ecoom briefs
EXPERTISE CENTRE FOR R&D MONITORING
GHENT UNIVERSITY
N° 42 – March 2023 – ecoom@ugent.be

Employment of PhD holders: non-academic sectors mapped

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INTRODUCTION

Most PhD holders sooner or later leave university and enter the non-academic job market. In this ECOOM brief, we focus on those PhD holders who left university immediately after successfully defending their PhD. More specifically, we look at their first job's sector of employment and check for differences according to gender and science cluster.

Specifically, in this brief we answer the following questions:

1. *In which non-academic sectors are PhD holders employed in their first job after obtaining their PhD?*
2. *Are there differences according to gender?*
3. *Are there differences according to science cluster?*

ANSWERS BASED ON THE PHD CAREER SURVEY

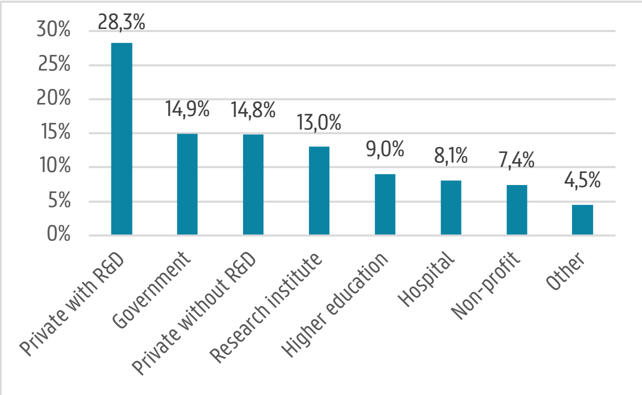
We answer the above questions based on the PhD Career Survey conducted by ECOOM-UGent in 2017. For a detailed discussion we refer to ECOOM-brief 25. For a visual overview we refer to the website https://www.phdcareersflanders.com/en/. In short: the PhD Career Survey maps the career paths of PhD holders who obtained their PhD at one of the Flemish universities. In what follows we analyze the answers of PhD holders for whom the first job after obtaining the PhD is a non-academic job (*N* = 1535).

IN WHICH NON-ACADEMIC SECTORS ARE PHD HOLDERS EMPLOYED IN THEIR FIRST JOB AFTER OBTAINING THE PHD?

We distinguish eight non-academic sectors in which PhD holders can be employed after obtaining their PhD: (1) hospital; (2) research institute (imec, VIB, Flanders Make, VITO); (3) higher education excluding university; (4) government; (5) private with Research & Development (R&D) activities; (6) private without R&D activities; (7) non-profit organization; and (8) other. The last category includes freelance, independent worker and non-higher education.

Based on Figure 1, we find that just over one in four PhD holders in the PhD Career Survey has a job in a private sector with R&D activities (28.3%). Next is the public sector (14.9%). The private sector without R&D activities completes the top 3 (14.8%).

Figure 1. Share of PhD holders by non-academic sector in their first job after obtaining the PhD (*N* = 1535).



ARE THERE DIFFERENCES ACCORDING TO GENDER?

The sector in which the highest proportion of male and female PhD holders are employed is the private sector with R&D activities (22.2% women; 33.3% men). Next, we see differences between female and male PhD holders in terms of the non-academic sectors in which they are employed. For female doctorate holders, the second largest sector of employment is the government (16.0%). The third largest sector of employment is the private sector without R&D activities (14.1%). Next are the research institutes (12.0%), higher education (10.9%), the nonprofit sector (9.9%) and hospitals (8.7%). The "other sectors" close the series (6.2%). For male doctorate holders, the second largest non-academic sector is the private sector without R&D activities (15.4%), followed by the government (13.9%), research institutes (13.8%), hospital sector (7.6%), higher education (7.4%), non-profit sector (5.4%) and "other sectors" (3.1%).

Next, we compare the shares of male and female PhD holders employed within each sector. We see that significantly more male PhD holders are employed in the private sector with R&D activities than female PhD holders (men: 33.3%; women: 22.2%). Also, significantly more female PhD holders are employed in higher education (women 10.9%, men: 7.4%), non-profit sector (women: 9.9%, men: 5.4%) and the other sectors (women: 6.2%, men: 3.1%) than male PhD holders.

ARE THERE DIFFERENCES ACCORDING TO SCIENCE CLUSTER?

