PHD SURVEY 2022

REPORT

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Table of content

1 Introduction

This report presents the results of the PhD survey 2022. The survey is organized annually by the Researcher Training and Development Office (RTDO) of the Vrije Universiteit Brussel (VUB). It is aimed at investigating the satisfaction of the PhD candidates at the VUB concerning their work environment and job conditions. A pilot study was launched in 2017, in which three faculties were invited to participate. Since 2018, the sample has been expanded to PhD candidates of all the faculties at the VUB. This is the sixth edition of the survey. For earlier reports, see Verbeylen, Minnen et al. 2017, Glorieux, te Braak et al. 2018, Glorieux, te Braak et al. 2019, Glorieux, te Braak et al. 2020, Glorieux, van Tienoven et al. 2021.

The main goal of this survey is to gather data on how PhD candidates experience the PhD trajectory, and to eventually be able to create an optimal environment for junior researchers to successfully complete their PhD. The survey allows PhD candidates to anonymously report where support is lacking or where the work environment does not live up to their expectations, and in that way provide input for new doctoral policies at VUB and faculty level.

The PhD survey is also a self-evaluation tool for the PhD candidates. After completing the survey, they get access to their data and can compare their results to that of their peers. In this way, PhD candidates can reflect on the year that has passed and on how they are doing compared to other doctorates. The PhD survey also informs them on what instances they can contact in case help is needed.

The first chapter of this report discusses the methodology. The second chapter presents the background characteristics of the population. The third chapter handles variables that contribute to job satisfaction, and in the fourth chapter, these variables are used to conduct a latent class analysis, grouping together PhD candidates with a common experience of their trajectory. Finally, the fifth chapter discusses some additional support mechanisms for the PhD candidates, apart from their supervisor.

2 Methodology

2.1 Population

For this survey, all PhD candidates enrolled at the VUB as per January 1st, 2022, were invited. Contact information was provided by RTDO, based on their enrolment at one of the three VUB Doctoral Schools: the Doctoral School of Human Sciences (DSh), the Doctoral School of Natural Sciences & (bio-science) Engineering (NSE) and the Doctoral School of Life Sciences and Medicine (LSM). This contact information was handled with care and in compliance to the Belgian Privacy Act (1992) and the GDPR guidelines. All enrolled PhD candidates were invited via email to participate. In total, 1830 PhD candidates were invited.

2.2 Response

Of the 1830 PhD candidates that were invited, 830 completed the survey. This generated a response rate of 45.4%, which is the second to highest response rate of all editions (2018 to 2022). 83 people started the survey but did not finish it. Another six people did not consent to the privacy statement. These 89 respondents are not included in the database.

Table 1 shows the response rate by faculty. The highest response rate is among the PhD candidates that follow an interdisciplinary PhD or are doing a PhD in the Arts (68.2%) and in the faculty of Psychology and Educational Sciences (66.7%). The response rate of this latter faculty increased with 18.3 percentage points compared to last year. The faculty of Arts and Philosophy has the lowest response rate (34.5%). Compared to last year, the response of the faculty of Physical Education and Physiotherapy shows the biggest decline, with 6.1 percentage points.

Table 1: 2022 Response per faculty (based on CALI data)

	N	%
Interdisciplinary/PhD in the Arts	15	68.2
Psychology and Educational Sciences	68	66.7
Physical Education and Physiotherapy	35	50.0
Engineering Sciences	187	47.7
Social Sciences and Business Solvay School	124	46.1
Sciences and Bio-science Engineering	144	44.9
Law and Criminology	52	41.6
Medicine and Pharmacy	146	40.8
Arts and Philosophy	59	34.5
Total	**830**	

2.3 Instrument and timing

The study consisted of a single questionnaire. Respondents were invited through email to login on the MOTUS-website (https://www.motusresearch.io) with their personal credentials that were provided in the email. After this invitation, several reminders were sent throughout the fieldwork period to generate an optimal response rate. The data collection ran from April 19th to June 4th, 2022.

After logging in, the respondents were shown a welcome page on which they could find a page with extra information on the purpose of the study, a F.A.Q. page, a page with the full privacy statement, and a link to start the survey. After finalizing the survey, a thank-you page appeared, and the respondents were sent a confirmation e-mail of their successful participation. All online communication can be found in the technical report (see Glorieux, van Tienoven et al., 2022).

3 Background characteristics

One of the objectives of the annual PhD survey is to provide an up-to-date description of the population of PhD candidates at the VUB. Therefore, this chapter provides an overview of the background characteristics of the PhD candidates. We discuss several sociodemographic characteristics, such as gender, nationality, age, and living situation. Next, we investigate objective job characteristics, for example, the type of contract under which PhD candidates work and their previous work experience. Furthermore, we look into subjective indicators, that say something about how PhD candidates experience their job. These indicators are, for example, indicators of experienced time pressure and the extent to which they feel engaged in their research. Finally, we look at intrinsic indicators of the PhD candidates. These indicators say something about, for example, their level of self-efficacy and their motivation behind pursuing a PhD.

3.1 Sociodemographic characteristics

This section looks at how the PhD population is divided in terms of background characteristics.

3.1.1 Gender

Table 2 shows that 50.7% of the PhD candidates that completed the survey are female, and 49.3% are male. This distribution, in which slightly more female PhD candidates completed the survey than male ones, is a finding that occurs every year. 16 respondents didn't identify with any of these two genders or did not want to give more detail about this.

Table 2: Respondents by gender

	N	Valid %
Female	413	50.7
Male	401	49.3
Other	*3*	
I don't want to say	*13*	
Total	830	100

3.1.2 Nationality

According to Table 3, 43.4% of the PhD candidates has a Belgian nationality. 19.2% has a European (non-Belgian) nationality, and 37.4% indicated to have a non-European nationality.

Table 3: Respondents by nationality

	N	Valid %
Belgian	358	43.4
European, non-Belgian	158	19.2
Non-European	308	37.4
Missing	6	
Total	830	100

3.1.3 Age

Table 4 shows that the largest group of PhD candidates is between 26 and 30 years old (45.8%). 18.1% is between 31 and 35 years old, 18% is 25 years old or younger, and another 18% is 36 years old or older.

Table 4: Respondents by age

	N	Valid %
25 or younger	147	18.0
26-30 years old	374	45.8
31-35 years old	148	18.1
36 years or older	147	18.0
Missing	14	
Total	830	100

3.1.4 Living situation

As shown in Table 5, the largest group of PhD candidates lives without a partner or children (43.7%). 40.0% lives with a partner, without children. 14.2% lives with a partner and children. A small group (2.1%) pursues a PhD as a single parent.

Table 5: Respondents by living situation

	N	Valid %
No partner, no children	359	43.7
Partner, no children	329	40.0
Single parent	17	2.1
Partner and children	117	14.2
Missing	8	
Total	830	100

3.2 Job characteristics

This section investigates several objective job characteristics. We discuss to what doctoral schools the PhD candidates belong, how far they progressed in their PhD trajectory, what previous work experience they have, what type of contract they have, and whether they have a research plan.

3.2.1 Doctoral schools

Depending on their discipline, the PhD candidates at the VUB are assigned to one of the three doctoral schools. As shown in Table 6, 40.1% of the respondents in our sample come from the Doctoral School of Natural Sciences and (Bioscience) Engineering (NSE). 38.4% from the Doctoral School of Human Sciences (DSh). About one in five (21.4%) is affiliated with the Doctoral School of Life Sciences and Medicine (LSM). This sample is a good representation of the population.

Table 6: Respondents by doctoral schools

	N	% in sample	% in population
Doctoral School of Natural Sciences and (Bioscience) Engineering (NSE)	333	40.1	39.3
Doctoral School of Human Sciences (DSh)	319	38.4	37.8
Doctoral School of Life Sciences and Medicine (LSM)	178	21.4	22.9
Total	830	100	100

3.2.2 Phase of PhD

Table 7 shows the self-reported phase in which the PhD candidates currently are. The response to this question is rather intuitive, as the phases are not officially defined. The majority is currently in the executing phase of their research (54.3%), in which they gather data and execute their research plan. This is usually the phase that takes the longest time. About one in four (26.2%) is in the finalizing phase of their research. Roughly one in five (19.5%) is still in the starting phase of their research.

Table 7: Respondents by phase of PhD

	N	Valid %
Starting phase *Developing your research plan and design, reading...*	160	19.5
Executing phase *Working on experiments, data, executing research plan/method*	445	54.3
Finalizing phase *Writing up phase*	215	26.2
Missing	10	
Total	830	100

3.2.3 Previous work experience

As shown in Table 8, almost half of the PhD candidates did not have any work experience when they started their PhD (47.8%). 41.3% did have a job prior to starting their PhD research. Most of them used to work in the industry or private sector (36.0%) or at another university (26.6%). More than one in ten (11%) of the PhD candidates combines their research with another job, usually in the non-profit sector (27.0%), at another university (22.5%) or in the private sector (19.1%).

Table 8: Respondents by previous work experience

	N	Valid % within category	Valid %
No	396		47.8
Yes	342		41.3
Other university	*91*	*26.6*	
Other higher education institution	*15*	*4.4*	
Government	*26*	*7.6*	
Non-profit sector	*52*	*15.2*	
Industry and private sector	*123*	*36.0*	
Other	*35*	*10.2*	
Missing	*0*		
I still have another job while working at the VUB	91		11.0
Other university	*20*	*22.5*	
Other higher education institution	*11*	*12.4*	
Government	*8*	*9.0*	
Non-profit sector	*24*	*27.0*	
Industry and private sector	*17*	*19.1*	
Other	*9*	*10.1*	
Missing	*2*		
Missing	1		
Total	830		100

3.2.4 Type of contract

Table 9 shows that 13.3% of the PhD candidates are teaching assistants. Almost one in five (19.7%) has a personal mandate, meaning that their funding is specifically assigned to them. 39.7%, the biggest group, has project funding. This means that the funding was assigned to their supervisor, who hired the PhD candidate to execute the project. For 72.5% of those, their PhD project is their only project. One in five of them combines their PhD research with (an)other project(s) (20.5%). For 7.0%, the funding they receive is not related to their PhD project. 14.5% of the PhD candidates finances their own research, and 9.0% has an other type of contract (e.g., Chinese Scholarship Council, funded by another institution, funded by private company, etc.). 3.9% does not know what kind of contract they have.

Table 9: Respondents by type of contract

	N	Valid % Within category	Valid %
Teaching assistant	110		13.3
Personal mandate	163		19.7
Project funding	329	39.7	
Funding related to PhD research; PhD is only project	*237*	*72.5*	
Funding related to PhD research, but involved in multiple projects	*67*	*20.5*	
Funding not related to PhD project	*23*	*7.0*	
No contract, self-financed	120		14.5
Other	75		9.0
Don't know	32		3.9
Missing	1		
Total	830		100

3.2.5 Having a research plan

A research plan is an individualized plan in which defines long-term and short-term milestones for PhD research, trainings, and conferences, research goals, a publication strategy, and so on. This plan differs from the official research proposal, as it is more individualized and can be adapted over time. The analyses of previous PhD surveys recurringly showed that having such a plan is an important and beneficial aspect in the PhD trajectory (see Glorieux, van Tienoven et al., 2021). PhD candidates with a research plan were more satisfied, better on track and more confident about submitting their PhD successfully.

Table 10 shows that 18.1% does not have a research plan. The majority of PhD candidates has a plan (81.9%). Since 2020, PhD candidates are obligated to create an extended research plan within the first nine months of their doctoral trajectory.

Table 10: Do you have a research plan with clear milestones, deadlines…?

	N	Valid %
Yes	678	81.9
No	150	18.1
Missing	2	
Total	830	100

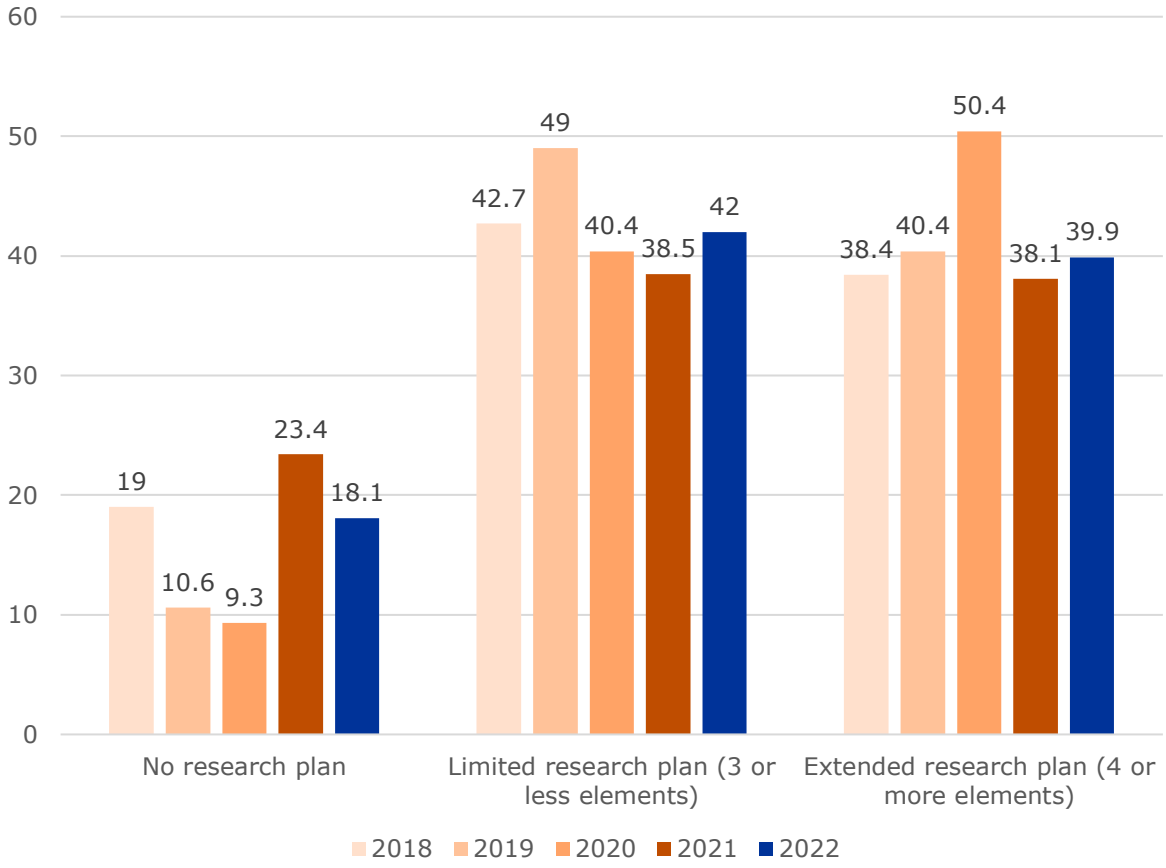
The different elements that can be included in a research plan are presented in Table 11. The majority of the PhD candidates that has a research plan included in this plan their research goals (88.2%), yearly milestones (68.5%) and a research strategy (62.5%). A training schedule for transferable skills (22.6%) and specialist training (15.4/%) are the least often included. Based on the number of elements that is included in the plan, we made a distinction between an *extended research plan* and a *limited research plan*. A plan with one to three elements is considered a limited research plan, whereas a plan with four or more elements is considered an extended research plan.

Table 11: Which of the following elements are included in your research plan?

	N	%
Research goals	597	88.2
Yearly milestones	464	68.5
Publication strategy	423	62.5
Conferences to attend	322	47.6
Dissemination of research results to a larger audience	211	31.2
Monthly milestones	189	27.9
Transferable skills training schedule	153	22.6
Specialist training schedule	104	15.4
Other elements	11	1.6

As shown in figure 1, 39.9% of the PhD candidates has an extended research plan (4+ elements). 42% has a limited research plan (1-3 elements) and 18.1% does not have a research plan. Compared to last year there is an increase in the number of PhD candidates with a research plan (both limited and extended), and a decrease in the number of those without a plan.

Figure 1: Having a research (in %) plan by measuring points



In Table 12, the use and development of the research plan is presented. For these analyses, we only take into consideration respondents with a research plan (n=677). The majority of PhD candidates says to follow their research plan (75.5%). 5.9% says to (rather) not follow the plan. Furthermore, 78.1% finds having a research plan helpful. This compares to 7.0% who does not find it helpful and 14.9% who is undecided. Most of the PhD candidates developed their plan during the first year of their PhD (53.3%). For one in four it was already there by the time they started (25.3%). About one in five developed it in a later stage (21.4%). Half of the respondents (51.0%) developed the plan together with their supervisor. 39.5% did it all by themselves. 2.7% developed it together with others and for 6.4% the supervisor did it. Exceptionally, someone else developed the research plan (0.4%). Most of those with a research plan evaluate their plan regularly together with their supervisor or other advisors (72.2%). However, more than one in four (27.8%) does not do this.

Table 12: Use of the research plan

	N	%
To what extent do you follow this plan?		
Not at all/rather not	40	5.9
Undecided	126	18.6
Rather yes/totally	511	75.5
To what extent do you find a research plan helpful?		
Unhelpful	47	7.0
Neutral	101	14.9
Helpful	527	78.1
When was your research plan developed?		
It was ready by the time I started my PhD	171	25.3
It was developed during the first year of my PhD	360	53.3
It was developed in a later stage of my PhD	145	21.4
Who wrote your research plan?		
Me	267	39.5
Me and (one of) my supervisor(s)	345	51.0
Me and other(s)	18	2.7
My supervisor(s)	43	6.4
Someone else	3	0.4
Do you have regular appointments to evaluate your research plan?		
No	188	27.8
Yes	489	72.2

As shown in Table 13, non-European PhD candidates are more likely to have an extended research plan (49.5%). One in five Belgian PhD candidates does not have a research plan (21.3%). Although they are still the relatively largest group without a plan, this is a decrease compared to last year, when 31% of the Belgian PhD candidates did not have a plan.

Like in 2021, teaching assistants are less likely to have a research plan compared to other types of contract. However, there is a decrease of 10 percentage points of teaching assistants without a research plan (26.4% compared to 36.8% in 2021). The number of teaching assistants with an extended research plan has increased with 12 percentage points compared to 2021 (30.9% compared to 18.9% in 2021). Note that the majority of teaching assistants are Belgian, which explains why there are less Belgian PhD candidates with an extended research plan. Just like last year, PhD candidates with another type of contract are most likely to have an extended research plan (53.3%).

PhD candidates without prior work experience are more likely than other PhD candidates to not have a research plan (20.1%). Those who did have another job prior to starting their PhD are more likely to have an extended research plan (46.3%).

More than one in four of those in the starting phase of their research do not have a research plan (26.4%). This is more compared to those in later phases. Of course, PhD candidates are required to develop a plan within their first year of enrollment, so it is possible that a part of this group has not done so yet. PhD candidates in the executing and finalizing phase of their research both show a similar pattern, where just over 41% has an extended research plan. The fact that in the finalizing phase there is still a relatively big group without a plan could be explained by the fact that the research plan only became mandatory in 2020, and that this group was thus exempt from the compulsory research plan.

Table 13: Having a research plan by other background characteristics (row percentages)

	No research plan	Limited research plan	Extended research plan	Total
Nationality ***				
Belgian	21.3	47.5	31.2	100
European	17.7	43.0	39.2	100
Non-European	15.0	35.5	49.5	100
Type of contract *				
Teaching assistant	26.4	42.7	30.9	100
Personal mandate	14.8	42.0	43.2	100
Project funding	18.0	40.2	41.8	100
No contract, self-financed	19.3	47.1	33.6	100
Other	10.7	36.0	53.3	100
Previous work experience *				
No	20.1	44.4	35.5	100
Yes	15.8	37.8	46.3	100
I still have another job	18.7	46.2	35.2	100
Phase in PhD *				
Starting	26.4	39.6	34.0	100
Executing	14.6	43.6	41.8	100
Finalizing	18.6	40.0	41.4	100

*Expected and observed frequencies of one or more categories vary significantly for *** p≤0.001, **p≤0.01 or *p≤0.05 based on Pearson's chi-squared test. Table only shows variables with significant effect (also tested against: gender, age, living situation and doctoral school).*

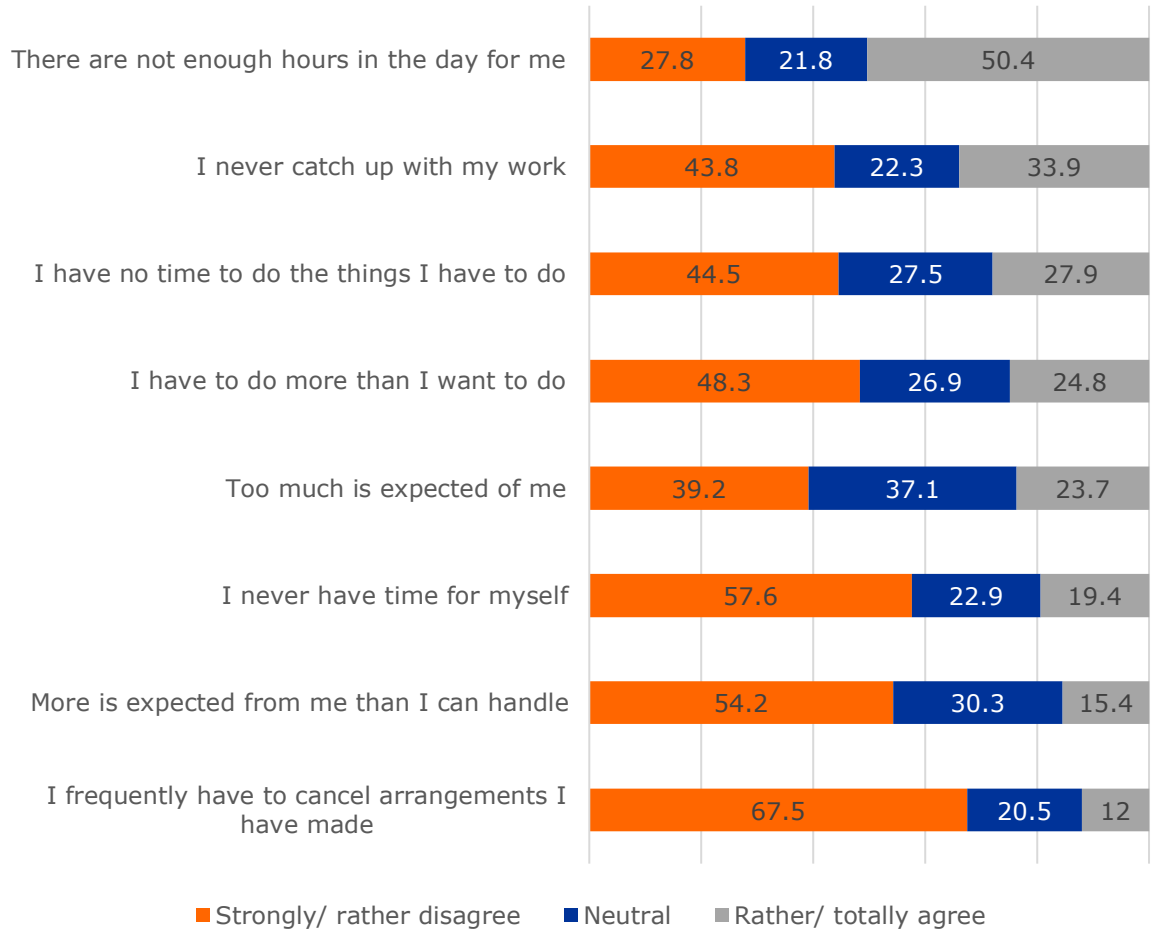
3.3 Subjective indicators

In this section, we investigate the subjective indicators of the job. These variables say something about how the PhD candidates experience their job, in terms of time pressure, competition, engagement with their job, work family balance, and the experienced harassment at the work floor. For each variable, we first give a descriptive overview. Next, we discuss the bivariate relationship between the variable in question and each background variable that we investigated previously in the report. Note that only significant bivariate relationships are reported.

3.3.1 Time pressure

Respondents were shown eight items about experiencing time pressure (see Figure 2). They were asked to what extent they agree with these statements on a 5-point Likert-scale. Half of the respondents (50.4%) feels like there are not enough hours in the day for them, and one in three (33.9%) has the feeling to never catch up with their work. 12% feels like they frequently have to cancel arrangements they have made, which makes it the least popular statement. However, this is an increase compared to 2021 (9.3%) and 2020 (8.0%), bringing the percentage back to the level of where it was before the COVID-19 pandemic.

Figure 2: Scores (in %) on items of time pressure



Using a principal component analysis, we checked whether the eight items loaded on one factor. The results of this can be found in Appendix Table A1. We combined the items into one variable on time pressure with a score ranging between zero and ten.

As shown in Table 14, the average score on time pressure is 4.2/10. This is not significantly different compared to other years. With this score, the time pressure PhD candidates experience runs along the same line as that of the Flemish population, for whom the average score is 4.8/10. PhD candidates that live without a partner and children experience the least time pressure (3.9/10), which is less than all other types of living situation. Single parents report the highest score on time pressure (5.6/10). The youngest age group (25 years or younger) experiences less time pressure (3.9/10) than the two oldest age groups (4.5/10). This can be since these age groups more often have to combine their work with family commitments. When it comes to the doctoral schools, PhD

candidates in the doctoral school of LSM experience more time pressure (4.7/10) than those in the DSh (4.2/10) and the doctoral school of NSE (4.0/10).

Table 14: Average time pressure by other background characteristics

		Time pressure (on 10)	
Living situation			
	No partner, no children	3.9	abc
	Partner, no children	4.4	a
	Single parent	5.6	b
	Two parent family	4.8	c
Age			
	25 or younger	3.9	ab
	26-30	4.2	
	31-35	4.5	a
	36 or older	4.5	b
Doctoral school			
	DSh	4.2	a
	LSM	4.7	ab
	NSE	4.0	b
Total mean		**4.2**	

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.
Table only shows variables with significant effect (also tested against: gender, nationality, phase of the PhD, previous work experience, type contract and having a research plan).

Next to performing their research, PhD candidates are also required to execute other tasks. The time pressure they experience can thus be influenced by whether they perform certain extra tasks. Table 15 shows that those who do perform other tasks next to their research experience more time pressure (4.3/10) than those who do not (3.9/10).

One of those extra tasks can be teaching. Those who teach experience more time pressure (4.4/10) than those who do not (4.0/10) (see Table 15). Note that among those who teach, the time pressure varies depending on whether the taught subject is related to the research topic of the PhD candidate. If teaching duties are strongly related to the subject of their research, PhD candidates experience less time pressure than when this not the case.

PhD candidates who assist in other projects or execute third party services experience more time pressure (4.5/10) than those who don't (4.0/10) (see Table 15). The same goes for those who execute administrative tasks (4.6/10).

Table 15: Average time pressure by tasks performed

	Time pressure (on 10)
Performing other tasks	
Yes	4.3 [a]
No	3.9 [a]
Teaching	
Yes	4.4 [a]
No	4.0 [a]
Taught subject is related to research subject	
Not at all/very little	4.5
Somewhat	4.6 [a]
To a great extent/totally	4.0 [a]
Assisting in other project/third party services (not related to own research)	
Yes	4.5 [a]
No	4.0 [a]
Cooperating with industry/other sectors	
Yes	4.4
No	4.2
Administration and other tasks	
Yes	4.6 [a]
No	4.0 [a]
Total mean	**4.2**

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.

Not only the tasks performed but also the timing of work can say something about the level of time pressure that is experienced. As shown in Table 16, working during morning hours (before 8 AM) is positively associated with experiencing time pressure. Those who usually work during the evening (between 6 PM and midnight) report higher levels of time pressure (4.7/10) than those who never (3.7/10) or occasionally (4.1/10) work in the evening. Similarly, occasionally working after midnight is associated with the experience of more time pressure (4.8/10) compared to those who never do this (4.1/10). Finally, frequently working in the weekend, whether it be Saturday or Sunday, is positively associated with the experience of time pressure.

Table 16: Average time pressure by working times

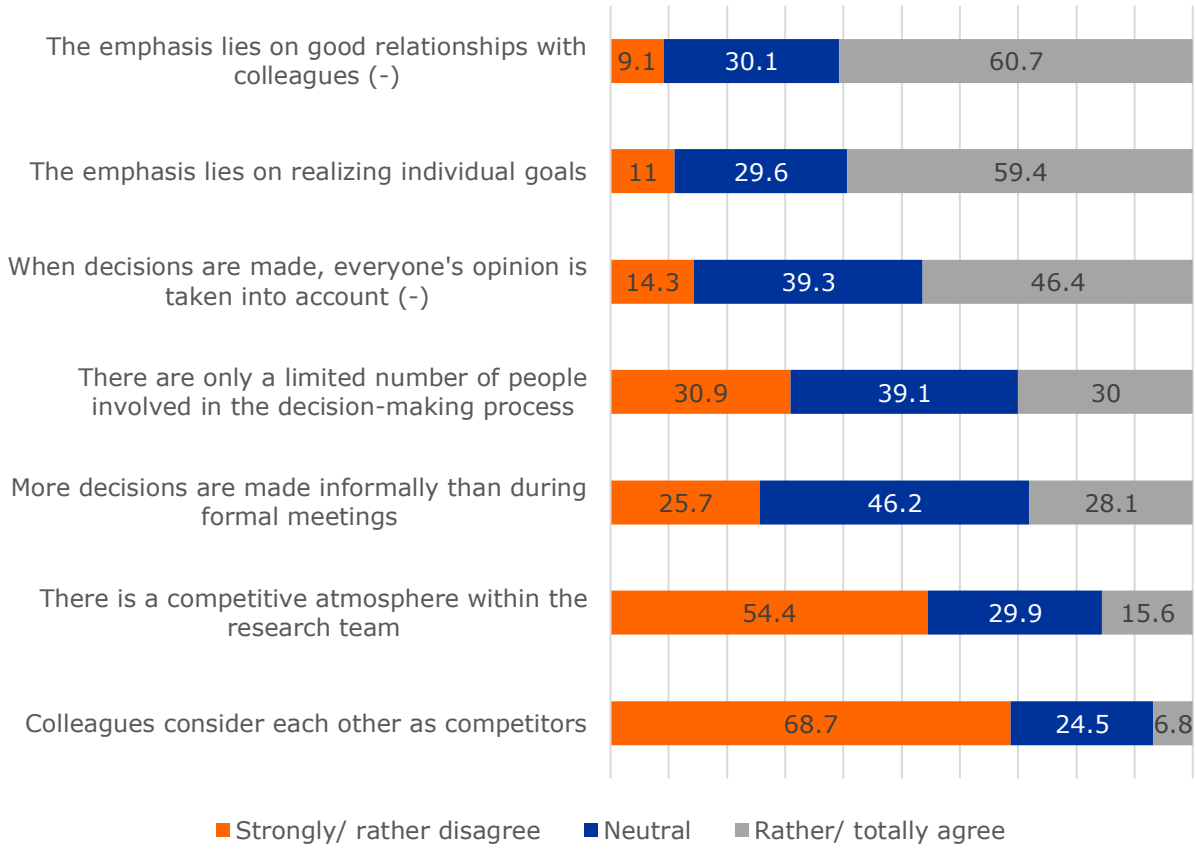
		Time pressure (on 10)
In the morning (before 8 AM)		
	Never/seldom	4.0 [ab]
	Occasionally	4.6 [a]
	Usually/always	4.7 [b]
During office hours (8 AM-6 PM)		
	Never/seldom	4.9
	Occasionally	4.3
	Usually/always	4.2
In the evening (6 PM-midnight)		
	Never/seldom	3.7 [a]
	Occasionally	4.1 [b]
	Usually/always	4.7 [ab]
At night (after midnight)		
	Never/seldom	4.1 [a]
	Occasionally	4.8 [a]
	Usually/always	4.2
On Saturdays		
	Never/seldom	3.8 [a]
	Occasionally	4.2 [b]
	Usually/always	4.9 [ab]
On Sundays		
	Never/seldom	3.8 [a]
	Occasionally	4.3 [a]
	Usually/always	4.8 [a]
Total mean		

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.

