

Flanders' knowledge potential: investing in Ph.D. degrees

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THE HRRF DATABASE

What are the effects of the investment in knowledge potential of the Flemish universities and the Flemish government? One of the ways of measuring these outcomes is an assessment of the critical success factors towards obtaining a Ph.D. degree at a Flemish university. This study provides answers to a number of questions which urge an evaluation of current research policies, such as: What is the impact of Ph.D. funding schemes on Ph.D. production? Are men more successful than women in a Ph.D. trajectory? To what extent does the degree of success, drop-out and time-to-degree vary across disciplines?

ECOOM, Flanders' Centre for R&D Monitoring at Ghent University, has constructed a database with data of all academic staff, Ph.D. student registrations and Ph.D. degrees of the five Flemish universities. This HRRF-database (**Human Resources in Research - Flanders**) anonymously registers every person with a first academic employment contract or Ph.D registration after October 1st 1990, and is updated annually. Every year, ECOOM-UGent provides the Flemish universities with a set of indicators monitoring academic HR personnel, Ph.D. trajectories, succesrates, focusing on key characteristics such as gender, nationality, field of research and funding routes.



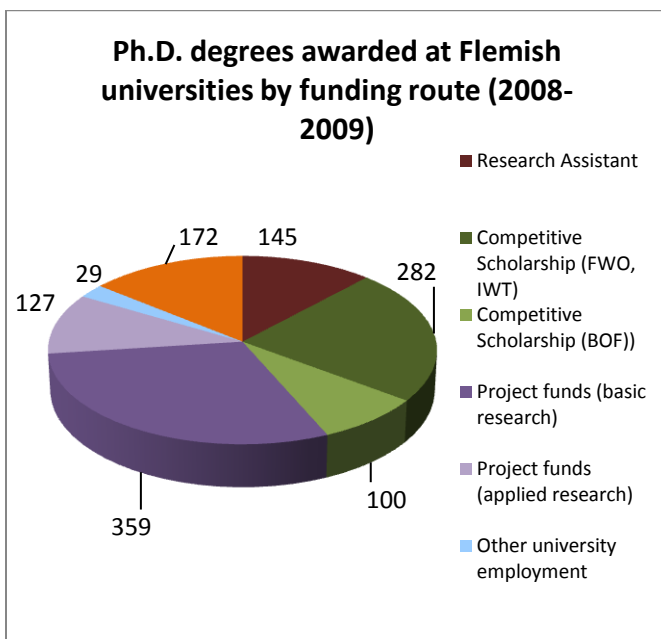
FOUR ROUTES TOWARDS A PH.D. DEGREE

Ph.D. researchers in Flanders are recognized as full professionals, while they also enjoy the benefits of having a student status. There are four different routes towards a Ph.D. degree at a Flemish university:

- **Competitive 4-year Ph.D. scholarships** from Flemish academic funding bodies (IWT, FWO) or from the university's own research funds (BOF), reserved for full-time doctoral research. About 1 in 3 Ph.D. graduates in Flanders received funding of this type.
- **Employment contract as "research assistant"**: these staff members spend minimum 50% of their time on doctoral research, and the remaining time on teaching support, lab support or administration for a duration of usually 6 years. This used to be one of the 'main' Ph.D. routes but as other types of Ph.D.-level appointments have increased, they now take up a share of about 12% of all conferred Ph.D. degrees.
- **Employment contract as researcher funded through "projects"**: these researchers are recruited by the Principal Investigator (P.I.) of a particular research project, for example funded through FP7, national projects, partnerships with industry or ngo's,.... Depending on whether they receive a 'Ph.D. bursary' or an employment contract, they may have an obligation to engage in doctoral research. While projects for basic research tend to generate more Ph.D. degrees than other projects, together they contribute to 40% of all Ph.D. degrees awarded at Flemish universities.
- Some Ph.D. students have their **own private funding**, are employed **outside the university**, or are funded directly from **international funding agencies**. These

students usually do not have an employment status at Flemish universities but are given the necessary research facilities on the basis of their Ph.D. student status. In the last few years, their registration has become more widespread and complete, but for retrospective analyses of the trajectory of these Ph.D. graduates, the data are not yet sufficiently reliable.

