensive services is the most important or common variables in this factor. Regions with large universities will rank high on this factor.
- Urban Services (F2): The most important variables for this factor are value-added share of services, employment in government administrations and population density. A key observation is that academic centres do not necessary co-locate with administration centres.
- Private Technology (F3) This factor is most strongly influenced by business R&D, occupation in S&T activities, and employment in high- and medium-high-tech manufacturing industries.
- Learning Families (F4). The most important variable in this factor is the share of the population below the age of 10. The Learning Families factor could also be interpreted as an institutional factor indicating a child-, learning- and participation- friendly environment, or even a 'knowledge-society-life-style' based on behavioural norms and values that are beneficial to a knowledge economy.

In a second step, the 200 plus EU27 regions were grouped into 11 types of regions (see appendix A) displaying similar characteristics by means of a cluster analysis. In the case of Luxembourg the country constitutes a one-region country. Luxembourg as a region is a member of the Low-tech Government cluster, a cluster that groups regions with a very low Public Knowledge score combined with a high share of employment in the Government sector. This cluster is typically characterized by severe unemployment, though GDP per capita is close to the regional average due to skewed population figures, as a result of the high proportion of foreign workers active in Luxembourg. Still, in the case of Luxembourg GDP per capita is currently not a pressing problem, but spreading the wealth and job opportunities across the country is.

The main indicator placing Luxembourg in this cluster is its low score on public research, a score that can be partly explained by the problem of measuring science and technology graduates in an economy that has to send most of its students abroad, and where 50% of the highly skilled workforce are foreigners. In light of the ongoing ambitious knowledge economy investments the country's score and cluster designation is likely to change in the future. The regional scorecard in exhibit 2 underlines the findings presented earlier.

Exhibit 2: Luxembourg regional score



Source: MERIT. The bars are stapled factor-scores showing the deviation ($1 = \text{standard deviation}$) per factor from the average of 215 EU regions (0.00). The longer the bar, the bigger is deviation.

Overall trends for the period 1996-2002 for the one-region country are given in exhibit 3.

Exhibit 3: recent trends per region in key indicators

	Unemployment	Per capita GDP	Industry share	Agriculture share	Population density	Tertiary education	R&D intensity
	1996-2003	1996-2002	1996-2002	1996-2002	1996-2002	1999-2002	1996-2002
	%-pnt ch.	% growth	%-pnt ch.	%-pnt ch.	% growth	%-pnt ch.	%-pnt ch.
EU25	--	--	--	--	--	--	--
Luxembourg	0.80	7.96	-2.36	-0.31	7.34	1.17	--

Source: MERIT based on Eurostat data for period indicated

In economic terms, Luxembourg is not large enough to be broken down into smaller regions for the sake of detailed analysis; the data is not available. However, despite Luxembourg's small size, four different areas can be distinguished in the geographical and socio economic climate of Luxembourg; namely the north, the east, the centre and the south.

The centre is home to the financial services sector, the banks and the international institutions. The north is part of the Ardennes-Eiffel hill region, a sparsely populated area with great tourist potential, and a higher number of SMEs than in the rest of the country. The east faces similar challenges to the north, having however the Moselle viticulture as an important asset. It has some industrial wasteland due to former industrial activity

The south, used to be home to heavy industry such as the steel and metal industry. As a result there are large patches of declassified industrial estates, which represent a potential for construction and development. Due to the south's important economic role in the past, the area is densely populated. Some industry remains, though these specific industries require increasingly specific skills, skills that are unmatched in the local population whose educational attainment levels are lower than the national average. Due to past Structural Funds investments in the past, infrastructure has been improved, and this area has developed the beginnings of a service sector with a tendency to innovation.

2.3 Conclusions: innovation and knowledge performance

Luxembourg's main weaknesses are the lack of public research and low-tech manufacturing, low-tech services and small livestock based familial agriculture¹⁰. Despite a relatively high level of private sector research according to the national scorecard, this is probably due to a very small number of R&D intense large corporations and a distorting patent filing incentive system.

Luxembourg is a small country, with a large foreign component of high skilled workers. This distorts Luxembourg's GDP per capita indicator score. The centre of the country is doing well, and the focus of investments is GDP growth through increased competitiveness and an improved quality of life, more evenly spread through out all parts of the country.

The northern, eastern and southern zones however, are experiencing varying levels of success in today's changing competitive climate. With targeted investments in new employment opportunities through stimulating higher value-added agriculture, manufacturing or services, Luxembourg's diversity can become an asset. This would however require better information about needs and progress, and most importantly, a coherent national strategy.

¹⁰ with the exception of the Moselle Valley, home to local Wine sector

Exhibit 4: summary of key disparities and needs per region

Region / group of regions	Key factors explaining disparity of performance (weaknesses)	Key needs in terms of innovation and the knowledge economy
Luxembourg	<ul style="list-style-type: none"> • Lack of innovation culture in companies and society at large • Small familial agriculture and SMEs in rural areas • Mismatches between skills available and skills required for R&D and KBE • Financial facilities (taxes and patent filing rights), but which will need to be modified by 2010 • Small national hinterland which hampers most RTDI initiatives • Most private research is done by private companies that have their HQ in Luxembourg but which develop their patents abroad • Disparities between northern and southern areas of the country and the more service based centre. • Major interrelationships with neighbouring regions (more than 50% of labour force daily commutes in and out; taxes,...) 	<ul style="list-style-type: none"> • Framework strategy for efficient use of resources • Adaptation of higher educational and vocational opportunities • Interregional dimension in order to have sufficient hinterland • Targeted investments through stimulating specific niches (like higher value-added agriculture, manufacturing or services, ...) so that Luxembourg's diversity can become an asset.

3 Innovation and knowledge: institutional context and policy mix at national and regional levels

Structural Fund support for innovation and knowledge is contingent on and seeks to strengthen the existing national (and/or regional) innovation system¹¹ in each Member State. In particular, institutional, legal and financial factors in the innovation system can limit the potential for certain types of intervention. Moreover, within the framework of the EU's "Lisbon objectives", Structural Fund interventions are expected to complement and provide added value to national (or regional) policy framework. In some Member States, Structural Fund interventions in favour of innovation and knowledge are marginal with respect to the national investment and policy effort, in others Structural Funds provide a main source of funding for such interventions. In both cases, there is a need to identify relevant national and EU policies that can have an impact on decisions on funding priorities.

3.1 Institutional and legal framework for innovation and the knowledge economy

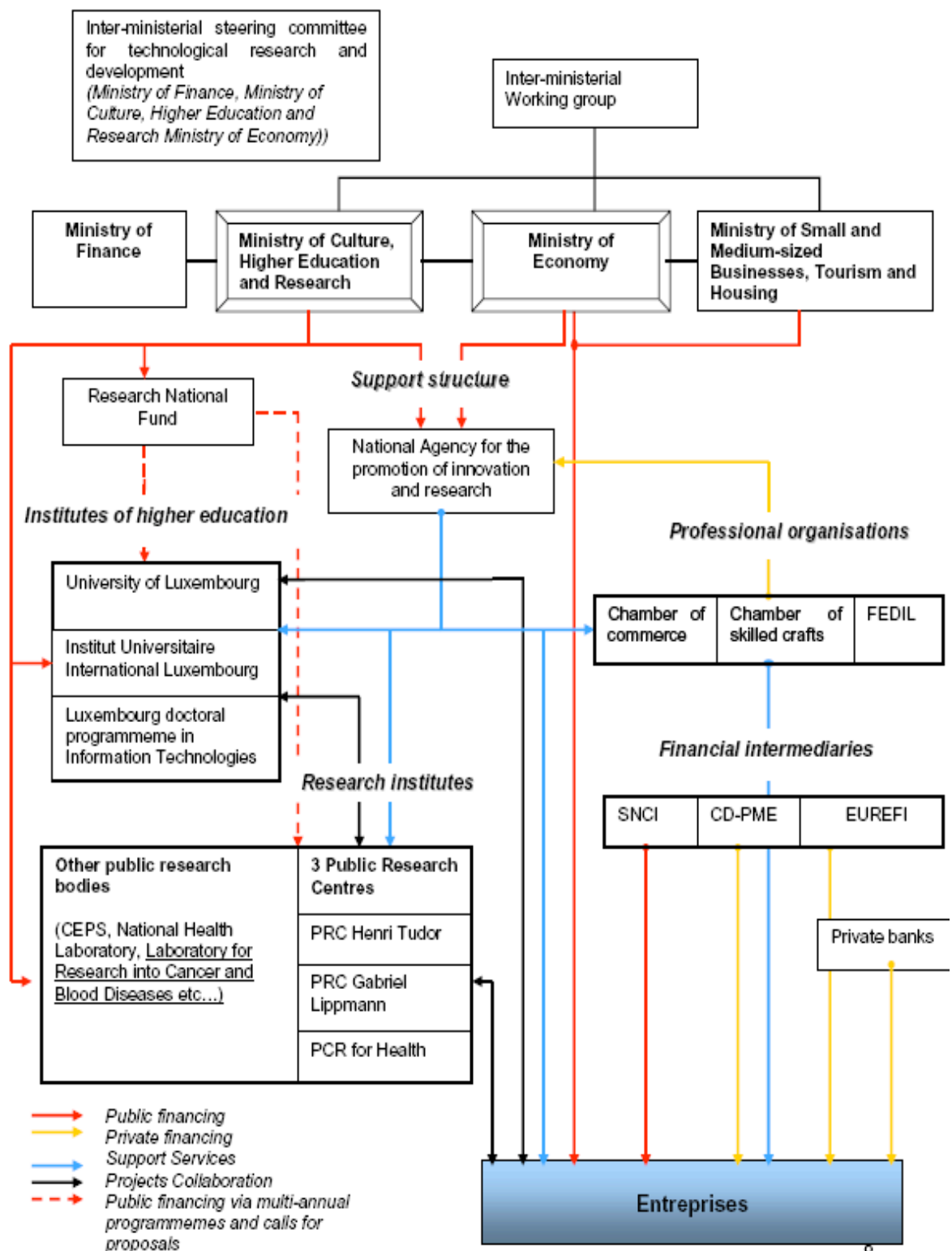
This section of the report appraises two broad factors that condition the potential for coordinated intervention of EU and national (regional) policies in favour of innovation and knowledge:

- The first concerns the organizational structures of public and semi-public bodies responsible for the design, implementation and monitoring of innovation and knowledge economy policies. In particular, the analysis considers the responsibilities for funding or managing specific types of measures liable to be considered for support under the Structural Funds;
- The second concerns the institutional, legal and financial frameworks, which condition the linkage of national (regional) financing with EU financing.

The national innovations system in Luxembourg (see organizational chart on following page) does not include many actors. Policy is made at the national level, with mainly three Ministries involved: a) the Ministry of Economy and Foreign Trade which is responsible for research in the private sector; b) the Ministry of Culture, Higher Education and Research, which is responsible for all other public research; and c) the Ministry of Small and Medium-Sized Businesses, Tourism and Housing which has during the last years assumed an important role in implementing the R&D incentive scheme for Small and Medium-sized Businesses.

Policy coordination was previously done through an inter-departmental working group, focused on carrying out a national plan to reach the 3% target. It involved representatives from the above three Ministries, plus the Ministry of Finance and the Ministry of Labour.

¹¹ The network of organisations, individuals and institutions, located within or active within national or regional boundaries, that determines and shapes the generation, diffusion and use of technology and other knowledge, which, in turn, explain the pattern, pace and rate of innovation and the economic success of innovation.