3.3.2 Work culture: level of competition

In Figure 3 we present the items that were used to measure to what extent PhD candidates experience competition between colleagues. 60.7% finds that the emphasis lies on good relationships with colleagues. At the same time however, 59.4% thinks the emphasis also lies on realizing individual goals. Only 6.8% thinks colleagues consider each other as competitors. These numbers are in line with last year.

Figure 3: Scores (in %) on items of culture in the work environment



A principal component analysis showed that the items could be reduced to one component (see Appendix Table A2). Before doing so, the items "when decisions are made, everyone's opinion is taken into account" and "the emphasis lies on good relationships with colleagues" were inverted. Next, a variable on competition was computed, with a score ranging between zero and ten. A higher score implies a higher level of competition.

Table 17 shows that the average score on experienced competition is 4.4/10. Between the years 2019 and 2021, the level of competition has been constantly increasing. However, this year there has been a significant decrease compared to 2021, when the average was 5.4/10. Female PhD candidates experience more competition (4.5/10) than their male peers (4.3/10). PhD candidates who live without partner or children experience less competition (4.2/10) than those who live with a partner (4.5/10) or with a partner and children (4.7/10). Younger PhD candidates also experience less competition than older age groups. Furthermore, PhD candidates who finance their own research experience more competition from their colleagues (5.0/10) than those with project funding

(4.1/10) or a personal mandate (4.3/10). Those without prior work experience feel less competition (4.2/10) than their colleagues who currently have another job (4.6/10) or had another job in the past (4.6/10). The further PhD candidates progress in their research, the more competition they seem to experience. Not having a research plan is related to experiencing more competition (4.7/10) compared to those with an extended research plan (4.3/10).

Table 17: Average level of perceived competition by other background characteristics

		Competition (on 10)
Gender		
	Male	4.3 [a]
	Female	4.5 [a]
Living situation		
	No partner, no children	4.2 [ab]
	Partner, no children	4.5 [a]
	Single parent	4.5
	Two parent family	4.7 [b]
Age		
	25 or younger	3.9 [acd]
	26-30	4.3 [bce]
	31-35	4.7 [de]
	36 or older	4.7 [ab]
Type of contract		
	Teaching assistant	4.5
	Personal mandate	4.1 [a]
	Project funding	4.3 [b]
	No contract, self-financed	5.0 [ab]
	Other	4.5
Previous work experience		
	No	4.2 [ab]
	Yes	4.6 [a]
	I still have another job	4.6 [b]
Phase in the PhD		
	Starting	4.1 [a]
	Executing	4.3 [b]
	Finalizing	4.8 [ab]
Research plan		
	No	4.7 [a]
	Limited	4.4
	Extended	4.3 [a]
Total mean		**4.4**

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons. Table only shows variables with significant effect (also tested against: nationality, doctoral school and time pressure).

3.3.3 Engagement

The respondents were shown twelve items that inquire about how engaged they are in their research (figure 4 and 5). The results of a principal component analysis showed that the items could be reduced to two variables: **job engagement** and **job contribution** (see Appendix Table A3 and Table A4). Both variables were rescaled to a score between zero and ten.

Figure 4 presents the descriptive results of the items underlying job engagement. 72.4% indicated to be enthusiastic about their job. 69.7% is happy when they are working intensely and 67.2% says they always or often feel immersed in their work.

Figure 4: Scores (in %) on items of job engagement

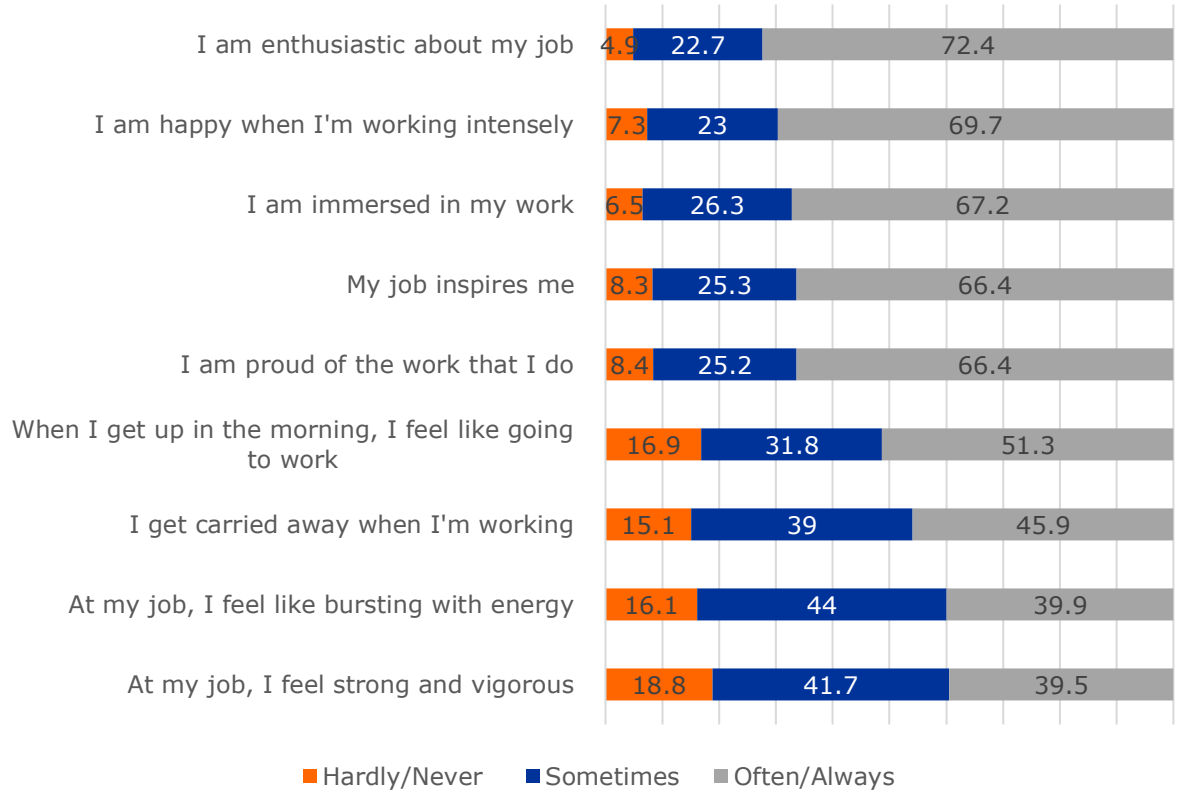
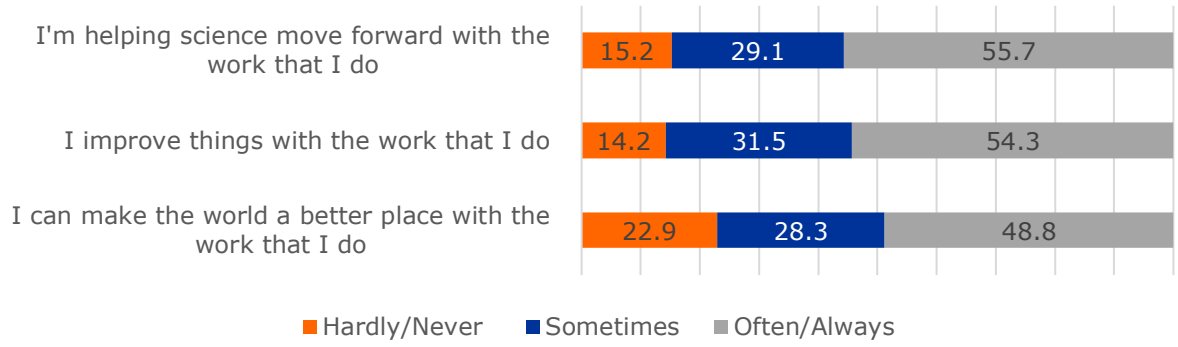


Figure 5 presents the descriptive results of the items underlying job contribution. More than half of the PhD candidates feel like they are helping science move forward with their work (55.7%). On the other side, 22.9% does not feel like they can make the world a better place with their research.

Figure 5: Scores (in %) on items of job contribution



The bivariate relationships between **job engagement** and the background characteristics are presented in Table 18. On average, PhD candidates score 6.4/10 when it comes to their engagement in their research, which is the same as in 2021. However, in 2020, PhD candidates felt less engaged in their research (6.2/10) compared to 2021 and 2022 (6.4/10). Male PhD candidates feel more engaged in their research (6.5/10) than their female peers (6.2/10). Also, non-European PhD candidates score higher (6.6/10) than those with a Belgian (6.2/10) or other European nationality (6.3/10). PhD candidates that live together with a partner and children have a higher score on engagement (6.9/10) than those without a partner and children (6.4/10) and those who only live with a partner (6.2/10). The oldest age group scores the highest on engagement (6.9/10). Furthermore, those who have another type of contract also feel more engaged in their research than all the other contract types (7.1/10). Those who combine their PhD research with another job score higher on engagement (6.9/10) than those without prior work experience (6.2/10). PhD candidates with an extended research plan score higher on job engagement (6.8/10) than those without a plan (6.0/10) and those with a limited research plan only (6.2/10).

When it comes to the feeling of being able to **contribute** to the greater good, we see a similar pattern (Table 18). On average, PhD candidates have a score of 6.2/10 for contribution, which is not significantly different compared to the two previous years. Male PhD candidates have a stronger feeling of being able to contribute something with their research (6.4/10) than female PhD candidates (6.1/10). Again, non-European PhD candidates score higher (6.6/10) than their Belgian (6.2/10) and other European peers (6.3/10). Those who live only with a partner have the lowest feeling of contribution (5.8/10), lower than those without

a partner or children (6.4/10) and those who live in a two-parent household (7.1/10). The oldest age group has a higher score on contribution than the other age groups. Those with another type of contract score higher on contribution (7.4/10) than teaching assistants (5.9/10), those with a personal mandate (5.9/10) and those with project funding (6.1/10). PhD candidates who combine their PhD research with another job have a stronger feeling being able to contribute (7.0/10) than those without (6.0/10) and with prior work experience (6.3/10). Having an extended research plan associates with a higher score on job contribution (6.7/10) compared to not having a research plan (6.0/10) or having a limited research plan (5.9/10).

Table 18: Average job engagement and contribution by other background characteristics

	Engagement (on 10)	Contribution (on 10)
Gender		
Female	6.2 [a]	6.1 [a]
Male	6.5 [a]	6.4 [a]
Nationality		
Belgian	6.2 [a]	6.2 [a]
European	6.3 [b]	6.3 [b]
Non-European	6.6 [ab]	6.6 [ab]
Living situation		
No partner, no children	6.4 [a]	6.4 [ab]
Partner, no children	6.2 [b]	5.8 [ac]
Single parent	6.6	7.1
Two parent family	6.9 [ab]	7.1 [bc]
Age		
25 or younger	6.4 [a]	6.2 [a]
26-30	6.2 [b]	6.0 [b]
31-35	6.4 [c]	6.2 [c]
36 or older	6.9 [abc]	7.0 [abc]
Type of contract		
Teaching assistant	6.1 [a]	5.9 [a]
Personal mandate	6.1 [b]	5.9 [b]
Project funding	6.4 [c]	6.1 [c]
No contract, self-financed	6.4 [d]	6.5
Other	7.1 [abcd]	7.4 [abc]
Previous work experience		
No	6.2 [a]	6.0 [a]
Yes	6.4	6.3 [b]
I still have another job	6.9 [a]	7.0 [ab]

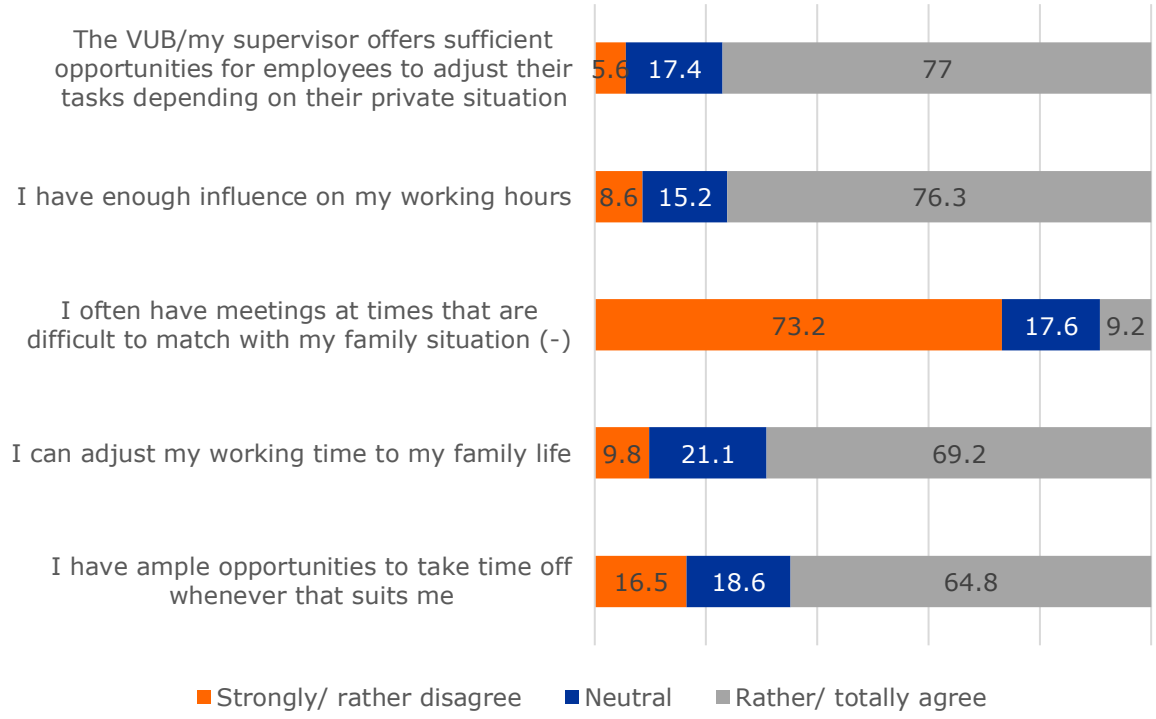
	Engagement (on 10)	Contribution (on 10)
Having a research plan		
No	6.0 [a]	6.0 [a]
Limited	6.2 [b]	5.9 [b]
Extended	6.8 [ab]	6.7 [ab]
Total mean	6.4	6.2

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.
Table only shows variables with significant effect (also tested against: doctoral school, phase of the PhD, time pressure and competition).

3.3.4 Work-family balance

With the items presented in Figure 6, we assessed how PhD candidates perceive the work family balance. 77% finds that the university and supervisor offer sufficient opportunities to adjust their tasks to their private situation. This is an increase of 3.3 percentage points compared to last year. 76.3% reports that they have enough influence on their working hours. Only 9.2% feel they have meetings too often at times that are difficult to match with their family situation.

Figure 6: Scores (in %) on items of satisfaction with work family balance



Based on the results of a principal component analysis (see Appendix Table A5), the items were combined into one variable on work family balance with a score ranging from zero to ten. A higher score implies more satisfaction with the work family balance.

Table 19 shows that the average score on the work family balance is 7.3/10. This is not significantly different from the last two years (2021 and 2020). It is interesting to note that since 2020 – the start of the COVID-19 pandemic and thus working from home – satisfaction with the work family balance has significantly declined compared to before COVID-19, when the average was 7.7/10 (in 2019, not shown in Table). This could be explained by the fact that the boundaries between private and work life became a little blurry due to teleworking. Non-European PhD candidates are less satisfied with their work family balance (7.0/10) compared to their Belgian peers (7.6/10). PhD candidates who live together with a partner and children score lower (6.8/10) compared to those who live without a partner and children (7.4/10). The youngest age group shows the highest satisfaction with their work family balance (7.7/10), whereas the oldest age group scores lower (6.9/10). PhD candidates who finance their own research are less satisfied with their work family balance (6.7/10) compared to those with project funding (7.4/10) or a personal mandate (7.6/10). PhD candidates who combine their research with another job are less satisfied with their work family balance (6.6/10) than those who do not currently have another job next to their doctoral research (7.4/10 and 7.3/10). Those in the doctoral school of LSM are the least satisfied with their work family balance of all three doctoral schools.

Table 19: Average satisfaction with work family balance by other background characteristics

		Work family balance (on 10)	
Nationality			
	Belgian	7.6	a
	European	7.4	
	Non-European	7.0	a
Living situation			
	No partner, no children	7.4	a
	Partner, no children	7.4	
	Single parent	6.4	
	Two parent family	6.8	a
Age			
	25 or younger	7.7	ab
	26-30	7.4	c
	31-35	7.0	a
	36 or older	6.9	bc
Type of contract			
	Teaching assistant	7.2	
	Personal mandate	7.6	a
	Project funding	7.4	b
	No contract, self-financed	6.7	ab
	Other	7.2	
Previous work experience			
	No	7.4	a
	Yes	7.3	b
	I still have another job	6.6	ab
Doctoral school			
	DSh	7.5	a
	LSM	6.7	ab
	NSE	7.4	b
Total mean		**7.3**	

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.
Table only shows variables with significant effect (also tested against: gender, nationality, living situation, phase of the PhD, having a research plan, time pressure, competition, engagement and contribution).

3.3.5 Harassment

In the survey, we assessed whether PhD candidates experienced or witnessed harassment on the work floor. As shown in Table 20, the largest group says to have never experienced or witnessed any type of harassment (73.1%). However, about one in four says to believe that it happens at the VUB (24%). 8.7% has experienced harassment: one in twenty (5.0%) has experienced it in the last academic year, 3.7% has experienced it before, but not this year. 5.4%

of the PhD candidates has witnessed harassment, in the sense that they know it happened to colleagues that they personally know. Note that 12.8% chose the "no answer" option, meaning that the actual number of experienced or witnessed harassment could be higher than this.

Table 20: Experience of harassment by colleagues or superiors a the VUB

	N	%
I am experiencing it now or have experienced it in the last academic year	41	5.0
I have experienced it before, but not in the last year	30	3.7
I have not experienced it, but I know that it has happened to colleagues that I personally know	44	5.4
I have not experienced or witnessed it, but I do believe it happens in the workplace (VUB)	197	24.0
I have not experienced or witnessed it, and I believe that non-harmful routine interactions are what others consider 'mistreatment'	41	5.0
I have no personal experience or knowledge of, or an opinion about, workplace mistreatment	362	44.1
No answer	105	12.8
Missing	10	
Total	830	100

Question: "While working at the VUB, have you ever experienced any type of harassment or mistreatment by colleagues or superiors? (E.g., discrimination, intimidation, humiliation, work sabotage, verbal or sexual abuse…)"

In the next question, we asked those who had experienced or witnessed harassment about the nature of the mistreatment (see Table 21). The most common type of harassment was personal harassment, for example humiliation or offensive jokes (46.9%). 42.5% experienced psychological harassment, like spreading rumors. About one in five cases of harassment were discriminatory, based on religion, ethnicity, sexuality, and the like (21.2%). One in ten were cases of sexual harassment (10.6%). In 3.5% of the incidents were cyberbullying. One PhD candidate reported to have experienced or witnessed physical harassment.

Table 21: Experience of harassment by colleagues or superiors a the VUB

	N	% of harassed	% of total
Personal harassment (E.g., humiliation, offensive jokes…)	53	46.9	6.5
Psychological harassment (E.g., ignoring one's presence, spreading rumors...)	48	42.5	5.9
Verbal harassment (E.g., cursing, yelling, insulting…)	32	28.3	3.9
Discriminatory harassment (E.g., based on religion, ethnicity, sexual orientation, disability…)	24	21.2	2.9
Other	15	13.3	1.8
Sexual harassment (E.g., inappropriate comments, jokes, gestures, or messages, physical transgressive behavior…)	12	10.6	1.5
Cyberbullying	4	3.5	0.5
Physical harassment (E.g., threats, attacks, destroying property…)	1	0.9	0.1

Question: "What is or was the nature of the workplace mistreatment that you experienced and/or witnessed? Multiple answers possible."

In Table 22, we present how the experience of harassment is related to background characteristics. Here, experiencing harassment means that the PhD candidate has personally experienced transgressive behavior by colleagues or superiors at any point while working at the VUB. Because of the uneven distribution of PhD candidates that have experienced harassment and those who haven't, we chose to not only report differences that are statistically significant, but to also look at notable patterns that might signal problems in certain subgroups. Female PhD candidates report more often than male ones to experience harassment (9.6% compared to 7.6%). However, male PhD candidates significantly more often chose to not answer the question (15.7%). Even though there is no statistically significant difference between the different nationalities, non-European PhD candidates indicated more often than other nationalities to have experienced harassment (10.9%) and also chose more often to not give an answer (14.9%). Also between the different types of living situation there is no significant difference, yet 23.5% of the single parents chose to not answer the questions. Not wanting to answer the question might signal that harassment is a sensitive subject for this group and that these people shun to give more detail about it. PhD candidates without children also tend to be more likely to have experienced harassment.

Teaching assistants experience harassment significantly more often than other groups, and those with an other type of contract tend to not answer the question more often. There is no significant difference between the doctoral schools when it comes to experiencing harassment. However, in the doctoral school of Life Sciences and Medicine, there are more PhD candidates who say to have experienced harassment or to not want to give an answer compared to the other two doctoral schools. Furthermore, experiencing harassment is related to a lower feeling of being engaged in the research. A high amount of time pressure and a low satisfaction with the work family balance is also related to the experience of harassment. Finally, the level of competition between colleagues is positively related to the experience of harassment.

Table 22: Experience of harassment by other background characteristics

	Has not experienced it	Has experienced it	No answer	Total
Gender *				
Male	76.8	7.6	15.7	100
Female	80.6	9.6	9.8	100
Nationality n.s.				
Belgian	81.5	7.6	10.9	100
European	81.8	7.1	11.0	100
Non-European	74.3	10.9	14.9	100
Living situation n.s.				
No partner, no children	77.0	10.1	12.9	100
Partner, no children	79.8	8.3	11.9	100
Single parent	70.6	5.9	23.5	100
Two parent family	81.7	5.2	13.0	100
Age *				
25 or younger	85.7	3.4	10.9	100
26-30	79.3	9.3	11.4	100
31-35	70.1	10.9	19.0	100
36 or older	78.9	9.5	11.6	100
Type of contract *				
Teaching assistant	75.5	14.5	10.0	100
Personal mandate	83.2	8.1	8.7	100
Project funding	81.0	8.0	11.0	100
No contract, self-financed	75.2	7.7	17.1	100
Other	70.7	6.7	22.7	
Doctoral school n.s.				
DSh	81.5	8.9	9.6	100
LSM	73.6	11.2	15.2	100
NSE	78.4	7.0	14.6	100

		Has not experienced it	Has experienced it	No answer	Total
Engagement ***					
	Low	73.0	14.3	12.6	100
	Median	81.0	8.3	10.7	100
	High	81.8	4.3	13.9	100
Time pressure ***					
	Low	87.6	4.4	8.0	100
	Median	77.2	9.8	13.0	100
	High	71.3	11.3	17.4	100
Work family balance ***					
	Low	69.5	10.8	19.7	100
	Median	79.2	9.4	11.3	100
	High	89.4	4.7	5.9	100
Competition ***					
	Low	87.3	4.1	8.6	100
	Median	80.8	8.7	10.5	100
	High	65.1	14.3	20.6	100
		91.3	8.7		

Table only shows variables with significant effects (also tested against: phase of the PhD, previous work experience, having a research plan and contribution).

3.3.6 Correlations between scales of subjective indicators

In this section, we look at the correlations between the scales concerning the subjective job indicators (see Table 23). Time pressure and competition are positively correlated, meaning that those who experience a lot of time pressure also experience a lot of competition in the workplace (r=0.24). Time pressure is negatively associated with satisfaction with the work family balance (r=-0.46). Moreover, those who experience a lot of time pressure are less engaged in their research (r=-0.23) and feel like they can contribute to a lesser extent (r=-0.18).

Experiencing competition in the work environment correlates with a lower satisfaction with the work family balance (r=-0.21), a lesser feeling of being engaged in the research (r=-0.22) and a lesser feeling of contribution (r=-0.18).

Finally, engagement is positively correlated with satisfaction with the work family balance (r=0.14) and with contribution (r=0.70). There is no correlation between the work family balance and the feeling of being able to contribute something to the greater good.

Table 23: Correlation matrix

	Competition	Work family balance	Engagement	Contribution
Time pressure	0.24 **	-0.46 **	-0.23 **	-0.18 **
Competition		-0.21 **	-0.22 **	-0.18 **
Work family balance			0.14 **	0.03 n.s.
Engagement				0.70 **

*Expected and observed frequencies of one or more categories vary significantly for *** p≤0.001, **p≤0.01 or *p≤0.05 based on Pearson's chi-squared test.*

3.3.7 Some reflections on the subjective indicators

In the previous section, we discussed several variables that say something about how PhD candidates experience their job. Overall, PhD candidates seem to be rather satisfied with how they experience their job. However, it is important to pay attention to certain subgroups within the population that appear to be vulnerable in certain aspects.

The age and living situation of PhD candidates is often related to how they evaluate their job. We saw that the youngest PhD candidates experience less time pressure and evaluate their work family balance better compared to the older PhD candidates. This relates to the finding that those who live together with children experience more time pressure and find it harder to balance their work- and family life. The youngest PhD candidates and those who live without children and partner also experience less competition compared to the older age groups and those who live in a two-parent family situation. In this light, it is striking that it is the oldest age group that is more engaged in their research and feels like they can contribute something with it, compared to the younger generation. It could thus be argued that the joy of doing the job and the feeling of doing something important is what motivates this group, despite their harder work conditions.

We see a similar trend regarding the type of contract with which PhD students start their PhD. Those who finance their own research experience more competition and are less satisfied with their work family balance. Those with research funding and a personal mandate, on the other hand, are more satisfied with these aspects. Self-financed PhD candidates are often older, more often have kids and are also more likely to combine their research with another job. This higher amount of work- and family commitments can explain why this group is

less satisfied with the work family balance. However, the self-financed PhD candidates report a higher level of engagement with their research and a stronger feeling of being able to contribute something.

3.4 Intrinsic indicators

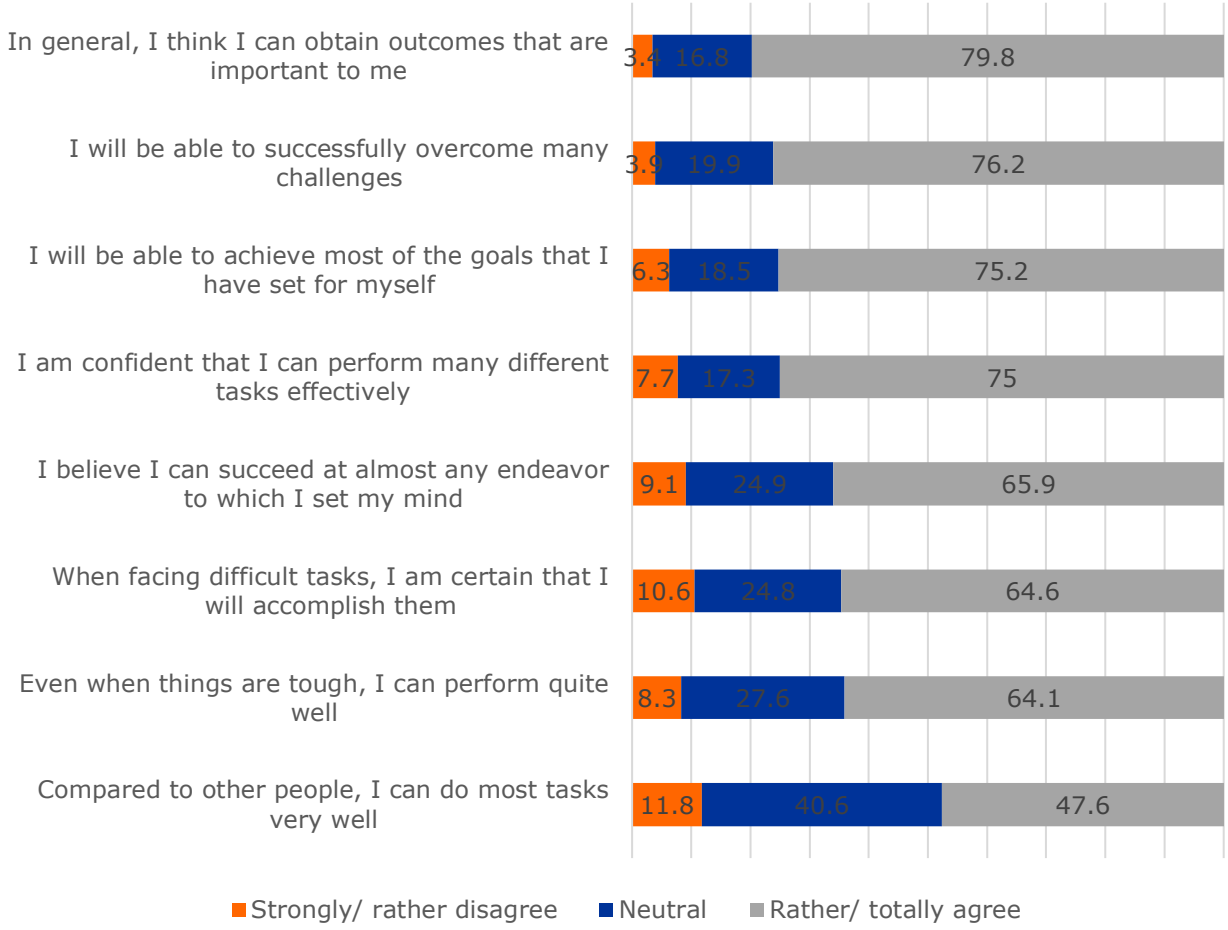
In this section we look at intrinsic indicators. These are merely characteristics of the PhD candidates themselves, which might also influence their overall job satisfaction. We look at their self-efficacy, the passion they have for their research, their motivation to pursue a PhD, and whether they expect a further career in academia after graduating. First, we give a descriptive overview of the variable. Hereafter we discuss the bivariate relationship between the variable in question and each of the background variable that we investigated previously in the report. Note that only significant associations are reported.

3.4.1 Self-efficacy

We included eight statements to measure the self-efficacy of PhD candidates (see Figure 7). The respondents were asked to indicate to what extent they agree with these statements on a 5-point Likert-scale.

79.8% agreed with the statement that they can obtain outcomes that are important to them. 76.2% reports they are able to successfully overcome challenges and three in four (75%) are confident that they can perform many different tasks effectively.