In the Flemish system, it can be difficult to distinguish the Ph.D. researchers from 'other' researchers. In the past, registration for the Ph.D. degree often did not happen until just before the Ph.D. defence. Therefore, the retrospective analyses are carried out on the basis of these researchers' employment data. As a result, the fourth of the above mentioned funding routes (14% of all Ph.D. degrees awarded in Flanders) is not included in this study.



2 OUT OF 3 PH.D. CANDIDATES OBTAIN THEIR PH.D. DEGREE

The ECOOM study reveals a steady increase of the overall return on investment in Ph.D. research. Of all Ph.D. researchers who started in the academic year 1990-1991, 43,6% obtained their Ph.D. degree within 8 years – a period we consider as 'reasonable time'. For Ph.D. researchers starting in 2000-2001, this success rate had already increased to 62,4% and continues to rise, even though the most recent cohort of researchers in the HRRF-database has not yet been observed for the full 8 years. These calculations are limited to those researchers who either have an obligation to do Ph.D. research (e.g. bursary recipients) or an intention to do Ph.D. research (e.g. registered as Ph.D. student).

The way a Ph.D. project is funded is the most significant predictor of Ph.D. success. The competitive selection process required to obtain a Ph.D. bursary from FWO (Research Foundation Flanders), IWT (Agency for Innovation by Science and Technology) or the university's own research funds (BOF), has continuously resulted in high success rates over the past two decades: 75% to 85% of recipients of these competitive bursaries have completed their Ph.D. degree in a reasonable period of time.

In the past 10 years, researchers contracted to carry out fundamental research as part of a research team with project funds, have more than doubled their chances – or their ambitions – to obtain a Ph.D. degree. For the most recent cohort starting in 200-2001, 57% obtained a Ph.D. degree. Researchers contracted to carry out projects commissioned by companies, governments or other external agencies (usually applied research), tend not to engage in Ph.D. research. Nevertheless, about 10 to 20% of them do complete their employment at the university with a Ph.D. degree.

Research assistants have a competitive disadvantage in the ECOOM-method of calculating success rates: as part-time researchers they tend to take longer to complete a Ph.D. degree. Their success rate of 42%, measured 8 years after commencing research, continues to increase more when measured over a longer period of time than is the case for researchers with other types of contracts.

Ph.D. bursaries at Flemish universities are sponsored generously. As a result, hierarchy in the prestige of Ph.D. routes is rooted in the level of autonomy and job security more than in the level of funding. Competitive Ph.D. scholarships therefore carry the highest prestige, attract the most ambitious researchers and are awarded to those with the highest expected potential.

A PH.D. IN BIOLOGY IS NOT A PH.D. IN HISTORY

Research in natural sciences, life sciences or applied sciences more often leads to the completion of a Ph.D. degree than research in humanities or social sciences. The chances of a natural scientist to obtain a Ph.D. degree within 8 years of research are higher than for a colleague in the humanities. Although success rates vary widely across disciplines, the success ratios of researchers in disciplines other than natural sciences have increased steadily, while that of natural scientists fluctuates between 52% and 65%. Chances of success are about 1 in 3 for researchers in social sciences and humanities. (*note: discipline-specific figures include ALL researchers, including those who may not be working towards a Ph.D.*). Not

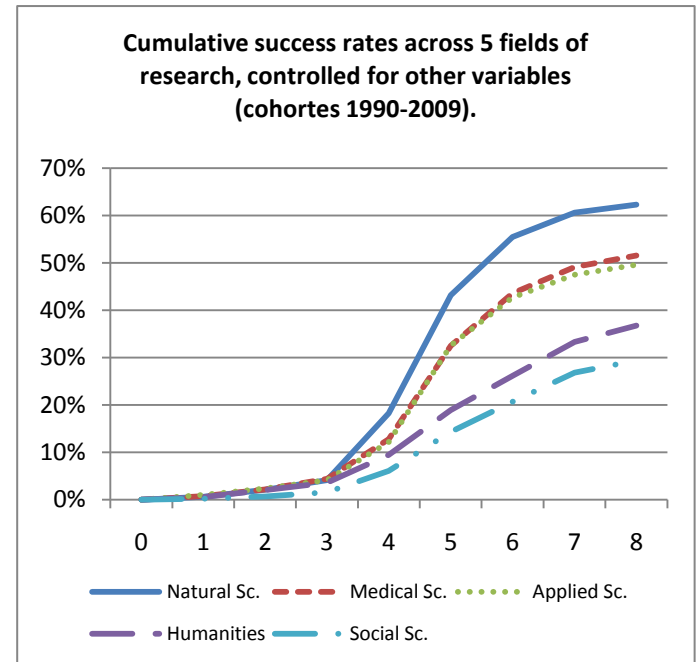
surprisingly, the disciplines with the highest completion rates are also the ones with the largest share of competitive Ph.D. bursaries, known for their high success rates. Performance pressure on behalf of supervisors as well as Ph.D. researchers has certainly contributed to better returns on investment. However, we can assume that drop-out rates will continue to be high and completion rates low in fields of research where the Ph.D. degree does not significantly improve one's career chances in the non-academic labour market. Specific labour market demands and highly attractive job offers for highly-skilled scientists in fields such as biotechnology, chemistry, ICT can to a large extent explain higher Ph.D. completion rates in these fields.

