

# Are PhD holders still involved in research after leaving the university?

Authors: Anneleen Mortier<sup>1</sup>, Katia Levecque<sup>1</sup>, Lien Wille<sup>1</sup>

<sup>1</sup> ECOOM–Ghent University, Department Work, Organization and Society

## INTRODUCTION

PhD holders develop excellent research skills throughout their doctoral trajectory. The question that arises is whether PhD holders continue to use these research skills when they leave the university. Based on the PhD Career Survey, we know that PhD holders pursue different career paths (see <https://www.phdcareersflanders.com/en> and ECOOM Letter 42) and that these can be roughly grouped into academic careers and non-academic careers (ECOOM Letter 25). For academic careers, research skills are evident. For non-academic careers, however, we do not know whether research skills are used. Therefore, this ECOOM brief looks at whether PhD holders in non-academic careers are involved in research and, if so, in what type of research that is (basic research, applied research, and/or experimental development).

Specifically, we answer the following questions in this brief:

1. *Are PhD holders still involved in research in their first non-academic job? What type of research are they still involved in?*
2. *Are there differences in the type of research according to gender?*
3. *Are there differences in the type of research according to science cluster?*
4. *Are there differences in the type of research according to sector of employment?*

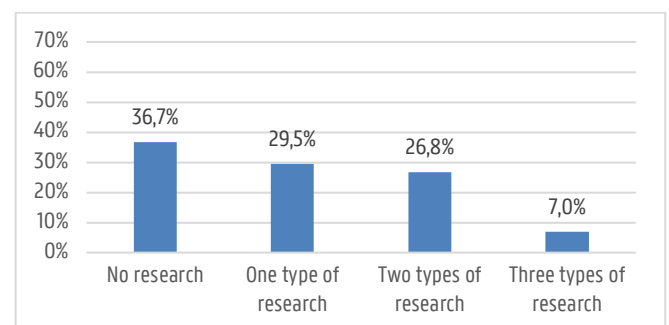
## ANSWERS BASED ON THE PHD CAREER SURVEY

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 ( $N=1535$ ).

## ARE PHD HOLDERS STILL INVOLVED IN RESEARCH IN THEIR FIRST NON-ACADEMIC JOB? WHAT TYPE OF RESEARCH ARE THEY STILL INVOLVED IN?

PhD holders can be involved in different types of research. More specifically, based on the Frascati manual (OECD, 2015), we distinguish the following three types of research: (1) basic research, which is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view; (2) applied research, which is original investigation undertaken in order to acquire new knowledge, but directed primarily towards a specific practical aim or objective; and (3) experimental development, which is systematic work drawing on knowledge gained from research and practical experience, that is directed to producing new materials, products and devices; to installing new processes, systems and services; or to improving substantially those already produced or installed. Respondents indicated for each of the three types of research whether they are involved or not. They could be involved in different types of research.

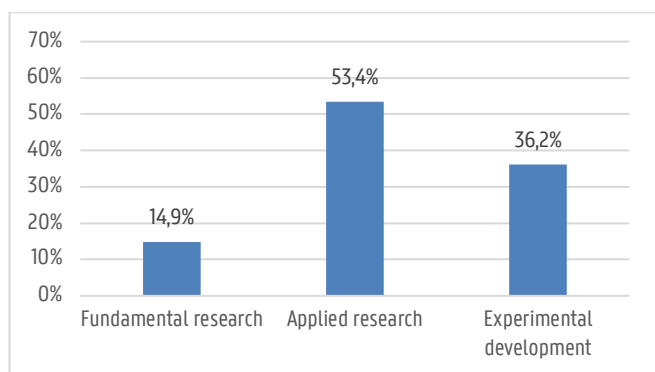
Figure 1: Percentage of PhD holders in a first non-academic job who report being involved in research (n = 1528).



Based on Figure 1, we see that 36.7% of PhD holders were not involved in any type of research. Almost three in ten were involved in one type of research (29.5%) or two types of research (26.8%). Only a small minority of PhD holders were involved in the three types of research (7.0%).

Next, we look at the type of research (Figure 2). Almost one in five is involved in basic research. More than half (53.4%) say they are involved in applied research, while one in three is involved in experimental development (36.2%).

