VRIJE UNIVERSITEIT BRUSSEL

PHD-SURVEY VUB 2020

REPORT

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Executive Summary

The 2020 edition of the annual PhD survey is the third edition for which PhD candidates of all faculties were invited to participate. This study is prepared by the research group Tempus Omnia Revelat (TOR), assigned by and in close collaboration with the Researcher Training & Development Office (RTDO) of the Vice-rectorate Research.

Main goals

The goals of this study are threefold. First, to increase insight into **the needs of the PhD candidates** and to what extend these needs are met. Secondly, identification of **PhD candidates potentially in need of some help** to improve their job circumstances and to increase the probability of a successful completion of their PhD trajectory. Finally, after completing the survey, the PhD candidates get insight into their own results and can compare their position to that of their peers. In this way, **the PhD survey also functions as a self-evaluation tool for the PhD candidates**.

Recurring analyses & results

In line with the response rate of previous years, 45,3% of all PhD candidates took the time to complete the survey. More than half of these respondents also took part during one of the earlier editions of the survey.

The data gathered in this research consist of background information of the PhD candidates and variables that say something about their job satisfaction. The background characteristics can be broken down in three groups: **personal characteristics** (gender, nationality, previous work situation, type of contract, Doctoral Schools & phase of PhD), **motivation and goal orientation** (engagement, passion for research, self-efficacy and having a research plan) and **roles and expectation** (time pressure, work-family balance, level of competition, victimization and expectations to work in academia after graduation).

Over the three years this survey has been organized, insight has been increased on the different components that contribute to the level of satisfaction in the PhD trajectory. These are summarized into 9 constituent variables of job satisfaction: satisfaction with work environment (broken down into **warmth of the work environment, structural factors** and **labour conditions**, satisfaction with supervisor (**freedom** and **support**), perceived obstacles (**personal** and **research-related**), **PhD on the right track** and **submitting the PhD successfully**.

A cluster analysis is performed on these variables to divide the respondents into groups with similar opinions on job satisfaction. In this year's survey, three clusters have been identified. The most important factors leading to grouping individuals in one of these three clusters are: feeling on the right track, assessment of successfully completing the PhD, support and freedom from the supervisor and the warmth of the work environment. The **moderate cluster** includes 47,8% of the respondents with a rather moderate opinion on the different aspects that contribute to the overall job satisfaction. The **doubtful, unsatisfied cluster** contains 28% of the respondents answering rather negatively on most aspects of job satisfaction. PhD canditates in this cluster experience a high number of obstacles, both personal and research related. They are not satisfied with their supervisor, specifically concerning the introduction by their supervisors to other prominent researchers in their field of interest, the frequency of meetings with their supersvisor and the lack of stimulation. The majority in this cluster is also not satisfied with the warmth of the work environment, more specifically with the general support to develop their research and the introduction to the research group/department. They encounter many structural issues and are not happy with their labour conditions. The most frequently mentioned obstacles to a successful completion are lack of a stimulative research environment and the lack of results or failed experiments. They have a gloomy picture of the future of their PhD trajectory. The **satisfied, confident cluster** includes 23% of the respondents who are overall very optimistic and positive as they see a clear pathway to their doctoral degree.

Several in-depth analyses were performed to link cluster membership to the background variables mentioned at the beginning of this section. Since the moderate cluster is a rather broad cluster it is not characterized by a very specific type of PhD candidate but rather comprises all the respondents that do not belong to the positive or negative extreme. The following factors are strongly related to the doubtful cluster: lack of a research plan, competition in the research environment, time pressure, low self-efficacy and phase of the research (respondents in the finalizing phase are less likely to belong to this cluster). Belonging to the satisfied, confident cluster is related to job engagement, high self-efficacy, less time pressure and little competition in the work environment.

Qualitative results

The survey includes a limited number of open-ended questions, in which PhD candidates can share their recommendations and complaints concerning (research) infrastructure at VUB, administrative support and the doctoral training offer. Recurring topics in infrastructure include 1) the library, more specifically the lack of digital access to journals for specific disciplines and the lack of essential books physically present; 2) work

offices with a lack of space, office materials and basic comfort and 3) labs failing to meet the required needs for equipment.

Concerning administrative support, PhD candidates are in need of useful and comprehensible information on their rights and duties. International PhD candidates also are in search of specific info and support but have to puzzle bits and pieces together from several services. Easily finding general or research-specific information or support is also on the wish list, next to more specific support concerning mental health.

Regarding the doctoral training offer PhD candidates mentioned the lack of certain courses (mostly research-related and critical thinking), the need to increase the existing offer,(especially concerning Academic English and mental health), and an elaborate offer online.

Explorative longitudinal analysis

To investigate changes over time in satisfaction of the PhD candidates, a longitudinal analysis was performed on the collected data over the three consecutive years. Evolutions in the satisfaction level can be the result of external factors (e.g., changes in the policy, different socio-economic composition of the population…) but can also be due to changes within the respondents themselves over the years, as they proceed through the PhD trajectory. Changes over time were measured for the following variables: being on the right track, perceived personal obstacles and satisfaction with the support and freedom of the supervisor and with labour conditions. The satisfaction with the support and freedom of the supervisor decreases over time as a PhD candidate evolves through the PhD process. Over the years, the general satisfaction with the support of the supervisor has increased. Feeling on the right track does not increase over the PhD trajectory, nor over time. PhD candidates with an 'other' type of contract (a rather heterogenous group) is less satisfied with labour conditions and experience more personal obstacles throughout their trajectory.

Policy recommendations

The policy recommendations can be broken down in two parts: lessons learned from the quantitative analyses, and suggested improvements based on the qualitative analysis.

The results of the survey strongly indicate the importance of the **work environment**, and the **relationship between the PhD candidate and the supervisor**. We warmly recommend both supervisors and PhD candidates

to see this relationship as a working alliance, which includes a regular rhythm of meetings, a proper, specific and continually revised research plan, reflection on the relationship, and room to discuss non research-related matters. This should be a constant reiterative process that is open to revision at all times. The **annual progress report** can be a starting point for this process.

This working alliance could be a tandem, but could also benefit from support from other members of the research group. Regular group meetings where they can present and offer feedback to each other's work should be a common practice in all departments/research groups.

Steering (a group of) researchers requires good leadership skills, but functioning within one is not easy either. Any group may benefit from improving skills such as teamwork, communication, conflict resolution, negotiation and other social skills. Supervisor **training** offered at VUB not only includes insight into literature on how to work with different types of PhD candidates, how to manage expectations and avoid conflicts, but also offers the possibility to share experiences and help supervisors to grow in this role.

Based on the qualitative analysis, respondents indicated points of improvements for several services at VUB. Regarding **infrastructure**, the inadequate availability of online journals and physical books at the library is an important concern. It is clear that PhD candidates also feel the need for **comprehensive and easily searchable digital databases and websites** to find the information they are looking for. Several sources of information are in place (via Sharepoint and Service Now) but it will require additional efforts to expand and keep these up to date, and to make sure that everyone is able to find their way to these sources when they need it. **Improving communication** towards PhD candidates concerning the existing training offer, possibilities for travel grants (not only for attending conferences but also international workshops) and support of mental health problems is another clear message, as suggestions for additional training and support are often already in place, but unknown for many researchers.

Introduction

This report presents the results of the PhD survey 2020. The PhD survey is a study that is annually organized by the Researcher Training & Development Office (RTDO) of the Vrije Universiteit Brussel (VUB) to measure the job satisfaction and working conditions of the PhD candidates enrolled at the VUB. The pilot study took place in 2017 and only included PhD candidates of three faculties. The three following editions (2018, 2019 and 2020) included all the PhD candidates of the university.

One of the main strategic goals of the Vice-Rectorate for Research Policy is to provide optimal support for all its researchers, including PhD candidates. By doing so, the aim is to provide an optimal environment for researchers to improve their research skills and to increase the successful completion of PhD trajectories.

Traditionally, the VUB monitors these PhD trajectories via administrative data, collected internally but also at the Flemish level via the HRRF[1] data collected by ECOOM-UGent. While these data give an idea on how the success rate and time to degree differ by gender, discipline and the type of contract, they lack indicators explaining these differences. The annual PhD Survey intends to fill this gap by providing a deeper insight into the needs of PhD candidates concerning their PhD trajectory and into aspects related to their job satisfaction. The survey allows PhD candidates to anonymously pinpoint where support is lacking or is insufficient, and provides input for new doctoral policies at VUB and faculty level.

Furthermore, the PhD survey has two additional goals. PhD candidates are provided with the opportunity to come in contact with their faculty ombudsperson or representatives to discuss specific problems. Also, the survey offers PhD candidates the opportunity to reflect on the year that has passed. A self-evaluation tool summarizing the main results of the study is also offered to all participants of the survey. The tool enables them to compare their own answers with that of their peers and includes a few tips and tricks to help on their PhD journey.

This report gives an overview of background characteristics of the participants and key indicators of work satisfaction. The latter are used as input for a cluster analysis. This analysis groups the PhD candidates in three clusters with specific common characteristics. Moreover, the answers on the open-ended questions are discussed in a short chapter detailing some of the recurring suggestions and complaints concerning infrastructure and doctoral training support. Finally, some first explorative analyses of longitudinal data are included in this report. This summary highlights the main findings and conclusions.

[1] Human Resources in Research for Flanders database – collecting administrative data in all Flemish universities to study doctoral cohorts, for more info see the website.