TIME TO DEGREE USUALLY EXCEEDS STANDARD PH.D. FUNDING PERIOD

Developments in average or median *time to degree* are difficult to measure as every Ph.D. still in progress can potentially alter the results comparing Ph.D. duration over time. Ph.D. graduates at Flemish universities who defended their Ph.D. in 2008-2009 needed a median of **4,81 years** (58 months) to complete their degree. We observe an increasing standardization in the Ph.D. time to degree: ultra-short Ph.D. tracks of less than 2 years (e.g. researchers who have already completed a large share of Ph.D.-related research abroad or in their spare time before registering at a Flemish university) or extremely long Ph.D. trajectories lasting 10 years or more, have become rather exceptional. In parallel with success rates, the duration of a Ph.D. track varies significantly across disciplines. They tend to be shorter in disciplines where success rates are higher (e.g. less than 4 ½ years for chemistry, physics); researchers in architecture, political & social sciences, and law on average need more than 6 years to complete the Ph.D. degree.

The way Ph.D. research is funded and the field of research have a major impact on Ph.D. completion rates, but also gender, nationality, age at starting the Ph.D. and absence from research (e.g. illness, pregnancy, period of unemployment) influence success. When we control for all other variables, the variation in success rate and time to degree across the 5 major fields of research for all researchers in the HRRF-database (including those who may not be engaged in research) is still very significant. Research in the natural sciences leads to a higher and faster Ph.D. production rate than research in other fields. The different success rates become obvious within 4 years after researchers commence their research work and continues to diverge. After six years, already 55,5% of natural scientists obtain their Ph.D. degree, compared to 43,6% and 42,7% of medical scientists and applied

scientists respectively, and even lower completion rates for humanities (26,2%) and social sciences (20,7%). At 8 years after starting as a researcher, the Ph.D. completion rate of natural scientists is twice as high as that of social scientists.



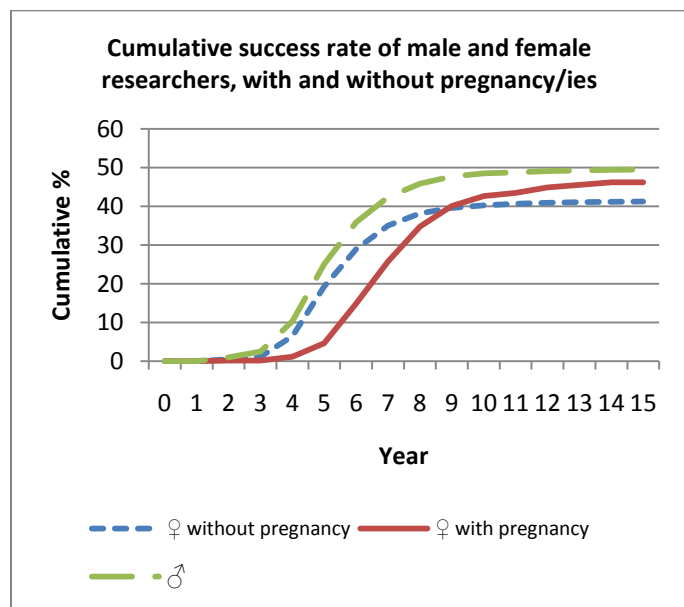
Ph.D. researchers often combine various funding schemes and research appointments in order to complete their Ph.D. degree. When the standard period of 4 years' full time funding is completed, many receive top-up funding through contract appointments. Another trend observed in *research contract hopping* is that more and more researchers are first 'groomed' into research through appointments by temporary contracts before they succeed in obtaining the most prestigious, competitive Ph.D. bursaries. Trends over time indicate an obvious move towards higher completion rates, but despite funding constraints, ECOOM observed no reduction in time to degree.

