

## **How to Build a Sustainable Public Research system in a Small Country with Limited Human Resources? The Luxembourg Case**

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**Submitted to the new theme “Design and use of indicators for small countries & regions”**

In Luxembourg, a small open economy, the interest for public research policies rose in the late 1980s. The building of the national public research system started in 1987 with the creation of three public research organisation (PROs) to carry out research and development (R&D) and technology transfer projects: the Public Research Centre for Health (CRP-Santé) focussed on biomedical research, the CRP-Gabriel Lippmann and the CRP-Henri Tudor Public Research Centres, both devoted to applied scientific research and technological development. 1989 saw the creation of a fourth PRO, Ceps/Instead, dedicated to social sciences research but it is only in 2003 that a university (the University of Luxembourg) was created. This creation implied a major change from education focus to research focus (OECD, 2007, p.155). Today these five main PROs constitute the research function of the Luxembourg public research system (Barré, 2007).<sup>1</sup> In 1999, two main actors of the public research system appeared: the Ministry of Culture, Higher Education and Research with intent of the orientation of the system and the National Research Found (FNR) in charge of the program function. It translates objectives defined by the government in priorities and research programs and allocates resources between PROs on the basis of research project funding. In 2006, the FNR launched a Foresight exercise aiming at identifying research domains and priority axes for the public sector. Six domains were identified as national research priorities: Innovation in services, Sustainable resource management, New functional and intelligent materials, Biomedical sciences, Labour market, educational requirements and social protection, Identities, diversity and integration). At the end of 2007, FNR put in place new pluri-annual research programs based on the results of the Fund's Foresight study and priorities.

The resources affected to this newly born national public R&D will be analyzed as well as its ability to produce high quality research results. Even if funding might not be a major problem in Luxembourg (the country is having the highest growth domestic product per capita - GDP/capita - in EU27), attracting and maintaining highly skilled human resources in a system under construction is still a challenge to take up<sup>2</sup>.

In order to investigate these issues, a first section will analyse the Luxembourg national public research's catching-up based on the R&D expenditures, human resources and scientific publications. A second part will focus on one specific PRO, the CRP-Santé. This case study aims at linking the evolution of the scientific production of CRP-Santé to the different steps of its construction and following its progressive insertion in the scientific community. The influence of the characteristics of the researchers (senior versus junior, country of education or training or previous working experience) on their scientific production at CRP-Santé will be emphasized. The ability of senior researcher educated abroad in establishing preferential and sustainable international collaboration with their former institutions will be given a particular attention.

Funding and human resources were extracted from the Eurostat website and publications from the on line Web of Science (WoS) database. The CRP-Santé case study was carried out using complementary sources such as on line researchers' cv, internet social network, the annual activity reports and the website of the CRP-Santé.

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<sup>1</sup> To that may be added several smaller public institutes (see OCDE, 2007, p.136 for a detail list). Some of these institutes are partly doing research even if their main functions are not focus specifically on research.

<sup>2</sup> “That's no problem at all for the employment of young researchers (junior researcher, Post-doc and PhD) and confirmed researchers for a short time period (visiting professor). However, it remains more difficult to attract confirmed researchers who already occupy a senior position”, Chambre de commerce Luxembourg (2011).

## **Catching up of the public R&D system**

**Resources:** In 1999, it was targeted to allocate to public research 0.3% of the GDP in 2004 and 1% in 2014. Between 2000 and 2009, the Luxembourg increased more than threefold the ratio of the public GERD/GDP (from 0.12% in 2000 to 0.44% in 2009).<sup>3</sup> If the public GERD/GDP (0.44%) still remains lower than the EU27 average (0.75%) in 2009, the GOVERD/GDP has caught up the EU27 level since 2008 (figure 1). Besides, the GOVERD/capita in Luxembourg is the highest one in Europe, being three times higher than the EU27 average and two times higher than in Germany. Thus, in Luxembourg, the funding allocated to public research should not be a factor slowing down the development of the public R&D. However, progresses still have to be made in the higher education sector. The HERD/GDP remains very low in 2009 (0.15% comparing to the EU27 average of 0.48%), but it has to be kept in mind that the University of Luxembourg is very recent, small (less than 3000 students in 2008) and does not cover all the domains (absence of a medical university, no faculties in pharmacology, architecture, art and design ...). Furthermore, there is a strong tradition for studying in foreign universities and, in 2006, 80.8% of the Luxembourg students were still studying in foreign EU27 universities.

Since 2002, the percentage of researchers from the public sector in the total population in Luxembourg is similar to the EU27 average (0.15% in Luxembourg, 0.16% in EU27 in 2008) but the human resources are still essentially concentrated in the public research centres only (8.4% of total researchers in Luxembourg belongs to the higher education sector, 40.5% in EU27 in 2008). Two features characterize the population of researchers in Luxembourg: they are young researchers (more than half of them are under 35) and the majority of them are not nationals (70% of them migrate from another European countries). The past (and further) development of the Luxembourg research system is thus linked to its ability to attract and maintain foreign and senior researchers. If Luxembourg is attractive in terms of wages and working conditions, its lack of the academic prestige may be considered as a real drawback considering the worldwide increasing competition to attract highly skilled researchers.<sup>4</sup>

**Scientific publications:** Luxembourg offers the unique possibility to follow the growth of the volume of scientific publications since its early beginning. In the early 1970s, only a very few publications originated from Luxembourg (from the private sector or European related institutions) and one had to wait the end of the 1970s to detect a first raise of the production linked to the creation of the Luxembourg Hospital Centre. In the 1990s, a further increase of the production follows the creation of the public research centres, but one has to wait until the creation of the University of Luxembourg in 2003 to assist to the take-off of the yearly number of publications and of the Luxembourg world share of publications (figure 2). This boom results from the production of the university but also from a steep increase of the production of all the main public research centres (CPR-Santé, CRP-Tudor, CRP-Lippmann). Within a few years, the volume of publications of the university with limited human resources exceeded that of the public research centres. The creation of university was thus a key step for the promotion and stepping up of the R&D. It quickly became a central pillar of the R&D system and enhances the overall research activity in Luxembourg.