1. Methodology

1.1 Population

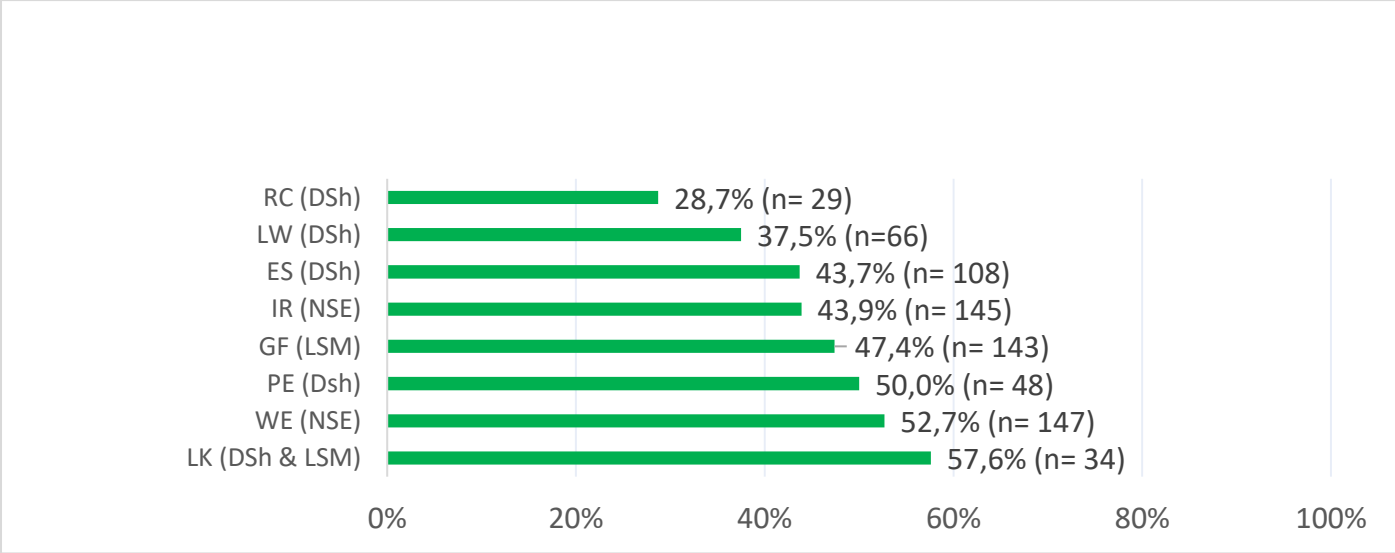
The population of this study consists of all PhD candidates enrolled at the VUB. All eight faculties are included in the study. Some of the respondents do not belong exclusively to one faculty. These PhD candidates are doing an interdisciplinary PhD. Please note that the percentages of these PhD candidates can fluctuate easily and are not always representative, since this group only exists out of 8 respondents.

The personal information of the respondents was available through people's 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). The personal data was handled with care and conform to the Belgian Privacy Act (1992) and the GDPR guidelines. All enrolled PhD candidates were invited via email to participate. In total, 1 607 PhD candidates were invited.

1.2 Response

Of the 1 607 PhD candidates that were invited to participate in the study, 728 (45,3%) of them started to fill out the survey. 679 (42,3%) completed the survey entirely and 49 (3,0%) only filled it out partially. 57,1% (416 respondents) already took part in one of the earlier editions of the PhD survey. Please note that two of the respondents follow a non-PhD track[2] and were not included in every analysis. The distribution of these PhD candidates over the different faculties can be found in figure 1. The doctoral school has been marked in brackets.

Figure 1: Total response rate per faculty (based on student administration data)



RC = Law & Criminology, LW = Arts & Philosophy, ES = Economic & Social Sciences & Solvay Business School, IR = Engineering Sciences, GF = Medical Sciences & Pharmacy, LK = Physical education & Physiotherapy, WE = Sciences & Bio-Science Engineering, PE = Psychology & Educational Sciences

[2] Meaning that they are enrolled as a PhD candidate but are currently not working on a PhD.

1.3 Instrument and timing

One single questionnaire was used to gather the data (see technical report for more detail on the questions). The respondents were invited by email and received a link to the MOTUS-website (www.motusresearch.io) where they could fill in the survey. They could login on the website with their personal username and password, provided in the same email. After the invitation email, several reminder emails followed to ensure an optimal response.

After logging in, the respondents were shown a welcome page containing the basic information about the study as well as a link to a page where they could find more specific information, such as a F.A.Q.-page, contact information and the goals and privacy concerns of the research. After finishing the questionnaire, the respondents were shown a thank you-page and were sent an email to confirm their successful participation. All online information can be found in the technical report[3].

The fieldwork ran from April 28, 2020 to June 5, 2020. It is important to note that on March 18, 2020 Belgium went into a national lockdown to fight the spread of the COVID-19 virus. During the whole course of the fieldwork, teleworking was obligated and there was limited access to the physical workplace at the VUB. Some questions about how working from home and how the uncertainty of this period affected the PhD candidates were included in the survey. The findings related to the impact of the COVID-19 crisis were reported in a separate report[4].

1.4 Weight by gender

Making sure that the used sample is a reflection of the whole population is an important consideration in order to draw valid and representative conclusions. This is challenging because certain groups may be over- or underrepresented in the sample due to sampling errors and/or non-response. The previous PhD surveys, executed between 2017 and 2019, taught us that the way the PhD trajectory is evaluated varies strongly between male and female PhD candidates. To be able to investigate these differences more accurately, and to prevent any bias from the sample that participated in the study, it was deemed necessary to introduce a post-stratification weight for gender.

[3] Glorieux, A., P. te Braak, I. Laurijssen, F. Van Deynze, H. De Grande, J. Minnen, B. Spruyt (2020): PHD Survey VUB 2020 – Technical Report. Brussel: Onderzoeksgroep TOR, Vakgroep Sociologie, Vrije Universiteit Brussel (145 blz.)

[4] Glorieux, A., P. te Braak, J. Minnen, B. Spruyt (2020): PhD Survey VUB 2020: Analyse van de gevolgen van Covid-19 op PhD kandidaten aan de VUB. Brussel: Onderzoeksgroep TOR, Vakgroep Sociologie, Vrije Universiteit Brussel (17 blz.).

To calculate this weighting variable, the percentage of female PhD candidates in the population was divided by the percentage of female PhD candidates in the sample, meaning the percentage that actually took part in the survey. The same procedure was applied to male participants. Female participants turned out to be overrepresented in our sample and, as a result, were assigned a lighter weight than their male colleagues. Table 1 gives an overview of the detailed numbers.

Table 1: Weight variables by gender

	% in population	% in sample	Weight
Female	48,0	51,1	0,94
Male	52,0	48,9	1,06

2 Background characteristics

In this chapter, we take a deeper look into the background characteristics of the PhD candidates. Next to the gender and nationality of the PhD candidates, we also look at the stage of the PhD trajectory they are in, their contract and their previous work experience. Furthermore, some more intrinsic characteristics will be discussed, such as the experienced time pressure, the perception of the work culture, self-efficacy and the engagement with the job. All background variables are tested against each other in a bivariate model, but only the significant effects are reported.

2.1 Personal characteristics

2.1.1 Gender

51,1% of the respondents are female, 48,9% are male. As discussed above, this means that female PhD candidates are overrepresented in our sample, as in the population of PhD candidates, men are in the majority (52,0%).

2.1.2 Nationality

The biggest group of the respondents is Belgian (46,6%), followed by non-Europeans (34,2%) is and Europeans (excl. Belgians, 19,2%). The non-European respondents are slightly overrepresented in the sample, whereas the European respondents are underrepresented.

2.1.3 Previous work situation

As presented in table 2, the majority of the PhD candidates (54,8%) does not have any work experience prior to the job they are currently doing at the VUB. 35,3% did have another job before they started their doctoral research, and this was usually in the private sector or at another university. Almost one in ten (9,9%) currently has another job next to their doctoral research. In most cases, this is at another university or in the non-profit sector.

Table 2: Respondents by previous work experience

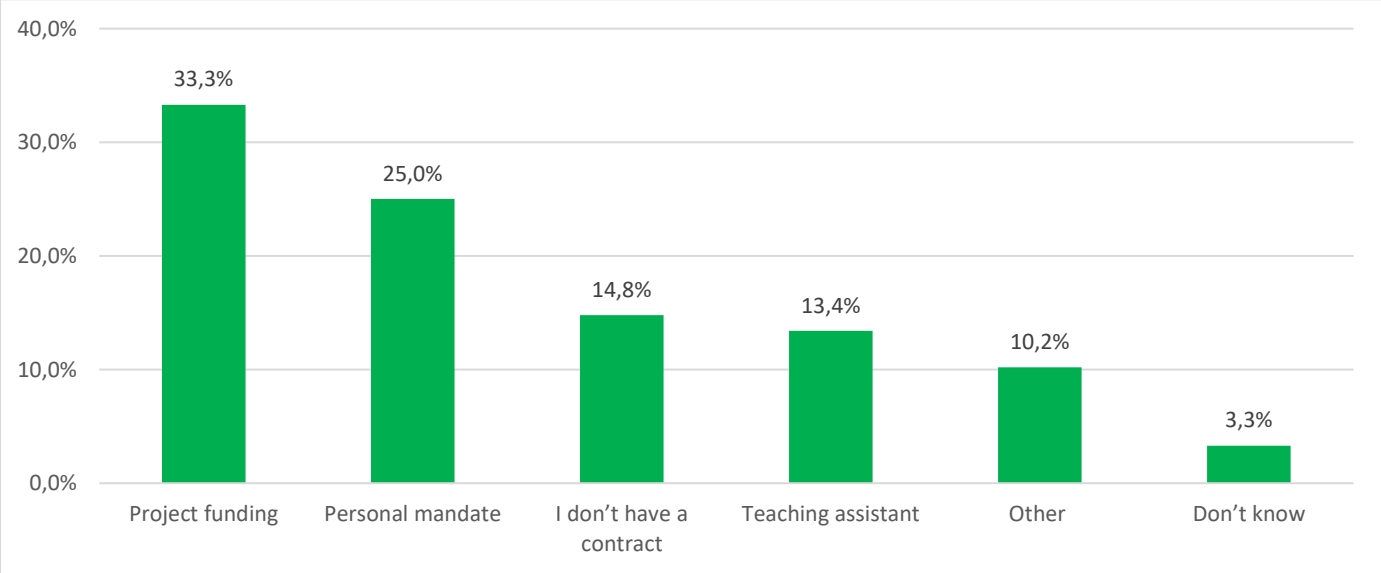
	N	In %
No	**397**	**54,8**
Yes	**256**	**35,3**
Other university	57	7,8
Other higher education institution	9	1,2
Government (federal, regional, local)	23	3,2
Non-profit sector	35	4,8

Industry or private sector	67	9,2
Other	23	3,2
I still have another job	**72**	**9,9**
Other university	20	2,7
Other higher education institution	8	1,1
Government (federal, regional, local)	6	0,8
Non-profit sector	18	2,5
Industry or private sector	11	1,5
Other	9	1,2
Missing	3	
Total	728	100

2.1.4 Type of contract

As can be seen in figure 2 below, one in three PhD candidates (33,3%) has project funding, meaning the funding of their research is assigned to their supervisor. 25% has a personal mandate, meaning that research funding is directly assigned to the researcher themselves. 14,8% does not have a contract, and thus finances their research with their own resources. 13,4% is a research assistant and 10,2% has another type of contract.