Source: DG REGIO

Unfortunately the 3% Working Group ceased to exist in 2005. The role of the working group may be taken up by the inter-departmental steering committee for technological R&D. This committee prepares proposals for the establishment of R&D programmes and R&D budget allocations and expenditures within the public sector. It only involves the Ministry of Economy, the Ministry of Culture Education and Research and the Ministry of Finance.

There are two advisory bodies; the Competitiveness Observatory (under the Ministry of Economy) in charge of collecting data on competitiveness and the business federations such as FEDIL (Federation of Luxembourg Industrialists). Professional chambers act as think tanks and consultation bodies on innovation regulations.

The three public research centres (PRCs) operating, under the overall supervision of the Ministry of Economy and Foreign Trade, are: i) Gabriel Lippman (innovative materials technology, sustainable management of natural resources and information society technology); ii) Henri Tudor (promotion of technological innovation in the private and public sector); and iii) Santé (advanced biomedical research) PRCs Gabriel Lippman, Henri TUDOR and Santé were established in 1987, 1987 and 1988 respectively. Initially the PRCs were staffed with foreign expertise brought in to respond to private sector demands. Due to his historical link, the PRCs are public research institutes, primarily carrying out research for the private sector. The PRCs have been followed by a small number of other research institutes, notably one for studies on population, poverty and socio-economic policies (CEPS/INSTEAD) in 1989.

Implementation of the Innovation Policy is done through three types of actors that play a major role beside the three ministries and departments that are directly implementing the innovation and R&D policy. The relatively newly established National Research Fund (NRF) provides funding for research projects within the framework of seven thematic programmes, through open calls for projects. It also subsidises accompanying measures to strengthen the general framework of scientific research (e.g. preparation of EU projects or mobility subsidies). The NRF has launched a multi-disciplinary research programme in 2001 called “Vivre demain in Luxembourg” (‘Live in Luxembourg tomorrow’). The budget totals 12 million Euro spread over five years. Its priorities are population development in Luxembourg (cohesion and social integration, identity and multilingualism); development of human capital; the information and communication age and its consequences for society; the role of a small country in the Saar-Lor-Lux region, the EU and a globalised world; spatial organization; and accompanying measures.

The National Agency for the Promotion of Innovation and Research (Luxinnovation), created in 1984 by the two main ministries implementing R&D policy, the FEDIL and the two professional chambers, is the one stop-shop for enterprises and research centres that have an innovative project. It also manages pilot projects (e.g. three technological clusters). It is an interface between ministries on the one hand and the enterprises and research centres on the other hand.

There are three financial intermediaries in Luxembourg’s national innovation system. There is the Société Nationale de Crédit et d’Investissement (SNCI), a public banking institution specialized in providing medium and long-term financing to businesses

(including start-up loans), the Société Luxembourgeoise de Capital de Développement pour les PME (CDPME) focused on financing businesses innovative projects (equity loans), and the Cross-border Development Fund (EUREFI) that provides financial assistance to businesses in the three border regions (BE, FR and LU) and which is an Interreg spin-off.¹²

Exhibit 5: main organizations per policy area.

Policy objectives	Type of organization	
	National (&/or regional) public authorities and agencies	Key private or non-profit organizations
Improving governance of innovation and knowledge policies	<ul style="list-style-type: none"> Ministry of Economy and Trade Ministry of Culture, Higher Education and Research 	
Innovation friendly environment	<ul style="list-style-type: none"> Luxinnovation The National Research Fund 	<ul style="list-style-type: none"> The FEDIL Société Luxembourgeoise de Capital Développement pour les PME (CDPME) The Cross-Border Development Fund (EUREFI)
Knowledge transfer and technology diffusion to enterprises	<ul style="list-style-type: none"> The three PRCs. Société Nationale de Crédit et d'investissement SNCI 	<ul style="list-style-type: none"> The University of Luxembourg
Innovation poles and clusters	<ul style="list-style-type: none"> Luxinnovation 	<ul style="list-style-type: none"> The FEDIL Three clusters t up by Luxinnovation and FEDIL: Aerospace cluster, ICT cluster, Surface & Materials technology cluster
Support to creation and growth of innovative enterprises	<ul style="list-style-type: none"> Ministry of Small and Medium-Sized Businesses, Tourism and Housing Luxinnovation 	
Boosting applied research and product development	<ul style="list-style-type: none"> Luxinnovation The three PRCs 	<ul style="list-style-type: none"> The FEDIL

Source: study team based on national/regional policy documents, TrendChart reports, OECD reports, etc. See appendix C for a detailed definition of the policy categories.

Until recently almost all research was carried out in the private sector or in cooperation with one of the research centres. The university was established in 2003 as a complementary actor focusing on research, as well as a provider of education in Luxembourg. Its research focus is both in applied and fundamental research

The main strength of the Luxembourg innovation system is the strong link between the public and private sector. An example of this is how private sector actors are approaching the new university asking for research to be carried out to help them become more competitive. One sector that has approached the university is the financial sector, looking for new ways to innovate and stay competitive. Ideally, this close link within the national innovation system will attract additional R&D facilities

¹² The above description draws on the European TrendChart.

from the private sector, facilities that otherwise are allocated to one of the university cities in the greater region but outside of the country.

3.2 Policy mix assessment

The next section provides a summary overview and analysis of the national and regional policy mix in favour of innovation and knowledge in which the Structural Fund interventions take place. The analysis is conducted with respect to six broad categories of objectives of innovation and knowledge policies (see appendix C for an explanation of each category).

Measures identified per category of the policy objectives are then further sub-divided in terms of the direct beneficiaries of funding (or legislative) action. To simplify, the report adopts three broad types of organization as targets of policy intervention:

- Policies supporting academic and non-profit knowledge creating institutions;
- Policies supporting intermediary/bridging organizations involved in innovation support, technology transfer, innovation finance, etc.;
- Policies supporting directly innovation activities in private sector.

The matrix below summarizes the current policy mix in at national level. The intensity of support (financial or political priority) for different policy areas and targets is indicated by a colour coding system.

Exhibit 6: Policy mix for innovation and knowledge

Policy objectives	Target of policy action		
	Academic /non-profit knowledge institutions	Intermediaries/bridging organizations	Private enterprises
Improving governance of innovation and knowledge policies		<ul style="list-style-type: none"> ▪ Suppression of 3% target working group ▪ OECD review 	
Innovation friendly environment		<ul style="list-style-type: none"> ▪ The Luxembourg Portal for Innovation and Research www.innovation.public.lu 	<ul style="list-style-type: none"> ▪ Start-up loans offered by SNCF
Knowledge transfer and technology diffusion to enterprises		<ul style="list-style-type: none"> ▪ Technology watch centre 	<ul style="list-style-type: none"> ▪ Short term patent
Innovation poles and clusters	<ul style="list-style-type: none"> ▪ The relocation of two out of three university faculties to the south of Luxembourg 		<ul style="list-style-type: none"> ▪ Three clusters in material and surface treatments, ICT and aeronautics and space
Support to creation and growth of innovative enterprises		<ul style="list-style-type: none"> ▪ Luxinnovation 	<ul style="list-style-type: none"> ▪ Start-up loan and three host structures, are at the disposal of innovative businesses as well

Policy objectives	Target of policy action		
	Academic /non-profit knowledge institutions	Intermediaries/bridging organizations	Private enterprises
			as an informal "Assistance Network to set up innovative business" ▪ The support Centre for Innovative Businesses (CAIE) ▪ Technoport Schlassgoart ▪ 1,2,3, GO network ▪ Ecostart
Boosting applied research and product development	▪ Cite de Sciences, de la Recherche et l'Innovation		

Legend	
Top policy priority	
Secondary priority	
Low priority	

Source: study team based on national/regional policy documents, TrendChart reports, OECD reports, etc.

Improving governance of innovation and knowledge policies

Even though during recent years the Government¹³ has published various reports on these issues, there still is no national strategic framework ensuring coordinated efforts by all stakeholders and a clear direction, and clearly defined actions that will get Luxembourg where it wants to be. This governance framework, will need to consider that with 50% of its labour force commuting from abroad, and surrounded by nations with reputed universities and research institutes, Luxembourg needs to continue to take full advantage of actively cooperating within the "greater region", as it has done until now.

The Government has asked for an OECD-type review to be made of the country's knowledge sector, which will be available in mid 2006. Resulting policy objectives and actions will likely not be formulated until the last quarter of 2006. While waiting for the result of the OECD review, there are no new policies being formulated, and no strategic decisions being made.

Innovation friendly environment

An important step was made with the adoption of a new R&D and innovation scheme that specifically addresses SMEs in the commercial and craft sectors. The many initiatives and the ready supply of funding for such initiatives show a clear

¹³ The Plan National "Pour l'Innovation et le Plein Emploi", has two chapters on innovation, and is a clear indication of the intended policy direction, but it lacks in measurable objectives and tangible actions. Luxinnovation has also published a report in 2002 on innovation in Luxembourg.

commitment to the creation of a more innovation friendly environment in Luxembourg. This is a new development over the last few years.

Knowledge transfer and technology diffusion to enterprises

Protection of intellectual and industrial property has been made easier through initiatives offering a short-term patent through a less cumbersome filing procedure, and the establishment of a technology watch centre. In addition, an increase in mobility of researchers and students is being supported through training-through-research fellowships. The policy is however fragmented and lacks a clear position within a strategic framework.

Innovation poles and clusters

The clusters programme¹⁴ was launched in 2002 by the Ministry of Economy and Trade, and is run by Luxinnovation in close cooperation with FEDIL, with the aim of fostering synergies between companies in Luxembourg in three fields:

- AeroSpace cluster (Aeronautics and aerospace technologies)
- InfoCom cluster (Information and Communications Technologies)
- SurfMat technology cluster (Surface treatment and new materials)

As discussions on the future of the clusters-programme¹⁵ show, cooperation and integration in the greater region is seen as an avenue to reach excellence on a level that Luxembourg's size will prevent it from reaching on its own, with initiatives within its borders. This raises issues about the existing cluster programme and its relevance or coherence for Luxembourg.

Support to creation and growth of innovative enterprises

Support to the start-up of technology-based companies has increased over the recent period, and consists of start-up loans and three host structures; (1) Hosingen relay centre "Op der Hei" in the north (started 2005), (2) an enterprise and innovation centre 'Ecostart' (started in 2002) in connection with the planned Cité de Sciences in the south and (3) a start-up incubator 'Technoport Schlassgoart' (1998) in the South. In addition there is an informal network "Assistance Network to set up innovative business". This area is a priority as evidenced by the number of initiatives undertaken and funded to support innovative enterprises.

Measures are targeting private SMEs but also attempt to create self-help opportunities, as exemplified by the establishment of public research facilities in the peripheral areas, which aim at financing the creation of micro-enterprises generated by applied research. This area is considered a priority, but there is a recognized need to better identify the potential beneficiaries and to better connect the financial supply with the SMEs that need funding and support.

¹⁴ These clusters are results of one of the few policy measures with a known end date (2007)

¹⁵ The ministry of Economy has recently launched a consultation among businesses about the usefulness and relevance of a cluster programme in Luxembourg's national context. It appeared that the clusters where the participating companies were complementary worked well, but not the others. In light of this, and due to Luxembourg's size, and so far relatively little developed RTDI capabilities, cooperation with its neighbours in the wider region is more an advantage than a weakness.