We see differences according to science cluster when we look at the different sectors of employment by science cluster (see Figure 3). For the **applied sciences**, we see a high proportion employed in the private sector with R&D activities (44.7%) and without R&D activities (16.1%). Employment in a research institute completes the top 3 (15.9%). The top 3 for the **exact sciences** looks similar to the one for applied sciences, only research institutes (18.5%) and the private sector without R&D activities (17.1%) swap places. For the **social sciences**, the largest share is employed in government (22.0%) and higher education (20.1%). Next is the private sector without R&D activities (15.9%). For the **humanities**, the most popular sector is government (32.9%). The private without R&D activities (15.6%) ranks second, followed by the higher education sector (13.9%). None of the PhD holders in humanities were employed in the hospital sector in their first job after obtaining their PhD. In contrast, a high proportion of PhD holders in the **(bio-)medical sciences** are employed in hospitals (29.9%). The top 3 for the (bio-)medical sciences is completed by the private sector with R&D activities (24.6%) and without R&D activities (9.6%).

Significance tests indicate a significant relationship between science cluster on the one hand and non-academic sector of employment on the other($X^2(28)$=626.72, p<.001; Cramer's V= .32, p<.001). We examine how the science clusters differ from each other using post hoc comparisons with a more rigorously applied significance level (p<.01). This involves comparing each science cluster with the others.

For the comparison of **the exact sciences with the (bio-)medical sciences**, we note significant differences (X^2 (7)=153.42, p<.001; Cramer's V= .47, p<.001). The proportion employed in research institutes, government, private sector with R&D and private sector without R&D is larger for PhD holders in the exact sciences compared to PhD holders in the (bio-)medical sciences. A larger proportion of PhD holders in the (bio-)medical sciences are employed in hospital, non-profit and other sectors compared to PhD holders in the exact sciences.

We also see differences between **the exact sciences and the social sciences** (X^2 (7)=84.46, p<.001; Cramer's V= .39, p<.001). The proportion of PhD holders in the social sciences employed in hospitals, higher education and the nonprofit sector is significantly larger than the proportion of PhD holders in the exact sciences. In contrast, the proportion of PhD holders in the exact sciences employed in research institutes and the private sector with R&D activities is significantly larger than the proportion of PhD holders in the social sciences.

We also note statistically significant differences between the **exact sciences and the humanities** (X^2(7)=125.42, p<.001; Cramer's V= .49, p<.001). The proportion of PhD holders in exact sciences employed in the private sector with R&D activities and research institutes is significantly larger than the proportion of PhD holders in humanities. The proportion of PhD holders in the humanities employed in higher education, government and the non-profit sector is significantly larger than the proportion of PhD holders in the exact sciences.

We note no significant differences in the sector of employment between the **exact sciences and the applied sciences**.

Comparing the **(bio-)medical sciences with the humanities**, we observe statistically significant differences between these two science clusters (X^2(7)=166.41, p<.001; Cramer's V= .56, p<.001). The proportion of PhD holders in the (bio-)medical sciences employed in hospitals and the private sector with R&D activities is significantly larger than the proportion of PhD holders in the humanities. The proportion of PhD holders in humanities employed in higher education, government, private sector without R&D activities and other sectors is larger than the proportion of PhD holders in (bio-)medical sciences.

Next, we look at **(bio-)medical sciences and social sciences**. Here we also see differences between the two science clusters (X^2 (7)=127.92, p<.001; Cramer's V= .48, p<.001). The proportion of PhD holders in (bio-)medical sciences employed in hospital, private sector with R&D activities and other sectors is larger than the proportion of PhD holders in social sciences. The proportion of PhD holders in the social sciences employed in higher education, government, private sector without R&D activities and non-profit sector is significantly larger than the proportion of PhD holders in the (bio-)medical sciences.

Comparing the **(bio-)medical sciences to the applied sciences**, we again see statistically significant differences (X^2(7)=194.50, p<.001; Cramer's V= .49, p<.001). Thus, the proportion of PhD holders in the (bio-)medical sciences employed in hospitals, non-profit sector and the other sectors is significantly larger than the proportion of PhD holders in the applied sciences. The proportion of PhD holders in the applied sciences employed at a research institute, government and private sector (both with and without R&D activities) is significantly larger than the proportion of PhD holders in the (bio-)medical sciences.

We also see significant differences between the **humanities and social sciences** (X^2 (7)=34.53, p<.001; Cramer's V= .30, p<.001). The proportion of PhD holders in the humanities employed in government and other sectors is significantly larger than the proportion of PhD holders in the social sciences. The proportion of PhD holders in the social sciences employed in hospitals and the private sector with R&D activities is significantly larger than PhD holders in the humanities.