Figure 2: Respondents by type of contract



For the majority of the PhD candidates that have project funding, this funding is related to their doctoral research (90,5%). However, 19,1% of these are also involved in other projects, next to the project they are funded for. For a minority of 9,5%, the project funding is not related to their doctoral research.

2.1.5 Doctoral Schools

The biggest portion of respondents belongs to the doctoral school of Natural Sciences & (bioscience) Engineering (NSE) (40,2%). 34,6% belongs to the doctoral school of Human Sciences (DSh) and 24,3% is part of the doctoral school of Life Sciences & Medicine (LSM) (24,3%). A small percentage (0,8%) does an interdisciplinary PhD and does not belong exclusively to one doctoral school.

2.1.6 Phase of PhD

Doing doctoral research is a long process which can be divided in several phases. The starting phases exists merely out of reading up on the research subject and developing a research plan and design. In the executing phase, the research plan is carried out. This phase consists out of gathering data, doing experiments etc. The finalizing phase is the writing-up phase of the research.

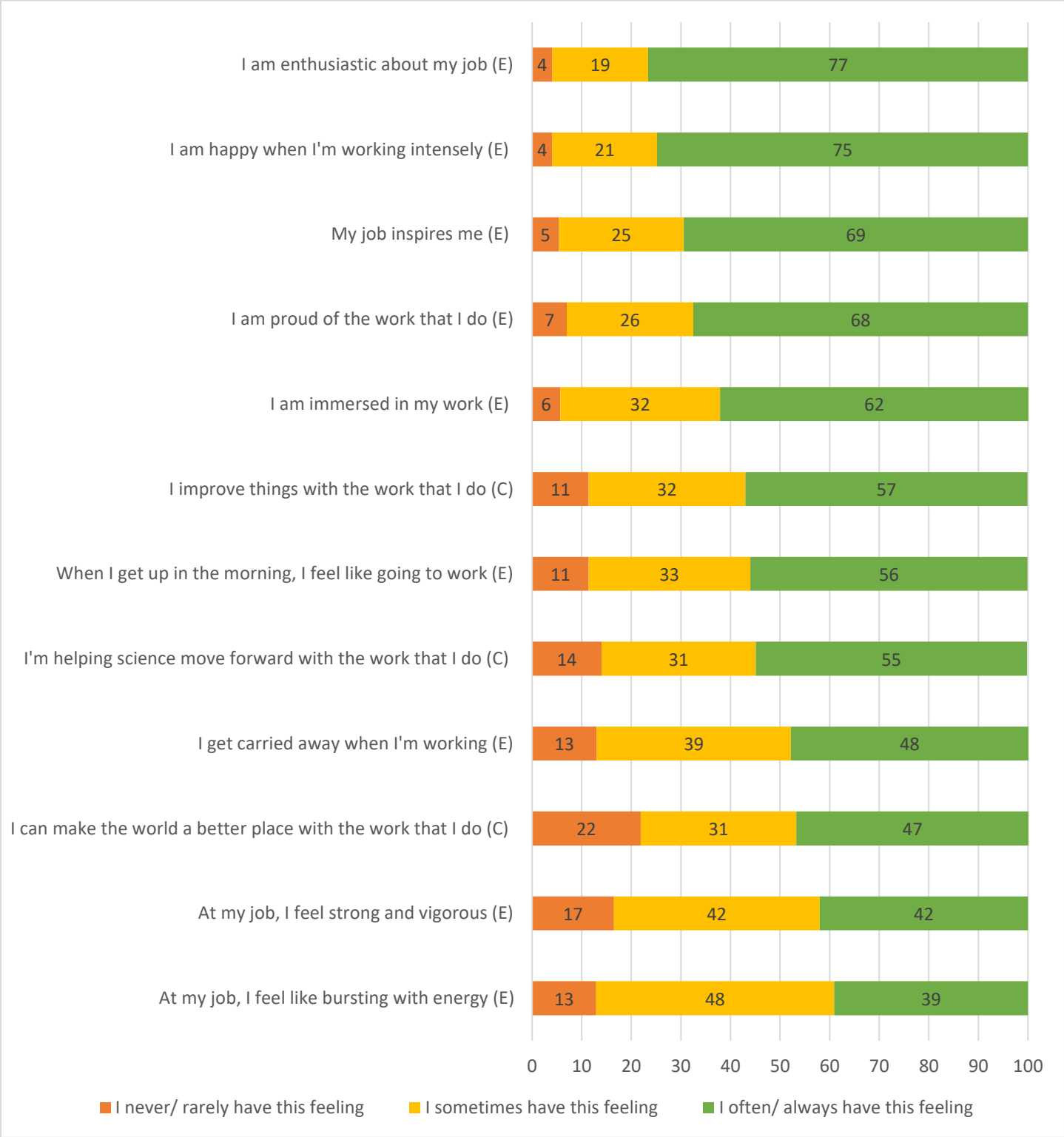
In the survey, we asked the respondents in which phase they currently are. The majority says to be in the executing phase (53,2%). This phase takes up the most time in the PhD trajectory. One in four (25,8%) is currently in the finalizing phase of their research. 21,0% is still in the developing phase.

2.2 Motivation and goal orientation

2.2.1 Engagement

The items presented in figure 3 measure how engaged the PhD candidates are with their job. This scale is a substitute for motivation-scale used in the previous report. The respondents were asked to rate each item on a 5-point Likert scale.

Figure 3: Scores (in %) on different items of engagement (n=701-709)



The items as described above can be synthesised into two variables: **job engagement (E)** and **job contribution (C)**, which says something about the extent in which the PhD candidates feel like they can contribute to society and science with their job. The results of the principal component analysis can be found in table 1 and table 2 in the appendix document.

The total average of job engagement is 6,2/10. Male PhD candidates score higher on job engagement than their female colleagues (appendix table 3). Also interesting is that respondents in the finalizing phase of their research are less engaged with their job (5,9/10) than the PhD candidates who are only just starting their research (6,5/10).

When it comes to job contribution, with a total average of 6,2/10, we can see the same tendency as with job engagement: male PhD candidates score higher (6,5/10) than female PhD candidates (6,0/10) (appendix table 4). This means they feel, more than women do, that their work contributes something to science and the world. Also the non-European PhD candidates score higher on this variable (6,9/10) compared to the Belgian (6,0/10) and other European respondents (5,6/10). PhD candidates with project funding have the lowest score on job contribution (5,9/10), and this varies significantly from those without a contract (6,9/10) or another type of contract (6,7/10). Moreover, when PhD candidates combine their research with another job, they feel more like their research contributes something to the greater good (6,9/10) than those without any work experience (6,1/10).

2.2.2 Passion for PhD research

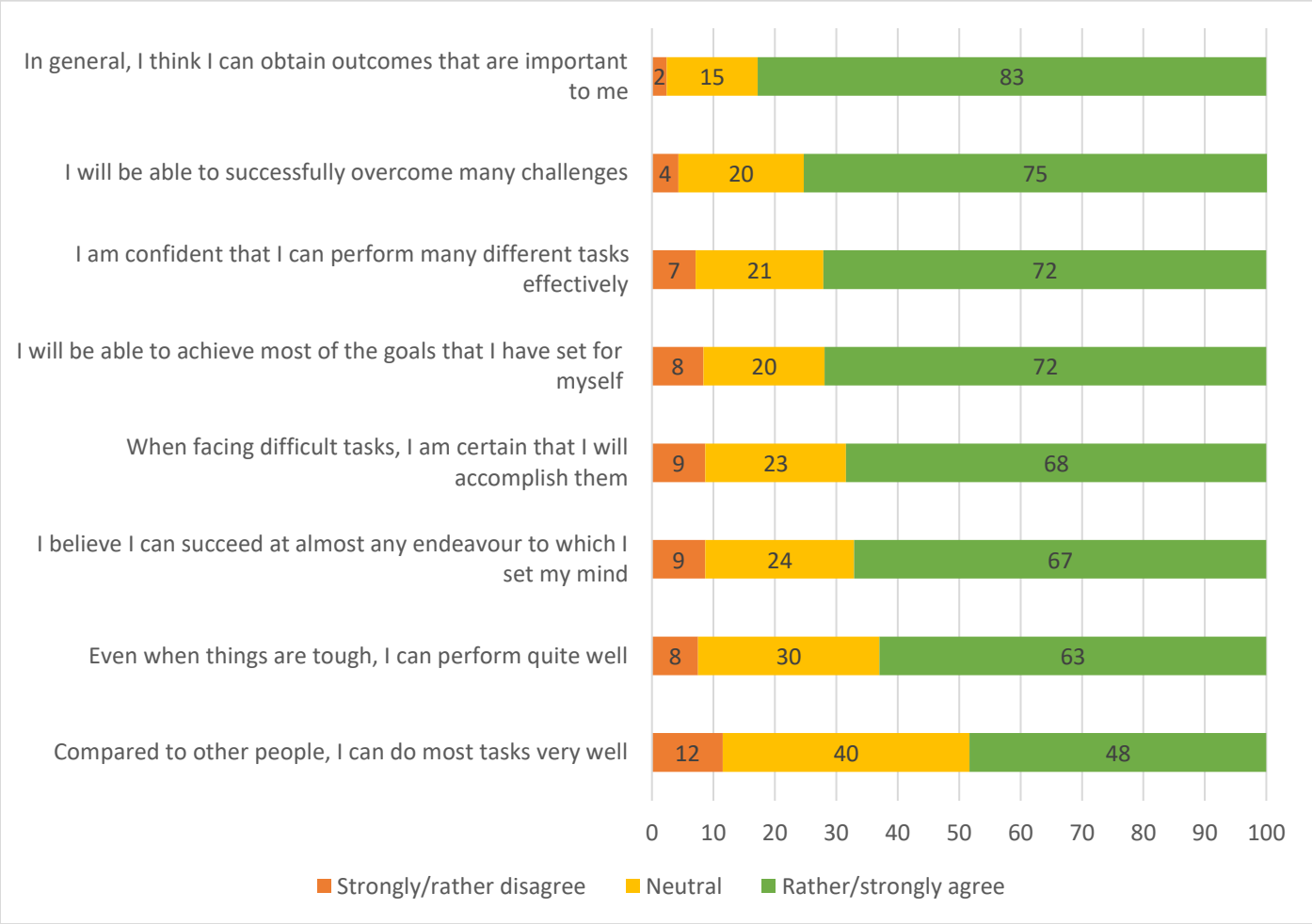
The respondents were asked to indicate the extent in which they are passionate about their research on a scale from 0 to 10. The majority (66,2%) gave a score of 8 or higher. 7,5% scored their level of passion with a 5 or lower. This is about 2% more than last year.