Figure 2: Percentage of PhD holders in a first non-academic job who report being involved in basic research, applied research and experimental development ( $n_{\text{fundamental}}=1533$ ;  $n_{\text{applied}}=1535$ ;  $n_{\text{experimental}}=1531$ )



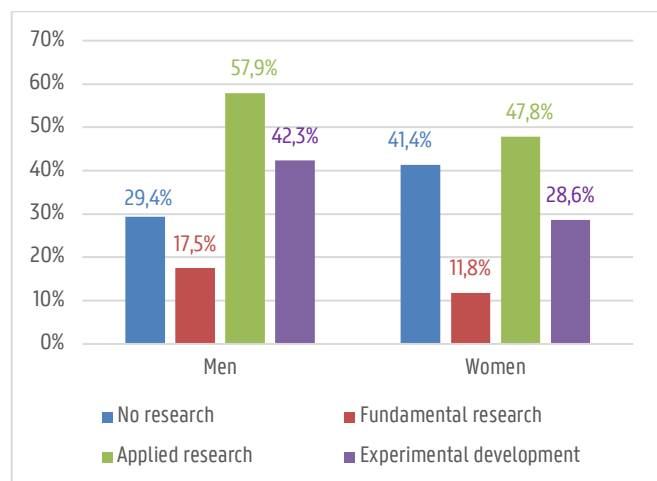
### ARE THERE DIFFERENCES IN THE TYPE OF RESEARCH ACCORDING TO GENDER?

We answer this question by looking at the shares of men and women that are involved in basic research, applied research and experimental development. Using Figure 3, we note that the shares of female PhD holders are systematically lower than the shares of male PhD holders for each type of research (basic research:  $\chi^2(1)=9.97$ ,  $p<.01$ ; Cramer's  $V=.08$ ,  $p<.001$ ; applied research:  $\chi^2(1)=15.4$ ,  $p<.001$ ; Cramer's  $V=.10$ ,  $p<.001$ ; experimental development:  $\chi^2(1)=30.86$ ,  $p<.001$ ; Cramer's  $V=.14$ ,  $p<.001$ ). Analogously, for female PhD holders, we see that the proportion no longer involved in research in the first non-academic job is significantly greater than the proportion of male PhD holders no longer involved in research ( $\chi^2(1)=22.72$ ,  $p<.001$ ; Cramer's  $V=.12$ ,  $p<.001$ ).

### ARE THERE DIFFERENCES IN THE TYPE OF RESEARCH ACCORDING TO SCIENCE CLUSTER?

Figure 4 shows for all science clusters that the largest share of PhD holders is involved in applied research, except for PhD holders in the humanities. Here, the largest share is no longer involved in research (49.1%), which is significantly different from all other science clusters except the social sciences ( $\chi^2(4)=24.7$ ,  $p<.001$ ; Cramer's  $V=.13$ ,  $p<.001$ ).

Figure 3: Percentage of male and female PhD holders in a first non-academic job who report being involved in no research, basic research, applied research and experimental development ( $n_{\text{men}}=843$ ;  $n_{\text{women}}=688$ )



Looking at basic research, we find no significant differences between science clusters ( $\chi^2(4)=4.04$ ,  $p>.05$ ; Cramer's  $V=.05$ ,  $p>.05$ ).

For applied research, we find significant differences between science clusters ( $\chi^2(4)=27.63$ ,  $p<.001$ ; Cramer's  $V=.13$ ,  $p<.001$ ). The largest shares involved in applied research are among PhD holders in the applied sciences (59.6%), social sciences (57.0%) and the (bio-)medical sciences (55.2%). These shares differ significantly from those involved in applied research in the exact sciences (48.8%) and the humanities (38.2%).

Finally, we look at experimental development, where we again find significant differences across science clusters ( $\chi^2(4)=104.07$ ,  $p<.001$ ; Cramer's  $V=.26$ ,  $p<.001$ ). The largest shares of PhD holders involved in this type of research are found in the applied sciences (51.6%), which is significantly different from all other science clusters. Next is the share of PhD holders in the exact sciences (41.4%). Completing the top three are PhD holders in the (bio-)medical sciences: 30.2% of them are involved in experimental development. The shares of social sciences (21.2%) and humanities (16.8%) conclude the order.

### ARE THERE DIFFERENCES IN THE TYPE OF RESEARCH ACCORDING TO SECTOR OF EMPLOYMENT?

Figure 5 shows for all sectors whether PhD holders are involved in research and, if so, the type of research in which they are involved.

