LUXEMBOURG

Small wonders: Luxembourg's scientific renaissance

Luxembourg has one of the highest standards of living in the world, but only opened its first university in 2003. How does this small country plan to make it big in science?

"The priority is to encourage public-private partnership."

Marc Schiltz, National Research Fund (FNR)

NESTLED AT the heart of Europe between Germany, France and Belgium, Luxembourg is respected for its financial acumen. Thanks to a history of solid economic growth, low inflation and low unemployment, the country's inhabitants enjoy an extraordinarily high standard of living and its GDP per capita is one of the highest in the world. With such a focus on fiscal strengths — the financial sector alone accounts for 30% of GDP — science took the back seat for many years. Prior to the 1980s, the country had few formal science policies or professional researchers. "Until recently there was no academic tradition in Luxembourg," says Marc Schiltz, secretary general of Luxembourg's National Research Fund (FNR). Now, after a shift in government priorities, one of Europe's smallest countries could soon become one of its most dynamic innovation hubs.

Luxembourg's scientific revolution began quietly in 1981 with the first allocation of public funds for the promotion of industrial research and development (R&D). Over the following few years the country's government officials began to appreciate the importance of building a research infrastructure. "The government realized that the European Union was creating framework programmes to fund research and that Luxembourg contributed to these funds without return," explains Fernand Reinig, director of the Gabriel Lippmann Public Research Centre (CRP Gabriel Lippmann), which specializes in applied research and technology. The rest of the country's innovation jigsaw was assembled piece by piece over the past three decades. In 1984, the government launched Luxinnovation, a national agency for innovation and research that provides support to public and private research partnerships. In 1987, it established the legal framework for the organisation of research in the country, which led to the creation of CRP Gabriel Lippmann and two other public research centres, CRP Henri Tudor and CRP Santé (see Inside View on pages 6–7). A social science research centre, CEPS/INSTEAD, opened its doors in 1989, and ten years later the government established a department of research and created the FNR. In 2003, Luxembourg's four higher education institutions were consolidated into the University of Luxembourg.

The creation of a basic research infrastructure has spurred on the country's ambitions, and the government now plans to exploit Luxembourg's prime location to firmly establish it on the European research map. Diversifying the economy will also help reduce a dependency on the banking sector. The challenge now is how to outshine the country's neighbouring R&D stars such as Germany and France, which developed research strategies far earlier. "The size of the country means that we do not have a critical mass to perform research in all directions at the same time," says Schiltz. To capitalise on the benefits of Luxembourg's small size, such as its agility, the government has adopted a two-pronged strategy to develop its research: exploiting international connections and targeting funding in niche sciences.

FONDS NATIONAL DE LA RECHERCHE

Marc Schiltz, secretary general of Luxembourg's National Research Fund (FNR), says the country must carry out specialized research because of its small size.

Going global

With a small internal market, Luxembourg had no option but to pursue a global strategy in order to promote the results of its research to world markets. »

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"With emerging countries such as China, India and Brazil, the only solution for us is to create products with high added-value and high margins," explains Gilles Schlesser, director of Luxinnovation.

To implement its strategy, Luxembourg has built on its unique features: its location at the crossroads of Europe and its truly international workforce, more than half of which — about 90,000 workers — come from neighbouring countries. It has established bilateral research agreements with key organisations in the countries that share its borders, including the German Research Foundation (DFG), the French National Centre for Scientific Research (CNRS) and the Federal Fund of the Flanders Region (FWO) in Belgium. Further afield it also collaborates with the Swiss National Science Foundation (SNSF) and the US National Science Foundation.

Such drive for international collaboration has already yielded success stories in the biomedical sector. In 2008, the government invested €140 million to create the Integrated BioBank of Luxembourg (IBBL), the Luxembourg Centre for Systems Biomedicine (LCSB) and Luxembourg Project Lung Cancer in an ambitious plan with three prominent US researchers: Jeffrey Trent from Arizona's Translational Genomics Research Institute (TGen), Nobel laureate Lee Hartwell, director of the Partnership for Personalized Medicine and president of the Fred Hutchinson Cancer Research Center in Seattle, and Amgen co-founder Leroy Hood, president of the Institute for Systems Biology in Seattle. The IBBL has started collecting blood and tissue samples to support Luxembourg Project Lung Cancer and has expanded its focus to include colon and breast cancer, diabetes and public health research. One of the LCSB's research priorities is Parkinson's disease, and in January this year it announced a collaboration with Cambridge University in the United Kingdom that will involve a systems biology approach to research into the disease.