The PhD candidates in the final phase of their research are significantly less passionate about it (7,5/10) compared to the PhD candidates in the starting and executing phase (respectively 8,1/10 and 7,9/10) (appendix table 5). PhD candidates who combine their research with another job indicate a higher level of passion for their research (8,3/10) than those without any prior work experience (7,9/10). There is a positive effect between the passion for the research and the level of engagement with the job and job contribution: a higher score on these variables is related to more passion for the research.

2.2.3 Self-efficacy

Self-efficacy is defined as “the belief in one’s capabilities to organize and execute the courses of action required to manage prospective situations” (Bandura, 1977). It is an important factor to take into consideration when talking about job satisfaction. Figure 4 below shows the different items that were presented to the PhD candidates in order to measure their level of self-efficacy. They were asked to score these on 5-point Likert scale.

Figure 4: Score (in %) on different items of self-efficacy (n=701)



The several items were computed into one score on 10 to indicate the level of self-efficacy (appendix table 6). The total average is a 6,5/10. Male PhD candidates have a higher level of self-efficacy (6,6/10) than female PhD candidates (6,3/10) (appendix table 7). This is a finding that reoccurs in each annual edition of this survey. Also non-European PhD candidates score higher on self-efficacy (6,9/10) than European (6,4/10) and Belgian (6,2/10) candidates. Moreover, people without a contract have the highest score on self-efficacy (6,9/10), and this differs significantly from the PhD candidates with a personal mandate (6,2/10).

The higher the level of job contribution, the more self-efficacy a PhD candidate experiences. The same effect is true for the level of job engagement. When PhD candidates indicate to have a high amount of passion for their research, they score significantly higher on self-efficacy (6,9/10) than those who only have an intermediate level of passion (5,7/10) or a low level of passion for their research (5,3/10).

2.2.4 Having a research plan

The majority of the PhD candidates says to have a research plan. The research plan differs from the official research proposal, as it is a more individualized plan that can include specific short-term and long-term

milestones, a publication strategy, extra training that needs to be followed to perform certain analyses etc. Almost half of the PhD candidates report to have a research plan with short-term as well as long-term milestones (47,5%). 22,2% only included short-term milestones in their research plan, whereas 21,0% only included long-term milestones. 9,3% does not have a research plan.

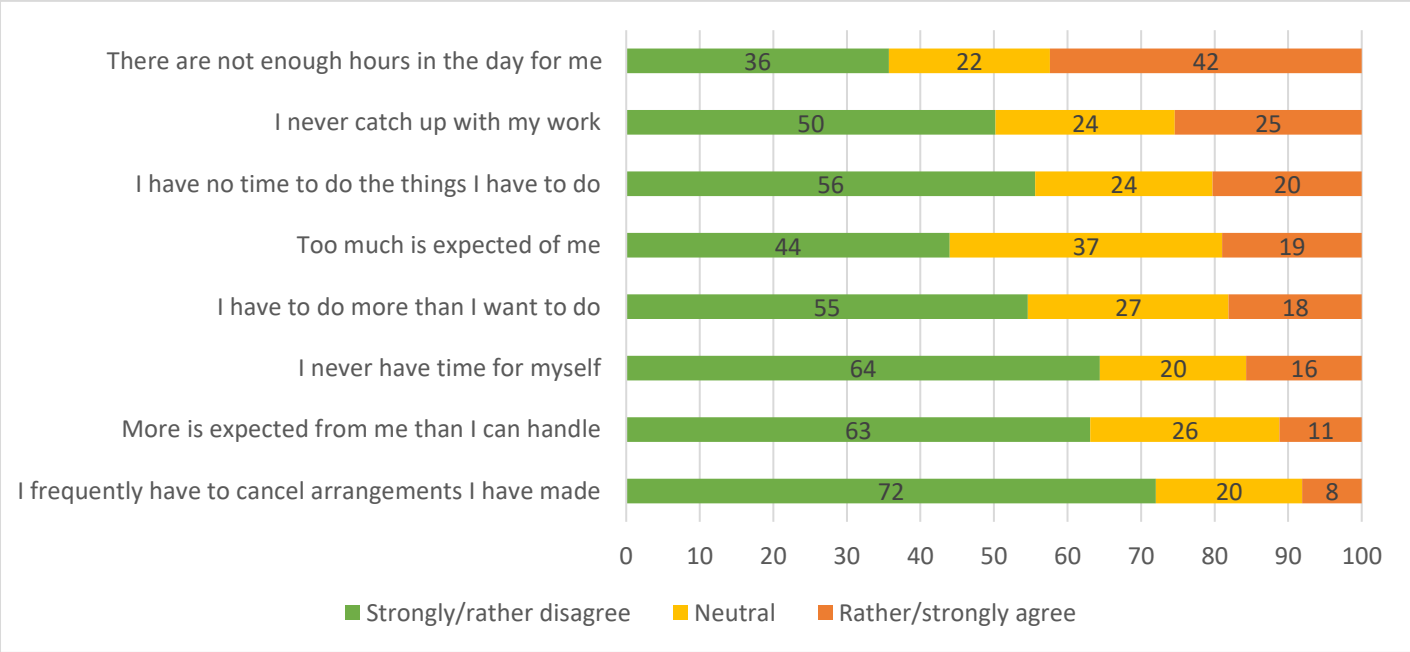
Belgian PhD candidates more often don't have a research plan (12,9%) compared to the other European (10,7%) and non-European respondents (3,3%) (appendix table 8). PhD candidates with no reseach plan rate their engagement substantially lower. The same is true for the feeling of contribution with their work: having no research plan leads to feelings of having only little to contribute to science and the world with their research. Moreover, lacking a research plan is also linked to a low level of passion for the research (71,2%).

2.3 Roles and expectations

2.3.1 Time pressure

To measure the amount of time pressure the PhD candidates experience, eight items on this matter were included in the survey (figure 5). The respondents mostly agree with the statement that there are not enough hours in the day for them (42,4%) and that they are unable to catch up with their work (25,4%). Overall, they don't really feel like they frequently have to cancel arrangements or that more is expected from them than they can handle. These findings are in the same line as the survey of last year.

Figure 5: Scores (in %) on different items of time pressure (n=689)



A principal component analysis was executed, and the different items were transformed into one scale of time pressure, with a total average of 4,2/10 (appendix table 9). PhD candidates in the doctoral school of NSE experience significantly less time pressure (3,9/10) compared to those in the DSh (4,4/10) and doctoral school of LSM (4,5/10) (appendix table 10). Moreover, the PhD candidates who are in the final phase of the PhD trajectory experience the highest level of time pressure (4,8/10) in comparison to the candidates in the starting phase (3,8/10) and the executing phase (4,1/10). Also, the people who combine their PhD research with another job score higher on time pressure (4,9/10) than those without any prior work experience (4,0/10). The more engaged PhD candidates are with their job, the less time pressure they experience. In the same line, the more PhD candidates have the feeling they contribute something with their work, the less time pressure they experience. The less self-efficacy one has, the more time pressure they report. Finally, respondents who indicate to have a high amount of passion for their research score significantly lower on time pressure (4,0/10) than those who are only moderately passionate about their research (4,7/10).

There is no significant difference in the perceived time pressure between PhD candidates who combine their research with teaching and those who don't (appendix table 11). We do see, however, that when PhD candidates assist in other projects or third-party services that are not related to their own research, they experience a higher amount of time pressure (4,6/10) compared to those who don't perform this activity (4,0/10). The same tendency can be observed when it comes to cooperating with industries or other sectors (4,8/10 compared to 4,1/10 when the activity is not performed).