Figure 7: Scores (in %) on items of self-efficacy



A principal component analysis showed that the items loaded on one factor (see Appendix Table A6). We combined these items into a new variable on self-efficacy, with a score ranging from zero to ten. As shown in Table 24, the average score on self-efficacy is 6.9/10. This is higher than last year when the average score was 6.5/10. It is interesting to note that the average level of self-efficacy was lower in both 2020 and 2021 – during the COVID-19 pandemic – compared to other years. Male PhD candidates score higher on self-efficacy (7.0/10) than their female colleagues (6.8/10). This is a recurring finding. Non-European PhD candidates have the highest score on this indicator (7.4/10), their Belgian peers score the lowest (6.4/10). PhD candidates who live together with a partner and children have a higher score on self-efficacy (7.4/10) than those who live without a partner or children (5.9/10) and those who live together with a partner (6.7/10). In the same vein, the two oldest age groups score higher (respectively 7.1/10 and 7.5/10) than the two youngest age groups (both 6.6/10). PhD candidates with another type of contract score higher on self-efficacy (7.4/10) than teaching

assistants (6.6/10) and those with a personal mandate (6.5/10). This latter group also scores lower than the self-financed PhD candidates (7.2/10). PhD candidates who combine their research with another job score the highest on self-efficacy (7.5/10). Those without any prior work experience score the lowest (6.6/10). PhD candidates with an extended research plan have a higher score on self-efficacy (7.2/10) than those without a research plan (6.6/10) and those with only a limited plan (6.7/10).

Table 24: Average self-efficacy by other background characteristics

		Self-efficacy (on 10)
Gender		
	Female	6.8 [a]
	Male	7.0 [a]
Nationality		
	Belgian	6.4 [a]
	European	6.9 [a]
	Non-European	7.4 [a]
Living situation		
	No partner, no children	5.9 [a]
	Partner, no children	6.7 [b]
	Single parent	6.9
	Two parent family	7.4 [ab]
Age		
	25 or younger	6.6 [a]
	26-30	6.6 [bc]
	31-35	7.1 [b]
	36 or older	7.5 [ac]
Type of contract		
	Teaching assistant	6.6 [a]
	Personal mandate	6.5 [bc]
	Project funding	6.9
	No contract, self-financed	7.2 [c]
	Other	7.4 [ab]
Previous work experience		
	No	6.6 [a]
	Yes	7.0 [a]
	I still have another job	7.5 [a]
Having a research plan		
	No	6.6 [a]
	Limited	6.7 [b]
	Extended	7.2 [ab]
Total mean		**6.9**

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.
Table only shows variables with significant effect (also tested against: doctoral school, phase of the PhD, time pressure, competition, engagement, contribution, work-family balance and harassment).

3.4.2 Passion for PhD research

We asked PhD candidates to what extent they are passionate about the research they do on a scale from zero to ten. The majority (64.3%) is highly passionate about their research and gave a score between eight and ten (see Table 25). 26.8% gave an average score of six or seven. A small group of 8.9% indicated a low amount of passion with a score between zero and five.

When we compare the scores over the years, the group that is highly passionate about their research is slightly smaller than usual (see Table 25). The group with a low level of passion for their research is slightly bigger than the previous years. These differences are not statistically significant.

Table 25: Scores on passion for research

	2018	2019	2020	2021	2022
	%	%	%	%	%
Low (0-5)	8.5	5.3	7.6	7.2	8.9
Median (6-7)	23.7	28.4	25.9	26.3	26.8
High (8-10)	67.8	66.3	66.5	66.5	64.3
Total	100	100	100	100	100

As shown in Table 26, the average score on passion for the PhD research is 7.8/10. Non-European PhD candidates have a higher score (8.2/10) than those with another nationality (7.6/10). Also, those who live together with a partner and children (8.1/10) score higher than those who live together with a partner only (7.6/10). The oldest age group has the highest amount of passion (8.3/10), more so than the two youngest age groups (7.8/10 and 7.6/10). Those with another type of contract score higher on passion (8.5/10) than teaching assistants (7.6/10), those with a personal mandate (7.7/10) and those with project funding (7.7/10). PhD candidates who combine their research with another job have on average more passion for their research (8.3/10) than those without prior work experience (7.6/10). PhD candidates with an extended research plan have a higher level of passion for their research (8.3/10) than those without a plan (7.3/10) and those with only a limited plan (7.6/10).

Table 26: Average passion for research by other background characteristics

		Passion for PhD (on 10)	
Nationality			
	Belgian	7.6	a
	European	7.6	b
	Non-European	8.2	ab
Living situation			
	No partner, no children	7.9	
	Partner, no children	7.6	a
	Single parent	8.0	
	Two parent family	8.1	a
Age			
	25 or younger	7.8	a
	26-30	7.6	b
	31-35	7.9	
	36 or older	8.3	ab
Type of contract			
	Teaching assistant	7.6	a
	Personal mandate	7.7	b
	Project funding	7.7	c
	No contract, self-financed	8.0	
	Other	8.5	abc
Previous work experience			
	No	7.6	a
	Yes	7.9	
	I still have another job	8.3	a
Having a research plan			
	No	7.3	a
	Limited	7.6	b
	Extended	8.3	ab
Total mean		**7.8**	

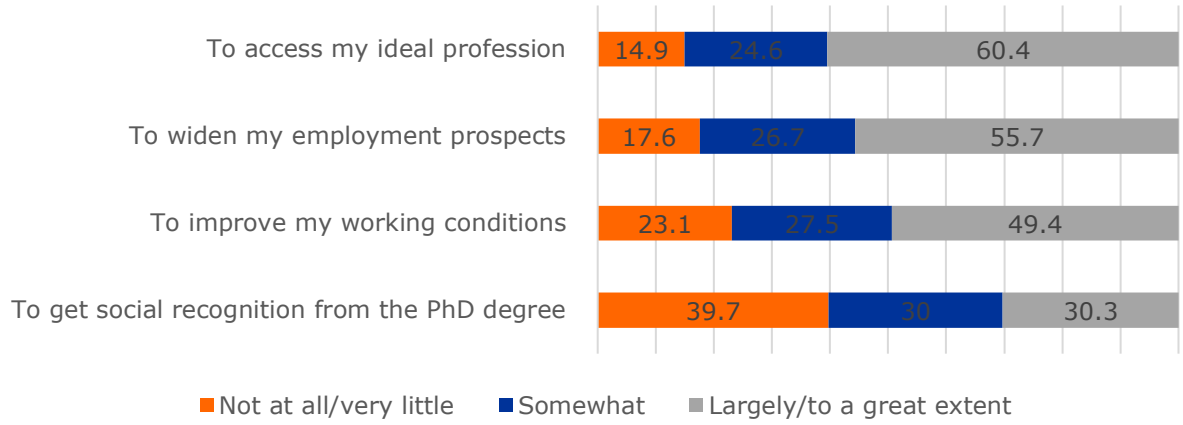
Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.
Table only shows variables with significant effect (also tested against: gender, doctoral school, phase of the PhD, time pressure, competition, engagement, contribution, work-family balance, harassment and self-efficacy).

3.4.3 Motivation to do a PhD

In this edition of the survey, we have included a new scale to gauge the motivation of PhD candidates to do a PhD (see Figures 8 and 9). Based on the results of a principal component analysis we constructed two new variables out of these items: **professional motivation** and **intellectual motivation**, both with a score ranging between zero and ten (see Appendix Table A7). Figure 8 shows the items underlying the professional motivation. 60.4% reports obtaining a PhD is a way for them to access their ideal profession. For almost one in three, the

social recognition of having a doctoral degree is a motivational factor to pursue a PhD.

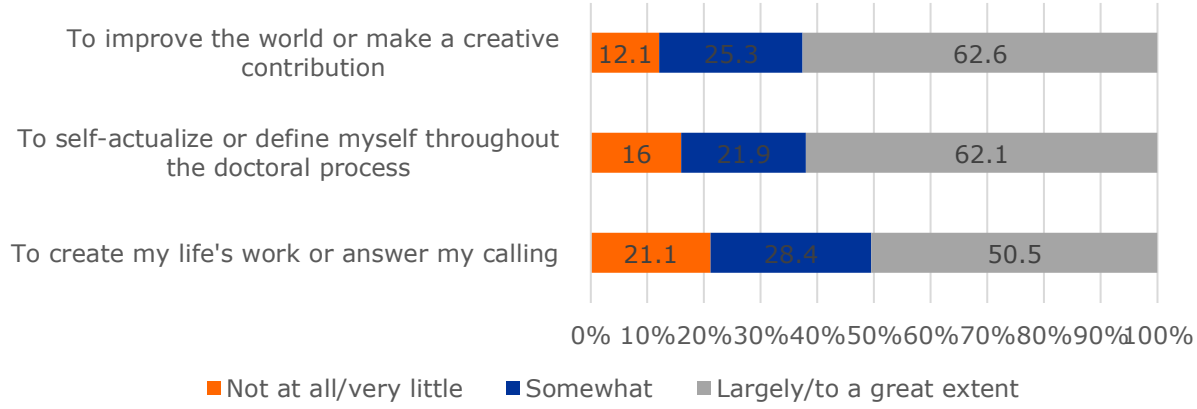
Figure 8: Scores (in %) on items of professional motivation to do a PhD



Question: Please indicate to what extent the following reasons contribute to your motivation to obtain a PhD

Figure 9 presents the items underlying the intellectual motivation. 62.6% want to do doctoral research to improve the world and to make a creative contribution. 62.1% reports self-actualization as a motivational factor in pursuing a PhD.

Figure 9: Scores (in %) on items of intellectual motivation to do a PhD



Question: Please indicate to what extent the following reasons contribute to your motivation to obtain a PhD

The average score on professional motivation is 5.8/10 (see Table 27). As this scale was newly introduced to the survey, we cannot compare whether this changed over the several measuring points. Non-European PhD candidates show the highest level of professional motivation (6.8/10), compared to other

nationalities. Those who live without children or partner score higher (6.0/10) than those who live together with a partner only (5.5/10). PhD candidates that have another type of contract have the highest score on professional motivation when compared to the rest (6.9/10). PhD candidates with an extended research plan show a higher rate of professional motivation (6.1/10) than those with only a limited research plan (5.5/10) or no research plan (5.6/10).

Table 27: Average professional motivation by other background characteristics

		Professional motivation (on 10)	
Nationality			
	Belgian	5.0	a
	European	5.5	a
	Non-European	6.8	a
Living situation			
	No partner, no children	6.0	a
	Partner, no children	5.5	a
	Single parent	6.2	
	Two parent family	5.9	
Type of contract			
	Teaching assistant	5.3	a
	Personal mandate	5.5	b
	Project funding	5.8	c
	No contract, self-financed	5.9	d
	Other	6.9	abcd
Having a research plan			
	No	5.6	a
	Limited	5.5	b
	extended	6.1	ab
Total mean		**5.8**	

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.
Table only shows variables with significant effect (also tested against: gender, age, doctoral school, phase of the PhD, previous work experience, time pressure, competition, engagement, contribution, work-family balance, harassment, self-efficacy and passion).

The average score on intellectual motivation is 6.4/10 (see Table 28). This means that PhD candidates are more motivated to pursue a PhD for intellectual reasons than for professional reasons. Again, non-European PhD candidates score higher on intellectual motivation (7.1/10) than Belgian (5.9/10) and other European (5.8/10) PhD candidates. Those who live together with a partner and children score higher on this indicator than PhD candidates who live together with a partner only. The oldest age group has the highest score on intellectual motivation (6.9/10). PhD candidates who have another type of contact (7.0/10) or finance themselves (6.9/10) score higher on this indicator than those with

project funding (6.1/10). PhD candidates who combine their research with another job score higher on intellectual motivation (7.0/10) than those who don't (6.2/10 and 6.4/10). Interestingly, those who are still in the starting phase of their research appear to have more intellectual motivation (6.8/10) than those in the executing (6.4/10) or finalizing phase (6.1/10). PhD candidates with an extended research plan show a higher rate of intellectual motivation (6.9/10) than those with only a limited research plan (6.1/10) or no research plan (5.9/10).

Table 28: Average intellectual motivation by other background characteristics

		Intellectual motivation (on 10)
Nationality		
	Belgian	5.9 [a]
	European	5.8 [b]
	Non-European	7.1 [ab]
Living situation		
	No partner, no children	6.4
	Partner, no children	6.1 [a]
	Single parent	7.1
	Two parent family	6.8 [a]
Age		
	25 or younger	6.2
	26-30	6.2 [a]
	31-35	6.2 [b]
	36 or older	6.9 [ab]
Type of contract		
	Teaching assistant	6.3
	Personal mandate	6.3
	Project funding	6.1 [ab]
	No contract, self-financed	6.9 [a]
	Other	7.0 [b]
Previous work experience		
	No	6.2 [a]
	Yes	6.4 [b]
	I still have another job	7.0 [ab]
Phase in the PhD		
	Starting	6.8 [ab]
	Executing	6.3 [a]
	Finalizing	6.1 [b]
Having a research plan		
	No	5.9 [a]
	Limited	6.1 [b]
	extended	6.9 [ab]
Total mean		**6.4**

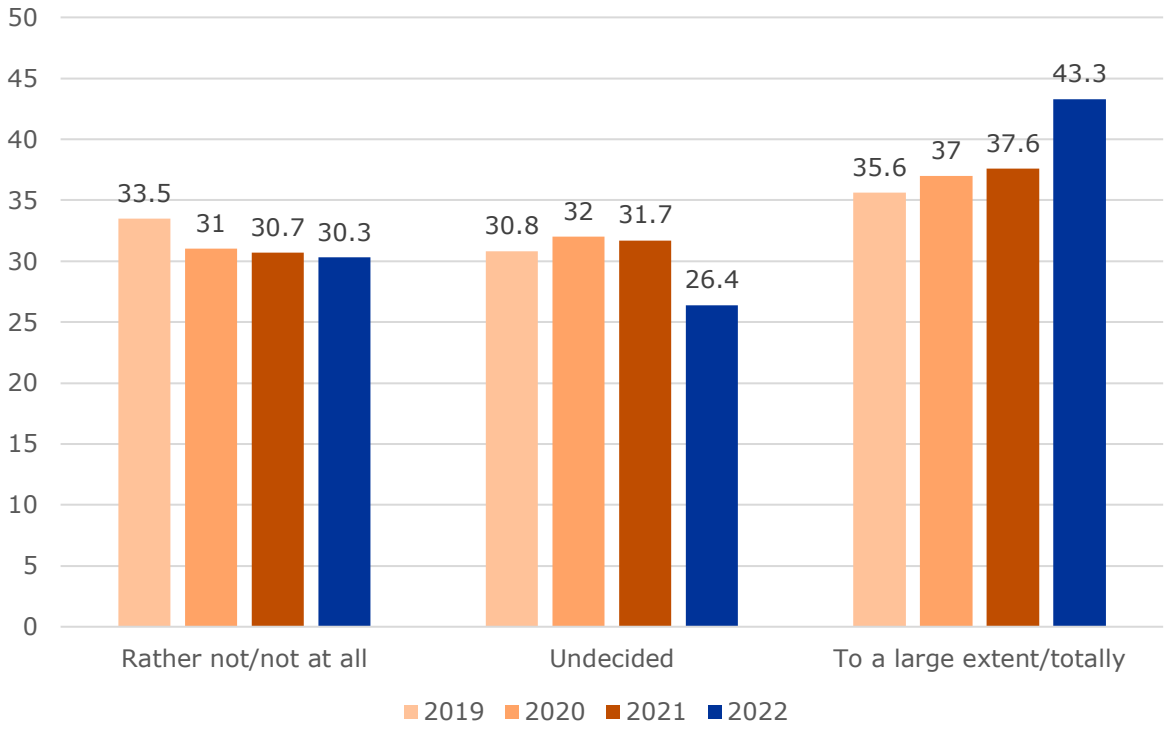
Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.

Table only shows variables with significant effect (also tested against: gender, doctoral school, time pressure, competition, engagement, contribution, work-family balance, harassment, self-efficacy and passion).

3.4.4 Expectations to work in academia

PhD candidates were asked to what extent they expect to work in academia after completing their PhD. As shown in Figure 10, 43.3% of the PhD candidates expects to work in academia after graduating. The number of PhD candidates that has this expectation increases every year, and the differences are statistically significant. 30.3% does not expect a career in academia.

Figure 10: Amount of PhD candidates expecting a career in academia (in %) over different measuring points



Question: "To what extent do you expect to work in academia (VUB or other university) after finishing your PhD?"

As shown in Table 29, non-European PhD candidates are more likely to expect a career in academia after graduating. Belgian respondents are most likely to not expect an academic career. This relates to the earlier finding that non-European PhD candidates are more professionally motivated than other nationalities. Single parents are most likely to expect an academic career. Those who live together with a partner only are the least likely to have this expectation. 42.4% of the youngest age group does not expect a career in academia. One the

other hand, more than half of the oldest age group does expect an academic career (54.2%). Teaching assistants are less likely to expect an academic career, whereas those with another type of contract and those who finance their own research more often do expect an academic career. It is also noteworthy that PhD candidates with a personal mandate are the least represented among those who expect an academic career, while this is a group that obtained a rather prestigious form of funding. About half of the PhD candidates with previous work experience or who combine their PhD with another job expect a career in academia. Among those without prior work experience, the opinions on whether a career in academia is expected is more divided. Respondents in the DSh are the most likely to expect a job in academia (47.8%), whereas those in the doctoral school of NSE are the least likely to expect such a career (36.0%). The higher the score on engagement and contribution, the more likely one is to expect an academic career. The same holds true for passion for the research and the level of self-efficacy. The more professional and intellectual motivation one has, the more likely they are to expect a career in academia. PhD candidates that have an extended research plan are more likely to expect a career in academia (53.0%). Those without a research plan on the other hand are more likely not expecting an academic career compared to the other two groups. The more time pressure one experiences, the less likely one is to expect an academic career. Finally, those who are highly satisfied with the work family balance in their job are less likely to expect a career in academia.

Table 29: Expecting an academic career by other background characteristics (row percentages)

	Rather not/not at all	Undecided	To a large extent/totally	Total
Nationality ***				
Belgian	44.8	30.0	25.3	100
European	34.5	27.5	38.0	100
Non-European	13.6	22.3	64.1	100
Living situation ***				
No partner, no children	28.0	22.8	49.2	100
Partner, no children	36.1	29.9	34.0	100
Single parent	6.7	13.3	80.0	100
Two parent family	25.9	28.7	45.5	100
Age ***				
25 or younger	42.4	24.6	33.1	100
26-30	32.3	29.9	37.8	100
31-35	21.3	24.8	53.9	100
36 or older	22.9	22.9	54.2	100
Type of contract ***				
Teaching assistant	39.8	18.3	41.9	100
Personal mandate	29.7	33.8	36.5	100
Project funding	33.6	27.0	39.4	100
No contract, self-financed	26.6	26.6	46.8	100
Other	13.0	17.4	69.6	100
Previous work experience ***				
No	34.1	31.2	34.7	100
Yes	28.0	21.2	50.8	100
I still have another job	22.9	26.5	50.6	100
Doctoral school **				
DSh	24.3	27.9	47.8	100
LSM	30.1	32.7	37.2	100
NSE	36.0	21.7	42.3	100
Engagement with research ***				
Low	47.6	26.0	26.4	100
Median	31.3	28.7	39.9	100
High	14.6	24.4	61.0	100
Contribution ***				
Low	43.7	27.6	28.7	100
Median	26.5	29.4	44.0	100
High	15.1	18.4	66.4	100
Passion for research ***				
Low	67.2	14.8	18.0	100
Median	42.4	28.8	28.8	100
High	20.4	26.8	53.8	100
Self-efficacy ***				
Low	37.5	32.5	30.0	100
Median	29.5	26.6	43.9	100
High	22.9	16.6	60.6	100

		Rather not/not at all	Undecided	To a large extent/totally	Total
Professional motivation ***					
	Low	41.7	29.3	29.0	100
	Median	27.2	26.8	46.0	100
	High	18.1	21.4	60.4	100
Intellectual motivation ***					
	Low	45.4	30.3	24.3	100
	Median	27.4	26.8	45.8	100
	High	15.8	19.7	64.5	100
Research plan ***					
	No	37.7	22.3	40.0	100
	Limited	35.2	29.5	35.2	100
	Extended	22.5	24.5	53.0	100
Time pressure *					
	Low	26.5	25.2	48.3	100
	Median	27.0	28.3	44.7	100
	High	37.1	25.7	37.1	100
Work family balance *					
	Low	30.3	27.4	42.3	100
	Median	23.6	26.6	49.8	100
	High	37.8	24.9	37.3	100
		30.3	26.4	43.3	

*Expected and observed frequencies of one or more categories vary significantly for *** p≤0.001, **p≤0.01 or *p≤0.05 based on Pearson's chi-squared test. Table only shows variables with significant effect (also tested against: gender, phase of the PhD, competition and harassment).*

3.4.5 Correlations between scales of intrinsic indicators

Table 30 presents the correlations between the indicators discussed in this section and the scales discussed in the previous section. Self-efficacy shows the strongest correlations with engagement (r=0.49) and contribution (r=0.47); a higher score on self-efficacy is associated with a higher score on these indicators as well. Time pressure on the other hand is negatively correlated with self-efficacy (r=-0.20).

Also, the variable on the passion for research shows the strongest correlations with engagement (r=0.72) and contribution (r=0.59). It is also positively associated with self-efficacy (r=0.45). Experiencing a lot of time pressure (r=-0.22) and a lot of competition (r=-0.17) are associated with a lower level of passion for the research.

Professional motivation shows the strongest correlation with self-efficacy (r=0.30). Also, the indicators on contribution (r=0.26) and passion for the research (r=0.25) are positively associated with professional motivation. The same is true for engagement with the research (r=0.21). PhD candidates who are satisfied with the work family balance are less likely to have a high score on professional motivation (r=-0.10).

The indicator on intellectual motivation shows the strongest correlations with contribution (r=0.44), professional motivation (r=0.43) and the passion for the research (r=0.41). Also being engaged in the research (r=0.40) and self-efficacy (r=0.30) are positively associated with intellectual motivation.

Table 30: Correlation matrix

	Self-efficacy	Passion for research	professional motivation	Intellectual motivation
Time pressure	-0.20 **	-0.22 **	-0.06 n.s.	-0.01 n.s.
Competition	-0.04 n.s.	-0.17 **	0.05 n.s.	-0.06 n.s.
Work family balance	0.03 n.s.	0.02 n.s.	-0.10 **	-0.05 n.s.
Engagement	0.49 **	0.72 **	0.21 **	0.40 **
Contribution	0.47 **	0.59 **	0.26 **	0.44 **
Self-efficacy		0.45 **	0.30 **	0.30 **
Passion for research			0.25 **	0.41 **
Professional motivation				0.43 **

3.4.6 Some reflections on intrinsic indicators

In the section above, we investigated the intrinsic characteristics of PhD candidates in terms of their self-confidence, passion, and motivation. We reported that there was an increase in self-efficacy compared to the previous two years, and that each year, a larger portion of PhD candidates expects an academic career. Some patterns within subgroups of the population were distinguished.

One striking finding is that non-European PhD candidates often significantly differed from the other nationalities. They have more self-efficacy and are more passionate about their research. Additionally, they are more professionally as well as intellectually motivated. In the previous section we already reported that they score higher on job engagement and contribution as well and are more likely to have an extended research plan. This is a recurring finding over the years, and one that can possibly be attributed to a selection effect. Moving to another

continent to obtain a PhD shows a strong motivation and requires a high amount of passion. Only those who are truly committed and confident enough about their abilities are likely to take this step.

Next, we witness a pattern between the different age groups. As already discussed in the previous section, the working conditions are more often experienced negatively among the oldest age groups than among the younger ones (e.g., the experience of more time pressure, worse work family balance and more competition). However, these older PhD candidates showed to feel more engaged in their research and able to contribute something with their research. In this section, we saw that the oldest age group also has a higher level of self-efficacy and passion for their research. They expect an academic career to a greater extent than the younger PhD candidates. This shows that this age group does not always work in the easiest of circumstances (often due to family commitments or combining their PhD with another job) but is a group of highly motivated and passionate PhD candidates.

We see a similar pattern among those who combine their PhD research with another job – which is closely related to the effect of age. 64.8% of those who combine their PhD with another job belongs to the oldest age category. About a quarter (24.2%) of this group belongs to the faculty of Medicine and Pharmacy, and thus probably combines working in the hospital with pursuing a PhD. The second largest group is part of the faculty of Arts and Philosophy (16.5%). The interdisciplinary doctorates (2.2%) and PhD candidates from the faculty of Law and Criminology (5.5%) are the least represented among those who combine their doctoral research with another job.

As explained in the previous section, self-financed PhD candidates and those with another type of contract (e.g., CSC, funded through another university or the private sector…) reported more competition and a lower satisfaction with the work family balance. However, this group also scores higher on self-efficacy, passion for the research, motivation (professional as well intellectual), and expects an academic career to a greater extent. So even though this group does not always work in the easiest circumstances, they do show a strong intrinsic motivation to pursue a PhD. Here, again, a selection effect might be at play. Financing one's own research shows a strong intrinsic motivation to pursue the PhD. Those with another

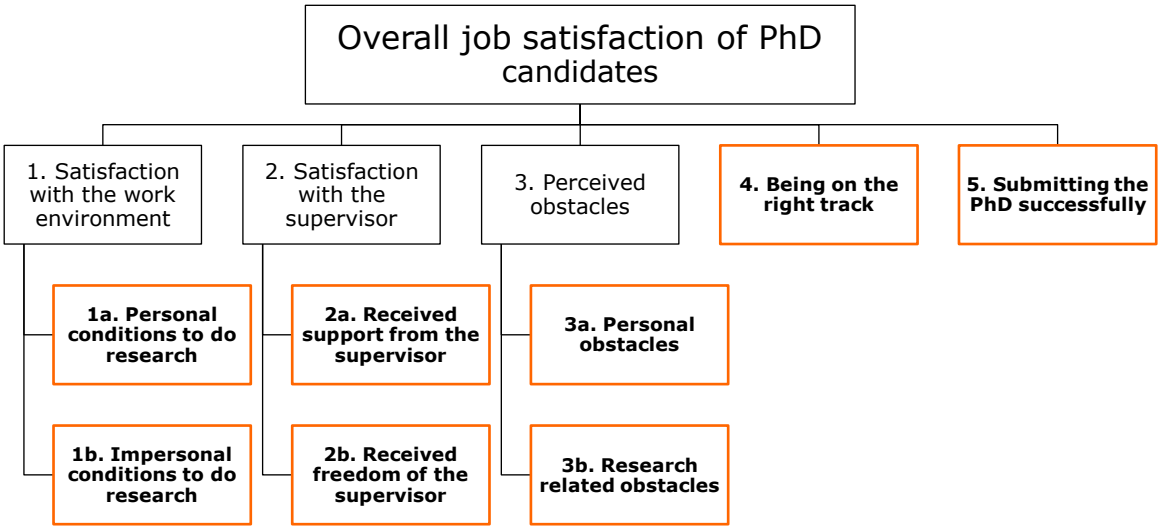
type of contract often have a non-European nationality and come from abroad to pursue their PhD.

4 Constituent variables of job satisfaction

In the previous chapter, we investigated what elements characterize PhD candidates at the VUB. The focus of this chapter is their actual job satisfaction. We investigate this by breaking down the overall job satisfaction into smaller components. As shown in Figure 11, five main components are considered: (1) satisfaction with the work environment, (2) satisfaction with the supervisor, (3) perceived obstacles during the trajectory, (4) the feeling of being on the right track with the research and (5) the self-estimated likelihood of submitting the PhD successfully.

The first three elements were measured by several items that were rated on a 5-point Likert-scale. Using principal component analysis, we reduced the items to six dimensions. Satisfaction with the work environment breaks down into (1a) satisfaction with personal work conditions and (1b) satisfaction with impersonal work conditions. Satisfaction with the supervisor breaks down into (2a) supervisor support and (2b) supervisor freedom. The perceived obstacles break down into (3a) personal obstacles and (3b) research related obstacles.

Figure 11: Overview of constituent elements of overall job satisfaction of PhD candidates

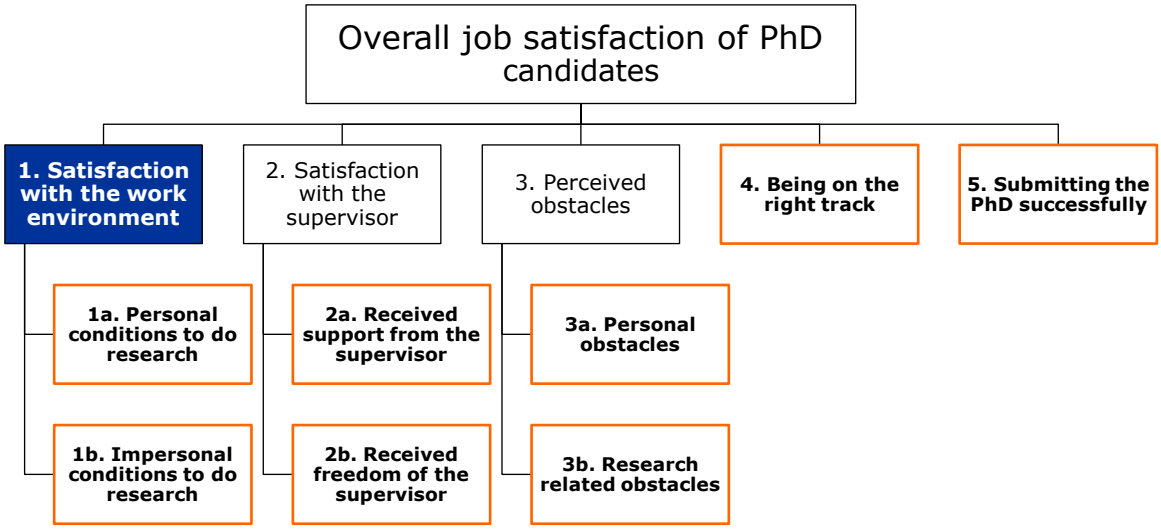


In the following sections, each element will be described and analyzed. Each section starts with a descriptive analysis of the element and, if applicable, the

items underlying it. Next, a multivariate regression analysis investigates associations between background characteristics and the respective element of job satisfaction. For each element, four models are presented. The first model includes sociodemographic and job characteristics, including gender (see section 3.1.1), nationality (see section 3.1.2), age (see section 3.1.3), living situation (see section 3.1.4), doctoral school (see section 3.2.1), phase of the PhD (see section 3.2.2), previous work experience (see section 3.2.3), type of contract (see section 3.2.4) and having a research plan (see section 3.2.5). The second model adds subjective indicators of how the job is experienced, including time pressure (see section 3.3.1), the level of competition (see section 3.3.2), job engagement (see section 3.3.3), work-family balance (see section 3.3.4), experienced harassment (see section 3.3.5). In the third model intrinsic indicators are included, which are self-efficacy (see section 3.4.1), the passion for the research (see section 3.4.2), the motivation to pursue a PhD (see section 3.4.3) and the expectancy for an academic career (see section 3.4.4). Finally, the fourth model summarizes significant associations only.

Each section closes with an overview of the mean scores on the respective element for all variables with significant associations.

4.1 Satisfaction with the work environment



First we investigate satisfaction with the work environment, which is the first element of overall job satisfaction. Two components are considered: (1a) personal conditions of the work environment (e.g., the expertise in the department, the introduction in the research group and the training opportunities offered within the university), and (1b) impersonal conditions (e.g., satisfaction with income, the possibility to take time off and the available funding to go to conferences, and summer schools).