We also note statistically significant differences between the **humanities and applied sciences** (X^2 (7)=171.79, p<.001; Cramer's V= .53, p<.001). The proportion of PhD holders in the humanities employed in higher education, government, non-profit and other sectors is significantly larger than the proportion of PhD holders in the applied sciences. The proportion of PhD holders in the applied sciences employed in a research institute or in the private sector with R&D activities is significantly larger than the proportion of PhD holders in the humanities.

Finally, we also see statistically significant differences between the **social sciences and the applied sciences** (X^2(7)=133.99, p<.001; Cramer's V= .45, p<.001). The proportion of PhD holders in the social sciences employed in hospitals, higher education, government and the nonprofit sector is significantly larger than the proportion of PhD holders in the applied sciences. The proportion of PhD holders in the applied sciences employed at research institutes and the private sector with R&D activities is significantly larger than PhD holders in the social sciences.

SUMMARY AND CONCLUSION

In general, we see that the largest proportion of PhD holders who are employed in a non-academic sector immediately after obtaining their PhD end up in the private sector with or without R&D activities. In addition, the government also appears to be a popular sector. These findings are in line with PhD candidates' interests in non-academic sectors during their PhD trajectory (ECOOM Brief 36). We find that men and women show different employment profiles towards the non-academic labor market after obtaining their PhD: more men than women choose the private sector with R&D. In turn, we found more women than men in the higher education, non-profit and other sectors. There are also differences depending on the science cluster in which the PhD was obtained: the largest proportion of PhD holders employed in the private sector (both with and without R&D activities) or in a research institute obtained their PhD in the applied or exact sciences. For the hospital sector, these are mainly PhD holders in the (bio)medical sciences. We see that a large proportion of PhD holders in the social and humanities are employed in the government, non-profit sector and within higher education. These findings are largely in line with the patterns found in the Careers of Doctorate Holders Survey (CDH), which was administered among PhD holders in 2010 to map their careers (Derycke & Van Rossem, 2014): (1) the private sector is the most popular non-academic destination for PhD holders in the applied and exact sciences; (2) the most popular sector of employment for PhD holders in the (bio)medical sciences is the hospital sector; (3) the most popular sector for humanities is government. Regarding PhD holders in the social sciences, there are some differences: in the CDH survey the most popular sector was the government, while the current brief points to higher education as the sector in which the majority of PhD holders in the social sciences ends up immediately after obtaining the PhD.

Perhaps gender differences are also related to differences in the science cluster in which the PhD was obtained. However, we cannot look at the sector of employment according to gender and science cluster since the numbers then become too small to make reliable statements. What we do know is that more men than women obtain a PhD in exact or applied sciences, 62% and 69% respectively. A PhD within the exact and applied sciences generally makes it easier to connect to the private sector with R&D activities than a PhD in other science clusters. The higher proportion of men with a PhD in exact or applied sciences possibly explains the observation that more men than women enter the private sector with R&D activities after obtaining their PhD. Such composition effects in the population of PhD holders may also explain why we find more female PhD holders after leaving university in a job in higher education, in government or in the non-profit sector. Indeed, there are more women than men who obtained their PhD in the social sciences and humanities (60% and 64%, respectively).

REFERENCES

Derycke & Van Rossem (2014). Careers of doctorate holders. In *Careers of Doctorate Holders Survey 2010.* Boosten, K., Vandevelde, K., Derycke, H., te Kaat, A. J., & Van Rossem, R. *R&D and innovation in Belgium series.*

ECOOM brief 17 – Levecque, K., Mortier, A., Debacker, N., & De Beuckelaer, A. (2019). Life as it is: Junior researchers at Flemish universities in 2018. ECOOM UGent.

ECOOM-Brief 25 - Mortier, A., Levecque, K. & Debacker, N. (2020). You have a doctorate! What's next? The career paths of doctorate holders. ECOOM-Ghent University.

ECOOM-Brief 36 - Wille, L., Legrand, V., Levecque, K. & Mortier, A. (2021). In which sectors are doctoral candidates interested to work after completing their doctorate? A look at Flanders in 2018. ECOOM-Ghent University.