We find statistically significant differences for PhD holders **no longer involved in research** according to sector of employment ( $\chi^2(7)=249.40$ ,  $p<.001$ ; Cramer's  $V=.40$ ,  $p<.001$ ). The largest shares not involved in research are for the private sector without R&D activities and the other sectors (69.6% and 63.8%, respectively). These shares are significantly different from all other sectors. Next, we note that about 3 in 10 to 4 in 10 of PhD holders employed in the nonprofit sector (44.7%), government (39.9%) and higher education (32.2%) are not involved in research. Next, we note that 24.2% of PhD holders employed in a hospital and 21.4% of PhD holders in the private sector with R&D activities are not involved in

research. Research institute closes the list with 10.0% of PhD holders no longer involved in research.

Next we look at **basic research**, where we also find statistical differences between sectors ( $\chi^2(7)=193.04$ ,  $p<.001$ ; Cramer's  $V=.35$ ,  $p<.001$ ). The highest proportion is seen in research institute: just under half are involved in basic research (45.7%). This is followed by the sectors hospital (20.2%), higher education (13.0%), government (12.7%), private with R&D activities (10.3%), other sectors (8.7%) and the non-profit sector (7.9%). The private sector without R&D activities closes the row with 2.7% of PhD holders involved in basic research.

We also find differences across sectors for **applied research** ( $\chi^2(7)=173.48$ ,  $p<.001$ ; Cramer's  $V=.34$ ,  $p<.001$ ). The highest shares of PhD holders involved in applied research are seen among research institutes (66.5%), private sector with R&D activities (66.0%), hospitals (66.5%) and higher education (59.9%). Next is government (51.5%), non-profit sector (46.5%) and other sectors (30.4%). The private sector without R&D activities concludes the order with 19.4% of PhD holders involved in applied research.

Finally, we look at **experimental development**, where we also find differences across sectors ( $\chi^2(7)=189.41$ ,  $p<.001$ ; Cramer's  $V=.35$ ,  $p<.001$ ). The largest proportion of PhD holders involved in experimental development is seen in the private sector with R&D activities (60.0%). Next are the research institutes (44.0%). Then we find all remaining sectors with the non-profit sector (28.9%), higher education (25.4%), government (25.4%), hospitals (25.2%), private sector without R&D activities (16.9%) and other sectors (14.7%).

## SUMMARY AND CONCLUSION

The current brief examines whether PhD holders are involved in research in their first job in the non-academic sector after obtaining their doctorate and, if so, whether they are involved in basic research, applied research and/or experimental development. We note that just over one in three PhD holders were not involved in research. We can only speculate why this is the case: for example, PhD holders may no longer be interested in research and therefore specifically seek a non-research related job. Another possible explanation is that PhD holders are no longer able to conduct research, for example because there are no resources to continue their own research or because there are no vacant jobs where their specific research competencies can be used. At the same time, it is also not inconceivable that employers make suboptimal use of existing research competencies among their employees. We note that the largest share is involved in applied research (53%), followed by experimental development (36%) and basic research (15%). The involvement in research differs according to the science cluster in which the doctorate was obtained: mainly PhD holders in humanities are less involved in applied research and experimental development. Involvement also varies depending on the sector in which PhD holders are employed. Thus, for all sectors except private without R&D activities and the remaining sectors, we note that PhD holders are

