

Chapter 3 Human resources in science and technology



1 - Introduction

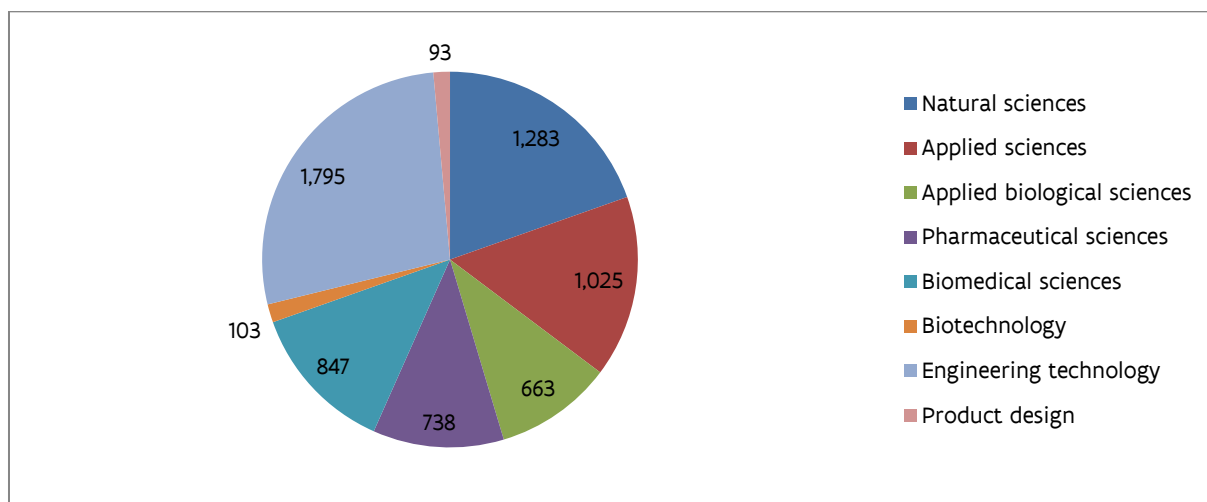
Highly educated and skilled personnel are a key resource for science and technology. Consequently, indicators for Human Resources in Science and Technology (HRST) are very important. HRST statistics always focus on two main aspects. Firstly, the stock of HRST that focuses on the characteristics of the current labour force involved in science and technology. Secondly, the flows showing the job-to-job mobility and the inflow from education to the science and technology labour force. In this case, particular attention is paid to scientists and engineers, who are often the innovators at the centre of technology-led development.

2 - S&T students

More than six out of every ten students start in higher education after their secondary education. In the 2015-2016 academic year, 47,457 students enrolled for the first time at a Flemish university or a university college. Of this group, known as first entry students, more than half started a professional Bachelor training at a university college.

About 6,547 first entry students (about 33% of the total) at the universities start in the S&T domains (grouping together the natural sciences, applied sciences, applied biological sciences, pharmaceutical sciences, biomedical sciences, biotechnology, engineering technology, product design).

Figure 20: The number of first entry students at Flemish universities in the S&T domain for the academic year 2015-2016, in absolute terms



Source : Education department – DHO database

In the professional and academic Bachelor at the university colleges, nearly 17% of first entry students opt for a study within the following science and technological domains: biotechnology, industrial sciences and technology, nautical sciences and product development.