Boosting applied research and product development

There are currently not many researchers in SMEs, even though the number of researchers in the public sectors has increased. There is no national or regional scheme in place within this field. The planned Cité de la Science et de la recherche will bring together education (secondary and tertiary) and research, industrial estate for innovative start-ups and technology companies, and government authorities. Two of the University's faculties¹⁶ will be relocated from the centre to this Cité. It is hoped that it will also attract participants from the "greater region" given its location.

Overall assessment of the Policy mix

The developing institutional RTDI context in Luxembourg seems to focus on investing in public research and higher education, while keeping the interaction between the existing players coherent. This is likely the result of the limited number of persons involved in RTDI policy making in Luxembourg, and their high level of interaction with players in the "greater region". However, Luxembourg needs to be well positioned within the "greater region", and hence to benchmark its performance against other neighbouring actors. This is not possible without detailed data from all stakeholders in the NIS and all actors in the greater region working in a resource maximizing way.

The main weakness of Luxembourg's national innovation system is the lack of institutionalized ministerial co-ordination, as exemplified by the dissolving of the 3% working group. It is hoped that the inter-departmental steering committee for technological R&D will eventually fill in this gap. Luxembourg is a small, social consensus based society, and most decisions are made after consultation of stakeholders. A possible future problem is the potential overlapping of R&D competencies in the public sector.

3.3 Conclusions: the national innovation system and policy mix

Luxembourg has initiated strong measures to increase innovation financing. Currently the paramount need is for Luxembourg to integrate the set of existing measures in a broad plan fixing objectives and orientations for a future innovation policy in order to increase the efficiency of each measure and to create a coherent set of measures.

Its strategic goals are to create international excellence in a few selected fields, while maintaining and leveraging its embedding in the greater region, so as to mitigate for its small size and resource base

Current policies are more project-like than programme-like, and without a policy framework they will remain less effective than they could be if they would be part of a coherent, formulated programme within a national strategy.

The national innovations system in Luxembourg does not include many actors and is based on a consensus decisions in consultation with the various public and private

¹⁶ The faculty of Science, Technology and Communication and the Faculty of Literature, Humanities, Arts and Educational Science.

stakeholders. This situation presents both an advantage (operational) and a weakness (small club of in-players in the absence of clear consultation and decision making frameworks).

Both these elements call for a coherent national strategy and the establishment of a coordination-unit which could ensure continued coherence, effective participation of all stakeholders and flexibility as Luxembourg's research and innovation system grows.

Exhibit 7: Key opportunities and constraints for investment by the Structural Funds

Policy objectives	Opportunities for Community funding (national priorities)	Constraints or bottlenecks (factors limiting Community funding)
Improving governance of innovation and knowledge policies	<ul style="list-style-type: none"> • Consultation of stakeholders, on the national and international levels • Support to defining a 'national cum "greater regional" innovation framework' 	<ul style="list-style-type: none"> • No action plan fixing objectives; suppression of eth 3% working group • 'Greater region' dimension of the framework
Innovation friendly environment	<ul style="list-style-type: none"> • Measures and support to building up SME's innovation capacity (access to innovation workers, innovation management skills...) • Developing knowledge and information sharing mechanisms open to the "greater region" 	<ul style="list-style-type: none"> • Mismatch between skills available and skills required • Limited SME networking and collaboration • Disparities at area level (north & east versus centre & south)
Knowledge transfer and technology diffusion to enterprises	<ul style="list-style-type: none"> • Development of technology watch centre • Improving access by companies to ITC and environmental friendly technologies. • Developing the university's liaison capacity with the private sector 	<ul style="list-style-type: none"> • Lack of inter-ministerial coordination • University still being established and developed
Innovation poles and clusters	<ul style="list-style-type: none"> • Existing clusters in innovative sectors, need to be re-centred within a "greater regional" context and opened up to international outreach 	<ul style="list-style-type: none"> • No evaluation of the "results" • Internal dynamics of clusters
Support to creation and growth of innovative enterprises	<ul style="list-style-type: none"> • Develop ad-hoc inter-phasing between innovative companies and local financial sector 	<ul style="list-style-type: none"> • Financial products supplied by the local financial sector disconnected from potential target groups
Boosting applied research and product development	<ul style="list-style-type: none"> • Facilitate employment of researchers by private sector 	<ul style="list-style-type: none"> • Small number of in house researchers in companies SMEs, and a small number of public researchers in academia

4 Structural Funds interventions to boost innovation and create a knowledge economy: 2000-2006

This section of the reports provides an analysis the patterns of Structural Fund expenditures in the fields of innovation and knowledge-based economy during the current programming period (2000-2006 for EU-15 or 2004-2006 for the new Member States). It examines the patterns from both a strategic point of view (the policy mix pursued by the Structural Funds programmes) and at an operational level (consumption of funds, management of innovation measures, indications of relative effectiveness of measures, case studies of ‘good’ practice).

4.1 Strategic framework for Structural Fund support to innovation and knowledge

4.1.1 Strategic approach to innovation & knowledge in Structural Fund programmes

Luxembourg is eligible for European Regional Development Fund (ERDF) support under Objective 2. In the 2000-06 period, this involves four types of areas: industrial, rural, urban and those dependent on agriculture and viticulture. Under the ERDF participation, Luxembourg was granted EUR 40 million, EUR 34 million for Objective 2 areas and EUR 6 million of transitional assistance.

European Social Fund (ESF) support under Objective 3 is designed to support the adaptation and modernization of education training and employment policies and systems. The Objective 3 funding allocated to Luxembourg in the 2000-06 period amounts to EUR 25 million (1999 prices), the same as for 1994-99.

ERDF funds are allocated according to five axes: Axis 1: Promotion of development of marginalized zones, Axis 2: Integration of wastelands in a socio-economic development policy, Axis 3: Promotion of research, technology and innovation development, Axis 4: Promotion of environmental protection. Axis 5: Technical assistance.

Luxembourg created a new strategy aimed at creating an “integrated and interconnected system for sharing knowledge”, within the ERDF framework in 2002. The framework’s objective is the introduction of:

- a system of clusters and networks of expertise and training;
- a strategic intelligence system (technology watch);
- a system of technology parks and relay centres;
- a diffusion, communication and networking system based on ICT.

According to the 2003 mid-term evaluation¹⁷, ERDF policy in Luxembourg had by then shown progress within the areas of SME promotion, R&D interventions and the

¹⁷ Mid-term evaluation – Objective 2 Luxembourg – ADE – January 2004

reconstruction of industrial declassified lands. Actual project implementation began late.

The calculations presented in the exhibit below are based on the allocation of Structural Fund budgets according to the EU intervention code classification. For practical purposes, the calculation of financial resources allocated to innovation and knowledge has been limited to the RTDI codes:

- 181 Research projects based in universities and research institutes
- 182 Innovation and technology transfers, establishment of networks and partnerships between businesses and/or research institutes
- 183 RTDI Infrastructure
- 184 Training for researchers

Additional calculations based on broader definitions of innovation are presented in Appendix D.

Exhibit 8: Overall allocation of resources at an objective 1 and 2 level (allocated figures in Euro) – Final Financial Matrix¹⁸

Objective	Total cost	SF			NF	
		Total	ERDF	ESF	Public	Private
RTDI INTERVENTIONS						
Objective 2	15,326,666.00	4,598,000.00	4,598,000.00	0.00	10,728,666.00	0.00
TOTAL COHESION POLICY						
Objective 2	145,026,668.00	44,000,000.00	44,000,000.00	0.00	101,026,668.00	0.00

Source: programming documents and financial data provided by DG REGIO

NB RTDI measures in the Luxembourg context correspond to measures under axis three in the following way; sub-axis 3.1 corresponds to 183; 3.2 corresponds to 182; and 3.3 corresponds to 181.

Structural Funds in Luxembourg are quite small amounts, and are used to complement public and other funding of innovation and research activities. The EDRF programmes co-finance projects with contributions of, on average, 23.4% of the overall project costs. Government funding represents 54.6 % and private funding 22%. The funds are invested in the priority projects of the Ministry of Economy and Foreign Trade.

Of the total funding only a small part (approximately 10%) was used to finance RTDI initiatives. However when using a wider set of EU intervention codes (see appendix D) this percentage increases to 17%. Both these percentages do not take into consideration infrastructural investments made under axis 1 and that were geared towards the construction of university buildings and the Cité de la Science complex.

¹⁸ If the original SPD had not been modified, the importance of Axis 3, would have been 22 % of the entire Objective 2 commitment for Luxembourg. See detailed figures in section 4.2.1.

4.1.2 Specific measures in favour of innovation and knowledge.

Specific measures in favour of innovation and knowledge have focused on:

- RTDI Infrastructure, among others the creation of the Cite de Science in the south, in order to try and even out inequalities in the availability of RTDI infrastructures within the country,
- Improved awareness of benefits and types of innovation, concentrating on improving the diffusion of knowledge between companies, and between companies and research centres.
- Research and development of new poles and clusters, in such a way as to orient corporate efforts into new directions

Exhibit 9 clearly shows that the ERDF supported RTDI interventions only went to public type investments, managed mainly by the PRC Henri Tudor. No measures or projects specifically addressed private sector sponsored projects. Furthermore it also indicates that the major share of investments went to infrastructure such as laboratories and buildings.

Exhibit 9: Key RTDI innovation & knowledge measures

Policy area	Number of identified measures (all programmes)	Approximate share of total funding for innovation & knowledge measures	Types of measures funded (possibly indicating importance)
Improving governance of innovation and knowledge policies			
Innovation friendly environment	1 project 3.2. and 1 project 3.3.	8.95%	Quality Pass ¹⁹ , New regional pole (SECURE PME) ²⁰ ,
Knowledge transfer and technology diffusion to enterprises	None under codes 181, 182, 183, 184		
Innovation poles and clusters	3 projects 3.3	52.67 %	New regional pole (SECURE PME), creation of national lab for cluster (topo mech & surface) ²¹ ,
Support to creation and growth of innovative enterprises	None under codes 181, 182, 183, 184		
Boosting applied research and product development	3 projects 3.1.	42.58 %	Creation of a new national lab (THERA) ²² , and a National accreditation lab (ISO 17025) ²³ , Housing of research centre ²⁴ by planned Cite de Science in the south

Nb: this table is a summary of the table in appendix D.2. The total of the percentage share per policy area may sum to more than 100 since certain measures fall into several categories.

¹⁹ Supported by PRC Henri Tudor.

²⁰ Directly introduced and supported by PRC Henri Tudor

²¹ Implemented by PRC Henri Tudor,.