The country's strength in collaboration is bolstered by its multilingual population — French, German, Luxembourgish and English are spoken fluently by many — and its truly international graduates. Because the University of Luxembourg was only established in 2003, many graduates currently working in the country have studied abroad. The university also has a strong international focus, with more than one third of its students hailing from other countries.

To add to its foreign connections, Luxembourg is linked to key international scientific organisations. It has been an official member of the European Space Agency (ESA) since 2005, and since 2009 it has hosted the World Health Organisation's Collaborative Centre for Reference and Research on Measles Infections, based at CRP Santé.

Targeted funding

During the 1990s it became clear that Luxembourg would need to develop a targeted funding structure to make the most of its emerging research infrastructure. Following examples of best practice from other EU countries, FNR started coordinating the distribution of a large share of public research funds. In 2007 it launched the Foresight exercise to help focus and optimize its spending in priority areas, which include: information security and e-commerce; sustainable resource management; materials, surfaces and sensors; and biomedical sciences.

These investments are already showing signs of a return. For example, in 2005 the European Network of Excellence Nanobeams was created, comprising 12 partners with expertise in analysis of nano-scale materials using ion and electron beams. Coordinated by CRP Gabriel Lippmann, the network includes manufacturers of scientific instruments as well as the leading laboratories in the nanoanalysis field from Germany, Belgium, the United Kingdom and France. The success of the network has led to the creation

Luxembourg Centre for Systems Biomedicine

The Luxembourg Centre for Systems Biomedicine (LCSB) at the University of Luxembourg is accelerating biomedical research by closing the link between systems biology and medical research. Neurodegenerative diseases like Parkinson's disease, metabolomics and disease network analysis are in the focus of LCSB's research. Key strategic partnership has been set-up with the Institute for Systems Biology (ISB) in Seattle, USA.

LCSB

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Bioinformaticians or Computer Scientists for Bioinformatics Core Facility (m/f)
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Postdoc in Metabolomics / Nanostructure Initiator Mass Spectrometry (m/f)
including a 6 month internship at Lawrence Berkeley National Laboratory, USA
Ref. I1C-DIR-COM-080000, full time, employee status

Postdoc and PhD student in Human Microbiomics (m/f)
Ref. I1C-DIR-COM-080000, full time, employee status

Postdoc and PhD student in Microbial Eco-Systems Biology (m/f)
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LE FONDS BELVAL

of a 'PhD school' for nanoanalysis at CRP Gabriel Lippmann. The materials science sector is also helping to attract highly qualified scientists from across the globe. "Recruitment is increasingly done outside the EU, for example in China and India, owing to the lack of candidates from Europe," says Reinig of CRP Gabriel Lippmann.

FNR has a number of innovative funding programmes to help finance research in Luxembourg and further afield. Its AFR grant scheme funds PhDs in any country for all nationalities in research areas of strategic importance to Luxembourg. "In addition, we have grants to finance PhDs and postdoctoral students working in companies that collaborate with a university or a public research centre," says FNR's Schiltz. Supplementary grants designed to encourage leading researchers from outside the country to relocate their laboratory to Luxembourg are also available; up to €1.5 million is on offer under the ATTRACT scheme and up to €5 million under the PEARL scheme.

Although Luxembourg's overall gross expenditure on R&D (GERD) is relatively modest compared with other European countries, the government's total budget to support R&D in both the public and private sectors has grown almost ten-fold in the past decade, increasing from €28 million (0.13% of GDP) in 2000 to €247 million (0.68% of GDP) in 2010.

Private sector strength

A defining feature of science in Luxembourg is that the majority of the country's R&D comes from the private sector. In 2008 four-fifths of the country's GERD was financed by industry, compared with around half in Ireland and three-quarters in Sweden. Some companies were also active in research prior to the country's academic awakening in the 1980s — Goodyear has been developing innovative tyres at its European R&D centre, GIC*L, in central Luxembourg since 1957.

Architect's impression of the House of Knowledge, the main building of La Cité des Sciences, de la Recherche et de l'Innovation due to be completed in 2014.