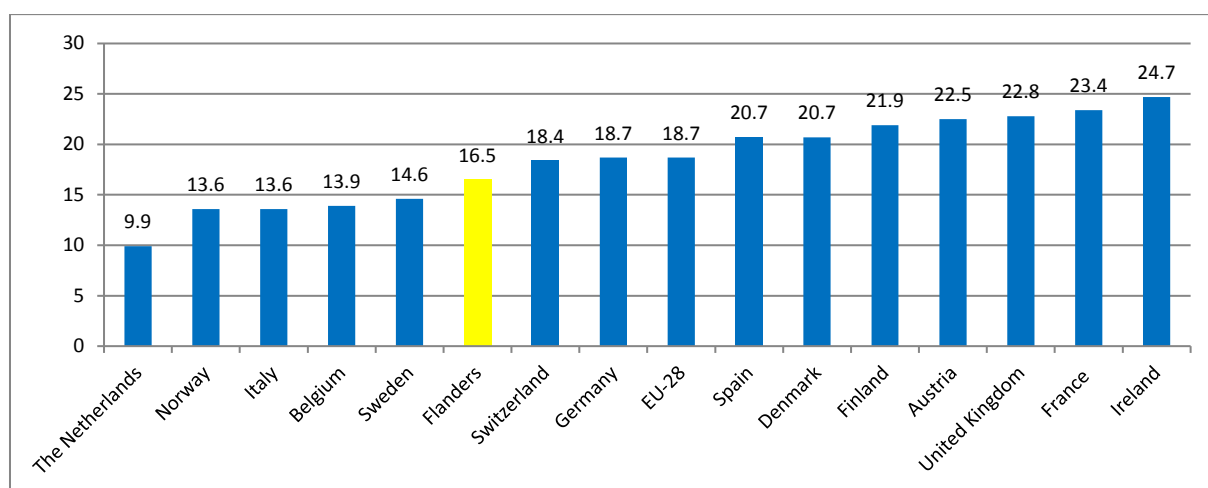
3 - S&T graduates

There has been a steady increase since 2003 (12.3%) in the 20-29-year-old population of Flanders with a higher degree in mathematics, science and technology. In 2013-2014, the figure was the highest with 16.5%. For 2014-2015 a slight decrease can be noticed. In this respect, Flanders ranks below the EU-28 average (18.7%) and the gap with the leaders - Ireland (24.7%), France (23.4%) for 2014, the United Kingdom (22.8%) and Austria (22.5%) - remains very high. On the other hand, Flanders scores better than the Netherlands, Norway, Italy and Sweden.

Table 6: Evolution of the proportion of graduates in mathematics, science and technology (higher education) in Flanders for the age group 20 to 29 years (2007-2015)

Academic year	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
Flanders	14.0	14.2	13.9	14.0	15.1	14.9	16.5	15.0

Table 7: International comparison of the proportion of graduates in mathematics, science and technology (higher education) for the age group 20 to 29 years (2013-2014)



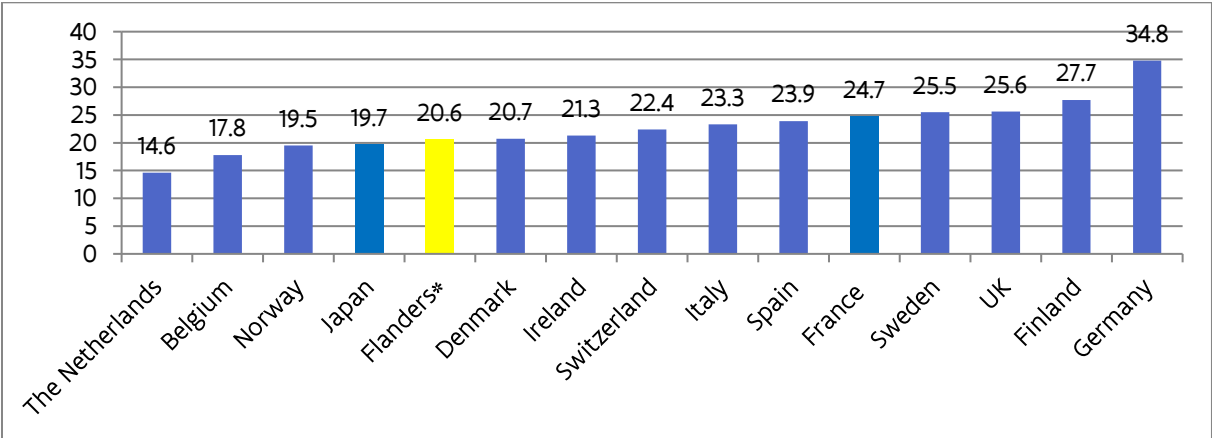
Source : Education department – DHO database