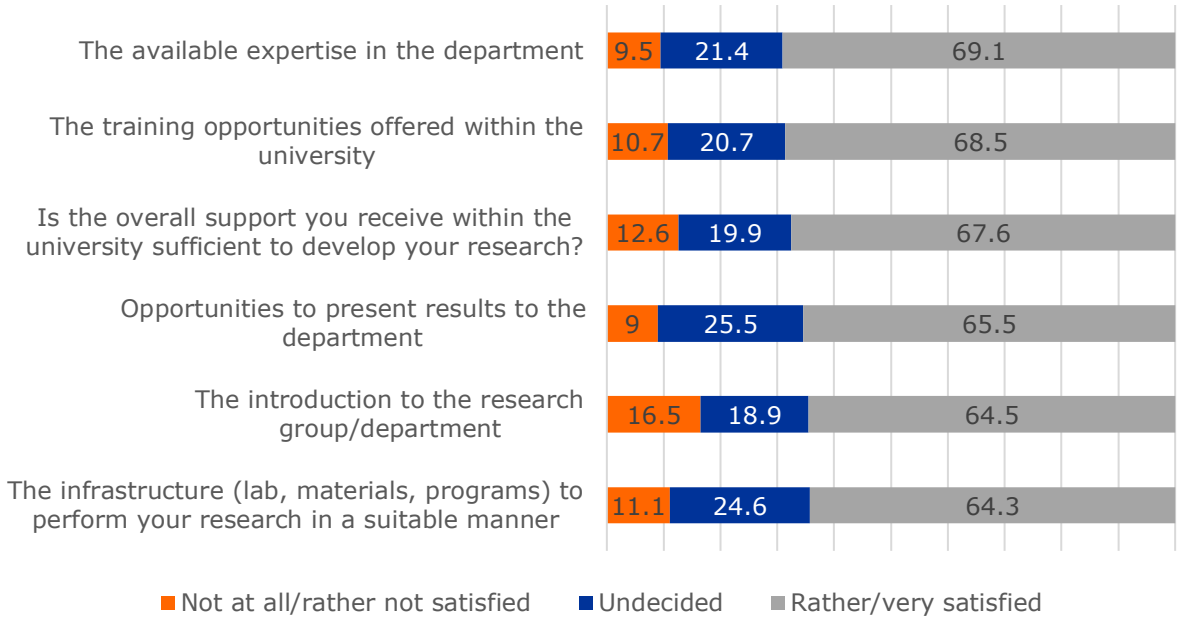
4.1.1 Descriptive results

Figures 12 and 13 show the descriptive results of the items that were used to measure satisfaction with the work environment. A principal component analysis showed that the items could be combined into two variables: satisfaction with the **personal conditions** and satisfaction with **impersonal conditions**. Both variables were rescaled to a score between zero and ten. The results of the PCA can be found in the Appendix Table A8.

Figure 12 presents the descriptive results of the items underlying the personal work conditions. 69.1% is satisfied with the expertise that is available in the department and 68.5% reports that there are ample training opportunities

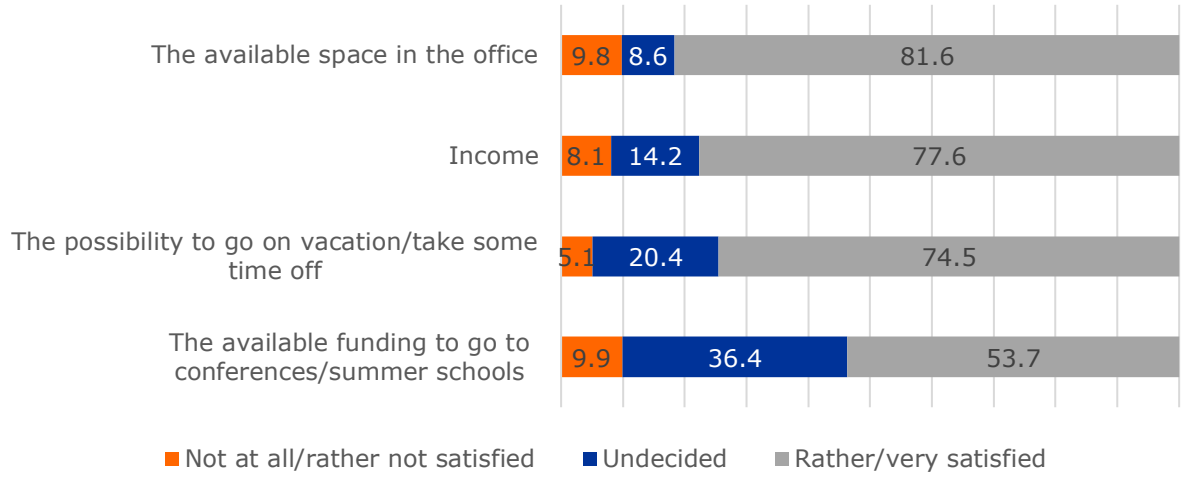
offered within the university. However, one in six (16.5%) is unsatisfied with how they were introduced to their research group or department. Satisfaction with the infrastructure is the lowest, with 64.3%.

Figure 12: Scores (in %) on items of satisfaction with the personal conditions in the work environment



In figure 13, the descriptive results of the items underlying satisfaction with the impersonal conditions in the work environment are presented. 81.6% is satisfied with the available space in the office and 77.6% is satisfied with their income. Only 53.7% indicated to be satisfied with the available funding to attend conferences or summer schools. Overall, there is an increase in satisfaction for each of these items compared to last year.

Figure 13: Scores (in %) on items of satisfaction with the impersonal conditions in the work environment



4.1.2 Qualitative results

Respondents were able to add additional comments on the infrastructure of the workplace in an open question in the survey. In this section we briefly discuss the most frequent answers.

One of the most common remarks about the workplace was that there are insufficient facilities and equipment to properly conduct the research. Most remarks of this nature related to a lack of specific labs (e.g., chemical lab, lab for behavioral research) but also to a lack of lab materials and outdated facilities.

Another recurring comment was about the condition of the office, the office space, and the availability of basic office supplies. Several respondents indicated that the offices were outdated, poorly heated, and that there was insufficient space. Some indicated to not have a desk at all. Moreover, there were remarks about the lack of basic office supplies (e.g., paper, writing materials, keyboard, computer, screen etc.).

"I have now finally been given an office space, but no furniture (desk, chair) or office supplies. I think those basics should be a priori provided for any new employee, but clearly it is not. It is also unclear to me who I have to contact for those things."

"I did not even get a keyboard, mouse, and a screen, let alone a computer. I sit in an office with 8 other desks. We are talking basics here."

A final recurring remark was the fact that the library is too small and under-resourced. According to these PhD candidates, there are not enough physical books as well as insufficient access to online databases and journals to conduct their research – forcing them to illegally download certain materials.

"(…) Programs like endnote & nvivo had to be bought and the access to journals, libraries online, databases is substandard at the vub. I needed to use illegal downloading tools to access publications."

4.1.3 Multivariate results: personal conditions at the workplace

Table 31 shows the results of the multivariate regression analysis for satisfaction with the personal conditions of the work environment.

Model 1 shows that non-European PhD candidates are more satisfied with the personal conditions than their Belgian peers (ß=0.11). Those who live together with a partner only are less satisfied with this aspect than those who live without a partner or children (ß=-0.10). PhD candidates in the DSh are less satisfied with the personal work conditions than those in the doctoral school of NSE (ß= -0.12). Furthermore, not having a research plan or having a limited research plan is associated with less satisfaction with the personal conditions in the work environment, compared to those who have an extended research plan (ß=-0.18 and ß=-0.11, respectively).

Model 2 shows that experiencing competition in the work environment is negatively associated with satisfaction with the personal conditions (ß=-0.30). Being engaged in the job on the other hand shows a positive association (ß=0.26). After controlling for this indicator, the effect of living with a partner disappears. Living together with a partner is associated with less job engagement and thus with less satisfaction with the personal conditions at the job. Furthermore, having experienced harassment is also negatively associated with satisfaction with personal work conditions (ß=-0.08). After the introduction of the indicators of model 2, being in the finalizing phase also renders significant. PhD candidates who are close to finishing their PhD are more satisfied with the personal conditions of their job (ß=0.09).

Model 3 shows that there is a positive association between being substantially professionally motivated and being highly satisfied with the personal

job conditions (ß=0.10). The combination of the newly introduced variables renders the association with nationality insignificant, which makes sense given the substantial variation in motivation across different nationalities (see section 3.4.3).

Model 4 summarizes the significant associations. Experiencing competition in the work environment has the strongest association with satisfaction with personal work conditions. A lot of competition is associated with a lower satisfaction (ß=-0.31). Being engaged in the job is associated with a high satisfaction with personal conditions (ß=0.29). PhD candidates in the DSh are less satisfied with the personal condition than those in the doctoral school of LSM (ß=-0.15). Professional motivation is positively associated with this variable (ß=0.12) and so is being in the finalizing phase of the PhD (ß=0.10). A lower satisfaction with the personal conditions is also found among those who have experienced harassment (ß=-0.09) and those who do not have a research plan (ß=-0.09). Finally, PhD candidates who live together with a partner only are less satisfied with the personal conditions at their job (ß=-0.08).

Table 31: Results of multiple regression analysis of satisfaction with personal conditions

	Model 1		Model 2		Model 3		Model 4	
Sociodemographic characteristics	β	Sig.	β	Sig.	β	Sig.	β	Sig.
Sex (ref. Male)								
Female	-0.01		0.00		0.00			
Nationality (ref. Belgian)								
European	0.07		0.07	*	0.05			
Non-European	0.11	*	0.08		0.04			
Age (ref. 26-30)								
Younger than 25	0.05		-0.01		-0.01			
31-35	0.01		0.02		0.02			
Older than 36	-0.04		-0.03		-0.03			
Living situation (ref. no partner, no children)								
Partner, no children	-0.10	**	-0.06		-0.06		-0.08	*
Single parent	0.04		0.05		0.05		0.03	
Partner and children	-0.01		-0.03		-0.03		-0.05	
Objective job characteristics								
Doctoral school (ref. NSE)								
DSh	-0.12	**	-0.12	***	-0.13	***	-0.15	***
LSM	-0.04		-0.02		-0.02		-0.05	
Phase of the PhD (ref. executing phase)								
Starting phase	0.02		0.01		0.00		0.00	
Finalizing phase	0.06		0.09	**	0.10	**	0.10	**
Previous work experience (ref. no)								
Yes	-0.06		-0.06		-0.05			
I still have another job	-0.03		-0.06		-0.05			
Type of contract (ref. personal mandate)								
Teaching assistant	-0.01		0.00		0.00			
Project funding: PhD is only project	0.06		0.03		0.02			
Project funding: multiple projects	-0.01		0.01		0.00			
Self-financed	0.02		0.04		0.04			
Other	-0.02		-0.03		-0.04			
Research plan (ref. extended plan)								
No plan	-0.18	***	-0.09	**	-0.09	*	-0.09	**
Limited plan	-0.11	**	-0.06		-0.05		-0.05	
Subjective job characteristics								
Time pressure			-0.04		-0.03			
Competition			-0.29	***	-0.30	***	-0.31	***
Job engagement			0.26	***	0.21	***	0.29	***
Job contribution			0.07		0.06			
Work-family balance			0.04		0.04			
Has experienced harassment			-0.08	*	-0.08	*	-0.09	**
Intrinsic and motivational indicators								
Self-efficacy					0.04			
Passion for PhD (ref. median)								
Low					-0.01			
High					0.01			
Professional motivation					0.10	**	0.12	***
Intellectual motivation					0.01			
Expecting to work in academia (ref. undecided)								
Rather not/not at all					0.02			
To a large extent/definitely					-0.01			
N	813		781		771		791	
Adjusted R^2	6.1		30.4		30.7		31.9	

Table 32 shows the mean scores of the component of satisfaction with personal work conditions for each of the variables that were significantly associated with the component. The score ranges from zero to ten, and the overall average score is 6.8/10, which is the same as last year. Since this variable was constructed differently before that, comparisons with earlier measuring points cannot be made.

When it comes to nationality, Non-European PhD candidates are the most satisfied with the personal condition at their job, more so than their Belgian peers (7.0/10 compared to 6.6/10). Those who live together with a partner only are less satisfied with the personal conditions than those who live without a partner or children (6.5/10 compared to 7.0/10). PhD candidates in the doctoral school of NSE are the most satisfied with the personal conditions at their work, with an average of 7.1/10. This is higher than those in the DSh (6.5/10) and the doctoral school of LSM (6.7/10). Having an extended research plan is related to a higher satisfaction with the personal conditions at work (7.2/10). This compared to those without a research plan (6.3/10) and with a limited research plan (6.7/10). Experiencing competition and harassment at work are negatively associated with the personal work conditions. Job engagement and professional motivation on the other hand show a positive association.

Being in the finalizing phase of the research does not show a significant bivariate effect. This association is only significant when also controlled for competition and job engagement.

Table 32: Bivariate effects between significant background variables and satisfaction with personal work conditions

		Personal conditions (on 10)
Nationality		
	Belgian	6.6 [a]
	European	6.8
	Non-European	7.0 [a]
Living situation		
	No partner, no children	7.0 [a]
	Partner, no children	6.5 [a]
	Single parent	7.1
	Two parent family	6.8
Doctoral school		
	DSh	6.5 [a]
	LSM	6.7 [b]

		Personal conditions (on 10)
	NSE	7.1 [ab]
Research plan		
	No	6.3 [a]
	Limited	6.7 [b]
	Extended	7.2 [ab]
Competition		
	Low	7.4 [a]
	Median	6.8 [a]
	High	6.0 [a]
Engagement with research		
	Low	5.9 [a]
	Median	6.9 [a]
	High	7.5 [a]
Has experienced harassment		
	No	6.9 [a]
	Yes	5.6 [a]
Professional motivation		
	Low	6.6 [a]
	Median	6.8
	High	7.1 [a]
Total mean		**6.8**

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.
Table only shows variables with significant effect (also tested against: gender, age, phase of the PhD, previous work experience, type of contract, time pressure, contribution, work-family balance, self-efficacy, passion, intellectual motivation and expectancy to work in academia).

4.1.4 Multivariate results: impersonal conditions at the workplace

Table 33 shows the results of the multivariate regression analysis for satisfaction with the impersonal conditions of the work environment.

Model 1 shows that PhD candidates in the DSh and those in the doctoral school of LSM are both less satisfied with the impersonal conditions at work than those in the doctoral school of NSE (ß=-0.10 and ß=-0.13, respectively). Also, those who are in the finalizing phase of their research have a higher satisfaction with these aspects, compared to those in the executing phase (ß=0.08). PhD candidates who have work experience in another workplace (either in the past or currently) are less satisfied with the impersonal conditions at the VUB (ß=-0.10). Those who have another type of contract are less satisfied with the impersonal conditions at work compared to those who have a personal mandate (ß=-0.13).

Finally, not having a research plan or having only a limited research plan is associated with a lower satisfaction with impersonal work conditions (ß=-0.09).

Model 2 shows that experiencing competition is associated with a lower satisfaction with impersonal work conditions (ß=-0.10). Also, the experience of harassment shows a negative association (ß=-0.12). Being satisfied with the work family balance is associated with a higher satisfaction with impersonal work conditions (ß=0.32). After the introduction of these additional indicators, being non-European becomes statistically significant. These PhD candidates are more satisfied with the impersonal conditions at work compared to Belgian ones (ß=0.09).

The variables that are introduced in model 3 do not show any additional significant associations.

Model 4 summarizes the significant associations. Satisfaction with the work family balance shows the strongest association with the impersonal work conditions (ß=0.34). Experiencing harassment and competition in the work environment both have an equally strong negative effect on this variable (ß=-0.14). Additionally, those who combine their PhD with another job (ß=-0.14) and those with previous work experience (ß=-0.12) are less satisfied with the impersonal work conditions compared to those who had no prior work experience. The same negative effect is true for both the PhD candidates in the DSh and those in the doctoral school of LSM (ß=-0.14 and ß=-0.07, respectively). Having another type of contract is also negatively associated with satisfaction with impersonal work conditions (ß=-0.13). Non-European PhD candidates on the other hand show a higher satisfaction (ß=0.09). Those without a research plan, or with a limited research plan only, are less satisfied with the impersonal conditions at their job (ß=-0.08). Finally, those who are in the finalizing phase of their research are more satisfied with this aspect than those in the executing phase of their research (ß=0.07).

Table 33: Results of multiple regression analysis of satisfaction with impersonal conditions

	Model 1		Model 2		Model 3		Model 4	
Sociodemographic characteristics	β	Sig.	β	Sig.	β	Sig.	β	Sig.
Sex (ref. Male)								
Female	0.01		0.03		0.02			
Nationality (ref. Belgian)								
European	0.05		0.06		0.06		0.04	
Non-European	0.05		0.09	*	0.08		0.09	*
Age (ref. 26-30)								
Younger than 25	0.05		0.00		0.01			
31-35	-0.02		0.00		0.00			
Older than 36	-0.09		-0.07		-0.07			
Living situation (ref. no partner, no children)								
Partner, no children	-0.02		0.00		0.01			
Single parent	-0.02		0.01		0.02			
Partner and children	-0.07		-0.05		-0.06			
Objective job characteristics								
Doctoral school (ref. NSE)								
DSh	-0.10	*	-0.14	***	-0.15	***	-0.14	***
LSM	-0.13	***	-0.08	*	-0.09	*	-0.07	*
Phase of the PhD (ref. executing phase)								
Starting phase	-0.06		-0.04		-0.04		-0.04	
Finalizing phase	0.08	*	0.09	**	0.10	**	0.07	*
Previous work experience (ref. no)								
Yes	-0.10	*	-0.10	**	-0.09	*	-0.12	***
I still have another job	-0.10	*	-0.09	*	-0.09	*	-0.14	***
Type of contract (ref. personal mandate)								
Teaching assistant	0.04		0.06		0.05		0.06	
Project funding: PhD is only project	0.06		0.03		0.02		0.04	
Project funding: multiple projects	-0.02		-0.02		-0.03		-0.01	
Self-financed	-0.07		-0.05		-0.05		-0.05	
Other	-0.13	***	-0.14	***	-0.15	***	-0.13	***
Research plan (ref. extended plan)								
No plan	-0.09	*	-0.07	*	-0.07		-0.08	*
Limited plan	-0.09	*	-0.06		-0.06		-0.08	*
Subjective job characteristics								
Time pressure			-0.03		-0.03			
Competition			-0.10	**	-0.10	**	-0.14	***
Job engagement			0.07		0.08			
Job contribution			0.03		0.04			
Work-family balance			0.32	***	0.32	****	0.34	***
Has experienced harassment			-0.12	***	-0.13	*	-0.14	***
Intrinsic and motivational indicators								
Self-efficacy					-0.03			
Passion for PhD (ref. median)								
Low					0.05			
High					0.03			
Professional motivation					0.05			
Intellectual motivation					0.03			
Expecting to work in academia (ref. undecided)								
Rather not/not at all					0.02			
To a large extent/definitely					-0.03			
N	813		781		771		813	
Adjusted R^2	11.3		27.0		27.0		29.1	

Table 34 shows the mean scores of satisfaction with impersonal work conditions for each of the variables that were significantly associated with the component. The score ranges from zero to ten, and the overall average score is 6.8/10. This is lower compared to last year when the average score was 7.1/10 ($p<0.05$). Since this variable was constructed differently before that, comparisons with earlier measuring points cannot be made.

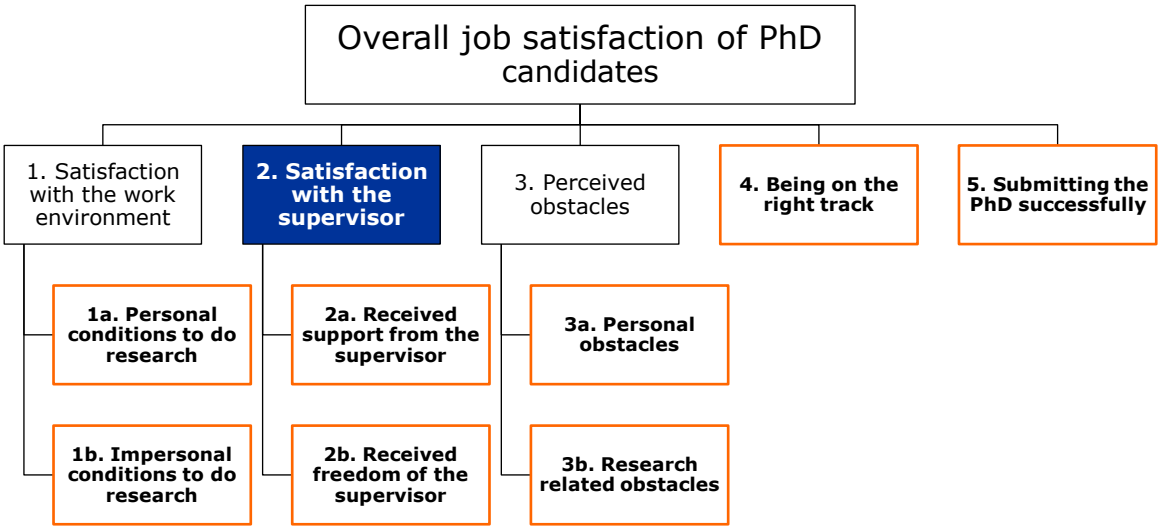
Similar to the personal conditions, PhD candidates in the doctoral school of LSM are the most satisfied with the impersonal conditions at their job (7.3/10), more so than those in the DSh (6.5/10) and NSE (6.5/10). Absence of prior work experience is associated with a higher satisfaction with the impersonal work conditions (7.3/10). PhD candidates who are self-financed or have another type of contract are less satisfied with the impersonal work conditions (6.1/10) than teaching assistants (6.9/10), those with a personal mandate (7.2/10), and those with project funding (7.2/10). Having an extended research plan is associated with a higher satisfaction with the impersonal conditions (7.1/10). Experiencing competition and harassment at work are both negatively associated with satisfaction with impersonal work conditions. Satisfaction with the work family balance shows a positive association.

Table 34: Bivariate effects between significant background variables and satisfaction with impersonal work conditions

		Impersonal conditions (on 10)
Doctoral school		
	DSh	6.5 [a]
	LSM	6.5 [b]
	NSE	7.3 [ab]
Previous work experience		
	No	7.3 [a]
	Yes	6.7 [a]
	I still have another job	5.7 [a]
Type of contract		
	Teaching assistant	6.9 [ad]
	Personal mandate	7.2 [be]
	Project funding	7.2 [cf]
	No contract, self-financed	6.1 [abc]
	Other	6.1 [def]
Research plan		
	No	6.6
	Limited	6.7 [a]
	Extended	7.1 [a]
Competition		
	Low	7.4 [a]
	Median	6.9 [a]
	High	6.1 [a]
Work family balance		
	Low	6.0 [a]
	Median	6.9 [a]
	High	7.7 [a]
Has experienced harassment		
	No	7.0 [a]
	Yes	5.5 [a]
Total mean		**6.8**

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.
Table only shows variables with significant effect (also tested against: gender, nationality, age, living situation, phase of the PhD, time pressure, engagement, contribution, self-efficacy, passion, professional motivation, intellectual motivation and expectancy to work in academia).

4.2 Satisfaction with the supervisor



Next, we investigate satisfaction with the supervisor as the second element of the overall job satisfaction. We consider two dimensions: (2a) satisfaction with the support received from the supervisor and (2b) satisfaction with the freedom given by the supervisor. The former deals with the expertise, involvement, and support from the supervisor, as well as the quality and frequency of meetings. The latter deals with the freedom to develop research ideas, the possibility to attend courses and conferences and to meet other experts in the field.

Before looking into how satisfied PhD candidates are with their supervisor, we discuss the expectations they have of their supervisor.

4.2.1 The context

Figure 14 lists several tasks of the PhD trajectory. PhD candidates were asked to what extent they consider each task their responsibility or the responsibility of the supervisor. The majority of PhD candidates considers writing the thesis (94.3%) and presenting it (75.7%) their responsibility. 61.3% reports it is their responsibility to make sure time is spent on the appropriate tasks, and more than half (52.2%) agrees that they are in charge to develop an appropriate timetable for research and study.

On the other hand, 60% reports it is the supervisor responsibility to make sure there is access to the appropriate services and facilities for the research. One in three (33.9%) finds the familiarization with the relevant policies, procedures and requirements related to the PhD candidature their supervisor's responsibility and 27.2% reports the supervisor is responsible for the standard of the thesis.

Figure 14: Responsibilities of supervisor and PhD candidate

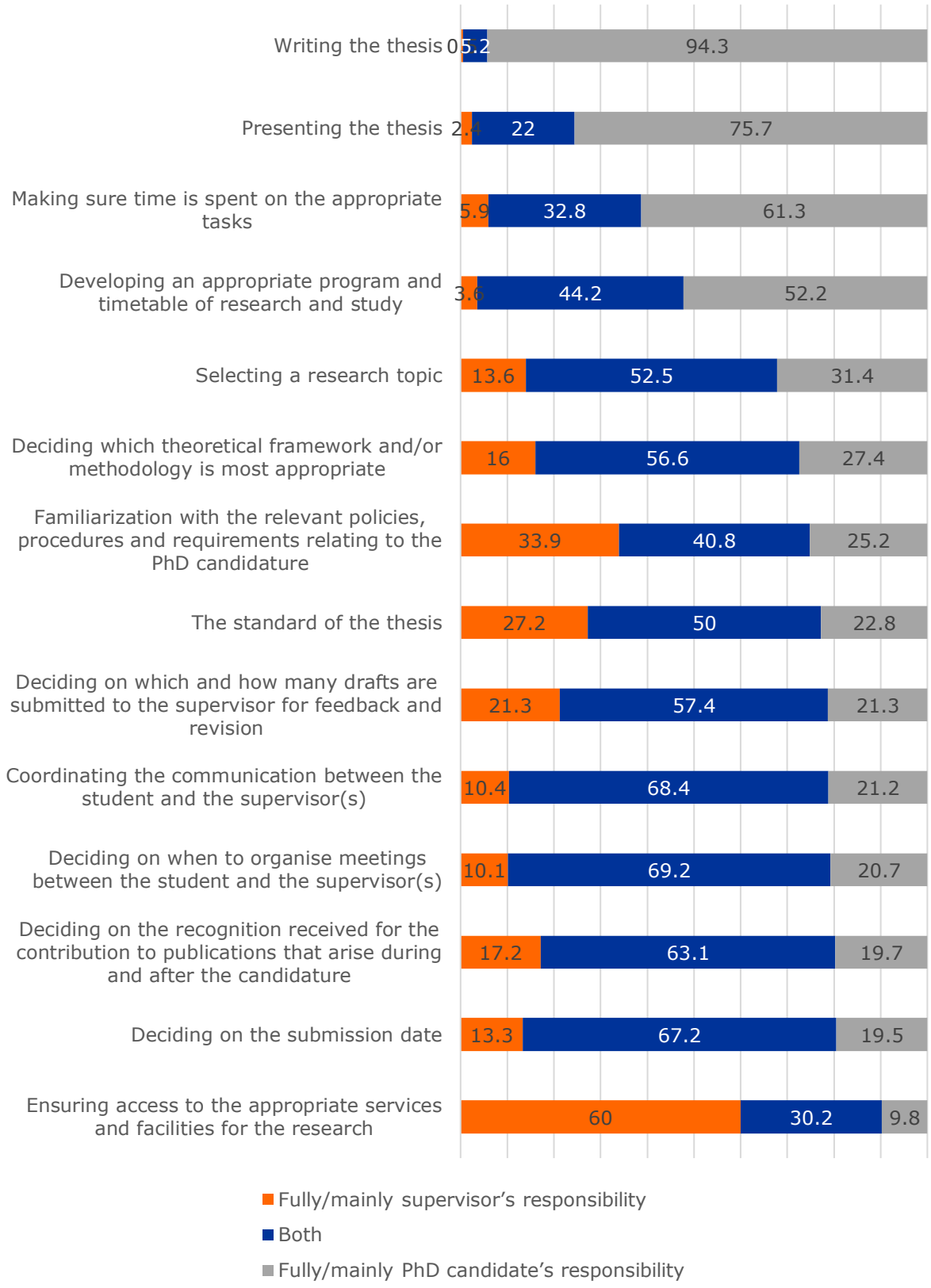


Table 35 shows how PhD candidates think about the ideal relationship with their supervisor. Almost half of them (49.7%) reports the relationship should be both professional and personal. 43.1% states that the relationship should be mainly professional. One in twenty (5.0%) reports the relationship should be purely professional, and a personal relationship should not develop. On the other end, 2.2% states that the relationship should be mainly or purely personal.

Table 35: Ideal relationship between supervisor and PhD candidate

	N	%
Purely professional, a personal relationship should not develop	41	5.0
Mainly professional	351	43.1
Both professional and personal	405	49.7
Mainly personal	9	1.1
Purely personal, a strong personal relationship is essential for successful supervision	9	1.1
Total	815	100

Question: "How do you see the relationship between supervisor and student?"

4.2.2 Descriptive results

Figures 15 and 16 show the descriptive results of the items that were used to measure satisfaction with the supervisor. The results of a principal component analysis showed that the items could be combined into two variables: satisfaction with the supervisor support and satisfaction with supervisor freedom. Both the variables were rescaled to a score between zero and ten. The results of the PCA can be found in the Appendix Table A9.

Figure 15 shows the descriptive results of the items underlying the support given by the supervisor. 80.4% is satisfied with their supervisor's expertise on the research subject. 77.8% is satisfied with the quality of the meetings. One in five is dissatisfied with the introduction to other prominent researchers (21%).

Figure 15: Scores (in %) on items of satisfaction with the supervisor support

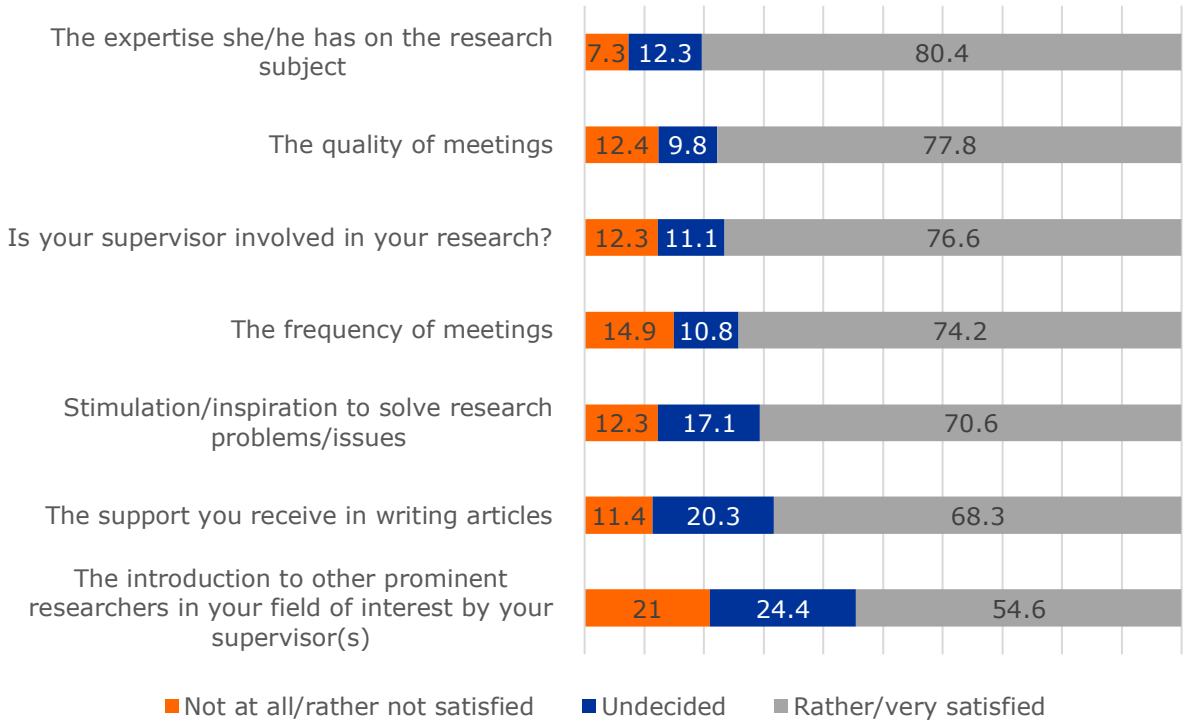
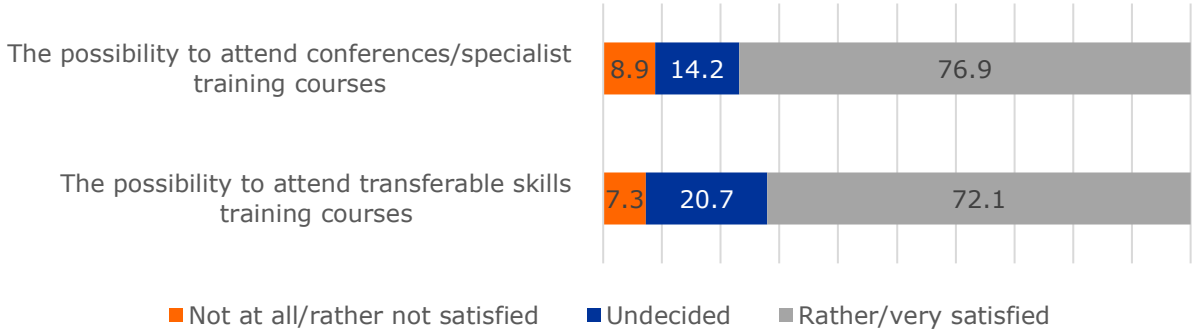


Figure 16 presents the items underlying satisfaction with the freedom given by the supervisor. 85.1% is satisfied with the freedom they get to come up with their own research ideas. 76.9% is satisfied with the possibility to attend conferences and specialist training courses, which is an increase of five percentage points compared to last year. This may be related to the loosening of restrictions after the COVID-19 pandemic.