mainly involved in applied research (percentages vary between 57% and 76%). For the private sector without R&D activities and the remaining sectors, more than half of the PhD holders are not involved in research. We note that the proportion of women involved in research is systematically lower than that of men for each of the three types of research. Based on our data, we find a correlation between science cluster and gender: there are percentagewise more men with doctorates in the exact and applied sciences (62% and 69%, respectively). It is precisely the PhD holders from these two science clusters that have a higher share of employment in the sectors with research & development (see ECOOM letter 42) and indicate that they are still involved in applied research and experimental development. To explore this further, we check within the applied and exact sciences whether there is a difference between the proportion of men and women involved in each type of research (not depicted in the ECOOM brief). These analyses show a statistically significant difference<sup>1</sup> regarding experimental development only within applied sciences: 57.8% of men are still involved compared to 37.8% of women ( $n_{men}=301$ ;  $n_{women}=141$ ). We also look at whether there is a difference between the shares of men and women involved in each type of research for the science clusters with a higher proportion of female PhD holders, namely the social sciences and the humanities. Here, we again note one statistically significant difference between men and women: the proportion of male PhD holders in the social sciences still involved in basic research is larger (18.0%) than the proportion of female PhD holders in the social sciences involved in basic research (6.2%) ( $n_{men}=100$ ;  $n_{women}=113$ ). Again, we can only speculate why men in the applied and social sciences are more involved in experimental development and basic research respectively. Why are women less involved in research when they leave university? This calls for additional research. One possible research perspective is professional interests: have female PhD holders lost interest in research more than their male colleagues after obtaining their doctorate? A second possible research avenue is that of opportunities: do female and male PhD holders on the non-academic labor market get equal opportunities to use their research competencies? Or do specific obstacles and stereotypes cause female research talent to be less picked up and consequently more discarded?

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<sup>1</sup> ( $\chi^2(1)=15.36$ ,  $p<.01$ ; Cramer's  $V=.19$ ,  $p<.01$ )

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Figure 4: Percentage of PhD holders in a first non-academic job who indicate involvement in basic research, applied research and experimental development by science cluster (n<sub>exact sciences</sub>=346; n<sub>(bio-)medical sciences</sub>=354; n<sub>humanities</sub>=173; n<sub>social sciences</sub>=214; n<sub>applied sciences</sub>=447)

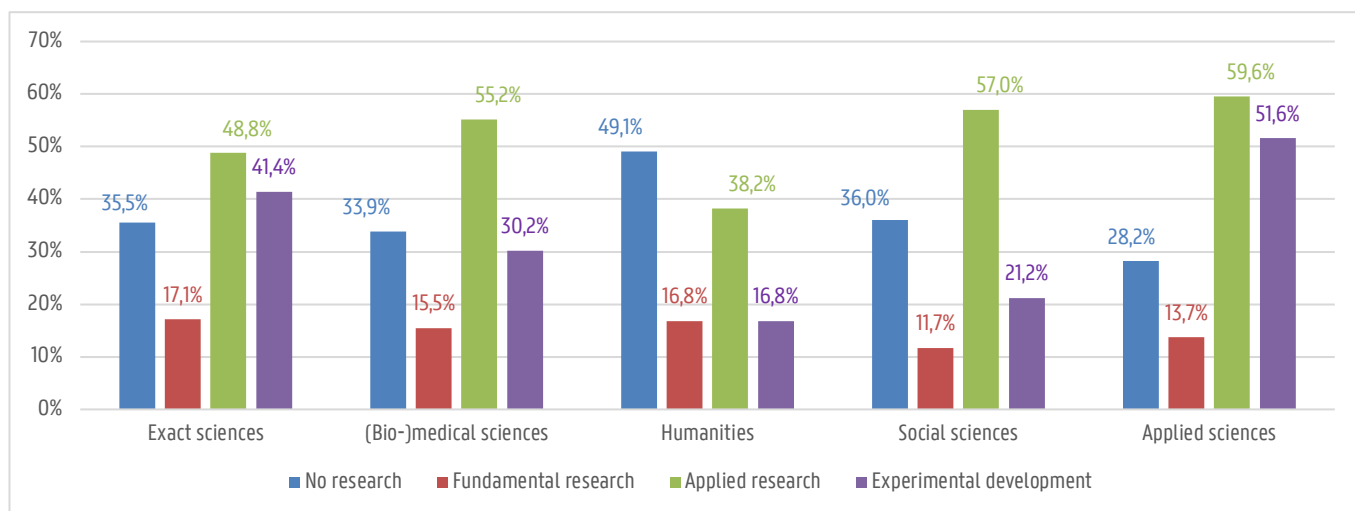


Figure 5: Percentage of PhD holders in a first non-academic job who report being involved in basic research, applied research and experimntal development by sector of employment (n<sub>hospital</sub>=123-124; n<sub>research institute</sub>=199-200; n<sub>higher education</sub>=137-138; n<sub>government</sub>=227-228; n<sub>private with R&D</sub>=435; n<sub>private without R&D</sub> = 225-227; n<sub>non-profit</sub> = 114 ; n<sub>other</sub> = 68-69). N varies because of missing data.