The proportion of S&T graduates in the total number of graduates in Flanders increases slightly between 2011 and 2014. Viewed from an international perspective, in 2013-2014 Flanders was ranked rather low and well below the leaders (Germany, Finland, the UK and Sweden), where more than 25% of all degrees are awarded in science, mathematics and technology. The Netherlands, Norway and Japan also score poorly with regard to their proportional number of ST&M graduates.

Table 8: Evolution of the percentage of degrees in mathematics, science and technology in higher education as a proportion of all degrees in higher education for Flanders (2012-2014)

Academic year	2011-2012	2012-2013	2013-2014
Flanders	17.8%	18.7%	20.6%

Figure 21: International comparison of the percentage of degrees in mathematics, science and technology in higher education as a proportion of all degrees in higher education (2014)



Source : Education department – DHO database; *Flanders: figures for Flemish Community

4 - R&D personnel

In 2015, the total number of R&D personnel for Flanders reached 46,517 full-time equivalents (FTE), which is an increase of 22.8% since 2010. Over the past five years, the number of research staff has increased both in companies and in the public sector. The public sector groups together all research institutes from the higher education sector (HES), the government sector (GOV) and the private not-for-profit sector (PNP). The majority of the R&D personnel (59.3%) work in the private sector (BES). The overall share of the public component (PNP, HES and GOV) rather declines since 2010. The HES component is the most important element of the public component (with 14,454 FTE or 76.4%) in 2015, followed by the GOV component (4,212 FTE or 22.3%).