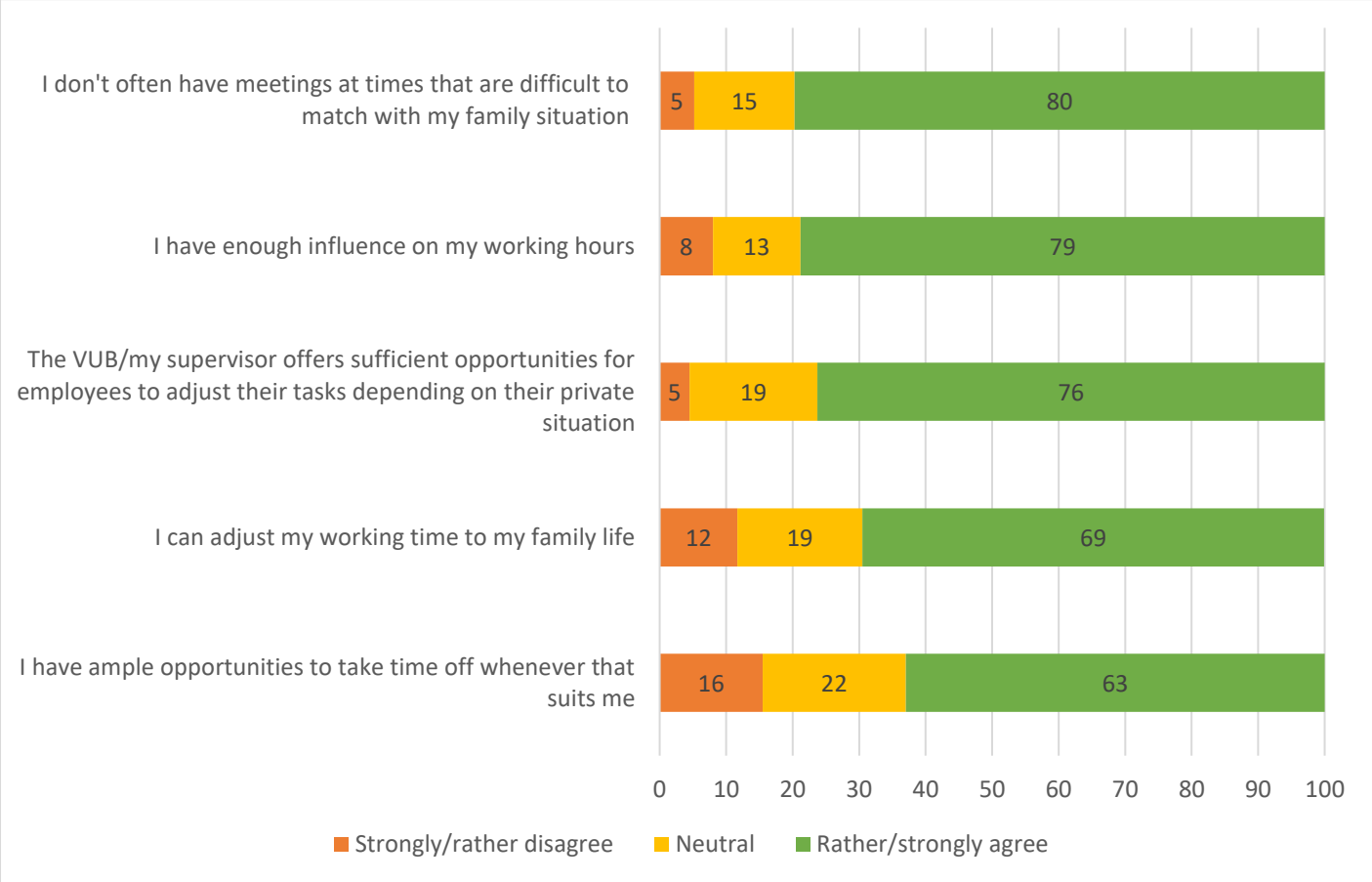
Also the timing of the work has an influence on how much time pressure PhD candidates experience (appendix table 12). Working more often in the evening (after 6 PM) goes hand in hand with a higher score on time pressure. Moreover, PhD candidates who never work at night (after midnight) experience significantly less time pressure (4,0/10) than those who occasionally (4,9/10) or often (5,2/10) work at night. Working during the weekends is also significantly linked to time pressure. PhD candidates who regularly do this score higher on time pressure (4,8/10) than those who occasionally (4,0/10) or never (3,7/10) do this. Lastly, PhD candidates who usually work in the mornings before 8 AM experience more time pressure (4,9/10) than the ones who rarely do this (4,1/10).

Of course, it is just as likely that the time pressure determines the timing of the work rather than the other way around.

2.3.2 Work-family balance

Five items in the survey were aimed to measure the evaluation of the work-family balance (figure 6). 79,7% of the respondents indicate to not have difficulties matching meetings with their family situation and 78,8% says to have enough influence on their working hours. Having enough opportunities to take time off whenever it suits them is the least popular statement; 15,5% disagrees with this. After a principal component analysis, these 5 items were computed into one variable of work-family balance (appendix table 13). The total resulting average is 7,1/10.

Figure 6: Scores (in %) on different items of work-family balance (n=687-690)



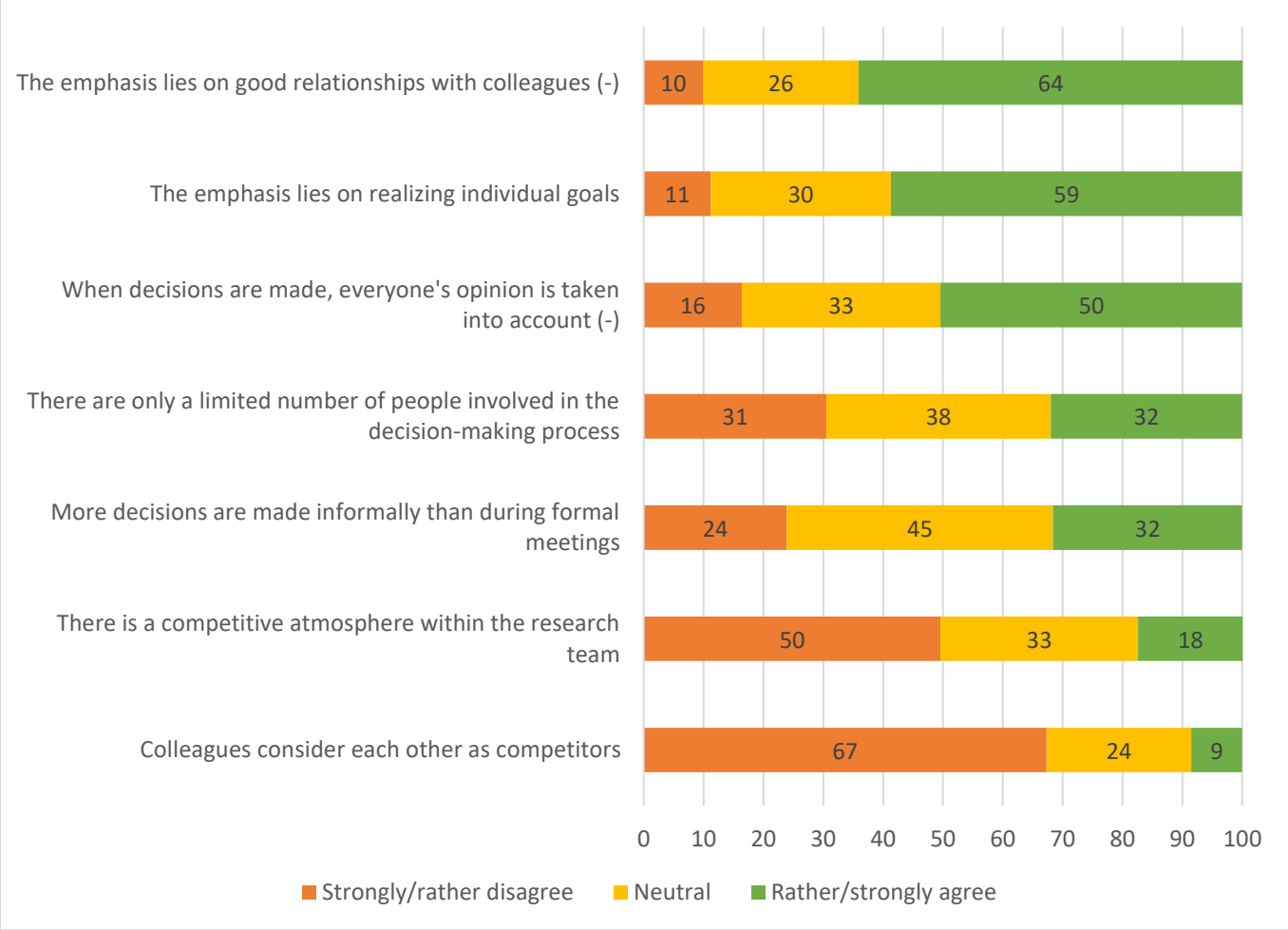
Non-European PhD candidates are significantly less satisfied with the work-family balance (6,6/10) compared to their Belgian (7,3/10) and other European (7,2/10) colleagues (appendix table 14). The doctoral school of NSE appears to have the best work-family balance (7,3/10) and scores significantly higher than the doctoral school of LSM (6,8/10). PhD candidates who combine their doctoral research with another job are less satisfied with the work-family balance (6,0/10) than those without previous work experience (7,3/10) and those who had another job before starting their PhD (7,0/10). Respondents with a personal mandate are more satisfied with the work-family balance (7,5/10) than those without a contract (6,5/10). PhD candidates with a

high level of engagement with their job are more satisfied with the work-family balance (7,3/10) than their colleagues with a low level of engagement (6,8/10). Moreover, the higher the amount of time pressure, the less satisfaction there is with the work-family balance. Combining doctoral research with assisting in other projects and cooperating with the industry or other sectors also leads to a lower rate of satisfaction with the work-family balance. PhD candidates with a limited research plan are less satisfied with the work-family balance of their job (6,8/10) than those with an extended research plan (7,2/10) or no research plan (7,8/10).

2.3.3 Culture: level of competition

Several items where included to the measure how PhD candidate rate the culture within the research team, or more specifically: the competition in the research team. As presented in figure 7, the majority of the PhD candidates (64,2%) agrees with the statement that the emphasis in the working culture lies on good relationships with colleagues. Yet 58,7% also believes that there is a strong emphasis on realizing individual goals. The least popular statement is that colleagues consider each other as competitors (8,5%).

Figure 7: Scores (in %) on different items of work culture (n=669-670)



Based on the results of a principal component analysis, the several items were computed into a variable: competition (appendix table 15).

In appendix table 16, the perceived level of competition in the working culture is presented against the several background characteristics. The total average is 4,8/10. The DSh shows the highest amount of competitiveness (5,1/10) and this differs significantly from the doctoral school of NSE (4,6/10). The interdisciplinary doctorates are disregarded since this group is not representative. PhD candidates who are in the final stage of their research experience significantly more competitiveness (5,1/10) than researcher in the starting (4,6/10) or executing (4,8/10) phase. When PhD candidates don't have a contract, they also experience more competitiveness (5,2/10) than those with a personal mandate (4,6/10).