²² Implemented by PRC Henri Tudor ("THERA")

²³ Implemented by PRC Henri Tudor

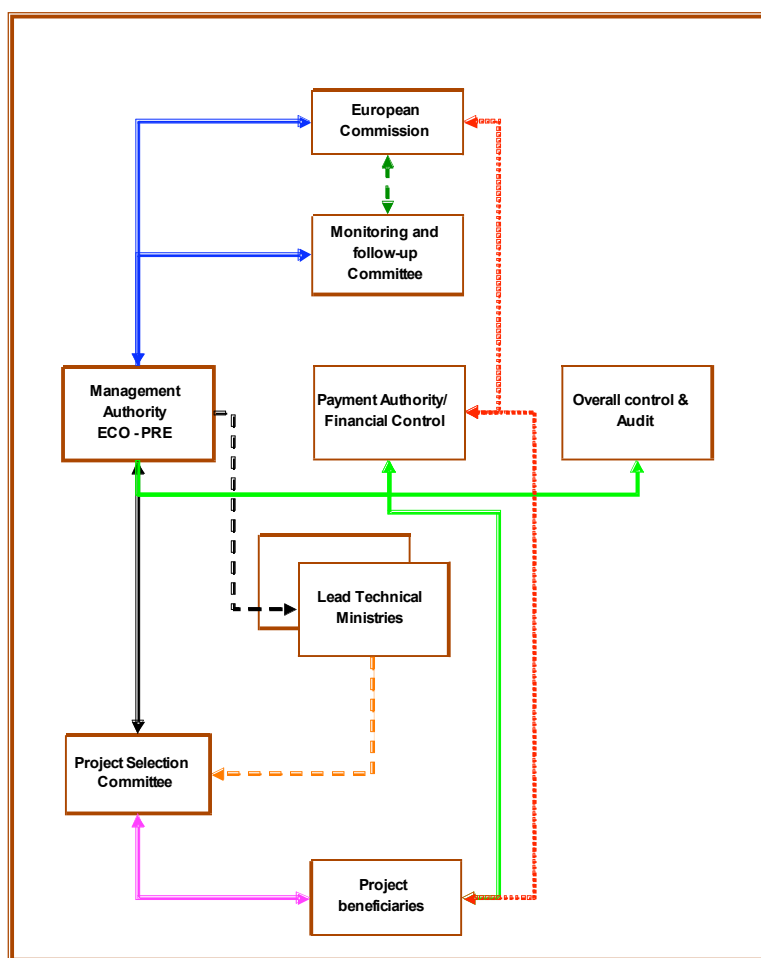
²⁴ Construction of building and moving the PRC Gabriel Lippman to the 'future' Cité des Sciences

4.2 Learning from experience: the Structural Funds and innovation since 2000

4.2.1 Management and coordination of innovation & knowledge measures

This section reviews the overall management of Structural Fund interventions in favour of innovation and knowledge during the current period. It examines the coherence and role of key organizations or partnerships in implementing Structural Funds measures for innovation and knowledge, the linkages between Structural Fund interventions and other Community policies (e.g. the RTD Framework Programme) and the financial absorption and additionally of the funds allocated to innovation and knowledge.

Given the one-region nature of Luxembourg there is no lower level political institution deciding on the use of funds, all decisions are made by the Ministry of Economy and Trade. Overall management of Structural Funds is organised schematically as shown in the following figure. Calls for projects are launched after a nation wide promotion campaign. Project proposals are reviewed by a selection committee before being signed by the Minister of Economy and Foreign Trade.



Source – Mid-term evaluation report – ADE 2°003

This committee is composed of four members of the regional policy unit of the Ministry of Economy and Foreign Trade (PRE), one member of Ministry of women's promotion, one member of the Ministry of environment and one member of the Ministry of interior.

Lead technical ministries are only consulted on an ad hoc basis by the Management Authority and partially involved in the final selection of projects.

A specific technical assistance team of three persons has been mobilised through Axis 5 and provides the on-going support to the daily management of the overall programme. This TA is located within the PRE.

Programme start up was

delayed²⁵ and the first projects were only accepted during 2003. Absorption capacity of the third axis relating to Innovation and Knowledge has been very low and the mid-term evaluation recommended to hold the expenditures for this axis to levels as planned in 2003 and to re-allocate remaining funds to the first axis of the programme. In the original SPD, the total investment for Axis 3 was 38.547 million Euro, of which ERDF's share was 9.02 M€. By the mid-term evaluation, only 4.793 M€ had been mobilized, of which 1.1 M€ from ERDF. As a result, the amounts allocated by ERDF to axis 3 (RTDI measures) were reduced by 4.422.000 euro corresponding to a 49% decrease.

Exhibit 10: Absorption capacity by field of intervention ²⁶

CODES	ALLOCATED	DISBURSED	EXPENDITURE CAPACITY
OBJECTIVE 2			
181 - Research projects based in universities and research institutes	1,021,767.00	165,120.56	16.2%
182 - Innovation and technology transfers, establishment of networks and partnerships between businesses and/or research institutes	218,405.00	28,238.67	12.9%
183 - RTDI infrastructure ²⁷	3,357,828.00	2,367,168.42	70.5%
TOTAL OBJ. 2	4,598,000.00	2,560,527.65	55.7%

Source: DG Regio, calculations ISMERI

The reasons given for this re-allocation were lack of projects given the saturated absorption capacity of the local actors in the targeted Objective 2 zones. The zoning problem, typical of the 2000-2006 programming period, has effectively resulted in restricting interventions to very small portions of the national territory. In the new programming period, this issue is addressed as programmes will be national or regional, without specific zoning.

However, one can also query the way the axis has been mobilized, as its design and implementation seem to have over emphasized public supported projects. It is striking that all projects have been presented and are implemented by the Henri Tudor PRC, except for the moving of the PRC Lipmann to the Cité de la Science. Another observation that can be made is that in the financial matrix co-funding for this axis was restricted to the sole public sector. The Innovation and Knowledge axis was designed as a means to support a series of government inspired infrastructure projects.

²⁵ The SPD was approved by the commission in December 2001 and the PC in February 2002.

²⁶ Based on the original SPD and CP financial matrix, absorption capacities would have respectively been:

	Allocated Original SPD-CP	Disbursed	Expenditure capacity
Code 181 (measure 3.1)	5,412,000.00	165,120.56	3%
Code 182 (measure 3.2)	1,804,000.00	28,238.67	1.5 %
Code 183 (measure 3.3)	1,804,000.00	2,367,168.42	131 %
Total	9,020,000.00	2,560,168.65	28.3 %

²⁷ After the latest evaluation in November 2005 the ERDF allocations was once again amended and measure 3.3 increased. The logic of intervention had changed slightly towards boosting applied research and product development, with the establishment of local research facilities of the Gabriel Lippman PRC in the southern zone at the future sight of the planned Cite de science, and additional investment in a research laboratory in the materials cluster.

Even for those two sub-measures where private companies and universities or research institutes seemed to be targeted, projects and fund mobilization had to happen through public funding.

Furthermore, during the mid-term review, the attitude of the Government was to concentrate funds on axis 1 which focuses on regional economic development and on axis 2 which focuses on rehabilitation of industrial declassified lands. It was felt that funds to support innovation and research were already available through other national programmes and that those for environmental protection would be better used to expand axis 2²⁸.

Even if knowledge about the programme was widely distributed, and opportunities to apply open to everyone, many project proposals could not be finalised, due to the lack of comprehension by potential beneficiaries of SF procedures and the lack of technical preparedness of project proposals. Line technical Ministries were only systematically consulted during the formal selection of project and, unlike in other countries, seem to play an insignificant role in diffusing information and promoting project proposals in their own fields of technicality.

The Management authority being within one Ministry, without a specific management unit operating through a network of focus persons for each sub-measure within other Ministries, can in part explain the overemphasis on the Ministry's own priorities and projects. The absence of private and community based stakeholder representatives in the monitoring committee and in the selection committee does not help restoring the overall balance.

4.2.2 Effects and added value of Structural Fund support for innovation and knowledge

This section of the report analyses the effects and added value of the Structural Fund interventions in favour of innovation and knowledge during the current programming period. The analysis is based on two main sources, namely: a) available evaluation reports or studies concerning Structural Fund interventions; and b) interviews and additional research carried out for this study. Accordingly, this section does not pretend to provide an exhaustive overview of the effects or added value²⁹ of Structural Fund interventions.

Structural Fund interventions in Luxembourg during the last programme period were delayed, and did not start until 2003. The impact of the measures and allocated funds is hard to measure due to the short period of implementation, the lack of clear underlying strategy of the SPD and little specific impact monitoring other than ensuring regular financial reallocations of funds within the overall budget, in order to ensure maximum disbursement of overall ERDF funds by the end of the programming period. Regarding RTDI supportive measures, the fact that Luxembourg's RDTI

²⁸ Ministry of Environment at the time of the mid term evaluation seemed to have little command over SF procedures and to be able to mobilize sufficient projects.

²⁹ A good definition is "The economic and non-economic benefit derived from conducting interventions at the Community level rather than at the regional and/or national level". See Evaluation of the Added Value and Costs of the European Structural Funds in the UK. December 2003. (Available at : www.dti.gov.uk/europe/structural.html)

policy as a whole is in a very early stage, has not enabled the programme to really maximize its impact within the country's economic fabric. Added value has been created up to a certain point through national level testing laboratories, and the emergence of the "Cité de la science" mega project³⁰. Their long term sustainability and their future financial operation still need to be proved, as project descriptions are not comprehensive as to how downstream beneficiaries or operators will contribute or be part of their future operation.

There seems to have been very little direct added value to the non public sector innovation actors. First no specific measures were designed with this intention and second during implementation PRC Henri Tudor seems dominated with little evidence from project documentation on how private partners are involved.

The RTDI axis of the Luxembourg Objective 2 for the 2000-2006 programming period seems therefore to be a missed opportunity to try and expand through EU structural funds the various policy fields highlighted in exhibit 7 and where EU funding could help make a difference.

4.3 Conclusions: Structural Funds interventions in favour of innovation and knowledge

ERDF funds allocated to the Luxembourg Objective 2 for RTDI have been concentrated within one single axis (Promotion of research, technology and innovation development). Absorption capacity of this axis has been very low and the mid-term evaluation recommended to diminish the expenditures for this axis and to re-channel remaining funds to the first axis of the programme. As a result, the amounts allocated to axis 3 were reduced by 49%. RTDI interventions only went to public type investments and infrastructures, managed mainly by the PRC Henri Tudor. No measures or projects specifically addressed private sector sponsored projects.

One can query the way the axis has been mobilised as its design and implementation seem to have overemphasized public supported projects. Many project proposals could not be finalised, due to the lack of comprehension by potential beneficiaries of SF procedures and the lack of technical preparedness of project proposals. The Management authority being within the Ministry of Economy and Foreign Trade, without a specific management unit operating through a network of focus persons for each sub-measure within other Ministries, can in part explain the overemphasis on the Ministry's own priorities and projects. The absence of private and community based stakeholder representatives in the monitoring committee and in the selection committee does not help restoring the overall balance.

³⁰ ERDF funds have financed the feasibility studies and infrastructure investments to 15% under Axe 1: 1.1. under project name MECO. The planned Cite promises to become an important project for the southern region. Though not yet fully realized, there is widespread political commitment for its construction, and indeed several measures have been initiated. These measures include the move of the Gabriel Lippman CRP to the area, and the planned move of two of the faculties of the university.

The fact that Luxembourg's RDTI policy as a whole is in a very early stage, has not enabled the programme to really maximize its impact within the country's economic fabric. Main outcomes of the RDTI measures are summed up in exhibit 11.

Exhibit 11: main outcomes of innovation and knowledge measures

Programme or measure	Capability	Added value
Creation of RDTI Infrastructure in order to try and even out inequalities within the country	<ul style="list-style-type: none"> ▪ Beyond public infrastructure, this measure has shown no absorption at all local or private levels ▪ Moderate absorption as after an initial reduction of funding, funds were slightly increased during last monitoring exercise in November 2005 	<ul style="list-style-type: none"> ▪ Focus on a few public infrastructures such as national laboratories and the cite des sciences ▪ Long term sustainability and operation are still to be confirmed
Improved Awareness of benefits and ways of Innovation, concentrating on improving the diffusion of knowledge Research and development of new poles and clusters	<ul style="list-style-type: none"> ▪ Very low absorption rate and major part of funding reallocated 	<ul style="list-style-type: none"> ▪ The initial setting up of a pole on IT security for SMEs and a technology watch system, but again effective operation and long term sustainability are to be confirmed

Effectiveness → significant results achieved; good absorption and management performance.