OESO (2015). Concepts and definitions for identifying R&D, in Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, OECD Publishing, Paris. https://www.oecd.org/innovation/frascati-manual-2015-9789264239012-en.htm

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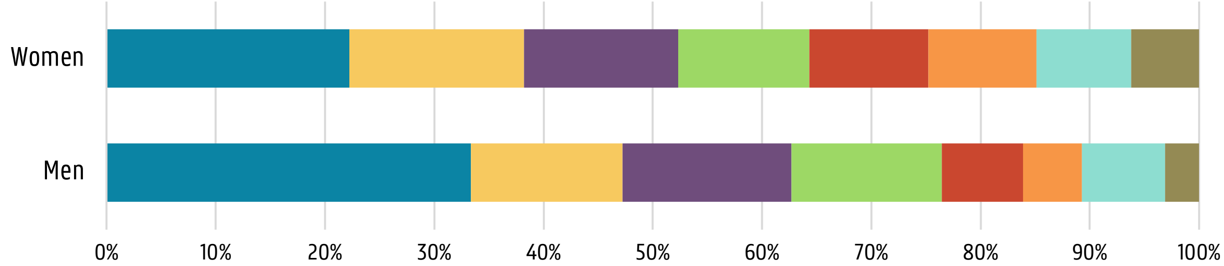
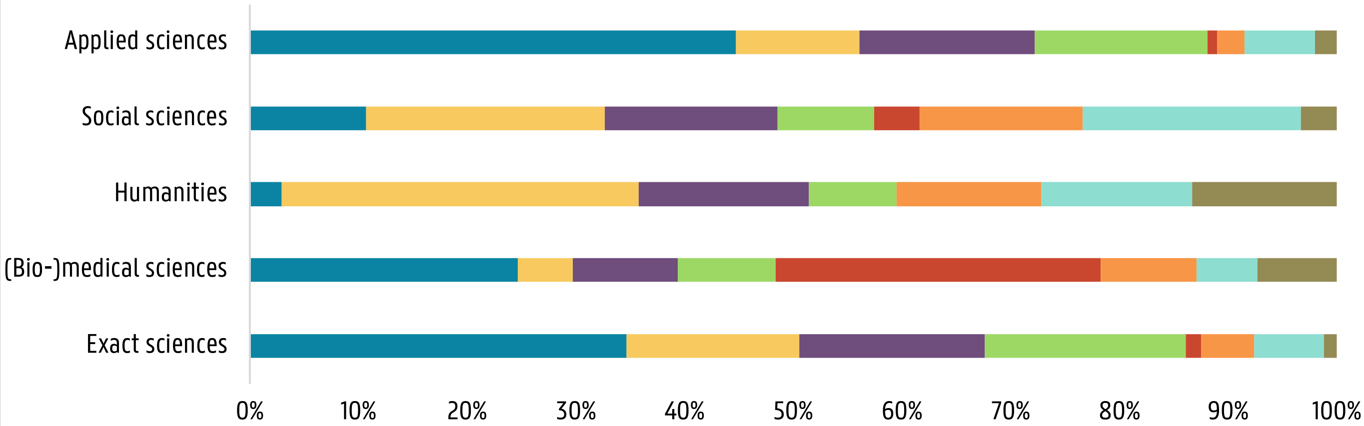
Figure 2: Employment in a particular non-academic sector according to gender (*N* = 1535). Percentages with an asterisk differ significantly from each other.



	Men	Women
Private with R&D	33,3%	22,2%
Government	13,9%	16,0%
Private without R&D	15,4%*	14,1%*
Research institute	13,8%	12,0%
Higher education	7,4%	10,9%
Non-profit	5,4%*	9,9%*
Hospital	7,6%*	8,7%*
Other	3,1%*	6,2%*

Figure 3: Distribution of PhD holders across non-academic sectors in their first job after obtaining their PhD by science cluster (*N* = 1534)



	Exact sciences	(Bio-)medical sciences	Humanities	Social sciences	Applied sciences
Private with R&D	34,7%	24,6%	2,9%	10,7%	44,7%
Government	15,9%	5,1%	32,9%	22,0%	11,4%
Private without R&D	17,1%	9,6%	15,6%	15,9%	16,1%
Research institute	18,5%	9,0%	8,1%	8,9%	15,9%
Hospital	1,4%	29,9%	0,0%	4,2%	0,9%
Non-profit	4,9%	8,8%	13,3%	15,0%	2,5%
Higher education	6,4%	5,6%	13,9%	20,1%	6,5%
Other	1,2%	7,3%	13,3%	3,3%	2,0%