## **Case study: the Public Research Centre for Health (CRP-Santé)**

The CRP-Santé, the leading public organisation for research in life sciences in Luxembourg, was founded in 1987. Its budget had risen from 3 million Euros in 2000 to 26.6 million Euros in 2009. Between 2005 and 2009, the CRP-Santé had also a huge increase of its staff (from 116 people in 2005 to 239 people in 2009). In 2009, its employees include 44% of researchers, 12% of student researchers among which only 26% originate from Luxembourg. The foreign employees essentially come from the neighbouring countries (35% from France, 19% from Belgium and 7% from Germany). Today, the

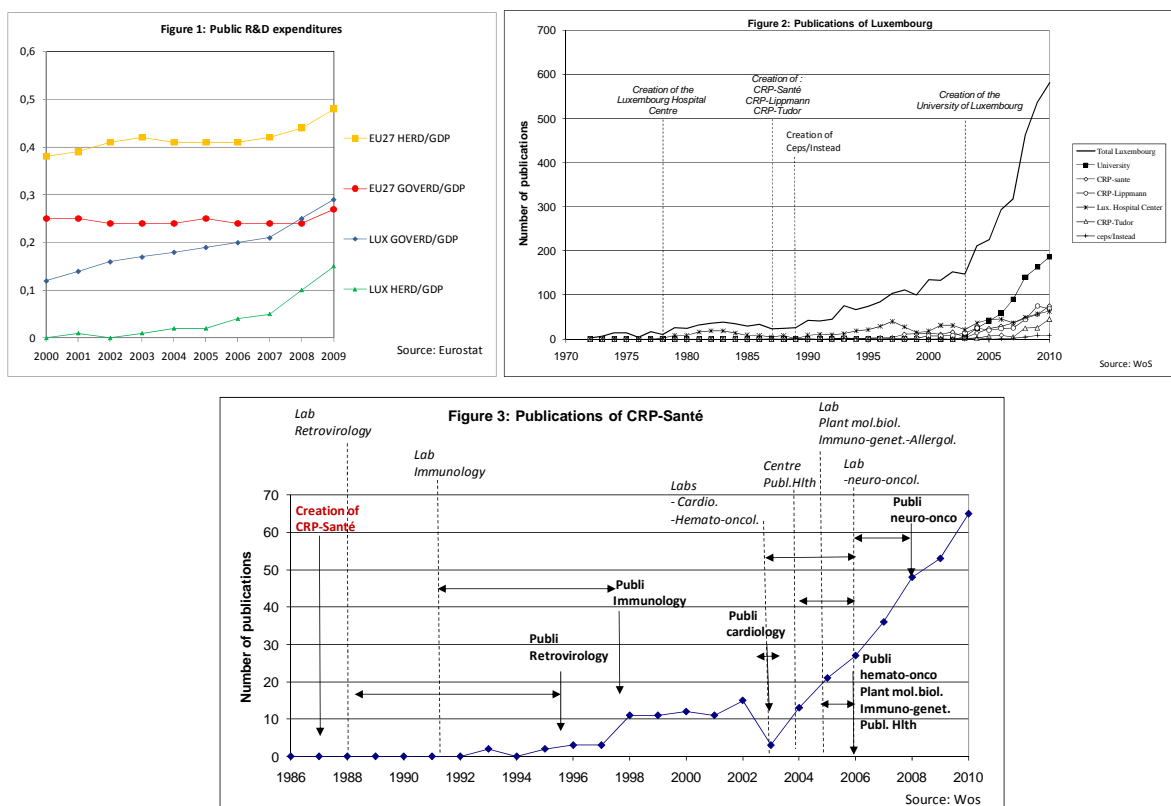
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<sup>3</sup> Public gross domestic expenditure on R&D (public GERD) = GOVERD + HERD + PNPRD. GOVERD is the government expenditure on R&D. HERD is the higher education expenditure on R&D. PNPRD is the private non-profit expenditure on R&D, which is equal to zero in Luxembourg.

<sup>4</sup> In 2008, the impact index of the Luxembourg publications is 0.70, below the world average (1.0); it is 1.04 in the EU27 –Report on Science and Technology Indicators from OST (2010)

research activities of CRP-Santé are developed within five thematic research departments (cardiovascular diseases, immunology, oncology, public health and virology-allergology-immunity).

During the first ten years, research at CRP-Santé did not produce a lot of articles. From 1998, the production was around ten publications per year but it grew rapidly from 2004 to 2010 (figure 3). This rise is linked to a diversification of the research domains in CRP-Santé with the creation of several new laboratories between 2003 and 2005. The delay between the creation of the new laboratories and the beginning of their scientific publications was rather short (one to three years). Since its beginning, the CRP-Santé is strongly embedded in international collaborations whilst national collaborations with the other institutions of the medical field are rather rare (and resulted probably from multi-affiliations of researchers). The growth of the production is associated to a diversification of the foreign collaborations (47 countries cosigned publications with the CRP since 2008 while only France and Germany had done it before 1997). We are currently investigating the link between the level and diversification of international collaborations with the researcher's background. First results may indicate that a high number of the senior researchers of CRP-Santé have established continuous collaborations with the foreign institutions they originated from (as PhD or Post-doc).



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