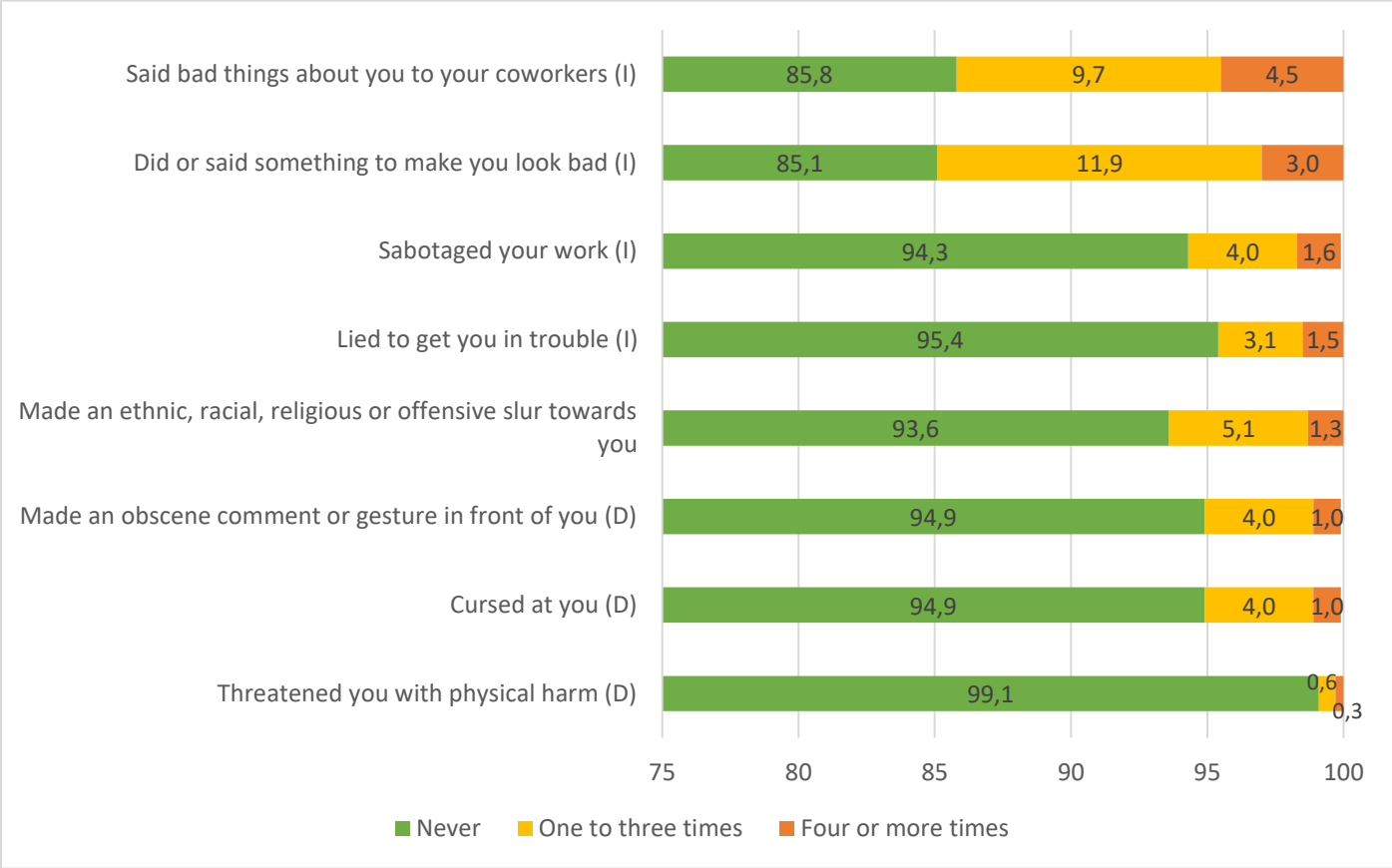
When PhD candidates experience a low level of engagement with their work, they experience more competition in their work environment. The same is true for their feeling of contribution to science and the world: the higher their score on this, the less competition they experience. The lower the self-efficacy of the PhD candidates is, the more competitiveness they experience in the working culture. The opposite is true for time pressure; a higher score on time pressure leads to a lower score on perceived competitiveness.

PhD candidates that report a high amount of passion for their research experience less competition among colleagues (4,7/10) than those with only an intermediate amount of passion for their research (5,2/10). The higher respondents score on the satisfaction with the work-family balance, the less competition they experience between colleagues.

2.3.4 Victimization

In this section, the perceived victimization of PhD candidates in the workplace was surveyed. The respondents were asked to indicate the number of times they had personally witnessed a co-worker directing the described behaviours towards them, within the last year (figure 8). The behaviours that occurred the most often are colleagues saying something to make the PhD candidate look bad (14,9%) or saying bad things about that PhD candidate to other colleagues (14,2%). 6,4% of the PhD candidates said to have received an ethnic, racial, religious or other offensive comment from a colleague at least once. The least common behaviour is being threatened with physical harm: 0,9% of the PhD candidates experienced this at least once.

Figure 8: Scores (in %) on different items of work victimization (n=669-670)



A principal component analysis of the items described above resulted in two new variables: direct victimization and indirect victimization (appendix table 17). The constituent variables are marked in the above figure with **(D) for direct victimization** and **(I) for indirect victimization**. The item "made an ethnic, racial, religious or offensive slur towards you" was left out of the analysis because it didn't load strongly enough on any of these variables.

The variable "indirect victimization" measures the occurrence of behaviours such as colleagues lying to get the PhD candidate in trouble, talking behind their back or sabotaging their work. The overall level of indirect victimization is rather low: on average 0,38 on 10. However, we do see some differences between groups of PhD candidates when it comes to the experience of indirect victimization.

Women report to experience indirect victimization more often than men (appendix table 18). Moreover, when PhD candidates have a low level of engagement with their work, they have a higher score on indirect victimization. Also PhD candidates who experience a lot of time pressure report more incidents of indirect victimization. PhD candidates with a low score on the work-family balance have experience more indirect victimization than those with a medium or high score. Finally, a high level of competition in the work environment is also linked to higher rates of indirect victimization.

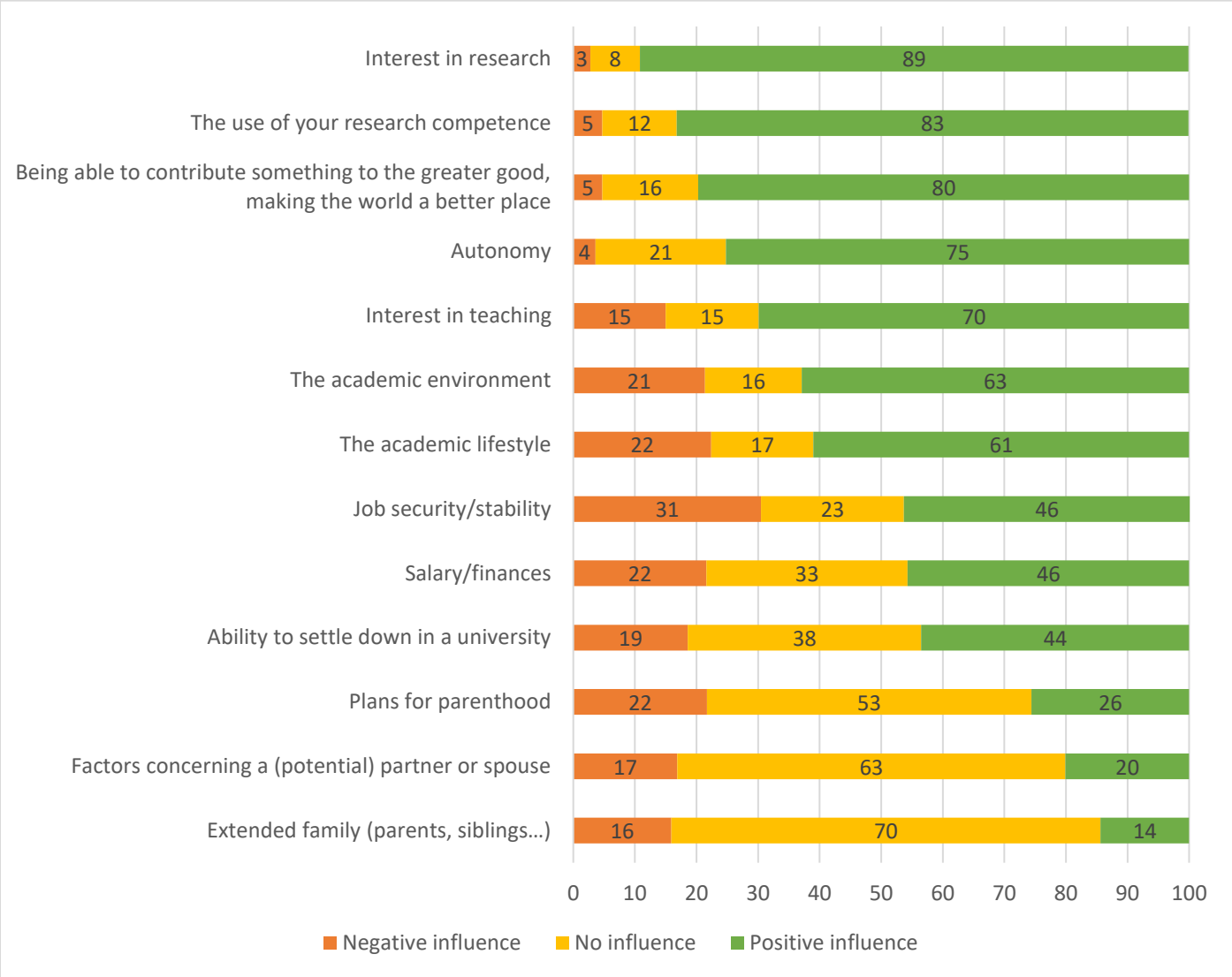
Direct victimization includes behaviour such as colleagues cursing at the PhD candidate, making obscene comments or gestures or even threatening with physical harm. The vast majority of PhD candidates never experienced these kinds of behaviours in the workplace. We see, however, that when a lot of competition is reported in the working environment, there are also more incidents of the direct victimization compared to when there is a low level of competition (appendix table 19). Moreover, respondents with a low level of satisfaction with the work-family balance also experience direct victimization more often than with a medium level of satisfaction for the work-family balance.