Figure 22: Evolution of the R&D personnel from 2009 to 2015

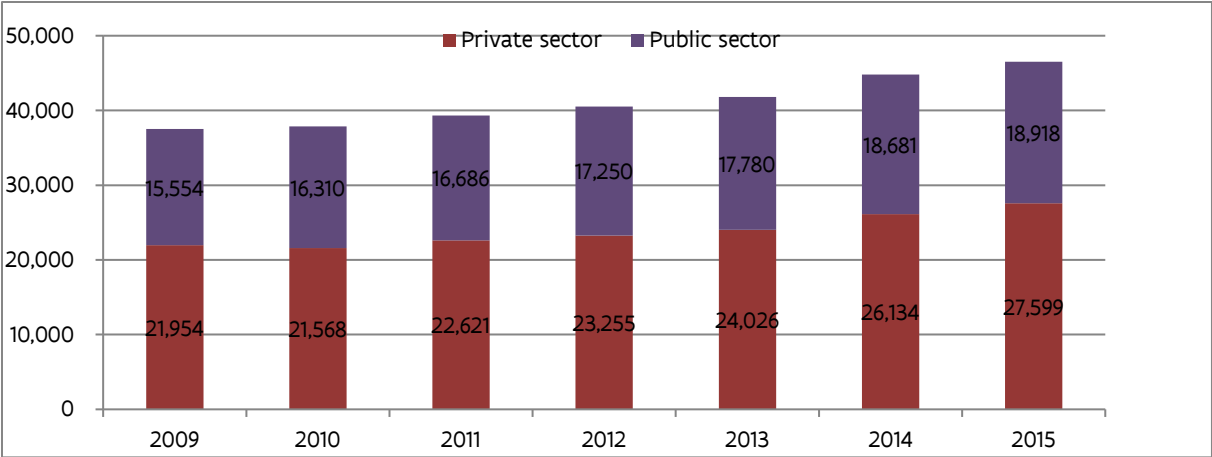
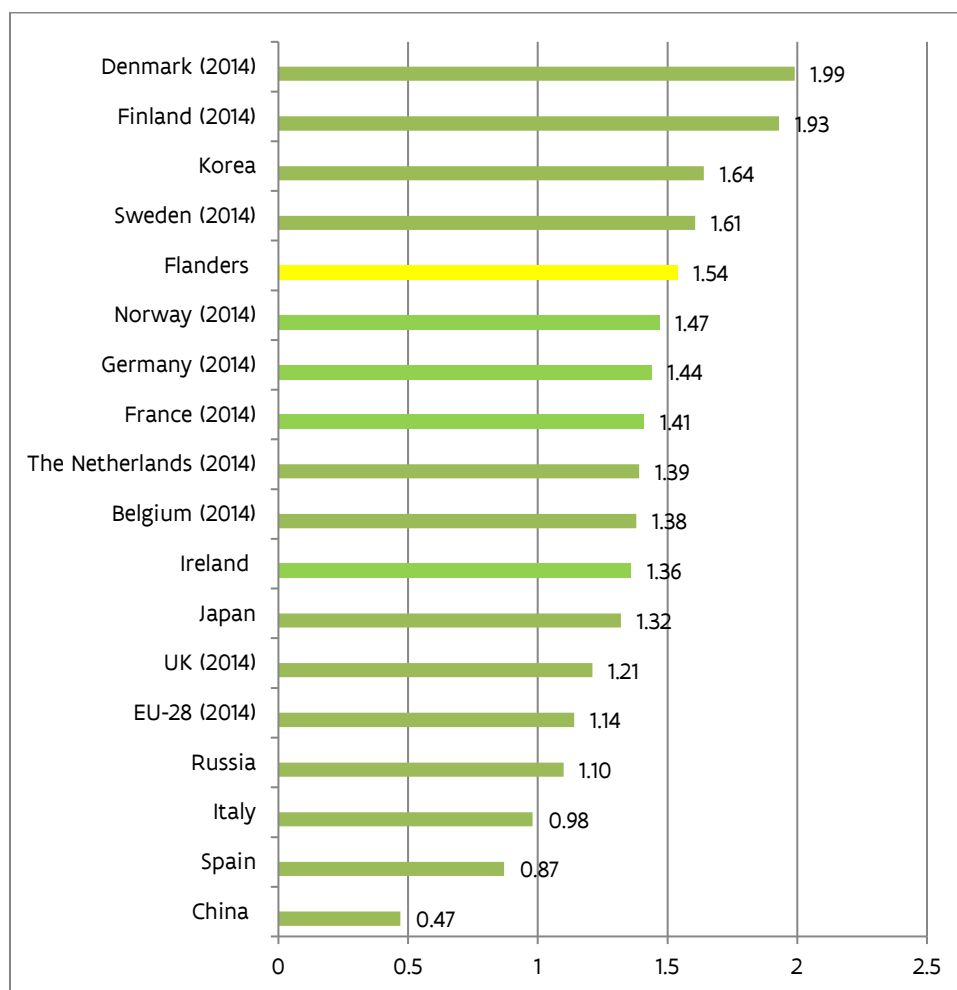


Figure 23: International position of Flanders for total R&D personnel (% of the labour force) (2015)