Added value of measures → reinforcement of national priorities, innovative approaches and solutions, institution building, etc.

The long term sustainability and their future financial operation of most interventions still need to be proved, as project descriptions are not comprehensive as to how downstream beneficiaries or operators will contribute or be part of their future operation. There seems to have been very little direct added value for the non public sector innovation actors.

5 Regional potential for innovation: a prospective analysis

This section of the report seeks to summarise and draw conclusions from the analysis of the preceding sections, available studies and interviews and focus groups carried out for this study in order to provide an analysis of the regional innovation potential. In doing so, the aim is to provide a framework for orientations in terms of future Structural Fund investments in innovation and knowledge.

5.1 Factors influencing regional innovation potential

Luxembourg's small size and limited number of knowledge and innovation actors limits both the capacity and usefulness of "sub-regional" innovation initiatives. Local investments are needed, but these need to be anchored in a national framework, and in eventually in the "greater region" context in coherence with neighbouring regions.

The economy of Luxembourg is currently focused on the centre of the country, where the service sector and especially the financial sector and various EU institutions are concentrated. With the changing tax and duties environment that the new EU directive will impose, efforts to diversify financial products and services to clients need to be undertaken. Integration of specific financial products to support innovative and knowledge ventures within the "greater region" is one of these challenges the financial sector is faced with.

Tourism, the development of the transborder natural parks in the northern parts ('Petite Suisse') of the country and the Moselle valley (in the east) represent specific and unique niches, faced with the adaptation of the local economic fabric to new products, and tourism logistics. A continued and sustained development of these niches, within an environmental friendly approach, needs to be promoted. New vine types and wine products still need to be supported in order to conserve and expand this very specific national asset.

With the establishment of the "Cité de la Science" in the southern zone, the drive of the new economy might become more balanced. The surface treatment and new materials cluster are in line with this area's specialisation in metal and materials, again with an important cross-border connotation, as the Lorraine region in France concentrates the same kind of historical past.

Exhibit 12: factors influencing innovation potential by type of region

Region / type of region	Main factors influencing future innovation potential
Luxembourg	<ul style="list-style-type: none"> • Small size of the country, but at the same time important integration within the "greater region" that surrounds it • Specific niches markets and activities in the more rural areas of the north and east, which are mainly led by SMEs and which need to be consolidated and adapted to new market requirements and the existence of transborder parks • Proximity of various major actors in the material and metal sectors in the southern area of the country and in the adjoining Lorraine region in France • Luxembourg's centre's brain drain towards services and institutional jobs • Mismatch of educational levels within the country, unemployment of higher educated and skilled people in some areas of the country whereas in others high unemployment levels of unskilled or poorly skilled labour forces, as a result of industries becoming more sophisticated.

5.2 A prospective SWOT appraisal of regional innovation potential

Luxembourg as a region's major strengths, weaknesses, opportunities and threats in terms of innovation and knowledge are listed in Exhibit 13.

Exhibit 13: Innovation and Knowledge SWOT

Luxembourg (Low-tech Government)	
Strengths	<ul style="list-style-type: none"> - Tradition of Transnational learning (ad hoc) and of transborder relationships and business. - Flexible and responsive government - Tradition of consultation of stakeholders through various federations and chambers
Weaknesses	<ul style="list-style-type: none"> - No action plan fixing future orientations for RTDI - Lack of R&D culture in businesses - Lack of human resources within innovation policy - Southern area educational attainment level underdeveloped and high unemployment - Northern and to some extent eastern areas marked by unemployment due to lack of opportunities according to (higher) educational attainment levels - No (public) evaluation of the measures - Barrier to put in place an evaluation culture
Opportunities	<ul style="list-style-type: none"> - Connection to greater region RTDI centres (universities, platforms and networks) - New regulations governing financial services at the European level - Specific traditional niche markets (tourism, viticulture, nature & recreation) and new niches to be secured in the material and metal sectors
Threats	<ul style="list-style-type: none"> - Delocalisation of large companies currently carrying out R&D in Luxembourg, the country is dependent on a small number of companies to carry out research in the business sector. - Suppression of the inter-department working group for the 3%

Source: Trend Chart and research presented in this report

5.3 Conclusions: regional innovation potential

Policy Headline 1: Improve and establish a comprehensive framework for innovation and knowledge policies

- Currently, most coordination and cooperation is done on an ad-hoc, informal basis. Due to Luxembourg's size and the relative low number of innovation programmes this has not been as detrimental as could have been expected. However, given the ongoing increase in programmes and the need for a long-term targeted approach (e.g. with respect to the north and 'greater region'), formal structures with clear responsibilities will be needed. There is also no nation-wide strategic framework incorporating the detailed strategic plans and actions of all players; PRCs, SMEs, the university, the National Research Fund, FEDIL, and positioning them in a coherent, efficiency maximizing, focused direction. This is acknowledged within Luxembourg, but the decision has been taken to first await the findings of an OECD review (due in 2006). Key in such a document will be to address the disconnection between the different sub-regions in the country, and how the "greater region" perspective will be reflected.

Policy Headline 2: Ensure that innovation efforts optimally align with Luxembourg's situation as part of the larger region

- More than most nations Luxembourg is strongly interwoven with and dependent on the regions that surround it. Its size is too small for some of the trappings of a bigger State, e.g. until recently it depended on other countries to provide university education to its population. While setting up its own university, Luxembourg has been careful to build upon what is already available in the region, in the process strengthening both itself and the region. The same approach should be followed with respect to its innovation programmes. For this to be done effectively, Luxembourg will need to be aware of what is already in place in the region, and an inter-regional approach would be useful.

Policy Headline 3: Provide backing to the traditional market niches markets and to establish new ones in the material and metal sector.

- Luxembourg enjoys a number of natural assets that have generated specific market niches. Ensuring their sustained consolidation and eventual expansion, requires combing environmental friendly approaches and management and innovation skills within these widely SME dominated activities. Various infrastructural investments have been supported by the Government over the recent years to try and withhold the nations' specific knowledge edge in the material and metal sectors, and specific spin-offs or niche markets need to be consolidated.

Policy Headline 4: Enable the systematic measurement of innovation support and promotion programmes

- If no benchmarking is done, the success or failure of programmes (both in an absolute sense and relative to each other) cannot be measured. As a result, it will be unclear whether programmes have had their intended effect. Since Luxembourg has only recently started with active innovation programmes, it is to be expected that a learning curve will have to be gone through, strengthening the need for measurement and comparison. A culture of collecting and using policy indicators will thus have to be developed.

6 Future priorities for Structural Fund support for innovation and knowledge: options for intervention

At the moment of writing this report, there is no National Strategic Reference Framework, and there are so far no draft operational programmes. The national authorities are currently waiting for the outcomes of the OECD review before formulating a detailed national strategic plan.

Without a clear policy it is difficult to comment on the fit or operational aspects of SF investments with the national knowledge economy policy. However under the present programming period the absorption capacity has been very disappointing. Overemphasis on public investments and infrastructures and a lack of real integration of all actors (technical ministries, socio-economic stakeholders and local authorities at communal level,...) together with the perception that other national funding mechanisms were available for RTDI interventions within the private sector, are responsible for this situation. This limited absorption capacity has to be addressed in the new NSRF.

During the 2000-2006 programming period, the SPD was approved at a very late stage and lacked any clear overall strategy in relation to RTDI. Waiting for the OECD report to draft a national or greater region framework, will eventually lead to a similar slow start up of the 2007-2013 programming period and present the risk that disbursement issues will take the lead over strategic planning and coherence of interventions.

6.1 Strategic orientations for Structural Fund investments in innovation and knowledge

Key conclusion 1: Luxembourg's small dimension is an asset and a treat at the same time.

For many major initiatives, cross-border and "greater region" initiatives are more appropriate and Luxembourg is fully engaged in such ties. Major examples are the way the University of Luxembourg has been established, more as a complement to other university platforms than as an additional and competing actor; the various cross-border natural parks in the north of the country, etc. Luxembourg has also been very active in various other ERDF Interreg programmes.

Recommendation 1: Establish a transborder permanent platform to address and co-manage a series of specific RTDI issues.

Such permanent platforms exist elsewhere and are slowly developing, depending on the various partners' dynamism. For example: i) Lille Métropole, which is an association of five cross-border development agencies and which is highly active in managing the economic and territorial development of this bigger region; and ii) the Euroregion between Maastricht, Aachen and Liège which has its own kind

of parliamentary system, could serve as a reference in doing so. By extrapolating on existing initiatives and experience gained through the various Interreg programmes, it should be possible to start a nucleus platform devoted to promoting RTDI policies within the "greater region" and providing the Luxembourg initiatives with a sufficient hinterland to be meaningful.

Key conclusion 2: Added value of structural funds in relation to RTDI has been disappointing and an opportunity has been missed.

Luxembourg is one of the EU's most developed nations and the Structural funds available to it are therefore small in size (especially compared to the national funds that are available). During the 2000-2006 programming period, the funds available for RTDI had to be reduced by 49 %. Reasons include restrictive Objective 2 zoning, but also weak design and implementation of the RTDI axis. This axis overemphasized public investments and infrastructures and the design of the sub-measures that were to be more private sector or research institutes oriented did not enable these beneficiaries to really submit projects. The major beneficiary of this axis is PRC Henri Tudor.

Recommendation 2: A comprehensive overall RTDI policy framework needs to be urgently developed and a specific coordination unit established.

During finalisation of the thematic study commissioned by the Government and that the OECD expert group still has to submit, a first draft of an overall RTDI policy can already be prepared and it should be basically open to the "greater region" dimension of RTDI and to most of the country's major niche markets. This document together with the expected OECD study should then serve as basis for a national consultation with all line ministries, business federations (small and big), sector chambers, local communal authorities, social partners and representatives of the "greater region". It is important that a consensus is established and that this in turn leads to the establishment of an open leading group (beyond the sole Ministry of Economy and Foreign Trade and its affiliated organisations). This leading group will be responsible to pilot the regular monitoring and evaluation of this policy framework and to act as focus group during the implementation of the various SF supported measures that this policy framework document will generate.

Key conclusion 3: There is a major mismatch between labour force educational levels and the innovation management and more sophisticated technological requirements of business sector

Rural areas are characterised by an important network of micro to small businesses with low levels of 'innovation and knowledge economy' awareness, of financial means to invest in innovation and of innovation management. On the other hand innovative businesses and major actors in the south of the country are faced with the challenge of developing new products and more sophisticated production lines. Rural areas and the former industrial south are characterized by high unemployment levels and by a mismatch between labour qualifications, which are often low, and the new activities to be developed. People with higher education levels are attracted by the Luxembourg town financial and service hub.

Recommendation 3: Improve, through a greater region perspective, labour force educational levels and mobility

Based on initiatives developed in other neighbouring transborder areas, and based on a clear regional needs assessment, develop a series of ad hoc transborder training packages, provide training checks to attend existing training packages, stimulate transborder mobility of labour force in both directions; develop specific ‘innovation workers’ insertion packages in SMEs and innovative companies,...