Figure 16: Scores (in %) on items of satisfaction with supervisor freedom



4.2.3 Multivariate results: supervisor support

Table 36 shows the results of the multivariate regression analysis for satisfaction with the support received from the supervisor.

Model 1 shows that non-European PhD candidates are more satisfied with the support they receive than their Belgian peers (ß=0.13). The youngest PhD candidates feel more supported than those between 26 and 30 years old (ß=0.09). Furthermore, those who live together with a partner only are less satisfied with the support their receive compared to those who live without a partner or children (ß=-0.13). There is less satisfaction with the support from the supervisor among those without a research plan (ß= -0.16) and those with a limited plan (ß=-0.14) compared to those who have an extended research plan.

Model 2 shows the effect of being part of the DSh renders significant. These PhD candidates are more satisfied with the support of their supervisor than those in the doctoral school of NSE (ß=0.09). Time pressure and competition among colleagues are negatively associated with the support from the supervisor (ß=-0.12 and ß=-0.20, respectively). Feeling engaged in the job shows a positive association (ß=0.20) and so does the feeling of being able to contribute to the greater good (ß=0.11). PhD candidates who have experienced harassment are less satisfied with the support from their supervisor compared to those without this experience (ß=-0.12). After controlling for competition, the association between gender and the supervisor support renders significant. Female PhD candidates are less satisfied with the support than male ones (ß=-0.06). Male PhD candidates experience more competition than their female peers and competition is negatively associated with support. Hence when we do not control for competition, the gender difference is masked. Also having prior work experience is negatively associated with the support from the supervisor (ß=-0.08).

Model 3 shows that professional motivation is positively associated with the support from the supervisor (ß=0.07). The newly introduced variables render the effect of being non-European and contribution insignificant.

Model 4 summarizes the significant associations. Job engagement has the strongest association with the support from the supervisor. The more one is engaged in their job, the more they also feel supported by their supervisor (ß=0.25). Experiencing competition between colleagues is negatively associated with the support from the supervisor (ß=-0.23). Also, time pressure shows a negative association with the support from the supervisor (ß=-0.15). Having

experienced harassment on the work floor is also negatively associated with the support from the supervisor (ß=-0.12). PhD candidates who live together with a partner feel less supported by their supervisor than those who live without a partner or children (ß=-0.12). Professional motivation is positively associated with supervisor support (ß=0.11). Not having a research plan is negatively associated with the support from the supervisor (ß=-0.10), and so is having a limited research plan (ß=-0.08). PhD candidates between 31 and 35 years feel less supported by their supervisor than those between 26 and 30 years old (ß=-0.07). Finally, female PhD candidates feel less supported by their supervisor than their male colleagues (ß=-0.06).

Table 36: Results of multiple regression analysis of satisfaction with supervisor support

	Model 1		Model 2		Model 3		Model 4	
Sociodemographic characteristics	β	Sig.	β	Sig.	β	Sig.	β	Sig.
Sex (ref. Male)								
Female	-0.03		-0.06	*	-0.07	*	-0.06	*
Nationality (ref. Belgian)								
European	-0.01		0.02		0.01			
Non-European	0.13	**	0.09	*	0.04			
Age (ref. 26-30)								
Younger than 25	0.09	*	0.01		0.01		0.01	
31-35	-0.06		-0.07	*	-0.07	*	-0.07	*
Older than 36	-0.01		-0.06		-0.06		-0.02	
Living situation (ref. no partner, no children)								
Partner, no children	-0.13	***	-0.13	***	-0.12	**	-0.12	***
Single parent	0.02		0.04		0.03		0.03	
Partner and children	-0.05		-0.03		-0.02		-0.03	
Objective job characteristics								
Doctoral school (ref. NSE)								
DSh	0.07		0.09	*	0.09	*		
LSM	0.04		0.07		0.07			
Phase of the PhD (ref. executing phase)								
Starting phase	-0.01		0.01		-0.01			
Finalizing phase	-0.02		-0.01		-0.01			
Previous work experience (ref. no)								
Yes	-0.06		-0.08	*	-0.07	*		
I still have another job	0.06		0.06		0.06			
Type of contract (ref. personal mandate)								
Teaching assistant	0.01		0.01		0.01			
Project funding: PhD is only project	0.05		0.01		0.03			
Project funding: multiple projects	-0.06		-0.07		-0.06			
Self-financed	-0.03		0.01		0.01			
Other	-0.01		-0.03		-0.03			
Research plan (ref. extended plan)								
No plan	-0.16	***	-0.11	***	-0.10	**	-0.10	**
Limited plan	-0.14	***	-0.10	**	-0.08	*	-0.08	*
Subjective job characteristics								
Time pressure			-0.12	***	-0.12	***	-0.15	***
Competition			-0.20	***	-0.22	***	-0.23	***
Job engagement			0.20	***	0.13	**	0.25	***
Job contribution			0.11	*	0.06			
Work-family balance			0.03		0.05			
Has experienced harassment			-0.12	***	-0.12	***	-0.12	***
Intrinsic and motivational indicators								
Self-efficacy					-0.01			
Passion for PhD (ref. median)								
Low					-0.01			
High					0.06			
Professional motivation					0.07	*	0.11	***
Intellectual motivation					0.07			
Expecting to work in academia (ref. undecided)								
Rather not/not at all					-0.03			
To a large extent/definitely					0.03			
N	813		781		771		775	
Adjusted R^2	7.3		32.3		33.4		31.5	

The overall average score on satisfaction with the support from the supervisor is 7.5/10. As shown in Table 37, this score is increasing over the years. The score of 2018 is significantly lower than in 2020, 2021 and 2022. The score of 2019 varies significantly compared to 2021 and 2022.

Table 37: Evolution of satisfaction with supervisor support over the years

2018	2019	2020	2021	2022
6.9^{abc}	7.1^{de}	7.3^{a}	7.5^{bd}	7.5^{ce}

Note: within groups, item means sharing a letter in their subscript are significantly different at α = 0.05 according to a pairwise comparison with Bonferroni correction for multiple comparisons.

Table 38 shows the mean scores of the component of support from the supervisor for each of the variables that were significantly associated with the component. Non-European PhD candidates are more satisfied with the support from their supervisor than the other European and Belgian ones (7.8/10 compared to 7.3/10 and 7.2/10). The youngest age group feels the most support from their supervisor (7.8/10), more so than the 31- to 35-year-olds (7.2/10). PhD candidates who live together with a partner only feel the least supported by their supervisor (7.1/10), less so than those who live without a partner or children (7.8/10). PhD candidates who have an extended research plan feel more supported by their supervisor (7.9/10) than those with a limited research plan (7.3/10) or no research plan (7.0/10). Time pressure and competition are both negatively associated with supervisor support. Engagement with the research and professional motivation are positively associated with this indicator. Finally, PhD candidates that have experienced harassment on the work floor feel less supported by their supervisor (6.1/10).

As explained above, the effect of gender is not significant unless controlled for competition. Similarly, the bivariate relationship between doctoral schools and the support from the supervisor does not show a significant association.

Table 38: Bivariate effects between significant background variables and satisfaction with supervisor support

		Satisfaction with supervisor support (on 10)
Nationality		
	Belgian	7.3 [a]
	European	7.2 [b]
	Non-European	7.8 [ab]
Age		
	25 or younger	7.8 [a]
	26-30	7.4
	31-35	7.2 [a]
	36 or older	7.6
Living situation		
	No partner, no children	7.8 [a]
	Partner, no children	7.1 [a]
	Single parent	7.8
	Two parent family	7.4
Research plan		
	No	7.0 [a]
	Limited	7.3 [b]
	Extended	7.9 [ab]
Time pressure		
	Low	8.2 [a]
	Median	7.4 [a]
	High	6.9 [a]
Competition		
	Low	8.0 [a]
	Median	7.4 [a]
	High	6.8 [a]
Engagement with research		
	Low	6.6 [a]
	Median	7.4 [a]
	High	8.3 [a]
Has experienced harassment		
	No	7.6 [a]
	Yes	6.1 [a]
Professional motivation		
	Low	7.2 [a]
	Median	7.4 [b]
	High	8.0 [ab]
Total mean		**7.5**

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.
Table only shows variables with significant effect (also tested against: gender, doctoral school, phase of the PhD, previous work experience, type of contract, contribution, work-family balance, self-efficacy, passion, intellectual motivation and expectancy to work in academia).

4.2.4 Multivariate results: supervisor freedom

Table 39 shows the results of the multivariate regression analysis for satisfaction with the freedom given by the supervisor.

Model 1 shows that non-European PhD candidates are more satisfied with supervisor freedom than their Belgian peers (ß=0.09). PhD candidates between 31 and 35 years old are less satisfied with the freedom given by their supervisor compared to the 26-to-30-year-olds. PhD candidates from the DSh are more satisfied with supervisor freedom than those in the doctoral school of NSE (ß=0.09). PhD candidates that do not have a research plan or have a limited plan only are less satisfied with supervisor freedom (ß=-0.20 and ß=-0.10, respectively) compared to those who have an extended research plan.

Model 2 shows that the experience of competition at work is negatively associated with the freedom given by the supervisor (ß=-0.11). The satisfaction with the work family balance is positively associated with supervisor freedom (ß=0.15). The effects of nationality, age and doctoral school disappear after the introduction of the new variables.

The introduction of the indicators of model 3 does not result in any additional significant changes.

Model 4 summarizes the significant associations. The satisfaction with the work family balance has the strongest effect on satisfaction with supervisor freedom (ß=0.20). Experiencing competition between colleagues shows a negative association (ß=-0.17). PhD candidates who do not have a research plan are less satisfied with supervisor freedom than those who have an extended research plan (ß=-0.16) and the same is true for those with a limited research plan (ß=-0.07). Finally, non-European PhD candidates are more satisfied with supervisor freedom than their Belgian peers (ß=0.07).

Table 39: Results of multiple regression analysis of satisfaction with supervisor freedom

	Model 1		Model 2		Model 3		Model 4	
Sociodemographic characteristics	β	Sig.	β	Sig.	β	Sig.	β	Sig.
Sex (ref. Male)								
Female	0.01		0.01		0.01			
Nationality (ref. Belgian)								
European	0.01		0.01		0.02		0.00	
Non-European	0.09	*	0.08		0.07		0.07	*
Age (ref. 26-30)								
Younger than 25	0.02		-0.01		0.00			
31-35	-0.08	*	-0.06		-0.07			
Older than 36	-0.07		-0.05		-0.06			
Living situation (ref. no partner, no children)								
Partner, no children	-0.06		-0.04		-0.03			
Single parent	0.02		0.04		0.03			
Partner and children	-0.08		-0.07		-0.07			
Objective job characteristics								
Doctoral school (ref. NSE)								
DSh	0.09	*	0.08	*	0.07			
LSM	-0.03		0.00		0.00			
Phase of the PhD (ref. executing phase)								
Starting phase	-0.06		-0.06		-0.06			
Finalizing phase	0.05		0.07		0.08			
Previous work experience (ref. no)								
Yes	-0.06		-0.07		-0.06			
I still have another job	-0.01		0.00		0.01			
Type of contract (ref. personal mandate)								
Teaching assistant	0.00		0.02		0.01			
Project funding: PhD is only project	0.02		0.01		0.01			
Project funding: multiple projects	-0.03		-0.02		-0.03			
Self-financed	0.03		0.03		0.04			
Other	-0.07		-0.07		-0.07			
Research plan (ref. extended plan)								
No plan	-0.20	***	-0.16	***	-0.16	***	-0.16	***
Limited plan	-0.10	*	-0.08	*	-0.08	*	-0.07	*
Subjective job characteristics								
Time pressure			-0.04		-0.05			
Competition			-0.11	**	-0.11	***	-0.17	***
Job engagement			0.08		0.11			
Job contribution			0.08		0.06			
Work-family balance			0.15	***	0.15	***	0.20	***
Has experienced harassment			-0.06		-0.06			
Intrinsic and motivational indicators								
Self-efficacy					-0.03			
Passion for PhD (ref. median)								
Low					0.05			
High					-0.01			
Professional motivation					0.02			
Intellectual motivation					0.04			
Expecting to work in academia (ref. undecided)								
Rather not/not at all					0.01			
To a large extent/definitely					0.03			
N	807		781		771		808	
Adjusted R^2	5.2		13.5		13.1		10.6	

The average score of satisfaction with the freedom given by the supervisor is 7.5/10. Table 40 shows the score of this variable over the years. It is remarkable that in 2020, just when the COVID-19 pandemic started and working from home became mandatory, there was the highest level of satisfaction with the freedom given by the supervisor. This difference is significant compared to 2019, 2021 and 2022.

Table 40: Evolution of satisfaction with supervisor freedom over the years

2018	2019	2020	2021	2022
7.5^{a}	7.2^{ab}	7.8^{bcd}	7.3^{c}	7.4^{d}

Note: within groups, item means sharing a letter in their subscript are significantly different at α = 0.05 according to a pairwise comparison with Bonferroni correction for multiple comparisons.

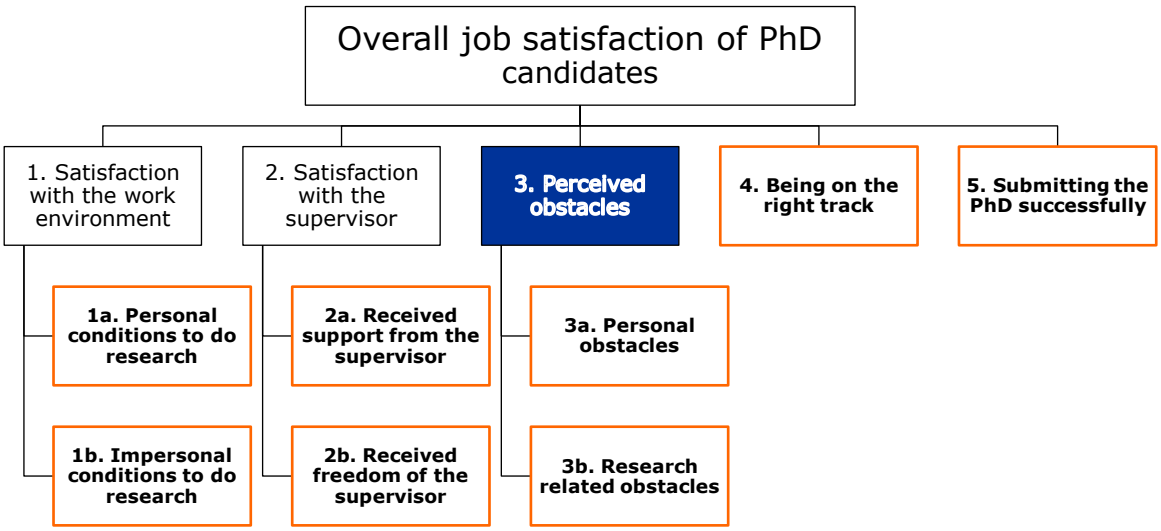
Table 41 shows the mean scores of satisfaction with the freedom of the supervisor for each of the variables that were significantly associated with the component. Those who live together with a partner and children are less satisfied than those who live without a partner or children (7.0/10 compared to 7.7/10). The PhD candidates in the doctoral school of LSM are the least satisfied with supervisor freedom (6.9/10), less so than those in the DSh (7.6/10) or in the doctoral school of NSE (7.4/10). PhD candidates without a research plan are the least satisfied with supervisor freedom (6.7/10), those with an extended research plan are the most satisfied (7.9/10). As stated above, time pressure and competition are negatively associated with supervisor freedom. Job engagement, contribution, and satisfaction with the work family balance are positively associated with this variable. Finally, PhD candidates who have experienced harassment are less satisfied with the freedom they receive from their supervisor (6.4/10 compared to 7.6/10).

Table 41: Bivariate effects between significant background variables and satisfaction with supervisor freedom

		Satisfaction with supervisor freedom (on 10)
Living situation		
	No partner, no children	7.7 [a]
	Partner, no children	7.4
	Single parent	7.8
	Two parent family	7.0 [a]
Doctoral school		
	DSh	7.7 [a]
	LSM	7.1 [a]
	NSE	7.5
Research plan		
	No	6.7 [a]
	Limited	7.4 [a]
	Extended	7.9 [a]
Time pressure		
	Low	8.0 [a]
	Median	7.5 [a]
	High	7.0 [a]
Competition		
	Low	8.0 [a]
	Median	7.4 [a]
	High	6.9 [a]
Job engagement		
	Low	6.9 [a]
	Median	7.4 [a]
	High	8.1 [a]
Job contribution		
	Low	7.0 [a]
	Median	7.5 [a]
	High	8.4 [a]
Work family balance		
	Low	6.9 [ab]
	Median	7.7 [a]
	High	7.9 [b]
Has experienced harassment		
	Yes	6.4 [a]
	No	7.6 [a]
Total mean		**7.5**

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.
Table only shows variables with significant effect (also tested against: gender, nationality, age, phase of the PhD, previous work experience, type of contract, self-efficacy, passion, professional motivation, intellectual motivation and expectancy to work in academia).

4.3 Perceived obstacles



In this section, we take a closer look at the challenges and doubts PhD candidates face throughout their trajectory. We presented the PhD candidates nine statements, for which they were asked to indicate to what extent these elements influence their belief in successfully completing their PhD.

4.3.1 Descriptive results

Figures 17 and 18 show the descriptive results of the statements that were used to measure the obstacles PhD candidates face. The results of a Principal component analysis showed that the items could be combined into two variables: personal obstacles and research related obstacles. Both variables were rescaled to a score between zero and ten. One statement was excluded from the analyses, as it did not load strongly enough on any of the two components: the uncertainty concerning funding (not shown in graph). 21.8% said to be worried about this, 61.6% said to not experience this concern. The results of the PCA can be found in the Appendix Table A10.

Figure 17 shows the descriptive results of the items underlying the experience of personal obstacles. 36.8% indicated to doubt their own capabilities. Almost one in three (29.6%) struggles with the unbalanced combination of work

and family. 8.7% finds their research topic not that interesting and 7% said to not have the ambition to do a PhD in the first place.

Figure 17: Scores (in %) on items of personal obstacles

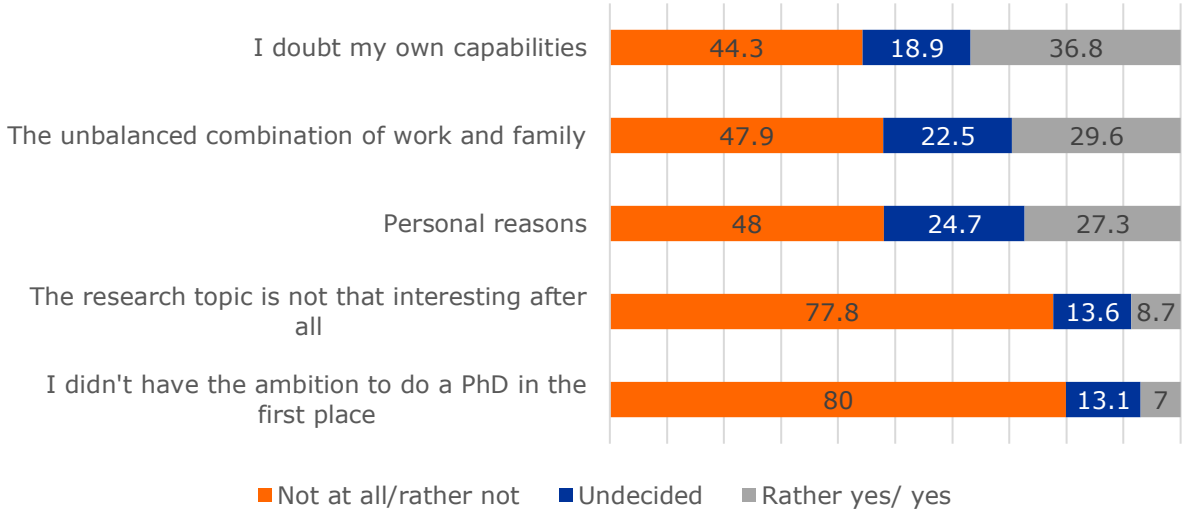
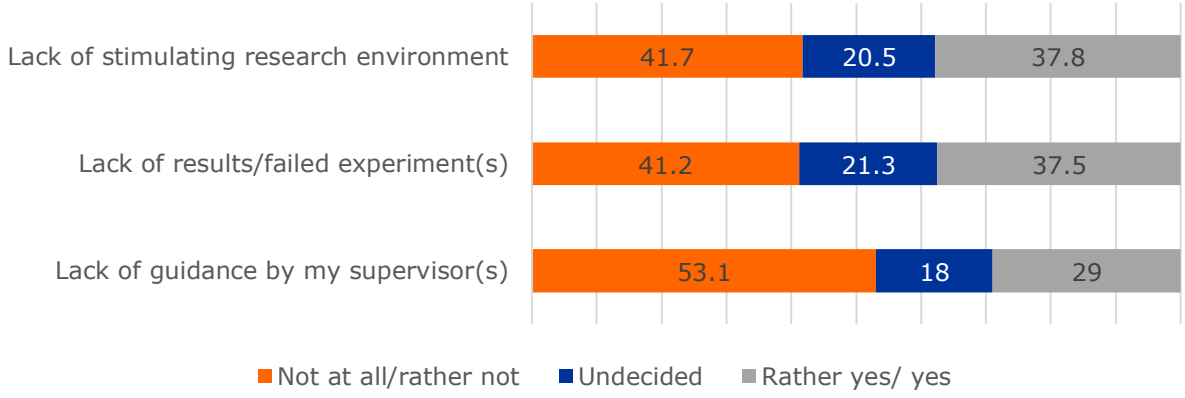


Figure 18 shows the descriptive values of the items that say something about the research related obstacles PhD candidates experience. 37.8% finds that there is a lack of a stimulating research environment. This is 3.3 percentage points lower than last year. 37.5% experiences a lack of results or failed experiments, and 29.0% indicated a lack of guidance by their supervisor.

Figure 18: Scores (in %) on items of research related obstacles



4.3.2 Multivariate results: personal obstacles

Table 42 shows the results of the multivariate regression analysis for the personal obstacles.

Model 1 shows that the oldest age category experiences fewer personal obstacles compared to 26- to 30-year-olds (ß=-0.14). On the contrary, single parents tend to experience more personal obstacles than those who live without a partner or children (ß=0.08). Furthermore, not having a research plan, or having a limited research plan only, is related to experiencing more personal obstacles (ß=0.08).

Model 2 shows that time pressure is positively related to experiencing personal obstacles (ß=0.29). Job engagement and job contribution, on the other hand, are negatively associated with this element (ß=-0.23 and ß=-0.11, respectively). The significant effects of being a single parent and the research plan disappear after the introduction of the new indicators. Single parents experience more time pressure and are less engaged in their job, which causes them to encounter more personal obstacles. The same applies to those who do not have an extended research plan.

Model 3 shows that self-efficacy is negatively associated with personal obstacles (ß=-0.18). Also being highly passionate about one's research shows a negative association (ß=-0.19). The initial effect of job engagement is explained away after the introduction of passion for their research. Those who are highly engaged in their job are also more passionate about it, which is related to experiencing fewer personal obstacles. The effect of job contribution is explained away by the combination of all newly introduced variables.

Model 4 summarizes the significant associations. Time pressure has the strongest association with personal obstacles. The more time pressure one experiences, the more personal obstacles one encounters (ß=0.27). Being highly passionate and the level of self-efficacy have an equally strong effect on the experience of personal obstacles (ß=-0.22). The more self-efficacy one has, the less personal obstacles one encounters. Likewise, someone who is highly passionate about their research, experiences fewer personal obstacles during the trajectory. On the other hand, someone who is not that passionate about research tends to experience more personal obstacles (ß=0.09). The effect of age is no longer significant in the fourth model. This variable only shows a significant association when controlled for living situation. PhD candidates who are 36 years

old or older experience fewer personal obstacles. However, because single parents are highly present in this age group and single parents tend to experience more personal obstacles, these effects cancel each other out.

Table 42: Results of multiple regression analysis of perceived personal obstacles

	Model 1		Model 2		Model 3		Model 4	
Sociodemographic characteristics	β	Sig.	β	Sig.	β	Sig.	β	Sig.
Sex (ref. Male)								
Female	0.00		-0.01		-0.01			
Nationality (ref. Belgian)								
European	0.05		0.04		0.06			
Non-European	-0.08		-0.02		0.02			
Age (ref. 26-30)								
Younger than 25	-0.04		-0.01		0.01			
31-35	-0.04		-0.05		-0.04			
Older than 36	-0.14	**	-0.11	*	-0.09	*		
Living situation (ref. no partner, no children)								
Partner, no children	0.02		-0.02		-0.03			
Single parent	0.08	*	0.06		0.06			
Partner and children	0.08		0.05		0.05			
Objective job characteristics			0.05					
Doctoral school (ref. NSE)								
DSh	0.05		0.05		0.05			
LSM	0.02		0.00		0.00			
Phase of the PhD (ref. executing phase)								
Starting phase	0.06		0.06		0.06			
Finalizing phase	-0.02		-0.04		-0.04			
Previous work experience (ref. no)								
Yes	-0.02		0.00		0.01			
I still have another job	-0.04		0.01		0.01			
Type of contract (ref. personal mandate)								
Teaching assistant	0.05		0.05		0.05			
Project funding: PhD is only project	-0.02		0.02		0.01			
Project funding: multiple projects	0.01		0.00		0.00			
Self-financed	-0.02		-0.02		-0.01			
Other	-0.01		0.00		0.00			
Research plan (ref. extended plan)								
No plan	0.08	*	0.02		0.00			
Limited plan	0.08	*	0.01		-0.02			
Subjective job characteristics								
Time pressure			0.29	***	0.25	***	0.27	***
Competition			-0.03		-0.03			
Job engagement			-0.23	***	-0.05			
Job contribution			-0.11	*	-0.04			
Work-family balance			0.01		-0.02			
Has experienced harassment			-0.02		0.00			
Intrinsic and motivational indicators								
Self-efficacy					-0.18	***	-0.22	***
Passion for PhD (ref. median)								
Low					0.07		0.09	**
High					-0.19	***	-0.22	***
Professional motivation					-0.01			
Intellectual motivation					-0.03			
Expecting to work in academia (ref. undecided)								
Rather not/not at all					0.02			
To a large extent/definitely					-0.02			
N	803		774		771		812	
Adjusted R^2	3.3		22.5		27.9		28.4	

Table 43 shows the average score of the experienced personal obstacles over the years. The average number of personal obstacles experienced increases every year. This year, the average score is 3.6/10. The two most recent years, this score is significantly higher than in 2018, 2019 and 2020. The COVID-19 pandemic might play a role here by triggering more personal obstacles.

Table 43: Evolution perceived personal obstacles over the years

2018	2019	2020	2021	2022
2.9^{ab}	3.2^{cd}	3.0^{ef}	3.8^{ace}	3.6^{bdf}

Note: within groups, item means sharing a letter in their subscript are significantly different at α = 0.05 according to a pairwise comparison with Bonferroni correction for multiple comparisons.

Table 44 shows the mean scores of the component of personal obstacles for each of the variables that are significantly associated with the component. The oldest age group reports to experience the least personal obstacles, less so than the two youngest age groups. Furthermore, as mentioned above, time pressure is positively associated with the experience of personal obstacles. Self-efficacy and being passionate about the research are both negatively associated with it.

Table 44: Bivariate effects between significant background variables and experienced personal obstacles

		Experienced personal obstacles (on 10)
Age		
	25 or younger	3.8 [a]
	26-30	3.8 [b]
	31-35	3.5
	36 or older	3.0 [ab]
Time pressure		
	Low	2.6 [a]
	Median	3.9 [a]
	High	4.4 [a]
Self-efficacy		
	Low	4.6 [a]
	Median	3.5 [a]
	High	2.5 [a]
Passion for research		
	Low	5.5 [a]
	Median	4.5 [a]
	High	3.0 [a]
Total mean		**3.6**

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.
Table only shows variables with significant effect (also tested against: gender, nationality, living situation, doctoral school, phase of the PhD, previous work experience, type of contract, having a research plan, competition, engagement, contribution, work-family balance, harassment, professional motivation, intellectual motivation and expectancy to work in academia).

4.3.3 Multivariate results: research related obstacles

Table 45 shows the results of the multivariate regression analysis for the research related obstacles.

Model 1 shows that foreign, European PhD candidates experience more research related obstacles than their Belgian peers (ß=0.10). Furthermore, those who live together with a partner experience more research related obstacles than those who live without a partner or children (ß=0.10). PhD candidates who combine their doctoral research with another job experience less research related obstacles than PhD candidates without any prior work experience (ß=-0.12). Those who have a limited research plan experience more research related obstacles than those who have an extended research plan (ß=0.12).

Model 2 shows that time pressure is positively associated with the experience of research related obstacles (ß=0.19). Also, experiencing competition in workspace is positively associated with research related obstacles (ß=0.13). Having a good work family balance appears to associate positively with the experience of research related obstacles, yet this significant effect disappears in other models (ß=0.08). The effect of combining a PhD with another job disappears in this model but having previous work experience associates negatively with the experience of research related obstacles (ß=-0.08). After controlling for competition, the effect of living with a partner disappears. This group experiences more competition than those who live without a partner or children, which causes them to experience more research related obstacles than the reference group.

Model 3 shows that none of the newly introduced indicators associate significantly with the dependent variables.