REPAIRING THE LEAKY PIPELINE

Almost as many men as women embark on a research career after their masters degree. The success rates of both men and women have increased, but at different rates. Male researchers' chances of completing the Ph.D. degree increased far more than those of female researchers. As a result, for researchers starting their Ph.D. degree in 2000-2001, 57% of men obtained the Ph.D. degree, but only 40% of women. In Natural and Applied Sciences, men and women perform on an equal footing when considering Ph.D. success ratios, but women are underrepresented in these populations. In Medical Sciences, Humanities and Social Sciences, female researchers outnumber men but

their male colleagues are significantly more successful in completing the Ph.D. degree.

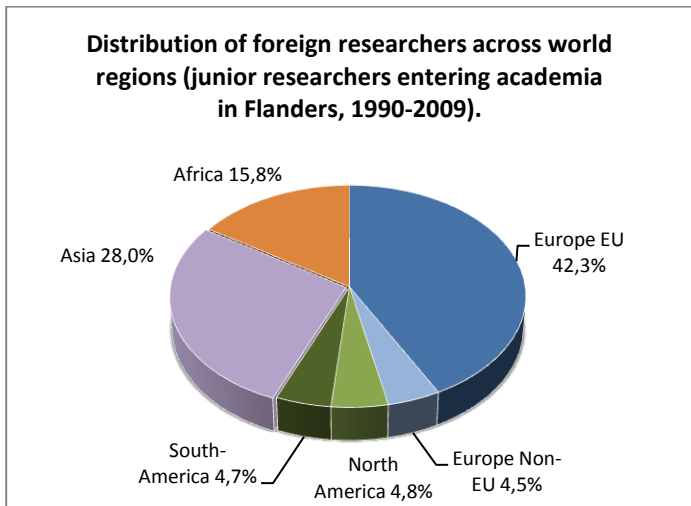
Interestingly, however, when we look at completion rates beyond the period of 8 years, we observe that pregnancy does not decrease women's chances of obtaining the Ph.D. degree. Cumulative success rates demonstrate that after 15 years of first entering academia as a junior researcher, 46,3% of all women in the HRRF-database who have had at least one pregnancy, obtained the Ph.D. degree, approaching their male colleagues' success rate and moving beyond the success rate of women who did not have children in the mean time (average success rate of all cohorts, all fields, all types of employment).



Given more time for research to make up for family-related responsibilities, completion rates for women could be increased considerably.

ACROSS NATIONAL BOUNDARIES

Ph.D.-researchers are the most internationalised community at Flemish universities. While the proportion of foreigners from inside or outside the EU was a mere 6% among new researchers at Flemish universities in 1990-1991, this figure increased to 30% two decades further on. Nearly half of them are European. Researchers from outside the EU have higher completion rates, followed by Belgian researchers. Completion rates of researchers from other EU-countries are lower. In 2008-2009, 19% of Ph.D. degrees at Flemish universities were awarded to foreign researchers. Unfortunately, institutional registration data cannot track foreign researchers - nor Flemish researchers - moving abroad to carry out or to continue their Ph.D. research elsewhere.



CONCLUSIONS

Today, the Ph.D. degree in Flanders no longer provides direct entry into an academic career at a Flemish universities. As career opportunities for the highly skilled become more diversified across national and sector boundaries, 'success' in Ph.D. investments cannot only be measured by evaluating Ph.D. completion rates. Researchers who 'drop out' and embark on other careers may still contribute significantly to the knowledge economy challenges, but the return for the university's investment in their potential is small. Differentiating Ph.D. support according to disciplines and focussing on transferable skills development for all researchers ought to be a priority in all universities.

The variety in funding routes for Ph.D. research at Flemish universities, expected to become even more diversified when taking into account increasing European Ph.D. schemes (joint programmes, Marie Curie grants,...), has its advantages in the sense that researchers can combine appointments in order to extend their funded Ph.D. research time, to gain additional experience or to vary between individual research work and project-based team work. Highly concerned about maintaining the high quality of Ph.D. research at Flemish universities, improving completion rates has yielded better returns on investment than reducing the time of funded Ph.D. programmes. Directing performance pressure towards reducing Ph.D. programmes to 4 years or less may be counterproductive to keeping the high level of completion rates.

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