Key conclusion 4: Innovation is only the means to an end and may be most efficiently focused on the financial sector

Innovation is meant to strengthen the current high GDP per capita and support further GDP growth. Luxembourg should focus its innovation efforts in those areas where it will generate the highest returns. Its main competitive advantage currently is the financial service sector. Luxembourg has been able to build this up through favourable banking, tax and personal privacy laws that (for instance) have attracted many private wealth institutions. However, these advantages will disappear due to EU harmonization, and Luxembourg will need to re-invent itself as a niche financial player (when compared to e.g. London or Frankfurt).

Recommendation 4: Regulatory innovation key to sustained GDP growth

Luxembourg should position itself as a hub for those EU-wide services that previously could only be offered on a national level. An example is the establishment of real estate investment funds, which in the past would have to register in each EU-country in which it wanted to operate. Currently an ‘EU passport’ exists, allowing for a single registration that enables a fund to be active throughout the EU. Through timely legislation and a pro-active attitude of the Luxembourg financial authorities Luxembourg has been able to convince an increasing number of such funds to list in Luxembourg.

Luxembourg is experienced in drafting financial regulation and the small but strong financial community should be able to act more quickly and decisively than its bigger competitors. Ideally, a positive feedback loop can be created whereby Luxembourg becomes the first stop for (financial service) companies looking to benefit from new EU regulatory developments. Clearly, this is a non-traditional form of innovation, but one that fits well within the Luxembourg context.

6.2 Operational guidelines to maximising effectiveness of Structural Fund interventions for innovation and knowledge

Key conclusion 5: Improve allocation procedure, since the current set-up does not allow for efficient absorption of allocated funds.

During the 2000-2006 programming period, many project proposals could not be finalised. This was due to the lack of comprehension by potential beneficiaries of SF procedures and the lack of technical preparedness of project proposals. Line technical Ministries were only systematically consulted during the formal selection of project and, unlike in other countries, seemed to play an insignificant role in diffusing information and promoting project proposal in their own fields of technicality. The existing management is basically in the hands of the PRE and the Minister of Economy and Foreign Trade. The project selection committee includes three other representatives, but the Ministry still has the upper hand. Moreover, to ensure even quality in fund applications, Luxinnovation has its existing network, and could support actors in preparation of fund applications.

Recommendation 5: Institute a wider management system of SF whereby line Ministries or specialised agencies such as Luxinnovation become focus points to prepare and monitor individual projects.

A distinction between overall project management and selection cum follow up of programme implementation should be made. The management authority should be opened to other agencies and only ensure limited coaching of project proposals and accepted projects. Project proposal appraisal, selection advice and daily follow-up during effective implementation should however involve specific focus persons within other technical line Ministries or ad hoc specialized agencies, such as Luxinnovation.

Key conclusion 6: Position SF funds within the national RTDI strategy, and evaluate measures against clearly defined objectives.

Recommendation 6: Allocation according to plan will however only be possible when there is a national strategy with operational objectives. But as the number of potential applicants increase, the need for clear objectives and evaluation measures increase. Accountability becomes key to efficient SF use.

Appendix A Methodological annex

A.1 Quantitative analysis of key knowledge economy indicators

A 1.1 Factor analysis

In order to analyse and describe the knowledge economies at regional level in the EU, the approach adopted was to reduce and condense all relevant statistical information available for a majority of regions. The approach involved firstly reducing the information from a list of selected variables (Table 1) into a small number of factors by means of factor analysis.

Table 1. Reduction of the dataset (215 EU-27 regions) into four factors by means of factor analysis

	The 4 factors			
	F1 'Public Knowledge'	F2 'Urban Services'	F3 'Private Technology'	F4 'Learning Families'
Higher education (HRSTE), 2003	.839	.151	.190	.184
Knowledge workers (HRSTC, core), 2003	.831	.164	.267	.327
High-tech services employment, 2003	.575	.367	.428	.323
Public R&D expenditures (HERD+GOVERD), 2002	.543	.431	.275	-.195
Value-added share services, 2002	.323	.869	.002	.121
Value-added share industry, 2002	-.265	-.814	.386	-.061
Employment government administration, 2003	-.217	.745	.124	-.175
Population density, 2002	.380	.402	.043	.038
High and Medium/high-tech manufacturing employment, 2003	-.073	-.331	.873	-.089
Value-added share agriculture, 2002	-.222	-.350	-.672	-.198
Business R&D expenditures, 2002	.335	-.050	.664	.267
S&T workers (HRSTO, occupation), 2003	.560	.178	.589	.382
Population share under 10 years of age, 2001	-.237	.060	-.015	.868
Life-long learning, 2003	.472	-.009	.165	.703
Activity rate females, 2003	.418	-.227	.281	.620

Note: Principal Component Analysis. Rotation Method: Equamax with Kaiser Normalization, a Rotation converged in 9 iterations. Main factor loadings are highlighted in bold. Source: MERIT, based on Eurostat data, mostly referring to 2002 or 2003

Based on the variable with the highest factor loadings we can characterise and interpret the four factors and give them a short symbolic name:

Public Knowledge (F1)

Human resources in Science and Technology (education as well as core) combined with public R&D expenditures and employment in knowledge intensive services is the most important or common factor hidden in the dataset. The most important variables in Public Knowledge are the education and human resource variables (HR S&T education and core). Cities with large universities will rank high on this factor. One interesting conclusion is that public and private knowledge are two different

factors (F1 and F3 respectively), which for instance has implications for policy issues regarding Science-Industry linkages. Public R&D and higher education seems especially related to high-tech services, whereas Business R&D especially serves high- and medium-high-tech manufacturing.

Urban Services (F2)

This second factor contains information on the structure of the economy. It is well known that industrial economies are quite different from services based economies. It is not a matter of development per se, because in the European regions the variety of economic structure is very large and for a large part based on endowments and path dependent developments like the extent to which government administration is located in a region or not. This factor takes into account the differences between an industrial area and a service based area including the public administration services of the government. Another observation is that there are two different 'urban' factors, indicating that academic centres not necessary co-locate with administration centres. What may not be surprising is that the Urban Services factor is not associated with R&D, since R&D is more relevant for innovation in manufacturing than for service industries.

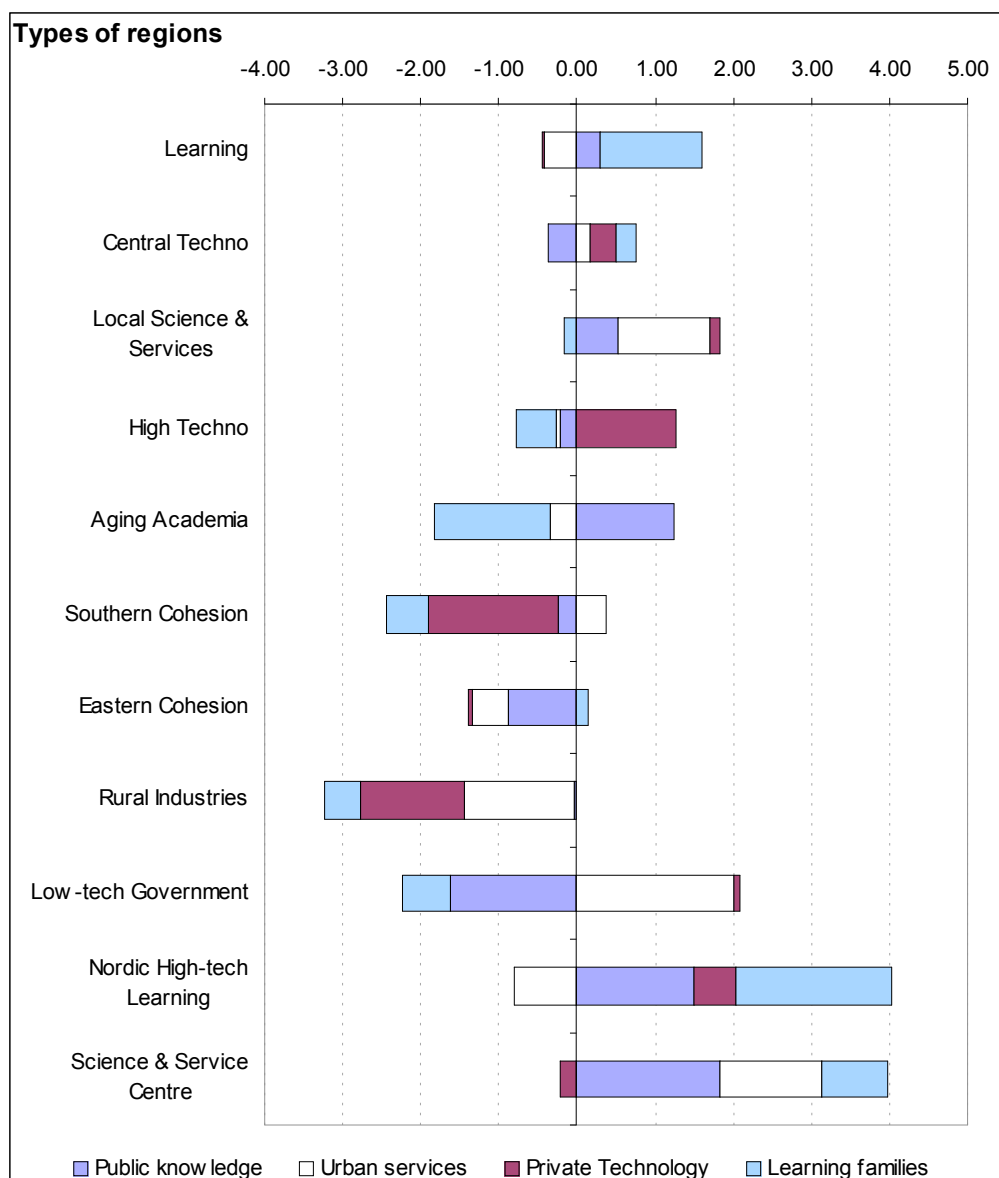
Private Technology (F3)

This factor contains business R&D, occupation in S&T activities, and employment in high- and medium-high-tech manufacturing industries. A countervailing power is the existence of agriculture in the region. One interpretation could be that agricultural land-use goes at the cost of possibilities of production sites. Another interpretation is that agriculture is not an R&D intensive sector.

Learning Families (F4)

The most important variable in this factor is the share of the population below the age of 10. Locations with relatively large shares of children are places that are attractive to start a family. Possibilities for Life Long Learning in a region seem associated with the lively labour participation of the mothers of these youngsters. The Learning Families factor could also be interpreted as an institutional factor indicating a child-, learning- and participation- friendly environment, or even a 'knowledge-society-life-style' based on behavioural norms and values that are beneficial to a knowledge economy.

A 1.2 Description of the 11 types of EU regions



1 Learning

The Learning regions are first of all characterised by the high score on the factor 'Learning Families', and the three main components of this factor: life-long-learning, youth and female activity rate. On the other factors the regions are close to the regional average. Unemployment is on average the lowest compared to the other EU regions. Employment in the government sector is limited. GDP per capita is rather high. The regions are located in Austria, Ireland, the Netherlands, Sweden and the UK. There are many similarities with the Nordic High-tech Learning regions, but the business sector in the Nordic version invest more in R&D.

2 Central Techno

This is a rather large group of regions located mostly in Germany and France with close to average characteristic, but the share of High-tech manufacturing is rather high. The factor-scores as well as GDP-per head is slightly above the regional average, except for the Public Knowledge factor which is slightly lower.

3 Local Science & Services

This group of regions with diverse nationality consist mainly of capital cities, such as Madrid, Warsaw, Lisbon, Budapest and Athens. These urban area's serve as national centres for business services, government administration, public research institutes and universities. Urban Services and Public knowledge are therefore the strongest factors for this type of region. GDP per capita is on average slightly below the EU25 average, but growing. The low score on life-long-learning is a weakness in most Local Science & Services regions, especially compared to the more wealthy and advanced Science & Service Centres.