Source: OECD database, Main Science and Technology Indicators

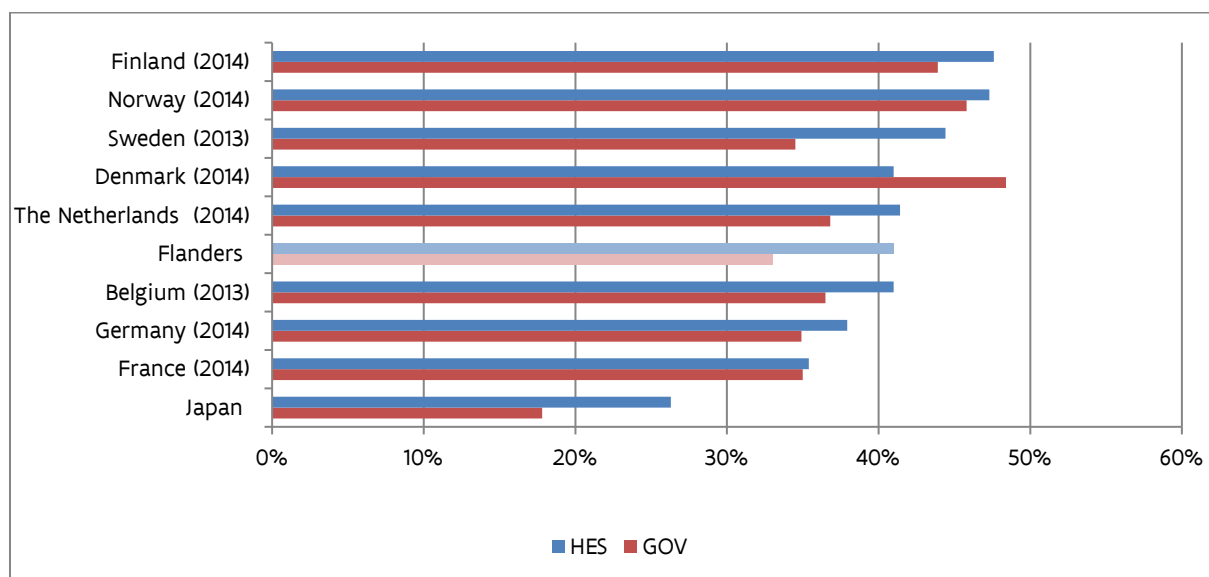
Spain, Sweden and the UK : estimated and rather overestimated; Russia, EU-28, the Netherlands, Germany, France, Japan and Denmark: estimated data

The level of R&D personnel corresponds to 0.72% of the total population and 1.54% (2015) of the labour force. Flanders therefore belongs to the sub-top with regard to R&D personnel numbers as a proportion of the total population. The Flemish figure is higher than the EU-28 average and compares favourably with the French, the German and the Norwegian figures. However, the other Scandinavian countries still have a significant lead.

81.4% of the R&D personnel working in the HES on R&D activities in Flanders are researchers (2015). This figure is high compared to the other European countries and much higher than the EU-28 average. Approximately 62% of the R&D personnel (2015) in the GOV in Flanders are also researchers. Once again, this figure is higher than for France, Germany and the EU-28 average, but this time lower than most of the Scandinavian countries.

With a figure of 41% for female researchers working in the higher education (HES), Flanders again compares favourably with neighbouring countries (the Netherlands and France), but the Scandinavian countries show higher rates here. For female staff working in public research centres (GOV), Flanders has a score quite similar to Germany and France, but once again cannot match the performance of the north European countries. Flanders needs to work harder to follow the international trend of an increasing proportion of female researchers in both HES and GOV.

Figure 24: International comparison - % share of women researchers in GOV and HES (headcount) (2015)