Model 4 summarizes the significant associations. Experiencing competition has the strongest association with experiencing research related obstacles. The more competition one reports, the more research related obstacles they experience (ß=0.26). The same is true for time pressure, yet this association is less strong (ß=0.20). PhD candidates who combine their research with another job experience less research related obstacles than those who have no prior job experience (ß=-0.12). Similarly, PhD candidate with prior job experience before starting their PhD encounter fewer research related obstacles (ß=-0.10). PhD candidates with a limited research plan experience more research related obstacles compared to those with an extended plan (ß=0.11). Those who are in the finalizing

phase of their research experience fewer research related obstacles than those in the executing phase (ß=-0.11). Single parents experience fewer research related obstacles than those who live without partner or children (ß=-0.08). Finally, foreign European PhD candidates experience more research related obstacles than the Belgian ones (ß=0.08).

Table 45: Results of multiple regression analysis of perceived research related obstacles

	Model 1		Model 2		Model 3		Model 4	
Sociodemographic characteristics	β	Sig.	β	Sig.	β	Sig.	β	Sig.
Sex (ref. Male)								
Female	-0.03		-0.04		-0.03			
Nationality (ref. Belgian)								
European	0.10	*	0.11	**	0.11	**	0.08	*
Non-European	0.05		0.11	*	0.10	*	0.03	
Age (ref. 26-30)								
Younger than 25	-0.04		0.00		0.00			
31-35	-0.02		-0.04		-0.03			
Older than 36	-0.06		-0.07		-0.06			
Living situation (ref. no partner, no children)								
Partner, no children	0.10	*	0.06		0.05		0.05	
Single parent	-0.05		-0.06		-0.06		-0.08	*
Partner and children	0.03		0.02		0.02		-0.03	
Objective job characteristics								
Doctoral school (ref. NSE)								
DSh	0.16		0.02		0.02			
LSM	0.07		0.07		0.07			
Phase of the PhD (ref. executing phase)								
Starting phase	-0.01		0.00		0.00		0.00	
Finalizing phase	-0.07		-0.09	*	-0.09	*	-0.11	**
Previous work experience (ref. no)								
Yes	-0.08		-0.08	*	-0.08	*	-0.10	**
I still have another job	-0.12	**	-0.08		-0.08		-0.12	**
Type of contract (ref. personal mandate)								
Teaching assistant	0.04		0.03		0.03			
Project funding: PhD is only project	-0.02		0.01		0.00			
Project funding: multiple projects	-0.02		-0.02		-0.02			
Self-financed	-0.03		-0.04		-0.04			
Other	-0.01		-0.01		-0.02			
Research plan (ref. extended plan)								
No plan	0.07		0.02		0.02		0.06	
Limited plan	0.12	**	0.10	**	0.09	*	0.11	**
Subjective job characteristics								
Time pressure			0.19	***	0.18	***	0.20	***
Competition			0.13	***	0.13	***	0.26	***
Job engagement			-0.09		-0.05			
Job contribution			-0.08		-0.05			
Work-family balance			0.08	*	0.07			
Has experienced harassment			0.05		0.05			
Intrinsic and motivational indicators								
Self-efficacy					-0.04			
Passion for PhD (ref. median)								
Low					0.00			
High					-0.08			
Professional motivation					0.02			
Intellectual motivation					0.00			
Expecting to work in academia (ref. undecided)								
Rather not/not at all					0.02			
To a large extent/definitely					0.03			
N	803		774		771		800	
Adjusted R^2	4.7		14.2		14.1		12.5	

Table 46 shows the average score of research related obstacles over the years. The average score this year is 4.4/10. In the 2018, the average score on research related obstacles was significantly lower than in the other years.

Table 46: Evolution of perceived research related obstacles over the years

2018	2019	2020	2021	2022
3.1^{abcd}	4.4^{a}	4.1^{b}	4.3^{c}	4.4^{d}

Note: within groups, item means sharing a letter in their subscript are significantly different at α = 0.05 according to a pairwise comparison with Bonferroni correction for multiple comparisons.

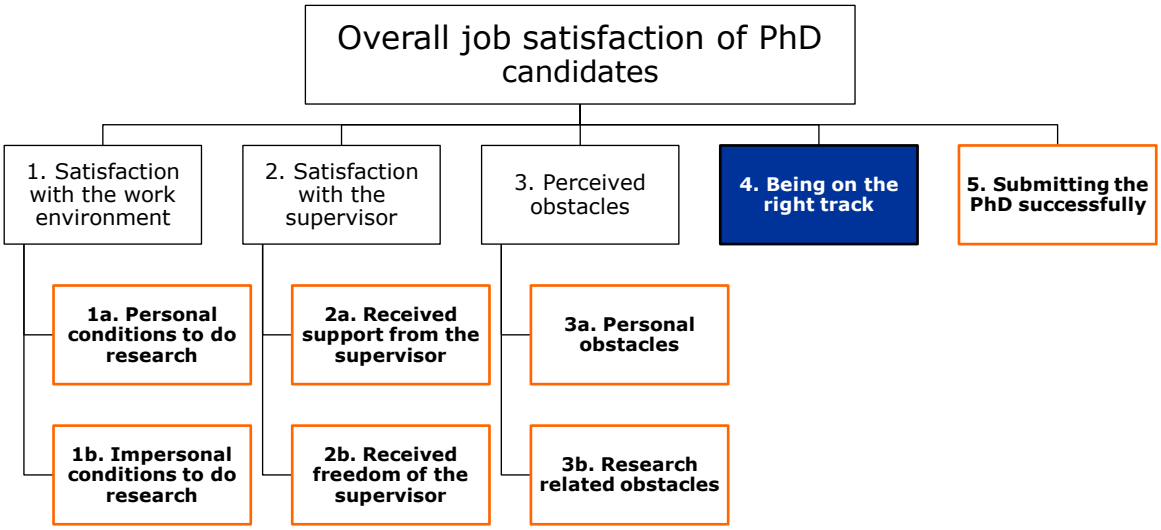
Table 47 shows the mean scores of the component of research related obstacles for each of the indicators that were significantly associated with this component. Single parents experience the fewest research related obstacles, whereas those who live together with a partner experience the most. PhD candidates who are in the executing phase of their research experience the most research related obstacles, more so than those in the finalizing phase. This could be explained by the fact that this phase of the trajectory is the core of the whole research process, in which data is gathered and analyses are done. At the same time, those in the finalizing phase of their research already executed the biggest part of their research and are overall more experienced and confident. PhD candidates who had no work experience prior to starting their PhD experience the most research related obstacles, more so than those who have other work experience. Those with an extended research plan experience the least research related obstacles. Finally, time pressure and competition are positively associated with research related obstacles. The bivariate relationship between research related obstacles and nationality does not show a significant association.

Table 47: Bivariate effects between significant background variables and experienced research related obstacles

		Experienced research related obstacles (on 10)
Living situation		
	No partner, no children	4.3 [a]
	Partner, no children	4.8 [bc]
	Single parent	2.4 [ab]
	Two parent family	3.9 [c]
Phase in the PhD		
	Starting	4.5
	Executing	4.6 [a]
	Finalizing	4.0 [a]
Previous work experience		
	No	4.8 [ab]
	Yes	4.3 [a]
	I still have another job	3.6 [b]
Research plan		
	No	4.6 [a]
	Limited	4.8 [b]
	Extended	4.0 [ab]
Time pressure		
	Low	3.8 [ab]
	Median	4.5 [a]
	High	5.0 [b]
Competition		
	Low	4.0 [ab]
	Median	4.8 [a]
	High	4.8 [b]
Total mean		**4.4**

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.
Table only shows variables with significant effect (also tested against: gender, nationality, age, doctoral school, type of contract, engagement, contribution, work-family balance, harassment, self-efficacy, passion, professional motivation, intellectual motivation and expectancy to work in academia).

4.4 PhD on the right track

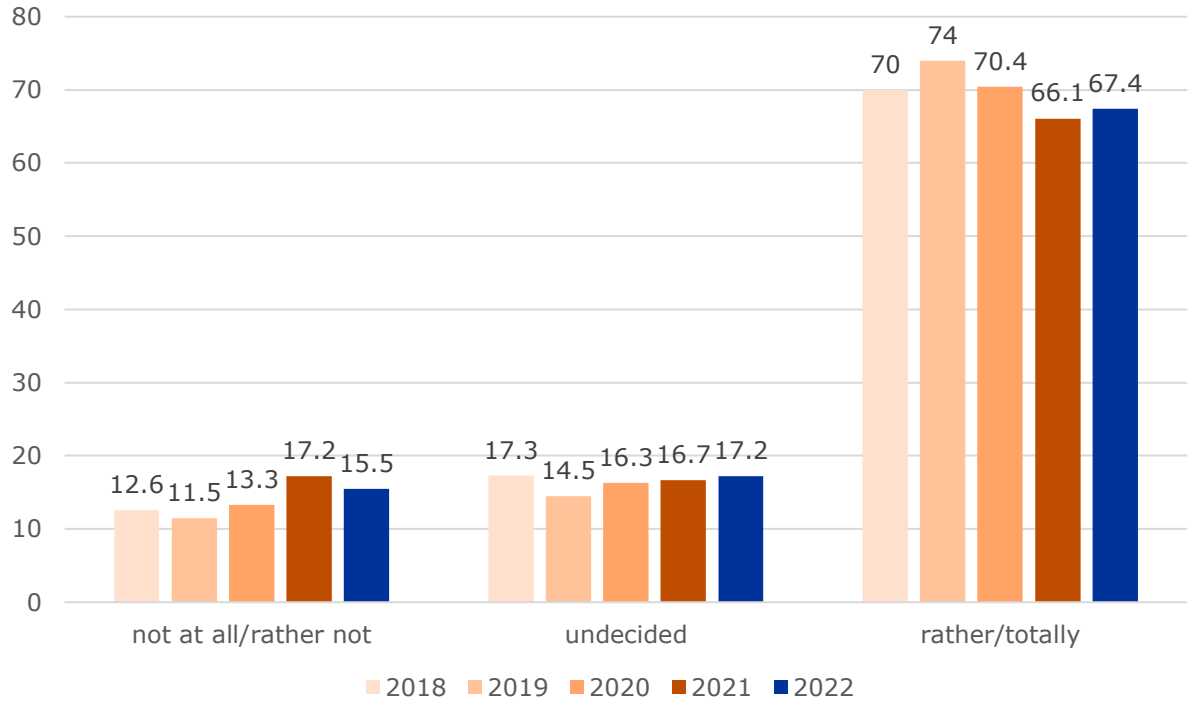


The fourth component of the overall job satisfaction is the extent in which PhD candidates feel to be on the right track with their research. To get an understanding of this, respondents were asked to indicate on a five-point Likert scale to what extent they feel on the right track, ranging from "not at all on track" to "totally on track".

4.4.1 Descriptive results

As shown in Figure 19, 67.4% feels rather or totally on the right track. 17.2% is undecided, and 15.5% does not feel on the right track with their research. When we compare these numbers with those of previous years, we see that in 2020 and 2021, the number of PhD candidates that felt on the right track declined compared to earlier years. The COVID-19 pandemic may have played a role here. The consequences of this might have been more visible one year after the start of the pandemic (April-May 2021) than right at the beginning of the pandemic (April-May 2020). The number of PhD candidates that feels on the right track has slightly increased compared to last year, but it is still lower than before COVID-19 (2019). The differences between the waves of the PhD Survey are statistically significant.

Figure 19: Being on the right track with the PhD, over different measuring points



4.4.2 Multivariate results: feeling of being on the right track

Table 48 shows the results of the multivariate regression analysis for feeling on the right track.

Model 1 shows that non-European PhD candidates are more likely to feel on the right track than their Belgian peers (β=0.12). PhD candidates that live together with a partner only feel less on the right track than those who live without a partner or children (β=-0.11). The same is true for single parents (β=-0.07). PhD candidates who are in the finalizing phase of their research feel more on the right track than those who are still in the executing phase of their research (β=0.14). Finally, not having a research plan or only having a limited research plan is related to a lesser sense of being on the right track compared to those with an extended research plan (β=-0.18 and β=-0.15, respectively).

Model 2 shows that experiencing a lot of time pressure and competition between colleagues associate with a lesser sense of being on the right track (β=-0.22 and β=-0.14). Feeling highly engaged in the job associates with a higher sense of being on the right track (β=0.25).

Model 3 shows that self-efficacy is positively associated with feeling of being on the right track with the research (β=0.12). Also, professional motivation is positively associated with this variable (β=0.14).

Model 4 summarizes the significant associations. Time pressure and job engagement have the strongest effect on being on the right track. Experiencing a lot of time pressure is associated with a lesser sense of being on the right track (β=-0.20); whereas a high amount of job engagement is associated with a higher sense of being on the right track (β=0.19). Experiencing a lot of competition is associated with a lower sense of being on the right track (β=-0.16). PhD candidates who are in the finalizing phase of their doctorate feel being more on the right track than those in the executing phase (β=0.16); whereas those who are still in the starting phase feel being less on the right track (β=-0.07). A high amount of passion for research is related to a higher sense of being on the right track (β=0.15). European PhD candidates feel more on the right track than their Belgian peers (β=0.07). Finally, having a limited research plan is associated with a lower sense of being on the right track, compared to those with an extended research plan (β=-0.07).

Table 48: Results of multiple regression analysis of feeling on the right track

	Model 1		Model 2		Model 3		Model 4	
Sociodemographic characteristics	β	Sig.	β	Sig.	β	Sig.	β	Sig.
Sex (ref. Male)								
Female	-0.03		-0.03		-0.03			
Nationality (ref. Belgian)								
European	0.07		0.08	*	0.08	*	0.07	*
Non-European	0.12	**	0.06		0.03		0.04	
Age (ref. 26-30)								
Younger than 25	0.08		0.03		0.02			
31-35	0.03		0.04		0.04			
Older than 36	0.04		0.03		0.02			
Living situation (ref. no partner, no children)								
Partner, no children	-0.11	**	-0.08	*	-0.07	*		
Single parent	-0.07	*	-0.03		-0.03			
Partner and children	-0.04		-0.04		-0.04			
Objective job characteristics								
Doctoral school (ref. NSE)								
DSh	0.01		0.03		0.03			
LSM	0.03		0.06		0.06			
Phase of the PhD (ref. executing phase)								
Starting phase	-0.07		-0.08	*	-0.08	*	-0.07	*
Finalizing phase	0.14	***	0.16	***	0.16	***	0.16	***
Previous work experience (ref. no)								
Yes	-0.01		-0.02		-0.03			
I still have another job	0.07		0.03		0.02			
Type of contract (ref. personal mandate)								
Teaching assistant	0.00		0.01		0.01			
Project funding: PhD is only project	0.01		-0.03		-0.02			
Project funding: multiple projects	-0.03		-0.01		-0.01			
Self-financed	-0.06		-0.05		-0.06			
Other	-0.01		-0.03		-0.03			
Research plan (ref. extended plan)								
No plan	-0.18	***	-0.09	**	-0.07	*	-0.06	
Limited plan	-0.15	***	-0.10	**	-0.07	*	-0.07	*
Subjective job characteristics								
Time pressure			-0.22	***	-0.20	***	-0.20	***
Competition			-0.14	***	-0.13	***	-0.16	***
Job engagement			0.25	***	0.13	*	0.19	***
Job contribution			0.08		0.03			
Work-family balance			-0.03		-0.01			
Has experienced harassment			-0.05		-0.07	*		
Intrinsic and motivational indicators								
Self-efficacy					0.12	**	0.11	**
Passion for PhD (ref. median)								
Low					-0.04		-0.03	
High					0.14	***	0.15	***
Professional motivation					0.01			
Intellectual motivation					0.02			
Expecting to work in academia (ref. undecided)								
Rather not/not at all					0.01			
To a large extent/definitely					0.03			
N	807		775		771		792	
Adjusted R^2	7.5		28.9		31.5		32.5	

Table 49 shows the mean scores of the component of being on the right track for each of the indicators that are significantly associated with the component. Non-European PhD candidates score higher (3.8/5) than their Belgian peers (3.5/5). Those in the finalizing phase of their research feel more on the right track (3.9/5) than those in the executing (3.6/5) or starting phase of their research (3.4/5). Having a research plan also shows a significant association with being on the right track. Those with an extended plan score higher (3.9/5) than those without a plan (3.4/5) or a limited plan only (3.5/5). Time pressure is negatively associated with feeling on the right track, and the same goes for the level of competition that is experienced among colleagues. Higher scores of engagement in research, self-efficacy and passion for research are associated with a higher sense of being on the right track.

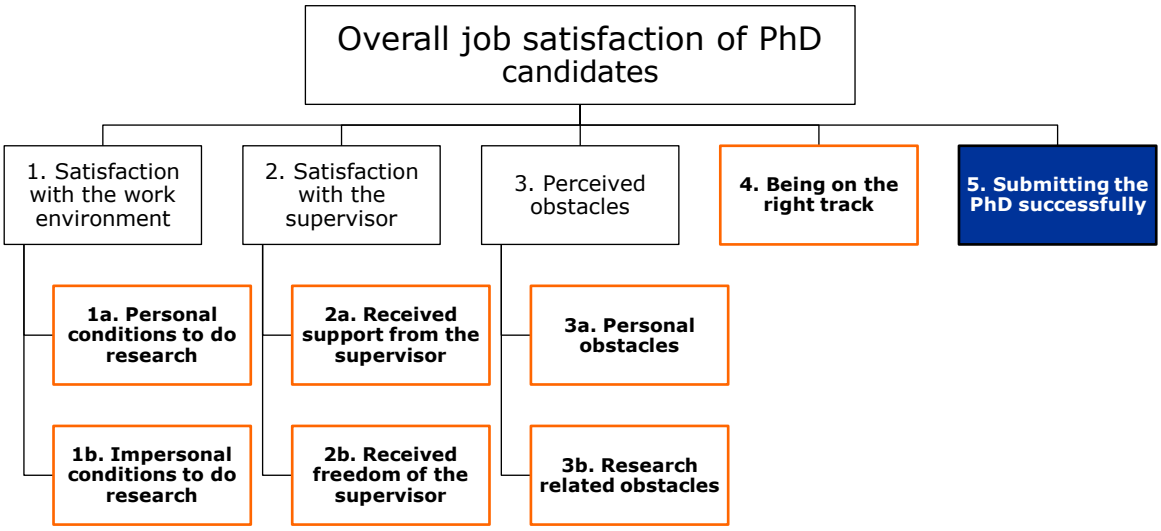
Table 49: Bivariate effects between significant background variables and feeling on the right track

		Feeling on the right track (on 5)
Nationality		
	Belgian	3.5 [a]
	European	3.7
	Non-European	3.8 [a]
Phase in the PhD		
	Starting	3.4 [a]
	Executing	3.6 [b]
	Finalizing	3.9 [ab]
Research plan		
	No	3.4 [a]
	Limited	3.5 [b]
	Extended	3.9 [ab]
Time pressure		
	Low	4.0 [a]
	Median	3.6 [a]
	High	3.3 [a]
Competition		
	Low	3.8 [a]
	Median	3.6 [a]
	High	3.4 [a]
Engagement with research		
	Low	3.0 [a]
	Median	3.7 [a]
	High	4.1 [a]

		Feeling on the right track (on 5)
Self-efficacy		
	Low	3.2 [a]
	Median	3.8 [a]
	High	4.0 [a]
Passion for research		
	Low	2.8 [a]
	Median	3.3 [a]
	High	3.9 [a]
Total mean		**3.6**

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.
Table only shows variables with significant effect (also tested against: gender, age, living situation, doctoral school, previous work experience, type of contract, contribution, work-family balance, harassment, professional motivation, intellectual motivation and expectancy to work in academia).

4.5 Estimated chance to submitting the PhD successfully



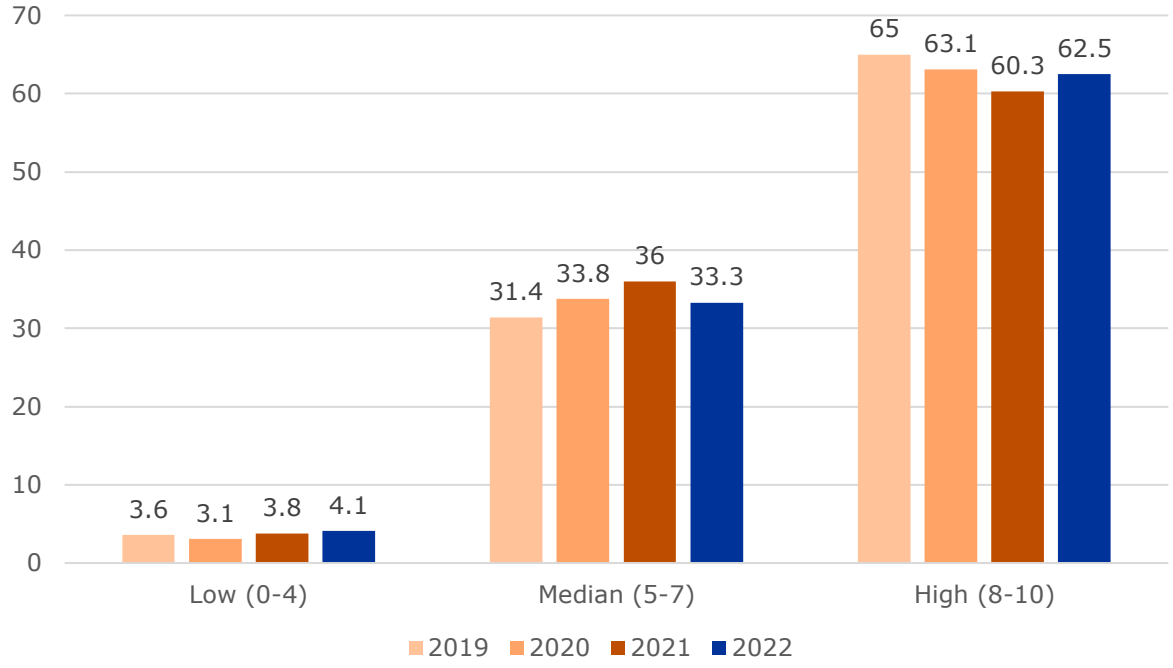
The final component we use to measure the job satisfaction of PhD candidates is the extent to which they estimate they will be able to successfully complete their doctoral research. To measure this, the respondents were asked the following question: "On a scale of 0 to 10: do you think you will successfully submit your PhD?".

4.5.1 Descriptive results

As shown in Figure 20, the majority of the PhD candidates estimates their chance of successful completion high (62.5%). One in three gives a median score (33.3%) and 4.1% estimates their chance low.

In 2020 and 2021, there was a decrease in the number of PhD candidates that estimated their chances as high. This could be related to the COVID-19 pandemic, of which the effect might have become visible only after one year (2021). Compared to last year, the number of PhD candidates that estimates its chance as high has increased, yet it is still lower than in 2020 and 2019. The differences between the years are not statistically significant.

Figure 20: Estimated chance to submit the PhD successfully, over different measuring points



4.5.2 Multivariate results: successful submission

Table 50 shows the results of the multivariate regression analysis for the self-estimated chance of successful completion.

Model 1 shows that foreign PhD candidates estimate their chance of successful completion higher compared to Belgian PhD candidates. This effect is stronger for non-European PhD candidates (β=0.11) than for other European PhD candidates (β=0.09). PhD candidates in the finalizing phase of the research estimate their chance to submit successfully higher than those in the executing phase (β=0.19), which is unsurprising since they already progressed further in their trajectory. Finally, not having a research plan or having a limited research plan is associated with a lower estimation of successful completion. This effect is stronger for those without a research plan (β=-0.11) than for those with a limited research plan (β=-0.09).

Model 2 shows that time pressure is negatively associated with the estimated chance of successful completion (β=-0.17). Job engagement (β=0.33) and job contribution (β=0.12) are positively associated with the estimated chance to submit successfully. After the introduction of these two last variables, the effect of a research plan disappears. As shown earlier, those who do not have a research plan, or have a limited plan only, score lower on engagement and contribution.

Model 3 shows that self-efficacy is positively associated with the estimated chance of successful completion (β=0.26). Furthermore, being highly passionate about the research is positively associated with the estimated chance of successful completion (β=0.11), whereas not being passionate about research shows a negative association (β=-0.14). After the introduction of self-efficacy, the effect of contribution renders insignificant.

Model 4 summarizes the significant associations. Self-efficacy has the strongest effect (β=0.24). PhD candidates with a high level of self-efficacy estimate their chance to successfully complete their PhD higher. Also, being in the finalizing phase of the research is strongly and positively related to a high estimation of successful completion (β=0.21). A high score on job engagement is positively associated with the estimation of successful completion (β=0.17). The more time pressure is experienced, the lower PhD candidates estimate their chance of successful completion (β=-0.16). Being passionate about research is also associated. Those who are not very passionate about their research estimate their chance of successful completion lower (β=-0.14). The opposite is true for those who are highly passionate about their research (β=0.13). Finally, European PhD candidates estimate their chance of successful completion higher than their Belgian peers (β=0.08).

Table 50: Results of multiple regression analysis of estimated chance for successful submission

	Model 1		Model 2		Model 3		Model 4	
Sociodemographic characteristics	β	Sig.	β	Sig.	β	Sig.	β	Sig.
Sex (ref. Male)								
Female	-0.07		-0.05		-0.05			
Nationality (ref. Belgian)								
European	0.09	*	0.10	**	0.08	*	0.08	**
Non-European	0.11	*	0.06		0.01		0.02	
Age (ref. 26-30)								
Younger than 25	0.04		0.01		-0.01			
31-35	0.00		0.00		-0.01			
Older than 36	0.00		-0.04		-0.06			
Living situation (ref. no partner, no children)								
Partner, no children	-0.06		-0.03		-0.03			
Single parent	0.00		0.00		0.01			
Partner and children	0.00		0.01		0.02			
Objective job characteristics								
Doctoral school (ref. NSE)								
DSh	0.02		0.03		0.03			
LSM	-0.01		0.01		0.01			
Phase of the PhD (ref. executing phase)								
Starting phase	-0.04		-0.06		-0.05		-0.05	
Finalizing phase	0.19	***	0.21	***	0.21	***	0.21	***
Previous work experience (ref. no)								
Yes	0.01		0.00		-0.02			
I still have another job	0.03		-0.02		-0.03			
Type of contract (ref. personal mandate)								
Teaching assistant	-0.03		-0.04		-0.03			
Project funding: PhD is only project	0.00		-0.03		-0.02			
Project funding: multiple projects	-0.03		-0.03		-0.02			
Self-financed	0.00		0.00		-0.01			
Other	0.02		-0.01		-0.01			
Research plan (ref. extended plan)								
No plan	-0.11	**	-0.03		0.00			
Limited plan	-0.09	*	-0.01		0.02			
Subjective job characteristics								
Time pressure			-0.17	***	-0.12	***	-0.16	***
Competition			-0.04		-0.03			
Job engagement			0.33	***	0.13	**	0.17	***
Job contribution			0.12	**	0.04			
Work-family balance			0.04		0.06			
Has experienced harassment			0.04		0.00			
Intrinsic and motivational indicators								
Self-efficacy					0.26	***	0.24	***
Passion for PhD (ref. median)								
Low					-0.14	***	-0.14	***
High					0.11	**	0.13	***
Professional motivation					-0.04			
Intellectual motivation					0.02			
Expecting to work in academia (ref. undecided)								
Rather not/not at all					-0.04			
To a large extent/definitely					0.02			
N	807		775		771		804	
Adjusted R^2	6.3		29.2		36.9		37.3	

Table 51 presents the average estimate of submitting the PhD successfully over the years. This year, the average score is 7.9/10. There is no significant difference over the years when it comes to this component of overall job satisfaction.

Table 51: Evolution of estimated chance for successful completion over the years

2018	2019	2020	2021	2022
7.9	8.0	7.9	7.8	7.9

Note: within groups, item means sharing a letter in their subscript are significantly different at α = 0.05 according to a pairwise comparison with Bonferroni correction for multiple comparisons.

Table 52 shows the mean scores of the component of the self-estimated chance of successful completion for each of the variables that were significantly associated with the component. Belgian PhD candidates estimate their chance lower than their foreign colleagues (7.6/10 compared to 8.1/10). PhD candidates who are in the finalizing phase of their research rate their chance higher (8.5/10) than those in the executing (7.7/10) and starting phase (7.5/10). Time pressure is negatively associated with the self-estimated chance to complete successfully. For engagement, self-efficacy and passion for the research, we see an opposite pattern: a higher score on these indicators is associated with a higher estimated chance of successful completion.

Table 52: Bivariate effects between significant background variables and estimated chance to submit PhD successfully

		Estimated chance for successful completion (on 10)
Nationality		
	Belgian	7.6 ^{ab}
	European	8.1 ^{a}
	Non-European	8.1 ^{b}
Phase in the PhD		
	Starting	7.5 ^{a}
	Executing	7.7 ^{b}
	Finalizing	8.5 ^{ab}
Time pressure		
	Low	8.4 ^{a}
	Median	7.9 ^{a}
	High	7.3 ^{a}

		Estimated chance for successful completion (on 10)
Engagement with research		
	Low	6.7 [a]
	Median	8.0 [a]
	High	8.6 [a]
Self-efficacy		
	Low	7.0 [a]
	Median	8.0 [a]
	High	8.9 [a]
Passion for research		
	Low	6.0 [a]
	Median	7.3 [a]
	High	8.4 [a]
Total mean		**7.9**

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons. Table only shows variables with significant effect (also tested against: gender, age, living situation, doctoral school, previous work experience, type of contract, having a research plan, competition, contribution, work-family balance, harassment, professional motivation, intellectual motivation and expectancy to work in academia).

5 Cluster analysis

In the previous chapter, we described and analyzed eight components that contribute to the job satisfaction of PhD candidates: the personal and impersonal conditions of their work environment, the support and freedom they receive from their supervisors, the obstacles they experience (research related as well as personal), whether or not they feel on the right track with their research, and to what extent they estimate they will be able to successfully complete their PhD. In this chapter, we use these eight components to construct clusters within the population of PhD candidates. These clusters group together PhD candidates that have a similar experience of their PhD trajectory.

In previous editions of the survey, only PhD candidates that had a physical workplace at the VUB were included in this analysis. However, teleworking has become more common since the COVID-19 pandemic. Many PhD candidates work from home for a significant amount of time – and some may not even have a physical office anymore. For this reason, all PhD candidates are considered for the cluster analyses. However, 17 PhD candidates were excluded. Seven of those follow a non-PhD track – and are thus currently not working on a PhD. The other 10 respondents showed a missing value on one or more of the eight components involved in the cluster analysis.

5.1 Cluster determination

We distinguish three dimensions that are decisive in defining the clusters:

1) **Intrinsic dimension:** this reflects how PhD candidates estimate their own capabilities and the obstacles they experience throughout their trajectory. The underlying components of this dimension are the *personal obstacles* and the *research related obstacles*.
2) **External dimension:** this dimension indicates how the PhD candidates evaluate aspects that are directly related to the work environment. More specifically, it comprises satisfaction with the *support* and *freedom given by the supervisor* and satisfaction with the *personal* and *impersonal work conditions.*
3) **Progress dimension:** this dimension refers to how the PhD candidates estimate how they are doing in the trajectory. The underlying

components are *being on the right track* with the PhD, and the *estimated likelihood to submit the PhD successfully.*

As shown in Table 53, being on the right track explains most of the variance within the clusters (R^2=0.56). Also satisfaction with the support from the supervisor and with the personal conditions in the work environment have a relatively strong influence (R^2=0.42 and R^2=0.40, respectively). Satisfaction with the impersonal working conditions has the least influence (R^2=0.17). This is in line with previous editions of the survey, except that the contribution of the personal conditions at the workplace became stronger. As shown in figure 21 and Table 53, four clusters can be defined.