4 High Techno

The High Techno regions host many high-tech manufacturing industries. They are mostly located in Germany (e.g. Bayern and Baden-Wurtemberg), some in Italy (e.g. Lombardia and Veneto) and two French regions. This type is very strong in Private Technology and has a high level of GDP per capita. The factors Public Knowledge and especially the Learning Family factor shows a relative weakness, e.g. in life-long-learning. Growth in terms of GDP per capita has been low and unemployment didn't improve much in the previous years.

5 Aging Academia

This group of regions is mostly located in East-Germany and Spain and also includes the capital regions of Bulgaria and Romania. The strength in the Public Knowledge factor is mostly based on the high share of people with tertiary education. The low score on the Learning Family factor is due to little life-long-learning and hosting relatively few children. The unemployment situation has improved, but is still very high.

6 Southern Cohesion

Southern cohesion regions are located in Southern Europe, consisting of many Greek, some Spanish and two Portuguese regions. The low score on the Private Technology factor is striking. There is hardly any high-tech manufacturing nor business R&D. Services is the most important sector, but also agriculture is still a rather large sector. The share of manufacturing industry in value added is very limited. Population density is low, but on average it has been increasing.

7 Eastern Cohesion

Manufacturing industries is the dominant sector, whereas services and agriculture are rather small sectors. This type of region is mostly located in Poland, Czech Republic, Hungary and Slovak Republic. Two Portuguese regions are also included. The Public Knowledge factor is the main weakness of this type of regions. However, the score on the Private Technology factor is close to average, which means that it is much stronger in this respect than the Southern Cohesion regions. Unemployment is high, even compared to Rural Industries and Southern Cohesion regions.

8 Rural Industries

Besides a low per capita GDP, Rural Industries regions have in common a low score on both the factors Urban Services and Private Technology. Population density is very low. The service sector is often very small. Especially agriculture but also manufacturing industries are relatively large sectors. Besides regions in Bulgaria and Romania and Greece, there is also a more Nordic sub-group consisting of Estonia, Lithuania and Itä-Suomi

9 Low-tech Government

This type of region, mostly located in southern Italy is characterised by a very low score on Public Knowledge combined with a high share of employment in the Government sector. Unemployment is severe, on average comparable to Eastern Cohesion regions. GDP per capita is however close to the regional average.

10 Nordic High-tech Learning

The Nordic version of the learning regions are typically strong in the Learning Family factor, but this type also has by far the highest business R&D intensity. In contrast with the popular characterisation of Nordic societies, the size of the government administration is the lowest of all the types. The low score on Urban Services is also due to the low population density. A rather unique feature of this type of regional knowledge economy is the combined strength in both the Public Knowledge and the Private Technology factor.

11 Science & Service Centre

The main characteristics of this urban group of regions are the high scores on the Public Knowledge and Urban Services factors. Population density is very high. This type also has the highest GDP per capita and productivity. The variables that are captured by the factor Learning Families also show a score above the regional average, but disappointing is the relatively low presence of high and medium-high-tech manufacturing and the business R&D intensity.

A.2 Qualitative analysis and preparation of country reports

In summary, the country reports were prepared in the following stages:

A first country document was prepared by the core study team in the form of a **template country report**. It contained overall guidance to the country experts and included a number of pre-filled tables, graphs and analysis sections based on information available at EU level.

Next, the core team members and the national experts who were involved in the pilot phase of the project commented completed elements of the templates. Drafted elements and templates were completed and compiled into **first country briefings (draft pilot reports)** by the national experts involved in the pilot phase of the project. These pilot country reports were prepared by experts for Belgium, Greece, Italy, France, and Poland.

Once the five first country briefings were completed, a **final set of guidelines** was prepared by the core team. These guidelines were agreed with the Commission services responsible for this evaluation. Prior to this, all first country briefings were reviewed during the January 2006 and presented to a first meeting of the scientific committee.

The work during the **country analysis phase** included:

- Undertaking a series of key interviews (KI) with policy decision makers;
- Organising a focus group (FG) with key national or regional RDTI stakeholders;
- Collecting additional information and finalising short case studies; and
- Preparing the synthesis notes of these various activities.

The above-mentioned work served as qualitative data and allowed the national experts to compile the draft **country reports**. All reports were subsequently reviewed, checked and finalised by the core team and the consortium members. Once this first check was completed, the core team organised a final peer reading of the document to verify its overall consistency and to ensure a final English language editing of the document. The core team then completed the final editing and layout of the document with a view to publication.

An overall synthesis report of all has been prepared and will be published by the European Commission providing an overview of the issues addressed in each of the 27 country reports produced by the evaluation team.

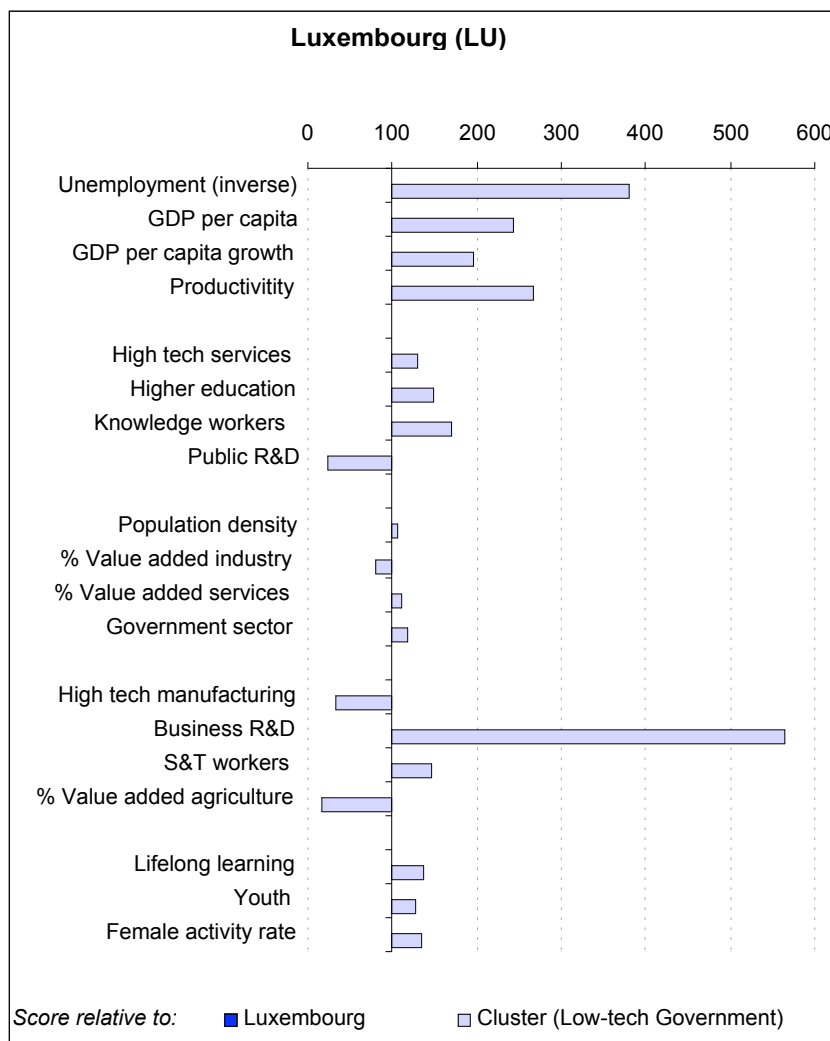
Appendix B Statistical tables and regional scorecards

B.1 Overall quantitative analysis per region (Luxembourg)

		Economic performance				Public knowledge				Urban services			Private technology				Learning families			
Cluster	Unemployment	GDP per capita		Productivity	High tech services	Higher education	Knowledge workers	Public R&D	Population density	% Value added	% Value added	Government sector	High tech manufacturing	Business R&D	S&T workers	% Value added	Lifelong learning	Youth		
		1996-2002	2002							2002	2002					2002			2002	2002
EU25		9.22	1170	4.8	4556	3.2	20.7	11.6	0.69	117	27.0	70.9	7.5	6.6	1.24	20.7	2.1	8.7	10.8	
Regional average		9.41	1888	2	3914	2.8	18.9	10.7	0.49	294	28.9	66.6	7.6	6.5	0.80	19.5	4.3	7.1	10.5	
Luxembourg	LU	3.74	5026	8.0	12980	2.9	14.9	10.5	0.13	173	16.8	82.6	15.3	1.4	1.58	23.9	0.6	6.3	12.9	
Relative to EU25		249	213	167	285	92	72	91	19	148	62	117	204	21	127	115	27	72	119	
Luxembourg	LU	9	3.74	5026	8.0	12980	2.9	14.9	10.5	0.13	173	16.8	82.6	15.3	1.4	1.58	23.9	0.6	6.3	12.9
Learning	1	4.32	3139	4.7	4900	3.2	22.1	12.5	0.40	216	30.5	66.0	6.0	6.2	1.12	22.0	2.4	15.1	12.2	
Central Techno	2	7.52	0700	4.0	4884	2.9	18.7	10.6	0.42	182	30.0	66.8	8.2	7.5	0.84	20.7	3.1	6.7	11.2	
Local Science & Services	3	9.21	9852	6.0	3780	4.3	23.6	13.7	0.88	389	22.0	76.2	9.8	4.6	0.79	22.4	1.8	5.9	10.4	
High Techno	4	6.12	5202	3.6	5591	3.1	17.5	10.3	0.58	288	31.7	66.7	7.3	11.9	1.31	22.8	1.6	5.6	9.7	
Aging Academia	5	13.31	7508	5.3	3649	2.5	27.4	13.2	0.67	185	30.1	66.9	7.6	6.7	0.57	18.8	3.0	4.8	7.4	
Southern Cohesion	6	10.71	6213	6.3	3082	1.2	14.7	8.2	0.37	66	19.9	70.0	7.5	1.5	0.11	11.2	10.2	3.1	10.0	
Eastern Cohesion	7	14.2	9776	5.3	1230	1.9	12.0	7.2	0.26	113	34.2	61.3	6.6	6.6	0.33	15.9	4.5	4.1	11.0	
Rural Industries	8	10.3	8204	5.6	1120	1.6	14.8	7.8	0.17	62	33.6	52.0	6.0	4.5	0.18	12.9	14.5	2.6	10.1	
Low-tech Government	9	14.11	8553	4.1	4848	2.3	10.0	6.2	0.55	161	21.2	75.1	12.9	4.2	0.28	16.2	3.7	4.6	10.1	
Nordic High-tech Learning	10	6.42	3323	4.7	5202	4.5	28.5	18.7	0.41	67	29.9	67.9	5.4	7.6	3.05	30.2	2.3	25.0	11.9	
Science & Service Centre	11	6.13	4489	5.3	6663	5.6	28.5	16.8	0.98	2118	16.8	81.2	7.4	3.8	1.00	30.5	0.8	12.8	11.4	

B.2 Regional Scorecards

Since the region Luxembourg is the same as the country Luxembourg, there is only one cluster scorecard for the entire area. For comments please see chapter 2.