Promoting private investment in R&D has been a priority for the government since it began building the country's scientific capacity. Initially it focused on research that enhanced existing industries such as steel manufacturing and automotive equipment. More recently, the government has implemented several policies and regulations to foster collaboration between the private and public sectors. In 2002, it launched the Cluster Initiative to encourage cross-sector networking. The five primary 'clusters' focus on materials, information and communication technology, space, biomedicine and eco-innovation. Legislation introduced in 2009 contained a broad spectrum of incentives for collaboration, such as grants for up to 80% of expenses incurred by private companies, as well as general research and development awards. For the government, "the priority is to encourage public-private partnership," says FNR's Schiltz.

Companies to benefit from this unique support framework include those in the information security and trust management sector, which is essential for the continued stability of Luxembourg's banking and financial institutions as well as the development of other areas of innovation. For example, the University of Luxembourg now hosts the Interdisciplinary Centre for Security, Reliability and Trust, which involves private and public researchers from Luxembourg and several other European countries. Recruitment of scientists to serve the needs of this sector is on the increase, according to Reinig of CRP Gabriel Lippmann.

A city of science

Few countries have experienced the rapid formation of an R&D infrastructure as has Luxembourg. To fasten connections between stakeholders, many of the country's research activities will centre on a new science park known as La Cité des Sciences, de la Recherche et de l'Innovation (see image). This €650-million initiative represents an integral part of a large-scale brownfield redevelopment in Belval in southern Luxembourg. The LCSB, currently based at the University of Luxembourg in Luxembourg City, will be the first research centre to be inaugurated at the park in September 2011. A personalized medicine symposium will be held on the new campus in September to mark its opening. A new headquarters for the university's science faculty is due for completion in 2014, and the country's three public research centres will all eventually have facilities at the Cité's campus.

"The new science park is an integral part of Luxembourg's ambition to reinvent itself," says University of Luxembourg spokeswoman Britta Schlüter. The country's private sector strengths, agility and focus on specialised research provide ample opportunities to achieve this ambition and establish Luxembourg as an innovation hub. And what is good for science is also good for business, says Luxinnovation's Schlesser: "Companies increasingly realize that innovation is key for survival on competitive markets."

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More information about ATTRACT and PEARL as well as the other funding opportunities offered by the National Research Fund Luxembourg can be found on the FNR's website.
Go and see what's behind on **www.fnr.lu**

Fonds National de la Recherche Luxembourg
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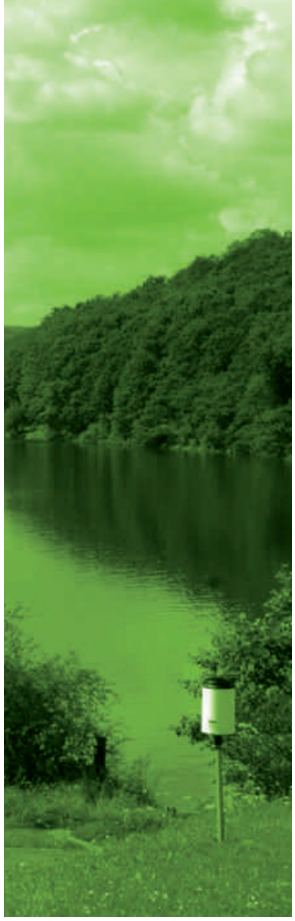

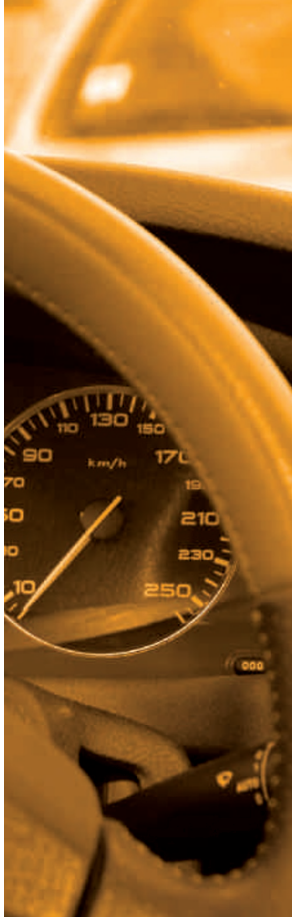

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