Cluster 1: the moderate cluster (41.6%)

The largest proportion of PhD candidates belongs to the moderate cluster. This cluster is characterized by an average number of experienced obstacles, both personal as well as research related. They are moderately satisfied with the support they receive from their supervisor. When it comes to the freedom given by their supervisor, and the personal conditions of their job, they are moderately to a little satisfied. The impersonal conditions of their work (office space, income, possibility to take time of…) are a point of dissatisfaction. Even though they encounter some obstacles in their trajectory and their satisfaction with the external elements of their job is not optimal, this cluster is characterized by a strong feeling of being on the right track with their research and estimate their chance of successful completion of their PhD rather high.

Cluster 2: the satisfied, insecure cluster (20.5%)

PhD candidates in this cluster are satisfied with the external dimension of their job. They score highly on satisfaction with the support and freedom they get from their supervisor and are also relatively happy with the personal and impersonal conditions of their work environment. Nevertheless, these PhD candidates experience a relatively high number of personal obstacles, and a moderate number of research related obstacles. They feel less on the right track compared to those in the moderate cluster and estimate their chance of successful completion on the lower side. One in five PhD candidates belongs to this cluster.

Cluster 3: the unsatisfied, insecure cluster (19.9%)

Another one in five PhD candidates belong to this cluster. PhD candidates in this cluster experience the most obstacles of all, both personal as well as research related. Moreover, they are highly unsatisfied with the support from their supervisor. They also score rather low on satisfaction with the freedom given by their supervisor. PhD candidates in this cluster are not satisfied with the personal and impersonal conditions of their job. They do not feel on the right track with their research, and estimate their chance of successful completion low, compared to the other clusters.

Cluster 4: the satisfied, confident cluster (18.0%)

18.0% of the PhD candidates belongs to the most optimistic cluster of the four. Respondents in this cluster experience few obstacles during their trajectory. They are satisfied with their supervisor and with their work environment. As a result, they feel on the right track with their research, and estimate their chance of successful completion high.

Note: a cluster analysis was also incorporated in previous editions of the survey and even though the clusters that were defined this year are similar to those of last year, it is important to note that a substantive comparison between the clusters over years is not possible. A cluster analysis is always relative to the sample and, due to and in- and outflow of PhD candidates, this sample changes each year. Belonging to a certain cluster means that the PhD candidate has a higher or lower satisfaction with the PhD trajectory compared to the other respondents in the sample. In other words, there is no absolute benchmark to belong to a certain cluster – making comparison over the years impossible.

Figure 21: Mean scores on constitutive variables of job satisfaction by cluster

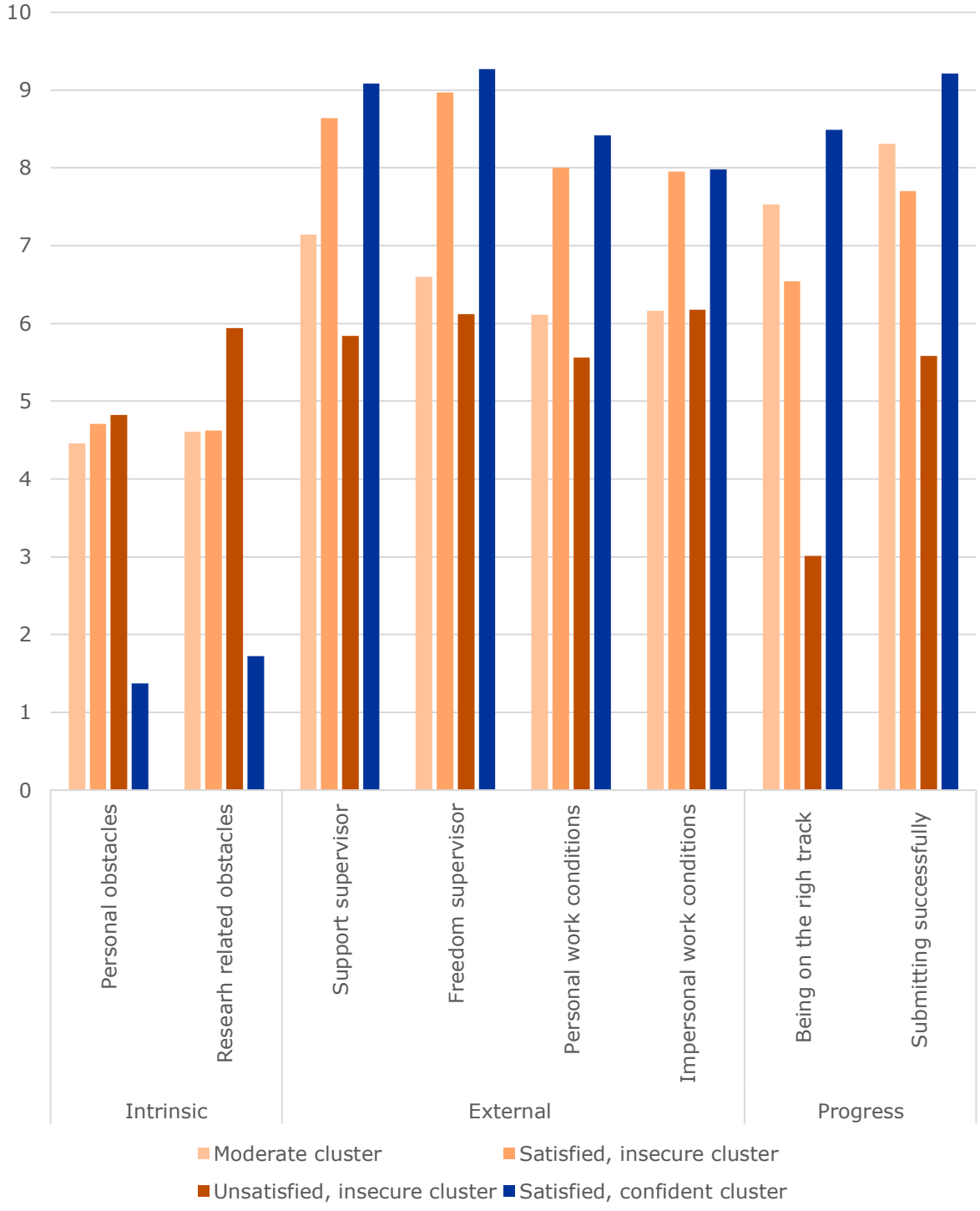


Table 53: Latent class analysis

	Cluster1	Cluster2	Cluster3	Cluster4	Overall	R^2
Cluster Size (%)	41.6	20.5	19.9	18.0	100	
Cluster Size (n)	338	167	162	146	813	
Personal obstacles						**0.24**
Low	0.33	0.17	0.13	0.81	0.33	
Median	0.39	0.36	0.34	0.17	0.33	
High	0.28	0.48	0.53	0.02	0.33	
Mean (0-10)	4.46	4.71	4.82	1.37	3.61	
Research related obstacles						**0.21**
Low	0.30	0.26	0.11	0.76	0.33	
Median	0.38	0.38	0.31	0.20	0.33	
High	0.32	0.36	0.58	0.04	0.33	
Mean (0-10)	4.61	4.62	5.94	1.72	4.43	
Satisfaction support supervisor						**0.42**
Low	0.38	0.08	0.78	0.02	0.33	
Median	0.44	0.36	0.20	0.22	0.33	
High	0.18	0.57	0.02	0.76	0.33	
Mean (0-10)	7.14	8.64	5.84	9.08	7.54	
Satisfaction freedom supervisor						**0.34**
Low	0.49	0.09	0.54	0.03	0.33	
Median	0.37	0.33	0.35	0.22	0.33	
High	0.14	0.57	0.11	0.75	0.33	
Mean (0-10)	6.60	8.97	6.12	9.27	7.47	
Satisfaction personal conditions						**0.40**
Low	0.48	0.07	0.57	0.02	0.33	
Median	0.39	0.33	0.35	0.20	0.33	
High	0.12	0.61	0.08	0.78	0.34	
Mean (0-10)	6.11	8.00	5.56	8.42	6.80	
Satisfaction impersonal conditions						**0.17**
Low	0.47	0.13	0.44	0.13	0.33	
Median	0.35	0.31	0.35	0.32	0.34	
High	0.19	0.56	0.21	0.55	0.34	
Mean (0-10)	6.16	7.95	6.18	7.98	6.86	
Being on the right track						**0.56**
Low	0.01	0.09	0.63	0.00	0.16	
Median	0.12	0.27	0.27	0.03	0.17	
High	0.87	0.65	0.09	0.97	0.68	
Mean (0-10)	7.53	6.54	3.01	8.49	6.60	
Submitting PhD successfully						**0.35**
Low	0.00	0.02	0.18	0.00	0.04	
Median	0.23	0.40	0.68	0.06	0.33	
High	0.77	0.58	0.14	0.94	0.63	
Mean (0-10)	8.31	7.70	5.58	9.21	7.85	

5.2 Cluster identification

In this section, we zoom in on the characteristics of PhD candidates in each cluster, in terms of their background characteristics (see section 3.1), objective job characteristics (see section 3.2), subjective job characteristics (see section 3.3) and intrinsic motivations (see section 3.4). We performed a logistic regression analysis for each cluster, with as dependent variable a dichotomic variable that measures cluster membership (1=member of the cluster, 0=not a member of the cluster). A logistic regression analysis estimates the odds ratio (OR) of belonging to a cluster for each of the categories of the independent variables relative to the reference category of those variables. An OR greater than 1 indicates a higher chance of belonging to a cluster whereas an OR smaller than 1 indicates a lower chance of belonging to a cluster. Similar to chapter 4, we built the logistic regression analyses in four steps. The first model includes background variables and objective job characteristics, such as gender, age, nationality, type of contract etc. In the second model, subjective job characteristics are added (e.g., time pressure, competition, work family balance). In the third model, motivational indicators were included, such as professional motivation and self-efficacy. In the fourth and final model, we consider the variables that have a significant effect on the dependent variable.

5.2.1 The moderate cluster

As shown in Model 1 of Table 54, non-European PhD candidates are less likely to be part of the moderate cluster (OR=0.59). PhD candidates who are self-financed or have another type of contract are more likely to belong to this cluster (OR=2.45 and OR=1.96, respectively).

Model 2 shows that the experience of competition in the workspace is positively related to being part of the moderate cluster (OR=1.22).

Model 3 introduces motivational indicators. PhD candidates who are highly passionate about their research are more likely to belong to this cluster (OR=1.85), whereas those with a low level of passion have a lower chance to belong to this cluster (OR=0.22). The more professional motivation one has, the less likely one belongs to this cluster (OR=0.90). After the introduction of these indicators, the effects of nationality and type of contract disappear.

Model 4 only takes into consideration the significant effects. Not being passionate about the research has the strongest effect: PhD candidate without passion for their research are less likely to belong to the moderate cluster (0R=0.33). Experiencing competition, on the other hand, increases the chance of belonging to the moderate cluster (OR=1.30). Finally, the more professional motivation one has, the less likely one belongs to this cluster (OR=0.08). 7% of the variance in the model is explained by this model. This rather low percentage can be attributed to the fact that this is a relatively larger cluster. 41.6% of the PhD candidates belongs to it, making it a heterogenous group of people with different background characteristics.

Table 54: Results logistic regression analysis cluster 1: the moderate cluster

	Model 1		Model 2		Model 3		Model 4	
Sociodemographic characteristics	OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.
Sex (ref. Male)								
Female	0.96		1.01		1.04			
Nationality (ref. Belgian)								
European	0.97		0.95		1.02			
Non-European	0.59	*	0.55	**	0.70			
Age (ref. 26-30)								
Younger than 25	0.87		0.90		0.84			
31-35	1.11		1.00		0.89			
Older than 36	0.71		0.66		0.63			
Living situation (ref. no partner, no children)								
Partner, no children	1.13		1.04		0.95			
Single parent	1.81		1.84		1.99			
Partner and children	1.29		1.29		1.18			
Objective job characteristics								
Doctoral school (ref. NSE)								
DSh	1.06		1.10		0.28			
LSM	1.34		1.27		1.50			
Phase of the PhD (ref. executing phase)								
Starting phase	0.79		0.78		0.85			
Finalizing phase	0.94		0.95		0.99			
Previous work experience (ref. no)								
Yes	1.32		1.26		1.18			
I still have another job	0.81		0.89		0.80			
Type of contract (ref. personal mandate)								
Teaching assistant	1.30		1.14		1.24			
Project funding: PhD is only project	1.17		1.14		1.11			
Project funding: multiple projects	1.06		1.03		1.06			
Self-financed	2.45	*	2.04	*	2.02			
Other	1.96	*	1.87		1.87			
Research plan (ref. extended plan)								
No plan	1.04		1.07		0.98			
Limited plan	1.39		1.39		1.36			
Subjective job characteristics								
Time pressure			0.97		0.96			
Competition			1.22	**	1.28	***	1.30	***
Job engagement			1.06		0.86			
Job contribution			0.99		0.94			
Work-family balance			0.91		0.92			
Has experienced harassment			0.96		1.04			
Motivational indicators								
Self-efficacy					1.15			
Passion for PhD (ref. median)								
Low					0.22	***	0.33	***
High					1.85	**	1.29	
Professional motivation					0.90	*	0.08	***
Intellectual motivation					0.97			
Expecting to work in academia (ref. undecided)								
Rather not/not at all					0.91			
To a large extent/definitely					0.70			
N	749		731		651		795	
Adjusted R^2	0.07		0.09		0.16		0.07	

5.2.2 The satisfied, insecure cluster

Model 1 of Table 55 shows that the oldest age group (36+) is less likely to belong to the satisfied, insecure cluster (OR=0.40). Also, those who live together with a partner, without children are less likely to belong to this cluster (OR=0.66). PhD candidates without a research plan or with a limited plan only are also less likely to be part of this cluster (OR=0.47 and OR=0.67, respectively).

Model 2 shows that time pressure associates positively with membership of this cluster. The more time pressure one experiences, the more likely one belongs to the satisfied, insecure cluster (OR=1.16). The time pressure might add to the obstacles and insecurity PhD candidates in this cluster experience. Those who experience a lot of competition on the work floor are less likely to belong to this cluster (OR=0.85). Finally, satisfaction with the work family balance is positively related to being a part of this cluster (OR=1.18).

Model 3 shows that passionate PhD candidates are less likely to belong to this cluster (OR=0.55). Furthermore, professional motivation is positively related to being part of this cluster (OR=1.14). The effects of age, time pressure and work family balance disappear after adding the indicators of model 3.

Model 4 summarizes the significant indicators of being part of this cluster. They explain 10% of the total variance. The effect of age is the strongest: PhD candidates who are 36 years old or older are less likely to belong to the satisfied, insecure cluster (OR=0.40). Next, not having a research plan is also negatively associated with membership of this cluster (OR=0.54). The more competition one experiences, the less likely they are to belong to this cluster (OR=0.80). Being satisfied with the work family balance, on the other hand, is positively related to the cluster membership (OR=1.19) and so is professional motivation (OR=1.15). Finally, those who experience a lot of time pressure are more likely to be part of this cluster (OR=1.14).

Table 55: Results logistic regression analysis cluster 2: the satisfied, insecure cluster

	Model 1		Model 2		Model 3		Model 4	
Sociodemographic characteristics	OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.
Sex (ref. Male)								
Female	1.05		1.10		0.99			
Nationality (ref. Belgian)								
European	1.31		1.34		1.37			
Non-European	1.06		1.24		0.96			
Age (ref. 26-30)								
Younger than 25	1.16		1.05		1.20		1.29	
31-35	0.58		0.63		0.72		0.66	
Older than 36	0.40	*	0.40	*	0.43		0.40	**
Living situation (ref. no partner, no children)								
Partner, no children	0.66	*	0.64	*	0.58	*		
Single parent	0.98		1.05		1.02			
Partner and children	0.75		0.72		0.65			
Objective job characteristics								
Doctoral school (ref. NSE)								
DSh	1.17		1.10		1.09			
LSM	0.97		1.07		0.98			
Phase of the PhD (ref. executing phase)								
Starting phase	1.20		1.23		1.17			
Finalizing phase	1.06		1.01		1.04			
Previous work experience (ref. no)								
Yes	0.77		0.76		0.88			
I still have another job	1.07		1.05		1.17			
Type of contract (ref. personal mandate)								
Teaching assistant	0.76		0.84		0.89			
Project funding: PhD is only project	0.91		0.95		1.12			
Project funding: multiple projects	0.72		0.72		0.91			
Self-financed	0.93		1.08		1.21			
Other	0.56		0.51		0.66			
Research plan (ref. extended plan)								
No plan	0.47	**	0.49	*	0.50	*	0.54	*
Limited plan	0.67	*	0.68		0.62	*	0.69	
Subjective job characteristics								
Time pressure			1.16	*	1.13		1.14	*
Competition			0.85	*	0.79	**	0.80	**
Job engagement			1.09		1.17			
Job contribution			0.99		1.01			
Work-family balance			1.18	*	1.11		1.19	**
Has experienced harassment			0.53		0.53			
Motivational indicators								
Self-efficacy					0.86			
Passion for PhD (ref. median)								
Low					1.07			
High					0.55	*		
Professional motivation					1.14	*	1.15	**
Intellectual motivation					1.11			
Expecting to work in academia (ref. undecided)								
Rather not/not at all					1.14			
To a large extent/definitely					0.79			
N	749		731		651		783	
Adjusted R^2	0.07		11.1		0.15		0.10	

5.2.3 The unsatisfied, insecure cluster

As shown in Model 1 of Table 56, self-financed PhD candidates are less likely to be part of the unsatisfied, insecure cluster (OR=0.42). Not having a research plan, on the other hand, is positively associated with belonging to this cluster (OR=3.49). The same is also true for having a limited research plan only (OR=1.18).

After adding the indicators of Model 2, the effect of being self-financed disappears and the phase in which the PhD candidates are appears to be a significant factor. Those in the starting phase of their research are more likely to be part of the unsatisfied, insecure cluster (OR=1.82), whereas those in a later stage are less likely to be part of it (OR=0.44). Time pressure and competition are positively associated with belonging to this cluster (OR=1.23 and OR=1.20, respectively). Job engagement and job contribution, on the other hand, are negatively associated with it (OR=0.63 and OR=0.84, respectively).

After the introduction of the indicaors in Model 3, we see that European (non-Belgian) PhD candidates are less likely to be part of this cluster (OR=0.46). Additionally, self-efficacy (OR=0.84) and being highly passionate about research (OR=0.48) are negatively related to membership of this cluster.

Model 4 only takes into consideration the significant effects. 35% of the variance is explained by these variables. Being in the finalizing phase has the strongest effect. These PhD candidates are less likely to be part of this unsatisfied, insecure cluster (OR=0.40). Those without a research plan are more than twice as likely to belong to this cluster compared to those with an extended plan (OR=2.18). Being highly passionate about the research is related to a lower chance of belonging to this cluster (OR=0.55); the same is true for feeling engaged in research (OR=0.68) and having a high level of self-efficacy (OR=0.81). Finally, the experience of competition in the work environment and having a lot of time pressure are both positively related to membership of this cluster (OR=1.30 and OR=1.22, respectively).

Table 56: Results logistic regression analysis cluster 3: the unsatisfied, insecure cluster

	Model 1		Model 2		Model 3		Model 4	
Sociodemographic characteristics	OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.
Sex (ref. Male)								
Female	1.03		0.97		1.04			
Nationality (ref. Belgian)								
European	0.69		0.56		0.46	*		
Non-European	0.76		0.91		0.95			
Age (ref. 26-30)								
Younger than 25	0.71		0.87		0.75			
31-35	1.34		1.27		1.45			
Older than 36	1.94		1.89		1.90			
Living situation (ref. no partner, no children)								
Partner, no children	1.37		1.12		1.17			
Single parent	0.58		0.36		0.32			
Partner and children	0.81		0.75		0.93			
Objective job characteristics								
Doctoral school (ref. NSE)								
DSh	0.97		0.97		0.85			
LSM	0.86		0.78		0.59			
Phase of the PhD (ref. executing phase)								
Starting phase	1.51		1.82	*	1.78		1.55	
Finalizing phase	0.67		0.44	*	0.40	**	0.40	**
Previous work experience (ref. no)								
Yes	0.97		1.06		0.99			
I still have another job	1.02		1.01		0.95			
Type of contract (ref. personal mandate)								
Teaching assistant	1.12		1.06		1.05			
Project funding: PhD is only project	0.75		0.86		0.70			
Project funding: multiple projects	1.22		1.28		1.14			
Self-financed	0.42	*	0.46		0.48			
Other	0.92		1.30		1.04			
Research plan (ref. extended plan)								
No plan	3.49	*	2.68	**	2.71	**	2.18	**
Limited plan	1.18	*	1.55		1.56		1.37	
Subjective job characteristics								
Time pressure			1.23	**	1.30	***	1.22	***
Competition			1.20	*	1.23	*	1.30	***
Job engagement			0.63	***	0.75	*	0.68	***
Job contribution			0.84	*	0.94			
Work-family balance			0.97		0.99			
Has experienced harassment			1.37		1.33			
Motivational indicators								
Self-efficacy					0.84	*	0.81	**
Passion for PhD (ref. median)								
Low					1.82		1.57	
High					0.48	*	0.55	*
Professional motivation					0.95			
Intellectual motivation					0.99			
Expecting to work in academia (ref. undecided)								
Rather not/not at all					0.73			
To a large extent/definitely					1.06			
N	749		731		651		788	
Adjusted R^2	0.10		0.34		0.38		0.35	

5.2.4 The confident, satisfied cluster

As shown in Model 1 of Table 57, non-European PhD candidates are more likely to be part of the confident, satisfied cluster compared to Belgian ones (OR=2.83). Also, the PhD candidates in the oldest age category have a higher chance to be part of this cluster (OR=2.17). When PhD candidates do not have a research plan, or have a limited research plan only, they have a lower chance to belong to this cluster (OR=0.55 and OR=0.54, respectively).

After adding the indicators of Model 2, the phase of the research shows a significant effect too. PhD candidates in the finalizing phase of their research have a higher chance to belong to this cluster, whereas those in the starting phase are less likely to be part of it (OR=1.86 and OR=0.48, respectively). The more time pressure one experiences and the more competition one faces, the less likely one is part of this cluster (OR=0.72 and OR=0.64, respectively). Job contribution and job engagement, on the other hand, both show a positive association with this cluster (OR=1.44 and OR=1.23, respectively). After the introduction of these indicators, the effects of a research plan disappear.

Model 3 shows that being passionate is related to a higher chance of being part of this cluster (OR=3.31). Moreover, PhD candidates who expect an academic career after graduating are more than twice as likely to belong to this cluster (OR=2.18). After the introduction of the indicators of this model, having other types of contracts show a significant negative effect with the cluster membership (OR=0.35). Moreover, the effects of nationality, age, and job contribution disappear.

Model 4 only takes into consideration the significant effects. Being passionate about research has the strongest determinative power for membership of this cluster. Additionally, PhD candidates who are passionate about their research are more likely to belong to this cluster (OR=3.20). Having other types of contracts also show a strong effect. These PhD candidates are less likely to belong to this cluster (OR=0.37). Non-European PhD candidates, and PhD candidates who are 36 years old or older are more likely to belong to the confident, satisfied cluster (OR=2.30 and OR=2.27, respectively). Moreover, those who expect an academic career have a higher chance to belong this cluster (OR=2.15). PhD candidates that progressed further in their trajectory, have a higher chance to belong to this cluster too (OR=1.98). There is a positive association between job engagement and cluster membership (OR=1.65). Time pressure and

competition, on the other hand, are negatively associated with it (OR=0.69 and OR=0.68, respectively). 44% of the variance in this cluster is explained by these indicators.

Table 57: Results logistic regression analysis cluster 4: the confident, satisfied cluster

	Model 1		Model 2		Model 3		Model 4	
Sociodemographic characteristics	OR	Sig.	OR	Sig.	OR	Sig.	OR	Sig.
Sex (ref. Male)								
Female	0.98		0.98		1.02			
Nationality (ref. Belgian)								
European	1.24		1.23		0.95		1.02	
Non-European	2.83	***	2.45	**	1.74		2.30	*
Age (ref. 26-30)								
Younger than 25	1.52		1.14		1.18		1.29	
31-35	1.13		1.30		1.04		0.93	
Older than 36	2.17	*	2.44	*	2.37		2.27	*
Living situation (ref. no partner, no children)								
Partner, no children	0.96		1.23		1.33			
Single parent	0.72		1.54		0.94			
Partner and children	1.09		1.20		1.25			
Objective job characteristics								
Doctoral school (ref. NSE)								
DSh	0.77		0.78		0.61			
LSM	0.69		0.84		0.74			
Phase of the PhD (ref. executing phase)								
Starting phase	0.72		0.48	*	0.43	*	0.47	
Finalizing phase	1.50		1.86	*	1.94	*	1.98	*
Previous work experience (ref. no)								
Yes	0.84		0.78		0.82			
I still have another job	1.24		0.74		0.91			
Type of contract (ref. personal mandate)								
Teaching assistant	0.68		0.67		0.68		0.65	
Project funding: PhD is only project	1.14		0.90		0.84		0.76	
Project funding: multiple projects	0.99		1.21		1.26		1.23	
Self-financed	0.60		0.65		0.52		0.43	
Other	0.67		0.52		0.35	*	0.37	*
Research plan (ref. extended plan)								
No plan	0.55	*	0.83		1.11			
Limited plan	0.54	**	0.72		0.85			
Subjective job characteristics								
Time pressure			0.72	***	0.74	***	0.69	***
Competition			0.64	***	0.67	***	0.68	***
Job engagement			1.44	**	1.39	*	1.65	***
Job contribution			1.23	*	1.07			
Work-family balance			1.07		1.14			
Has experienced harassment			0.72		0.73			
Motivational indicators								
Self-efficacy					1.24			
Passion for PhD (ref. median)								
Low					0.00		0.00	
High					3.31	*	3.20	*
Professional motivation					1.13			
Intellectual motivation					0.93			
Expecting to work in academia (ref. undecided)								
Rather not/not at all					0.97		1.16	
To a large extent/definitely					2.18	*	2.15	*
N	749		731		651		668	
Adjusted R^2	0.13		0.41		0.47		0.44	

5.2.5 Bivariate effects

In this section, we take a closer look at the bivariate relationships between the clusters and the background characteristics (see Table 58). As can be expected, the scores of the moderate cluster lie closely to the total average for each item. The average score of almost every item varies significantly of that of the unsatisfied, insecure cluster and the satisfied, confident cluster. And in most cases, they do not differ significantly from the satisfied, insecure cluster. However, PhD candidates in the moderate cluster experience more competition on the work floor than their peers in the satisfied, uncertain cluster. They are also less satisfied with the work-family balance. When it comes to the latter, the moderate cluster scores relatively low and does not differ significantly from the unsatisfied, insecure cluster.

Also, the satisfied, PhD candidates in the insecure cluster score relatively average for most items. However, when it comes to the competition they experience, they score relatively low, which is score in the same line as their peers in the satisfied, confident cluster. In terms of satisfaction with their work family balance they are closely related to their colleagues in the satisfied, confident cluster. In both clusters they score relatively high.

The PhD candidates in the unsatisfied, insecure cluster experience the most time pressure and the most competition on the work floor of all clusters. They also have the lowest score on job engagement and job contribution, and on self-efficacy, passion for research, and intellectual motivation. As explained above, they have a similar score on work family balance to their peers in the moderate cluster and when it comes to professional motivation, they do not differ significantly from their colleagues in the moderate cluster.

Finally, the PhD candidates in the satisfied, confident cluster experience the least time pressure and competition of all clusters. They are highly engaged in their job and feel like they can contribute something. They are satisfied with their work family balance, have a lot of self-efficacy and passion for their research. They have the highest score for both professional as well as intellectual motivation, although these do not differ significantly from their peers in the satisfied, insecure cluster.

Table 58: Bivariate relationships between background characteristics and cluster membership (average scores on 10)

	Moderate cluster		Satisfied, insecure cluster		Unsatisfied, insecure cluster		Satisfied, confident cluster		Total
	Avg.	Sig.	Avg.	Sig.	Avg.	Sig.	Avg.	Sig.	Avg.
Time pressure	4.4	ab	4.2	cd	5.2	ace	2.9	bde	4.2
Competition	4.6	abc	4.0	ad	5.0	bde	3.7	ce	4.4
Job engagement	6.4	ab	6.6	cd	5.1	ace	7.5	bde	6.4
Job contribution	6.2	ab	6.4	cd	4.8	ace	7.8	bde	6.2
Work-family balance	7.1	ab	7.7	ac	6.9	cd	7.8	bd	7.3
Self-efficacy	6.9	ab	6.7	cd	6.0	ace	7.9	bde	6.9
Passion for PhD	7.9	ab	7.8	cd	6.6	ace	9.0	bde	7.8
Professional motivation	5.6	a	6.1	b	5.3	bc	6.4	ac	5.8
Intellectual motivation	6.3	ab	6.7	c	5.5	acd	7.1	bd	6.3

Note: within groups, item means sharing a letter in their subscript are significantly different at $\alpha = 0.05$ according to a pairwise comparison with Bonferroni correction for multiple comparisons.

Half of the unsatisfied, insecure cluster exists out of Belgian PhD candidates (see Table 59). The Belgian nationality is also overrepresented in the moderate cluster. In the satisfied, confident cluster, however, we see an overrepresentation of the non-European PhD candidates.

In terms of age, the two youngest age groups are overrepresented in the satisfied, insecure cluster. Older PhD are underrepresented in this group. On the other hand, 27.9% of those in the satisfied, confident cluster are 36 years or older, while this group only makes up 18.1% of the population. Younger age groups are underrepresented in this cluster.

We find the same tendency when it comes to living situation. PhD candidates who live without children or a partner (e.g., typically younger PhD candidates) are overrepresented in the satisfied, insecure cluster, whereas PhD candidates who live with partner and children (e.g., who are typically older) are overrepresented in the satisfied, confident cluster. However, it must be noted that the former group is also slightly overrepresented in the satisfied, confident cluster. Those who live together with a partner but without children are overrepresented in the unsatisfied,

insecure cluster. Single parents belong more often to the moderate cluster and are underrepresented in the two insecure clusters.

PhD candidates in the earliest stage of their research belong most to one of the two insecure clusters. They are overrepresented in the unsatisfied especially. Those in the finalizing phase of their research are more likely to belong to the satisfied, confident cluster.

When it comes to having a research plan, PhD candidates without a plan are highly overrepresented in the unsatisfied, insecure cluster. Contrarily, more than half of the satisfied, confident cluster (56.8%) exists of PhD candidates with an extended research plan.

PhD candidates who have experienced harassment on the work floor belong more often to the unsatisfied, insecure cluster and are less likely to belong to a satisfied cluster.

Finally, PhD candidates who do not expect an academic career are mostly found in the unsatisfied, insecure clusters, but are also overrepresented in the satisfied, uncertain cluster. Those who do expect an academic career, however, are overrepresented in the satisfied, confident cluster.

There is no bivariate relationship between cluster membership and gender, doctoral school, previous work experience, or type of contract.