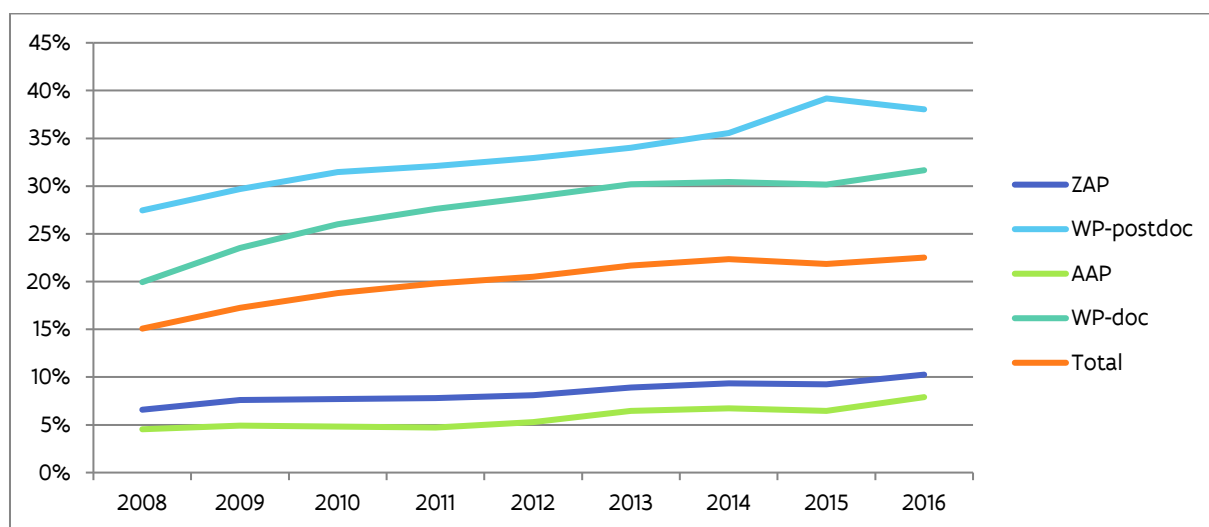
Source: OECD database, Main Science and Technology Indicators

EU-28, USA: no recent data available; France: underestimated data and break in time series; The Netherlands: includes other classes (GOVERD); Sweden and Germany: break-in-time series.

5 - Mobility of researchers

Between 2004 and 2016, the existing pattern of nationality for all statutes and levels of academic careers in Belgium gradually changed. These changes were least pronounced for Assisting Academic Staff or AAP (in 2004, 95.6% were Belgians and 92.1% in 2016) and for Senior Academic Staff or ZAP (95.0% in 2004 and still 89.7% in 2016). However, the changes were particularly strong for Scientific Staff or WP, above all in the sub-category “post-doctorates”, where the number of Belgian researchers declined from 77.2% in 2004 to 62.0% in 2016. The same trend is also noticeable for doctoral researchers: from 88.3% in 2004 to 68.3% in 2016.

Figure 25: Evolution of the non-Belgian nationality of researchers for the different statutes and levels of the academic career (2008-2016)



Source: VLIR

Dutch, Italian and German researchers are strongly represented among the group of foreign researchers in Belgium, but also researchers from China, Spain and India are quite good represented. Foreign researchers are mainly found in the doctoral and postdoctoral sub-categories. The share of non-EU researchers for ZAP (Senior Academic Staff) or AAP (Assisting Academic Staff) personnel is rather limited to 1.5% of the total.

The Human Resources in Research Flanders (HRRF) database indicates that 74.4% of the researchers who obtained a PhD in the academic years 2006-2007 to 2008-2009 were no longer active in a post-doc or ZAP function at a Flemish university, three years after getting their PhD. The largest part of these will most likely be employed by the non-academic labour market in Flanders. But a relevant part of these will be continuing an academic career outside Flanders. Unfortunately no reliable information is available on the size of each of these groups. A study some years ago showed the most popular destinations for Belgian Phd holders to continue their career. Most of them went to the United States due to the availability of positions at renowned research institutes. Belgian researchers also frequently chose neighbouring countries with strong research tradition, such as France, the United Kingdom, the Netherlands and Germany. This mobility pattern was similar to other Western European countries.