2.3.5 Expectations to work in academia after graduation

When we asked the PhD candidates whether or not they expect to work in academia after they finished their PhD research, opinions were divided. 37% has high expectations about working in academia, whereas 31% does not expect an academic career. 32% is rather undecided about the matter. These findings run along the same lines as last year.

In figure 9, different factors that might influence the decision to pursue an academic career are presented. Respondents were asked to indicate how these factors influence their decision. The interest they have in research (89,1%) and the use of their research competence (83,1%) are most often indicated as a research to pursue an academic career. Also being able to contribute something to the greater good ranks highly (79,7%). The job security in academia on the other hand is most often seen as a negative factor of pursuing an academic career (30,5%). Also the academic lifestyle (22,4%) and plans for parenthood (21,7%) impact the ambition for an academic career negatively. Women tend to indicate “plans for parenthood” as a negative factor more often than men, whereas the majority of male PhD candidates don’t think this has an influence on their decision.

Figure 9: Scores (in %) on factors that influence the decision to pursue an academic career (n=671-676)



The majority of the non-European PhD candidates indicates to expect an academic career (58,5%), whereas the biggest portion of people that don't expect an academic career are Belgian (41,4%) (appendix table 20). Other European candidates have a more divided opinion. Moreover, people with previous job experience (44,0%) and those who combine their PhD research with another job (48,6%) indicate to expect an academic career more often than those without any prior work experience. This last group mostly does not expect an academic career (35,4%) or is unsure about it (34, 6%).

The higher the level of self-efficacy, the more PhD candidates expect to work in academia after graduating. When PhD candidates are engaged with their work and feel like they can contribute something to the world and to science with it, they also have higher expectations to have an academic career in the future.

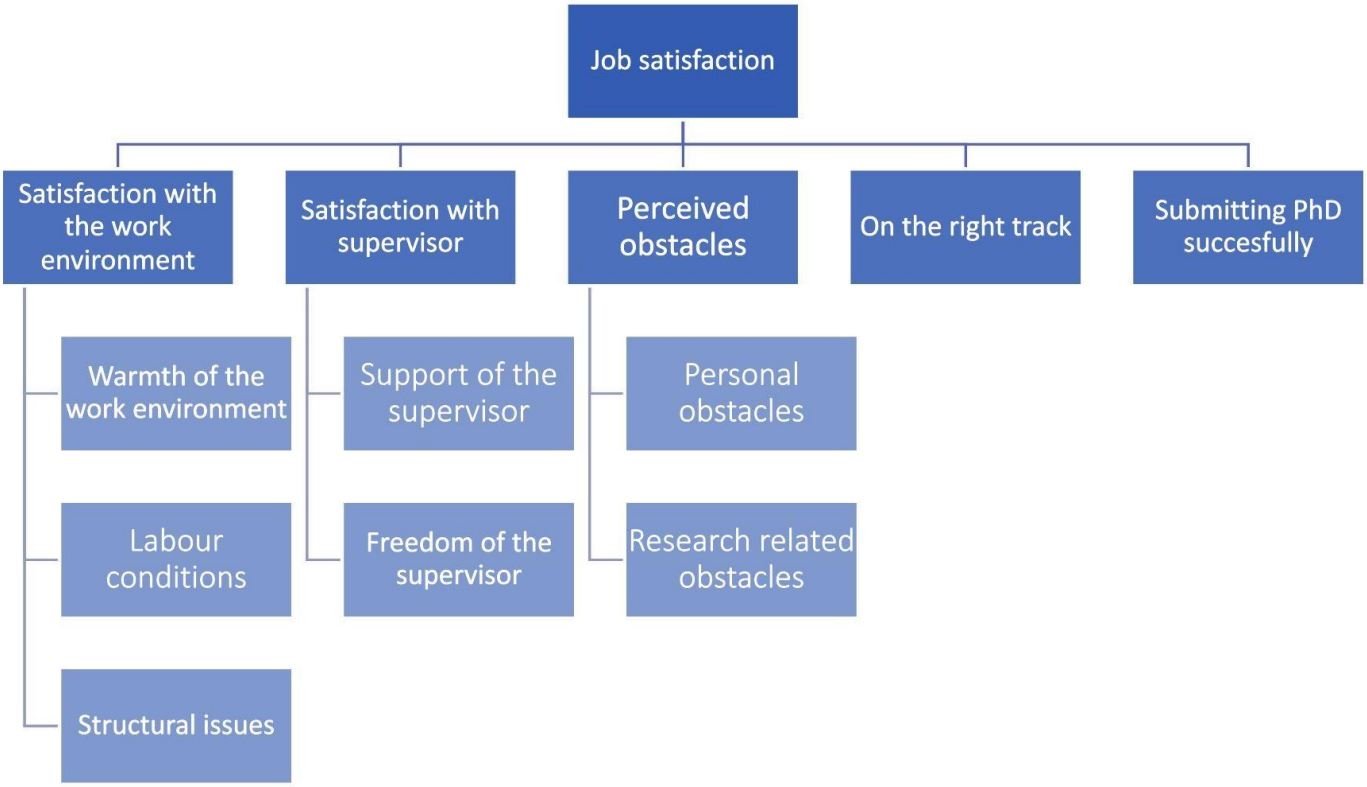
PhD candidates who report a low level of competition in the working culture indicate to expect an academic career (44,6%) more often than those who experience a moderate (33,0%) or high level of competition

(31,2%). The majority of the respondents with a low level of passion for their research says to not expect an academic career (63,8%), whereas expecting an academic career is most often linked with a high level of passion (44,8%).

Lastly, PhD candidates that don't have a research plan are more likely to not expect an academic career after graduating (49,2%). Respondents with a limited or extended research plan on the other hand, are more likely to expect an academic career, respectively 38,9% and 39,3%.

3 Constituent variables of job satisfaction

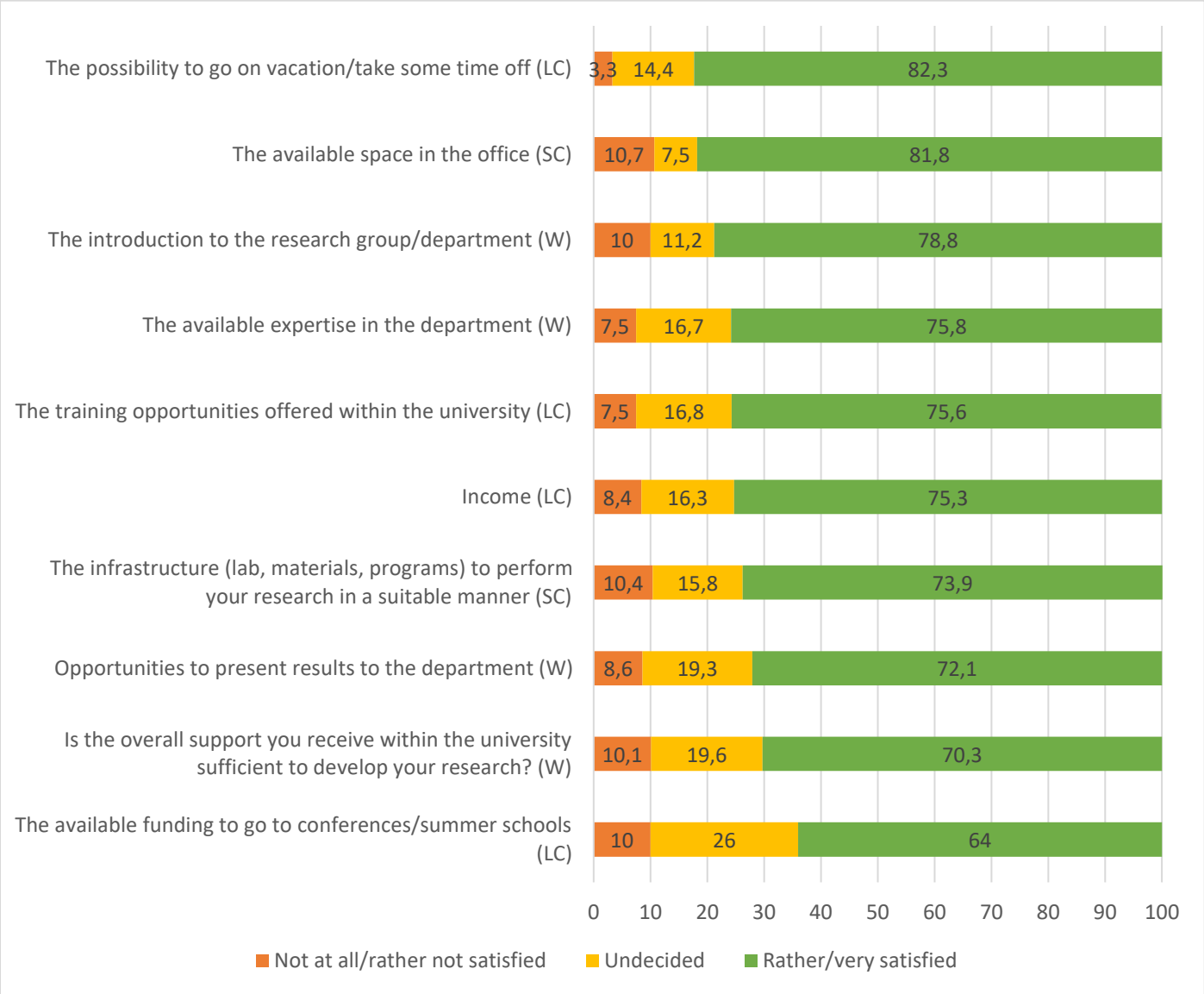
This chapter will discuss the different variables that measure the level of job satisfaction in this study. In total, five variables were distinguished. They can be seen below, along with variables they are composed of.