Table 59: Bivariate relationships between background characteristics and cluster membership (column percentages)

	Moderate cluster	Satisfied, insecure cluster	Unsatisfied, insecure cluster	Satisfied, confident cluster	Total
Nationality ***					
Belgian	47.2	44.9	52.5	26.2	44.0
European	20.9	19.2	16.3	15.2	18.6
Non-European	31.9	35.9	31.3	58.6	37.4
Age **					
Younger than 25	16.0	25.5	18.4	15.7	18.4
26-30	45.0	50.3	48.7	37.1	45.4
31-35	19.5	14.5	17.7	19.3	18.1
Older than 36	19.5	9.7	15.2	27.9	18.1
Living situation **					
No partner, no children	39.8	53.7	37.7	46.9	43.4
Partner, no children	42.4	36.0	49.4	31.7	40.6
Single parent	2.4	1.8	1.2	2.1	2.0
Partner and children	15.4	8.5	11.7	19.3	14.0
Phase of the research *					
Starting phase	17.5	22.9	25.3	13.1	19.4
Executing phase	53.8	54.2	54.9	53.8	54.1
Finalizing phase	28.7	22.9	19.8	33.1	26.5
Research plan ***					
No plan	16.9	13.3	30.9	12.3	18.1
Limited plan	46.6	38.0	45.1	30.8	41.7
Extended plan	36.5	48.8	24.1	56.8	40.2
Harassment ***					
Has experienced/is experiencing it	8.0	4.2	16.7	4.9	8.4
Has not experienced it	92.0	95.8	83.3	95.1	91.6
Expecting to work in academia ***					
Rather not/not at all	29.9	34.5	42.8	13.6	30.4
undecided	30.6	24.6	26.9	16.7	26.1
To a large extent/definitely	39.5	40.8	30.3	69.7	43.4

Expected and observed frequencies of one or more categories vary significantly for p≤0.001 based on Pearson's chi-squared test.

6 Additional support

In an earlier section of the report, we already discussed how PhD candidates evaluate the support they receive from their supervisor. Of course, PhD candidates are supported in their trajectory in more than one way and can also count on the support of their advisory commission, other actors, and the training opportunities that are offered by the Doctoral Schools and the Researcher Training and Development Office (RTDO). In this section, we look deeper into how PhD candidates experience the additional support they receive, next to their supervisors' support.

6.1 Advisory commission

During the first year of their research, PhD candidates are required to compose an advisory commission. The purpose of this commission is to follow up on their progression and give feedback on their work. In this section, we investigate whether this advisory commission is available to all PhD candidates, and how it is used.

As shown in Table 60, the majority of PhD candidates has an advisory commission (64.8%). 35.2% does not have one. Note that about one third of those (34.6%) is still in the starting phase of their PhD and thus might not yet have had the chance to compose a commission. Half of those without a commission says they would like to have one (50.2%).

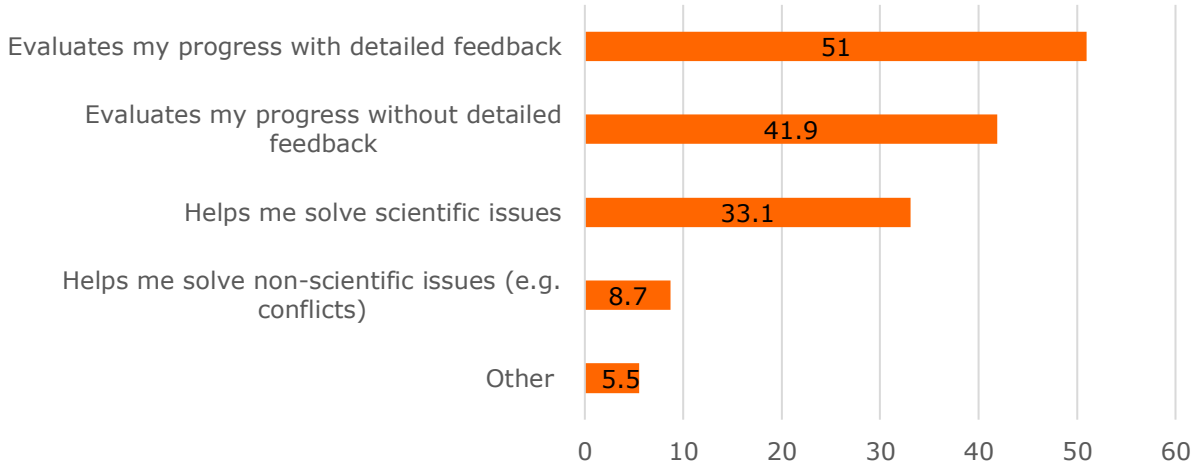
Most of the PhD candidates are satisfied with their commission (66.4%) (see Table 60). 8.8% says they are not satisfied with it and one in four is undecided (24.9%). The fact that such a significant number of PhD candidates is undecided about their advisory commission might be related to the fact that the majority of PhD candidates does not consult their commission very often. Two thirds meets with them at most once a year (67.1%). One in four meets several times a year (25.4%) and only a small group of 7.5% meets once a month or more.

Table 60: Respondents by having an advisory commission

		N	%
Do you have an advisory commission?			
	Yes	527	64.8
	No	286	35.2
	Missing	17	
Would you like to have an advisory commission?			
	Yes	141	50.2
	No	140	49.8
	Missing	5	
How satisfied are you with your advisory commission?			
	Not at all/rather not	46	8.8
	Undecided	131	24.9
	Rather/very	349	66.4
	Missing	1	
What is the frequency of meetings with your advisory commission?			
	Several times a week to weekly	14	2.7
	Several times a month to monthly	25	4.8
	Several times a year	132	25.4
	At most once a year	348	67.1
	Missing	8	

Figure 22 presents the tasks that are performed by the advisory commission. Half of the PhD candidates indicates that their advisory commission evaluates their progress with detailed feedback (51%). 41.9% indicates they do this without giving detailed feedback. For one in three (33.1%), the advisory commission helps them with solving scientific issues. In a minority of cases, the commission helps solving non-scientific issues (8.7%).

Figure 22: Tasks performed by advisory commission



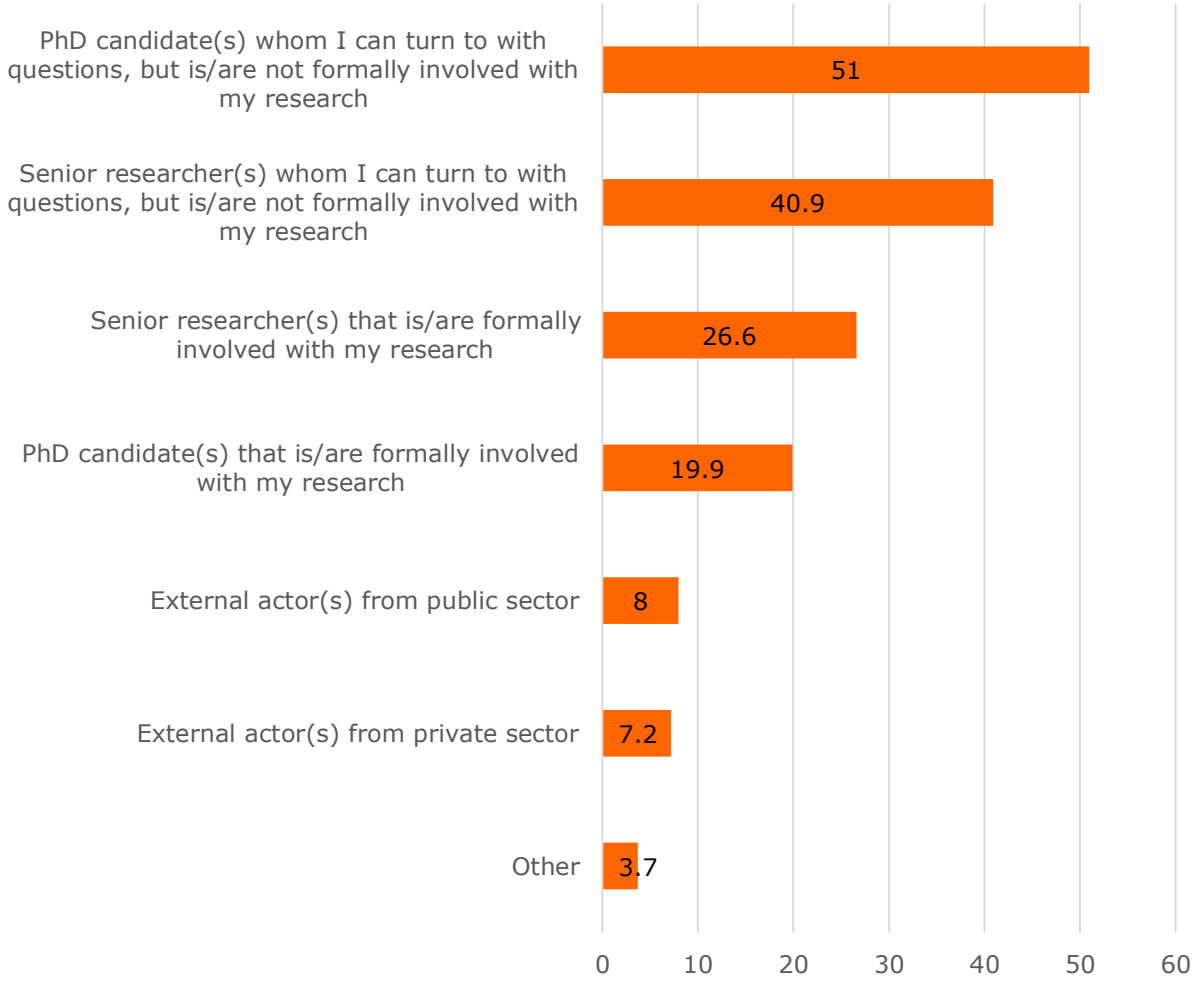
6.2 Other actors involved in the research

Apart from the supervisor and the advisory commission other actors might be involved, such as peers, colleagues, or third-party actors.

56.2% of the respondents reports that their colleagues are rather or totally involved in their research. This means that their colleagues know what their research is about, what they are doing, regularly ask questions about the progress, and so on (not shown in graph). 28.7% says that their colleagues are not at all, or rather not, involved. PhD candidates from the doctoral school of NSE report the most involvement of colleagues, those in the DSh the lowest.

Figure 23 shows what type of actors are specifically involved. Half of the respondents (51%) can rely on other PhD candidates that are not formally involved in their research to ask questions. 40.9% can count on the help of senior researchers who are not formally involved in their research. 26.6% gets help from senior researchers who are involved in their research (but who are not their supervisor). For about one in five (19.9%) there are other PhD candidates formally involved in their research. 8% receives help from an external actor in the public sector and 7.2% from an external actor in the private sector. For all these items, the PhD candidates in the doctoral school of NSE score higher, except for involvement of actors in the public sector. In that case, PhD candidates from the DSh score the highest.

Figure 23: Other actors involved in the research



Question: In addition to your supervisor(s) and advisory commission, are there other actors involved in and/or supporting you in your research? Tick all that apply

6.3 Doctoral training offer

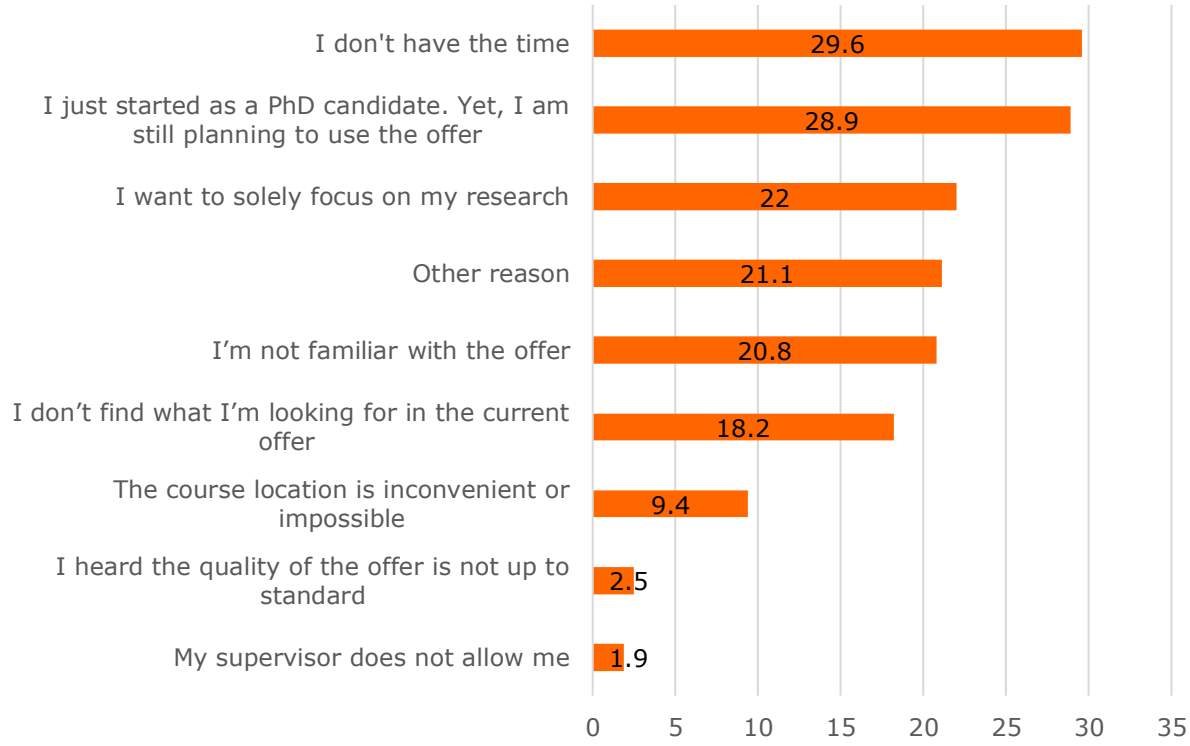
PhD candidates at the VUB are also supported through a training offer that they can use to improve their transferable skills and research skills and to broaden their knowledge. 80.5% has attended events or trainings organized by the Doctoral Schools or Research Training and Development Office (RTDO), apart from the mandatory introduction day (not shown in graph). This is an increase of 5 percentage points compared to last year.

Figure 24 presents the reasons why PhD candidates did not make use of the offer. 29.6% of those who did not attend any course report that they did not have time for it. 28.9% did not get around to do it yet and 22% only wants to focus on their research. The fact that the supervisor did not allow the PhD candidates to

follow a course (1.9%) or that the quality of the offer would not be up to standard (2.5%) were the least reported reasons not to attend courses or events.

21.1% indicated there is a "different" reason for not attending the doctoral training. In an open question, respondents were able to elaborate on that answer. The most common reasons were (1) that the VUB was not their main institution and they attended similar courses at their home university, (2) that they combined their PhD with another job and did not have time to attend courses during work hours, or (3) that they had an exemption. Several respondents also indicated they were not informed about the offer, that the spots filled up too quickly, or that they were unable to figure out how to enroll through TEO.

Figure 24: Reasons to not make use of the doctoral training offer (in %)



As shown in Table 61, the majority of PhD candidates prefers to attend a mix between physical and online courses and workshops (67.2%). 17.4% would like to attend online workshops only whereas about one in ten (9.6%) prefers to attend physical workshops only.

Table 61: Preference of organisation doctoral training offer after lifting COVID-19 measures

	N	%
Only follow physical workshops	78	9.6
Follow a mix of physical and online workshops	546	67.2
Only follow online workshops	141	17.4
Not follow any workshops	47	5.8
Missing	18	
Total	830	

In an open question, respondents were able to give additional remarks about the training offer. Many of these remarks were positive, saying that the courses were helpful to their PhD trajectory. However, some suggestions were made. PhD candidates often reported that the courses were too basic, and too much focused on transferable skills. They suggest more courses that are subject specific, as well as the possibility to follow courses from the regular curricula. Several respondents indicated the need for courses on conducting qualitative research.

Moreover, PhD candidates felt ill-informed about the availability of courses and indicated that it is hard to find available courses in TEO. A clear overview and reminders whenever spots open is considered helpful.

"My main complaints revolve with bureaucracy that is often confusing and slow and intranet tools that I find a chore to access every time I have to do something on TEO or PhD portfolio..."

"During the beginning of this academic year, I was looking for a schedule of available trainings (for example, Academic English), and it was difficult to find if (and if yes, when) they take place. Search in TEO and googling didn't give satisfying results."

"Please keep TEO up to date regarding which courses are available, since many are given as options, but no classes are planned in the future. It would make it easier for us to decide which courses we would like to follow. More courses on statistics for complete beginners would also be great."

Some popular courses need more spots, since they fill up quickly, or need to be organized more frequently (e.g., course on academic English). As mentioned above, for PhD candidates who combine their research with another job it is often hard to attend courses. In this respect, it would be useful to make the courses available online and provide the option to rewatch them whenever it suits the PhD candidates.

"The offer does not always align well with one's research plan (in terms of timing). Some courses could benefit from being provided on a continuous basis (e.g., through a MOOC setting)."

Finally, questions arose about the obligation to attend courses. Some said that there were no interesting courses for them, or that the interesting courses filled up too quickly. This led them to follow courses that were not relevant to their field of interest.

"I think it is very positive that a wide variety of courses are offered to the PhD students. Nevertheless, I think obliging students to attend a minimum number of courses to achieve the credit quadrant is not the way to go. It has as an effect that students are strategically chosing courses such that they obtain the necessary credits (i.e. the most time-efficient courses) and that afterwards don't have the time anymore to do the ones that truly interest them (maybe more time expensive ones). I don't believe in this structure. (But the fact that such courses are offered is great!)"

Others indicated that courses were repetitive and that there is a lot of overlap between the courses taught in the masters' program at the VUB.

"A very large part of the training is completely useless to people who did a master's thesis in Belgium (especially at VUB), because we have had to follow the same guidelines for our theses. There are some interesting parts, but they are buried between obligatory repetition.

7 Conclusion

In this report, we shed light on the job satisfaction of PhD candidates at the VUB in 2022. To do so, we first investigated the background characteristics of the population (see chapter 3). More specifically, we described sociodemographic characteristics, objective job characteristics, subjective job characteristics and finally we discussed intrinsic variables. In the next chapter, we described components that contribute to the overall job satisfaction of PhD candidates and investigated how the background characteristics related to these components (see chapter 4). Finally, we used these components to construct clusters to group together PhD candidates with a similar experienced job satisfaction (see chapter 5).

Overall, the majority of PhD candidates is rather confident they will submit their PhD successfully. However, one in five (19.9%) is rather doubtful about this. This is a group that experiences a lot of obstacles during their doctoral research and is also dissatisfied with several aspects of the trajectory, such as their supervisor and work conditions.

Next to this doubtful, unsatisfied group of PhD candidates, we identified three other clusters. The biggest one includes 41.6% of the PhD candidates that have a rather moderate opinion on the external elements of the job (satisfaction with the supervisor and the work conditions) and the obstacles they experience. Another 20.5% is much more satisfied with the external job elements but experiences a fair number of obstacles during their research – mostly on a personal level. The fourth cluster includes 18% of the PhD candidates. This is a highly satisfied and confident group of PhD candidates, that does not seem to experience many problems during their doctoral trajectory.

The support from the supervisor, the personal work conditions (e.g., the available expertise in the department, training opportunities, the introduction in the department…) and the feeling of being on the right track are the most decisive in the cluster construction, and thus play the most important role in the overall job satisfaction.

Throughout the report, certain indicators recurringly showed to be significantly associated with certain elements of the job satisfaction and with cluster membership. These variables are time pressure, competition among colleagues, having a research plan and job engagement.

Time pressure

Time pressure appears to be detrimental to job satisfaction of PhD candidates. This is a finding that recurs over the years. The levels of time pressure that is reported does not change over time. PhD candidates with children experience the most time pressure. Similarly, the two oldest age groups are more prone to it, which can be related to the fact that these age groups most often have young children. Those in the doctoral school of LSM experience more time pressure than the other two doctoral schools.

Time pressure is associated with experiencing a lot of personal and research related obstacles. PhD candidates who experience a lot of time pressure are less satisfied with the support they get from their supervisor and feel less on the right track with their research. As a result, they are also more doubtful about whether they will successfully complete their PhD. Because time pressure is strongly related to the experience of obstacles, PhD candidates who experience a lot of time pressure are more likely to belong to the unsatisfied, insecure cluster, or the satisfied insecure cluster. They are less likely to be part of the satisfied, confident cluster.

We found that time pressure is not only related to the own research. Our data shows that having other work-related responsibilities next to one's own research (such as teaching or third-party services) also adds to the time pressure. Work during the mornings, evenings, and weekends are all associated with more time pressure.

Competition

Competition among colleagues is another factor that recurringly seems to impact the job satisfaction. The experience of competition is the strongest related to being less satisfied with the personal work conditions and with support from the supervisor, and with experiencing more research related obstacles. Female PhD

candidates experience more competition than their male colleagues. Younger PhD candidates, and those without partner or children are less prone to it. Interestingly, the further PhD candidates progress in their trajectory, the more competition they experience.

PhD candidates who experience a lot of competition are more likely to belong to the moderate cluster or to the unsatisfied, insecure cluster. This shows that competition mainly influences satisfaction with external elements of the job and not so much satisfaction with intrinsic elements. It is interesting to note that the experienced competition in the work environment has been increasing between 2019 and 2021, whereas this year we see a significant decrease.

Given the fact that this is an element that has a significant influence on the job satisfaction, it would be an interesting topic for further investigation. A deeper understanding of what causes a competitive atmosphere, and how competition manifests itself throughout the different stages of the trajectory would be valuable in order to come up with initiatives to temper it.

Having a research plan

Having a research plan is another element that emerges every year as important. It is significantly related to almost every component that contributes to the overall job satisfaction. Those without a plan or with a limited plan are less satisfied with their work conditions – personal as well as impersonal – and with their supervisor. They experience more research related doubts and feel less on the right track with their research. Note that those with only a limited plan often tend to lean more towards those who have no plan at all in terms of dissatisfaction and doubts. In other words, it seems like a research plan needs to be rather elaborated before the positive effects of it are perceived.

Belgian PhD candidates are most likely to not have a research plan, and so are teaching assistants. This was also the case last year. Furthermore, not having a research plan is associated with multiple negative aspects, such as a lower level of self-efficacy and job engagement, and a lower feeling of contribution and passion for research. PhD candidates without an extended research plan experience more competition and are less professionally as well as intellectually motivated.

In terms of cluster membership, PhD candidates without an extended research plan are less likely to be part of the satisfied, uncertain cluster and have a higher chance to belong to the unsatisfied, insecure cluster. Those without a plan are more than twice as likely to belong to this latter cluster compared to those with an extended research plan.

Since the research plan has proven to be recurringly related to many aspects of job satisfaction over the years, it could be seen as an easily accessible indicator of a complex underlying process. Getting a deep understanding of how satisfied PhD candidates are is complicated and requires a lot of questions. However, looking at whether or not they have a research plan can be a good proxy to grasp it, especially on an aggregated level.

Engagement with the research

The feeling engagement says something about how enthusiastic, immersed, and inspired PhD candidates are by their job. In 2020, at the start of the COVID-19 pandemic, this feeling of engagement was dented. Luckily, in the two following years, it increased again. Feeling engaged in one's research is strongly related to being satisfied with personal work conditions and with the support from a supervisor. Those who are engaged in their research also feel that they are on the right track and estimate their chance of successful completion as being higher.

Female PhD candidates feel less engaged in their work than their male peers. Non-European PhD candidates score the highest on engagement and so do the oldest PhD candidates. Those who combine their PhD research with another job and/or with family commitments also feel the most engaged. Respondents who are very engaged in their research are less likely to belong to the unsatisfied, insecure cluster and have a higher chance to be part of the satisfied, confident cluster.

Self-financed PhD candidates

An interesting group within the PhD candidates are the self-financed doctorates. This group exists out of a high proportion of older PhD candidates, who often combine their doctoral research with family commitments and another job. This makes that this group is less satisfied with the work family balance of the job.

They also tend to experience more competition than those whose research is funded in any kind of way. Overall, self-financed PhD candidates tend to be less satisfied with the impersonal conditions of their work. However, when we look at more intrinsic elements, such as passion for the research, motivation and self-efficacy, this group tends to score higher than other PhD candidates. They also have a stronger feeling of being able to contribute something to the greater good and are more engaged with their research. Even though the work circumstances of self-financed PhD candidates are thus often perceived as less ideal, their determination and passion for their research makes that they estimate their chances to successfully submit the PhD higher than the other groups.

Overall, most of the PhD candidates feel satisfied with their job conditions. One in five, however, appears to have some difficulties. They are not satisfied with their supervisor. This dissatisfaction is particularly related to the quality and frequency of the meetings, and the introduction to other prominent researchers in the field. They also report dissatisfaction in terms of their work environment, especially when it comes to their introduction to the department and the available expertise in the department. This group of PhD candidates experiences many obstacles: more than half of the PhD candidates doubt their own capabilities, deals with failed experiments and a lack of results, and lacks a stimulating research environment. As a results, they are not confident about the progression and eventual submission of their PhD. The PhD candidates in this cluster are mainly Belgians, younger than 30 years old, and one in four is still in the starting phase of their research. They often do not have an extended research plan and do experience a lot of time pressure and competition in their job.

8 References

Glorieux, A., P. te Braak, J. Minnen and B. Spruyt (2018). PhD Survey VUB 2018. Brussels, Research Group TOR, Sociology Department, Vrije Universiteit Brussel. https://torvub.be/torwebdat/publications/t2018_35.pdf.

Glorieux, A., P. te Braak, J. Minnen and B. Spruyt (2019). PhD Survey VUB 2019. Brussels, Research Group TOR, Sociology Department, Vrije Universiteit Brussel. https://torvub.be/torwebdat/publications/t2020_12.pdf.

Glorieux, A., P. te Braak, I. Laurijssen, F. Van Deynze, H. De Grande, J. Minnen and B. Spruyt (2020). PhD Survey VUB 2020. Brussels, Research Group TOR, Sociology Department, Vrije Universiteit Brussel. https://torvub.be/torwebdat/publications/t2021_9.pdf.

Glorieux, A., T.P. van Tienoven, P. Te Braak, J. Minnen and B. Spruyt. (2021). PhD Survey VUB 2021. Brussels, Research Group TOR, Sociology Department, Vrije Universiteit Brussel. https://torvub.be/torwebdat/publications/t2022_14.pdf.

Glorieux, A., T.P. van Tienoven, P. Te Braak, J. Minnen and B. Spruyt. (2022). PhD Survey VUB 2022: Technical Report. Brussels, Research Group TOR, Sociology Department, Vrije Universiteit Brussel.

Verbeylen, J., J. Minnen, P. te Braak and I. Glorieux (2017). PhD Survey VUB 2017. Brussels, Research Group TOR, Sociology Department, Vrije Universiteit Brussel.

9 Appendix

Table A1: Principal component analysis on items of time pressure

I have no time to do the things I have to do	.842
More is expected from me than I can handle	.826
I have to do more than I want to do	.792
I never have time for myself	.762
I never catch up with my work	.732
Too much is expected of me	.730
I frequently have to cancel arrangements I have made	.709
There are not enough hours in the day for me	.702
Eigenvalue	4.661
Cronbach's alfa	0.895

Table A2: Principal component analysis on items of work culture

Colleagues consider each other as competitors	.787
There are only a limited number of people involved in the decision-making process	.712
There is a competitive atmosphere within the research team	.675
When decisions are made, everyone's opinion is taken into account	-.661
The emphasis lies on good relationships with colleagues	-.508
More decisions are made informally than during formal meetings	.473
Eigenvalue	2.502
Cronbach's alfa	0.680

Table A3: Principal component analysis on items of job engagement

I am enthusiastic about my job	.834
At my job, I feel strong and vigorous	.800
My job inspires me	.792
When I get up in the morning, I feel like going to work	.760
I am proud of the work that I do	.738
At my job, I feel like bursting with energy	.693
I am immersed in my work	.636
I am happy when I'm working intensely	.600
I get carried away when I'm working	.525
Eigenvalue	4.606
Cronbach's alfa	0.877

Table A4: Principal component analysis on items of job contribution

I improve things with the work that I do	.889
I can make the world a better place with the work that I do	.871
I'm helping science move forward with the work that I do	.862
Eigenvalue	2.293
Cronbach's alfa	0.844

Table A5: Principal component analysis on items of work-family balance

I can adjust my working time to my family life	.852
I have enough influence on my working hours	.824
I have ample opportunities to take time off whenever that suits me	.793
The VUB/my supervisor offers sufficient opportunities for employees to adjust their tasks depending on their private situation	.715
I often have meetings at times that are difficult to match with my family situation	-.293
Eigenvalue	2.632
Cronbach's alfa	0.744

Table A6: Principal component analysis on items of self-efficacy

When facing difficult tasks, I am certain that I will accomplish them	.817
I will be able to successfully overcome many challenges	.815
I believe I can succeed at almost any endeavor to which I set my mind	.812
I am confident that I can perform many different tasks effectively	.776
In general, I think I can obtain outcomes that are important to me	.774
Even when things are tough, I can perform quite well	.760
Compared to other people, I can do most tasks very well	.721
I will be able to achieve most of the goals that I have set for myself	.716
Eigenvalue	4.801
Cronbach's alfa	0.903

Table A7: Principal component analysis on items of motivation to pursue a PhD

	Professional motivation	Intellectual motivation
To widen my employment prospects	**.901**	.186

	Professional motivation	Intellectual motivation
To improve my working conditions	**.816**	.013
To access my ideal profession	**.531**	-.185
To get social recognition from the PhD degree	**.516**	-.338
To create my life's work or answer my calling	-.025	**-.842**
To improve the world or make a creative contribution	-.042	**-.775**
To self-actualize or define myself throughout the doctoral process	.078	**-.701**
Eigenvalue	2.868	1.220
Cronbach's alfa	0.706	0.690

Table A8: Principal component analysis on items of satisfaction with work environment

	Personal conditions	Impersonal conditions
The available expertise in the department	**.829**	-.072
The introduction to the research group/department	**.818**	-.098
Opportunities to present results to the department	**.775**	-.046
The infrastructure (lab, materials, programs) to perform your research in a suiTable manner	**.623**	.170
Is the overall support you receive within the university sufficient to develop your research?	**.541**	.276
The training opportunities offered within the university	**.416**	.306
Income	-.240	**.836**
The available funding to go to conferences/summer schools	.172	**.620**
The possibility to go on vacation/take some time off	.099	**.597**
The available space in the office	.187	**.467**
Eigenvalue	3.837	1.190
Cronbach's alfa	0.807	0.622

Table A9: Principal component analysis on items of satisfaction with supervisor

	Supervisor support	Supervisor freedom
The expertise she/he has on the research subject	**.855**	-.157
The quality of meetings	**.829**	-.005

	Supervisor support	Supervisor freedom
Stimulation/inspiration to solve research problems/issues	**.820**	.089
Is/are your supervisor(s) involved in your research?	**.810**	-.106
The support you receive in writing articles	**.678**	.139
The frequency of meetings	**.672**	.117
The introduction to other prominent researchers in your field of interest by your supervisor(s)	**.585**	.246
The possibility to attend transferable skills training courses	-.030	.922
The possibility to attend conferences/specialist training courses	.114	.836
The expertise she/he has on the research subject	.855	-.157
Eigenvalue	4.839	1.081
Cronbach's alfa	0.879	0.748

Table A10: Principal component analysis on items of experienced obstacles

	Personal obstacles	Research obstacles
Personal reasons	**.787**	.055
The unbalanced combination of work and family	**.712**	.063
I doubt my own capabilities	**.642**	.035
The research topic is not that interesting after all	**.619**	-.073
I didn't have the ambition to do a PhD in the first place	**.534**	-.241
Lack of stimulating research environment	.011	-.821
Lack of guidance by my supervisor(s)	-.002	-.815
Lack of results/failed experiment(s)	-.003	-.760
Eigenvalue	3.019	1.226
Cronbach's alfa	0.696	0.727