Appendix C Categories used for policy-mix analysis

C.1 Classification of policy areas

Policy area	Short description
Improving governance capacities for innovation and knowledge policies	Technical assistance type funding used by public authorities, regional agencies and public-private partnerships in developing and improving policies and strategies in support of innovation and knowledge. This could include past ERDF innovative action programmes as well as support for instance for regional foresight, etc.
Innovation friendly environment;	This category covers a range of actions which seek to improve the overall environment in which enterprises innovate, and notably three sub groups: innovation financing (in terms of establishing financial engineering schemes, etc.); regulatory improvements and innovative approaches to public services and procurement (this category could notably capture certain e-government investments related to provision of services to enterprises) ; Developing human capital for the knowledge economy. This category will be limited to projects in higher education aimed at developing industry orientated courses and post-graduate courses; training of researchers in enterprises or research centres ³¹ ;
Knowledge transfer and technology diffusion to enterprises	Direct or indirect support for knowledge and technology transfer: direct support: aid scheme for utilising technology-related services or for implementing technology transfer projects, notably environmentally friendly technologies and ITC; indirect support: delivered through funding of infrastructure and services of technology parks, innovation centres, university liaison and transfer offices, etc.
Innovation poles and clusters	Direct or indirect support for creation of poles (involving public and non-profit organisations as well as enterprises) and clusters of companies direct support: funding for enterprise level cluster activities, etc. indirect support through funding for regrouping R&D infrastructure in poles, infrastructure for clusters, etc.
Support to creation and growth of innovative enterprises	Direct or indirect support for creation and growth of innovative firms: direct support: specific financial schemes for spin-offs and innovative start-ups, grants to SMEs related to improving innovation management, marketing, industrial design, etc.; indirect support through funding of incubators, training related to entrepreneurship, etc.
Boosting applied research and product development	Funding of “Pre-competitive development” and “Industrial research” projects and related infrastructure. Policy instruments include: aid schemes for single beneficiary or groups of beneficiaries (including IPR protection and exploitation); research infrastructures for non-profit/public organisations and higher education sector directly related to universities.

³¹ This is part of the wider area of in-house training, but in the present study only the interventions targeted to researchers or research functions will be analysed.

C.2 Classification of Beneficiaries:

Beneficiaries	Short description
<i>Public sectors</i>	Universities National research institutions and other national and local public bodies (innovation agencies, BIC, Chambers of Commerce, etc.) Public companies
<i>Private sectors</i>	Enterprises Private research centres
<i>Networks</i>	cooperation between research, universities and businesses cooperation between businesses (<i>clusters of SMEs</i>) other forms of cooperation among different actors

C.3 Classification of instruments:

Instruments	Short description
<i>Infrastructures and facilities</i>	Building and equipment for laboratories or facilities for university or research centres, Telecommunication infrastructures, Building and equipment for incubators and parks for innovative enterprises
<i>Aid schemes</i>	Grants and loans for RTDI projects Innovative finance (venture capital, equity finance, special bonds, etc.) for innovative enterprises
<i>Education and training</i>	Graduate and post-graduate University courses Training of researchers

Appendix D Financial and policy measure tables

D.1 Additional financial tables

D 1.1 RTDI plus business (innovation technology) support

Overall allocation of resources at an objective 1 and 2 level (allocated Euro)

Objective	Total cost	SF			NF	
		Total	ERDF	ESF	Public	Private
RTDI INTERVENTIONS						
Objective 2	25,917,499.00	7,775,250.00	7,775,250.00	0.00	18,142,249.00	0.00
TOTAL COHESION POLICY						
Objective 2	145,026,668.00	44,000,000.00	44,000,000.00	0.00	101,026,668.00	0.00

* the two digit code 15 was not taken into account to avoid overestimate

** the two digit code 16 was not taken into account to avoid overestimate

*** the two digit code 32 has been included. Figures may be slightly overestimated.

Overall allocation of resources at an objective 1 and 2 level (allocated Euro)

Objective	Total cost	SF			NF	
		Total	ERDF	ESF	Public	Private
RTDI INTERVENTIONS						
Objective 2	25,917,499.00	7,775,250.00	7,775,250.00	0.00	18,142,249.00	0.00
TOTAL COHESION POLICY						
Objective 2	145,026,668.00	44,000,000.00	44,000,000.00	0.00	101,026,668.00	0.00

Categories 181 to 184 plus:

152 Environment-friendly technologies, clean and economical energy technologies

153 Business organisation advisory service (including internationalisation, exporting and environmental management, purchase of technology)

155 Financial engineering

162 Environment-friendly technologies, clean and economical energy technologies

163 Enterprise advisory service (information, business planning, consultancy services, marketing, management, design, internationalisation, exporting, environmental management, purchase of technology)

164 Shared business services (business estates, incubator units, stimulation, promotional services, networking, conferences, trade fairs)

165 Financial engineering

D 1.2 Broad innovation and knowledge economy funding

Absorption capacity by field of intervention

CODES	ALLOCATED	DISBURSED	EXPENDITURE CAPACITY
OBJECTIVE 2			
152 Environment-friendly technologies, clean and economical energy technologies (only for large enterprises)	503,200.00	111,329.48	22.1%
162 Environment-friendly technologies, clean and economical energy technologies (only for SMEs)	503,200.00	111,329.48	22.1%
181 Research projects based in universities and research institutes	1,021,767.00	165,120.56	16.2%
182 Innovation and technology transfers, establishment of networks and partnerships between businesses and/or research institutes	218,405.00	28,238.67	12.9%
183 RTDI infrastructure	3,357,828.00	2,367,168.42	70.5%
32 Telecommunications infrastructure and information society (detailed information unavailable)	2,170,850.00	1,020,323.99	47.0%
TOTAL OBJ. 2	7,775,250.00	3,803,510.59	48.9%

This third calculation adds RTDI plus business (innovation & technology) support plus information society. As D.1.1 plus:

- 322 Information and Communication Technology (including security and safe transmission measures)
- 324 Services and applications for SMEs (electronic commerce and transactions, education and training, networking)

Luxembourg's strategic framework for the ERDF funds from 2002 connects *innovation* with an *information society*, thus recognizing the two topics shared impact on a knowledge driven economy.

D.2 Summary of key policy measures per programme

Exhibit 10: main measures in favour of innovation and knowledge

Identified RTDI measure or major project	Focus of intervention (policy areas classification)*	Main Instruments**	Main beneficiaries***
RTDI Infrastructure, among others the creation of the Cite de Science in the south.-> Even out inequalities in the availability of RTDI infrastructure	Boosting applied research and product development	Infrastructures and facilities	Private and public Research Institutes, companies, and government organizations
Improved Awareness of benefits and ways of Innovation -> Facilitate the diffusion of knowledge between companies, and between companies and research centres.	Support to creation and growth of innovative enterprises	Infrastructures and facilities	Private and public Research Institutes, companies, and government organizations
Research and development of new poles and clusters -> Focusing corporate efforts into new directions	Innovation poles and clusters	Infrastructures and facilities	Private and public Research Institutes, companies, and government organizations

* Classification of RTDI interventions: Improving governance capacities for innovation and knowledge policies; Innovation friendly environment; Knowledge transfer and technology diffusion enterprises; Innovation poles and clusters; Support to creation and growth of innovative enterprises; Boosting applied research and product development (see appendix).

**Classification of instruments: Infrastructures and facilities; Aid schemes; Education and training.

***Classification of Beneficiaries: Public sectors; Private sectors; Networks

Main source: OPs, evaluation reports, annual implementation reports, etc.

Appendix E Case study

There are no case studies for the mono region of Luxembourg available

Appendix F Further reading

“about... research”, Le Gouvernement du Grand-Duché de Luxembourg, Service Information et Presse, August 2003

Annual report 2004, Luxinnovation, National Agency of Research, Luxembourg

C/2001/2586, Decision de la commission No CCI : 2000.LU.16.2.DO.001

DOCUP Objectif 2 2000-2006, Complément de programmation, Grand-Duché de Luxembourg, Ministère de l'Economie, reference to DOCUP, no CCI : 2000.LU.16.2.DO.001

DOCUP Objectif 2 (2000-2006) pour le Luxembourg

ERAWATCH Prototyping Phase ESTO study

Evaluation à mi-parcours Objectif 2 Grand-Duché de Luxembourg, rapport final Décembre 2003, Version Révisée Janvier 2004, ADE-ECAU

FEDER Objectif 2 (2000-2006), Présentation du Programme, reference DOCUP, no CCI : 2000.LU.16.2.DO.001

Fiche de Candidature, Feder Objectif 2 (2000-2006)

Fonds National de la Recherche Luxembourg, Rapport d'Activités 2004

“Les activités d'innovation et de recherche au Grand-Duché de Luxembourg – Etat des lieux et pistes de réflexion”, rapport du Ministre de l'Economie et du Commerce Extérieur du Grand-Duché de Luxembourg, Septembre 2005, Luxinnovation

Ministère de l'Economie, FEDER Objectif 2 (2000-2006), 4e appel à proposition de projets

Objectif 2 – Luxembourg (2000-2006), Evaluation à mi-parcours Axe 1 et 3, Réunion du 11 novembre 2003 - Luxembourg - Luxembourg, AE-ECAU, Rapport final – Décembre 2003

“Plan national pour l'innovation et le plein emploi - Programme national de réforme du Grand-Duché de Luxembourg 2005”, Rapport du Grand-Duché de Luxembourg à l'Union européenne, Le Gouvernement du Grand-Duché de Luxembourg

Plan Quadriennal de l'Université du Luxembourg (2006-2009), Version finale, 22 mars

Proposition de mise à jour de l'évaluation à mi-parcours, Objectif 2 (2000-2006) Ministère de l'Economie et du Commerce extérieur, version du 18/11/2005, reference to DOCUP, no CCI : 2000.LU.16.2.DO.001

Rapport d'activité 2004, Centre de Recherche Public Gabriel Lippmann

Rapport d'activité 2004, Ministère de la Culture, de l'Enseignement supérieur et de la Recherche, Le Gouvernement du Grand-Duché de Luxembourg, Mars 2005

Règlement (CE) No 448/2004 de la Commission, du 10 Mars 2004, L 72/66 Journal Officiel de l'Union européenne, 11.3.2004

Strategic Framework for the Université du Luxembourg, 2006-2009, 2010-2015, Rolf Tarrach, Luxembourg, November 2005

List of useful websites at national and regional level

Luxembourg Ministry of Culture, Higher Education and Research:
<http://www.mcesr.public.lu/>

Luxembourg Ministry of Economy and Foreign Trade:
<http://www.eco.public.lu/>

Luxembourg Ministry of Small and Medium-sized Businesses, Tourism and Housing:
www.mcm.public.lu

University of Luxembourg: <http://www.uni.lu/>

Website of Luxinnovation, the National Agency for Innovation and Research:
<http://www.luxinnovation.lu/servlet/front>

Website of European Commission Regional Policy, 'InfoRegio', and the use of Structural Funds (Objective 2) in Luxembourg:
http://europa.eu.int/comm/regional_policy/country/overmap/l/l_fr.htm

Appendix G Stakeholders consulted

Name	Position	Organisation
Mr. Pierre Decker	Conseiller de Gouvernement 1ère classe	Luxembourg Ministry of Culture, Higher Education and Research
Ms. Delphine Dussain	Responsable de projets	Luxinnovation, the National Agency for Innovation and Research
Mr. Guy Poos	Representative for the Rector and Secretary of the Board of Governors	The University of Luxembourg
Mr. Gilles Schlessler	Secrétaire Général	Luxinnovation, the National Agency for Innovation and Research

No focus group was organised in Luxembourg and meetings were reduced to face to face interviews with above-mentioned people.