Figure 26: Evolution of the number of PhDs in Flanders by gender from 2004-2005 to 2015-2016

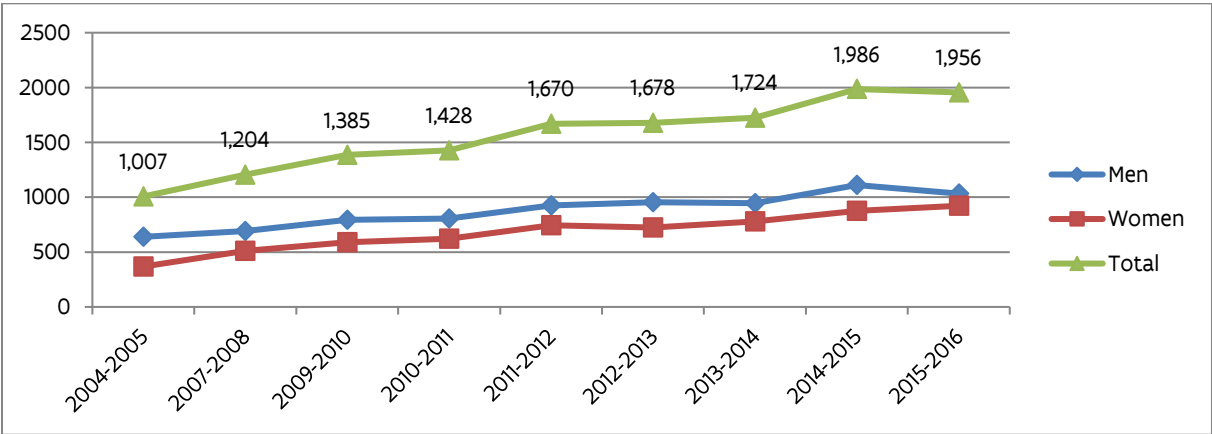
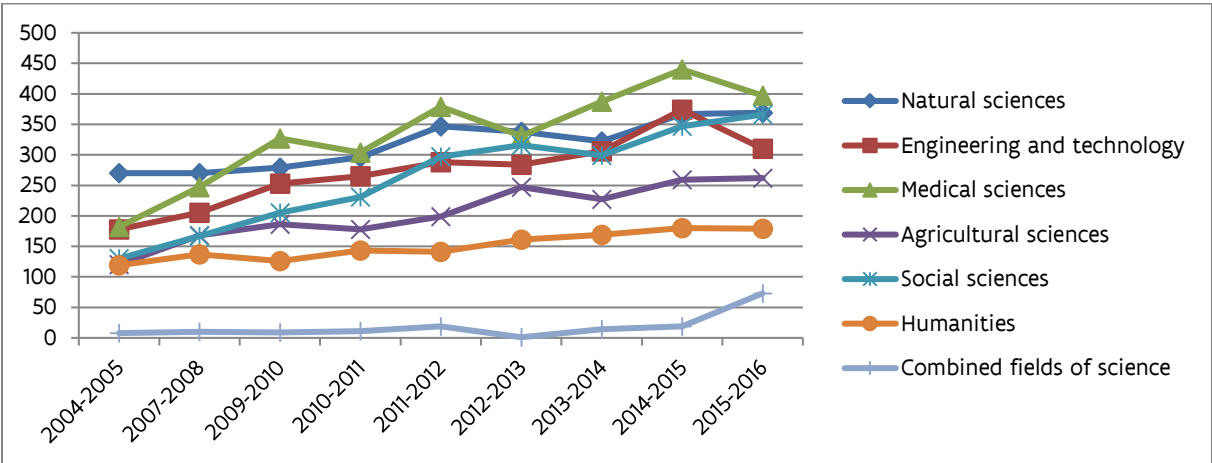


Figure 27: Evolution of the number of PhDs in Flanders by field of science from 2004-2005 to 2015-2016



During the past five years, the total number of PhDs in Flanders has increased by more than 37%, reaching a level of 1,956 new doctorate holders in 2015-2016. The number of female PhDs has also grown significantly (roughly doubled in the past ten years). Even so, the proportion of women holders is increased to 47%. An analysis of the number of PhDs per field of science shows a substantial increase for the medical sciences, the social sciences and engineering and technology in recent years. For the other fields of science, a slighter increase can be seen.