3.1 Satisfaction with work environment

The PhD candidates were presented with ten items to measure their level of satisfaction with the environment they work in (figure 10). Note that these questions only appeared for the respondents that have a physical workplace at the VUB (n=570). The PhD candidates are most satisfied with the ability to go on vacation or take some time off (82,3%) and the available space in the office (81,8%). However, there is also a high percentage of respondents who is not satisfied with the available space in the office. This is mainly due to the dissatisfaction of the PhD candidates in the faculty of Law and Criminology with this aspect. Other aspects PhD candidates are dissatisfied with are the infrastructure (10,4%), the overall support of the university (10,1%), the available funding to go to summer schools and conferences (10,0%) and the introduction to the research group (10,0%). These items run along the same lines as last year, yet the percentages of people who indicate to be dissatisfied with them are lower compared to 2019.

Figure 10: Scores (in %) on different items of satisfaction with the work environment (n=570)



The items discussed above were condensed into three new items: the satisfaction with **the warmth of the working environment (W)**, the satisfaction with the **structural conditions (SC)** (infrastructure, available space in the office…) and the satisfaction with **the labour conditions (LC)** (wage, holidays…). The results of the principal component analysis can be found in appendix table 21. In table 3, the correlations between the newly created variables are presented.

Table 3: Correlation between the different components of satisfaction with work environment

	Warmth working environment	Labour conditions	Structural issues
Warmth working environment	1,00	0,34	-0,34
Labour conditions		1,00	-0,30
Structural issues			1,00

3.1.1 Warmth of the working environment

We tested the satisfaction with the warmth of the working environment in a multiple regression analyses against several background characteristics. This was done through four steps. This same procedure was executed for all the constituent variables of job satisfaction, discussed in this chapter.

In the first model, the variable was tested against gender, nationality, doctoral school, the phase of the PhD, previous work experience, the type of contract and having a research plan. These are rather fixed, objective background characteristics. In the second model, self-efficacy, time pressure, competition, passion for the PhD, the expectation for working in academia after graduating and the work-family balance were added. In the third model, four more variables were introduced: job engagement, job contribution, indirect victimization and direct victimization. Finally, we add a fourth model which only contains the variables that showed a significant effect. The significant effects of this last model will be discussed here. In appendix table 22, all the models and its significant effects are presented.

The final model of the multiple regression explains 32,5% of the variance in the warmth of the working environment. The PhD candidates in the DSh are less satisfied with this aspect than the PhD candidates in the doctoral school of NSE (β -0,11). When PhD candidates don't have a research plan, they are also less satisfied with the warmth of the work environment than those with an extended research plan (β= -0,13). Time pressure, competition and the amount of passion for the PhD research also have a significant effect on the satisfaction with the warmth of the work environment. The more time pressure PhD candidates experience, the less satisfied they are with the warmth of the work environment (β= -0,08). Also, when there is a lot of competition between colleagues, PhD candidates experience lower satisfaction with the warmth of the working environment (β= -0,27).

PhD candidates with a low level of passion for their research rate the warmth of their work environment lower than those with an intermediate level of passion for the research (β= -0,08). Job contribution has a positive effect on the perceived warmth in the work environment. The higher PhD candidates score on this variable, the more satisfied they are with the warmth in their work environment (β=0,23). The opposite effect is true for indirect victimization. When PhD candidates experience indirect victimization in the work environment, they are less satisfied with the warmth of the climate at work (β= -0,12).

An overview of the bivariate relationships between the warmth of the work environment and the background variables can be found in appendix table 23. The average score on the satisfaction with the warmth of the

work environment is 7,6/10. The DSh scores lowest on the warmth of the work environment (7,1/10). This varies significantly from the doctoral school of NSE (7,8/10), which has the highest score, and the doctoral school of LSM (7,7/10). PhD candidates without a research plan are significantly less satisfied with the warmth of the work environment (6,6/10) compared to those with an extended (7,7/10) and limited research plan (7,5/10). A high amount of time pressure also leads to less satisfaction with the warmth of the working environment, as does competition. The lower the level of passion for the research, the lower the satisfaction with the warmth of the working environment. Respondents who score high on job contribution experience more warmth in the work environment (8,2/10) than those with an intermediate (7,7/10) or low score (7,0/10). PhD candidates who never experience indirect victimization also score higher on this variable (7,8/10) than those who experienced it at least once (7,0/10).

3.1.2 Labour conditions

In this part, we discuss the results of the multiple regression analysis between the satisfaction with the labour conditions (including the satisfaction with wage, days off, available funding etc.) and the background variables (see appendix table 24). There is a significant difference between the satisfaction with the labour conditions and nationality. The non-European PhD candidates are less satisfied with the labour conditions than their Belgian colleagues (β= -0,12).

Moreover, PhD candidates without a contract are also less satisfied with the labour conditions than those with a personal mandate (β= -0,18). This is a logical finding since these PhD candidates are self-financed. PhD candidates with project funding whose doctoral research is their only project on the other hand, are significantly more satisfied with the labour conditions than those with a personal mandate (β=0,10).

Self-efficacy (β=0,08) and work-family balance (β=0,25) both have a positive effect on the satisfaction with the labour conditions. The higher PhD candidates score on these elements, the more satisfied they are with the labour conditions of their job. The opposite effect is true for time pressure (β= -0,18) and competition (β= -0,13). A higher score on these aspects results in less satisfaction with the labour conditions. This model explains 28,4% of the variance in the satisfaction with labour conditions.

The bivariate effects between the satisfaction with the labour conditions and the background variables are presented in appendix 25. The average score on the satisfaction with the labour conditions is 7,2/10. Non-European PhD candidates are the least satisfied with the labour conditions (6,8/10) and this varies significantly from their Belgian colleagues, who have the highest score (7,4/10).

Respondents without a contract score significantly lower on the satisfaction with the labour conditions (5,8/10) than those with any other type of contract. PhD candidates with project funding who are not involved in other projects next to their PhD have the highest score on labour conditions (7,6/10). They score significantly higher than those without a contract, those with an "other" type of contract (6,7/10) and those who have project funding but are involved in other projects next to their PhD research (6,8/10). The effects for self-efficacy, time pressure, competition and work-family balance remain the same as discussed above.

3.1.3 Structural issues

The structural issues are about the available space in the office and the infrastructure of the workspace. On average, PhD candidates score 2,5/10 on the experienced structural issues.

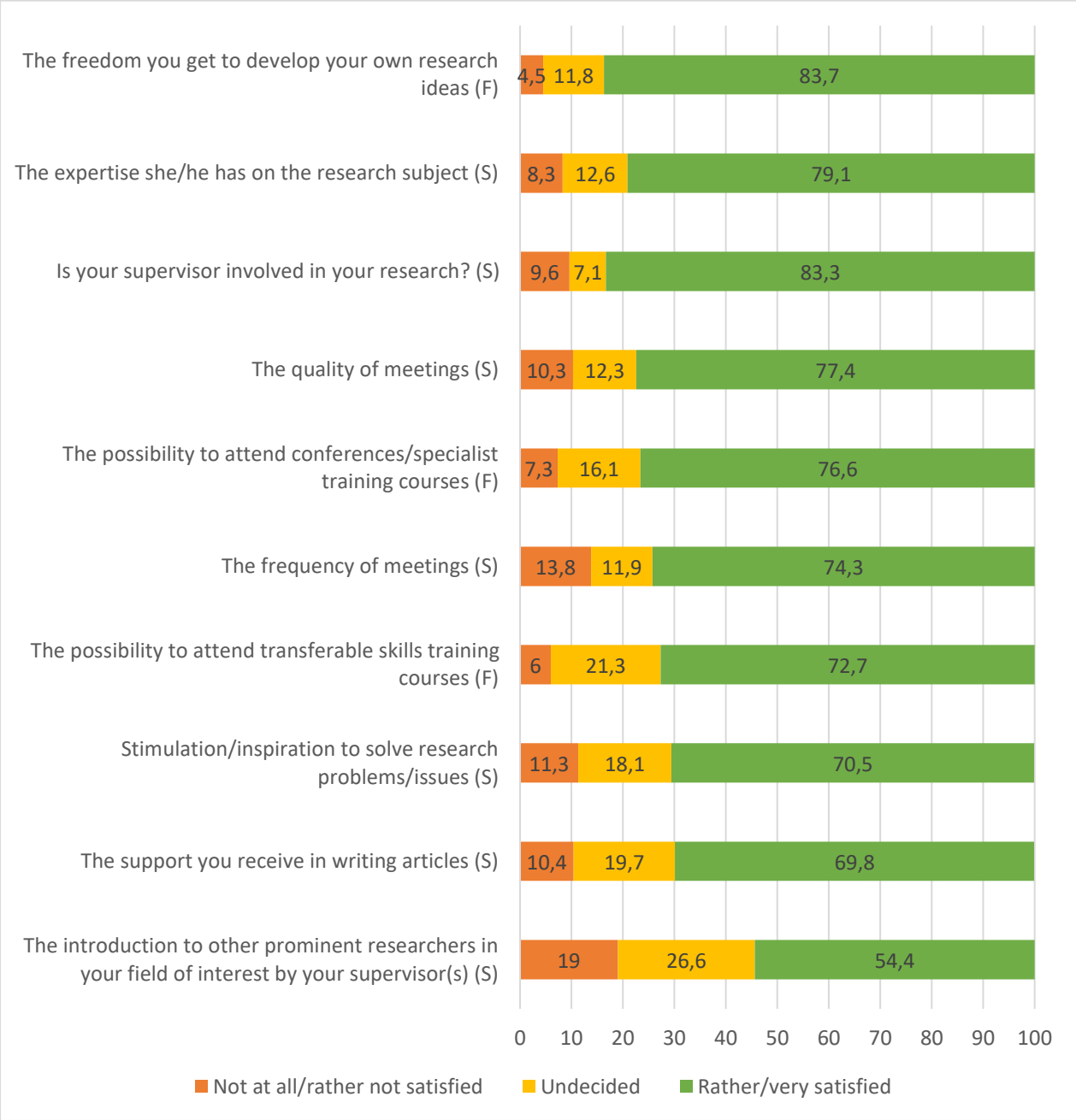
The final model of the multiple regression (see appendix table 26) analysis shows us that non-European PhD candidates experience less structural issues than Belgian PhD candidates (β= -0,10). The respondents without a research plan experience more structural issues than those with an extended research plan (β=0,11). Time pressure, competition and having a low level of passion for the research also show significant effects. A higher score on time pressure leads to more structural issues (β=0,12). The same is true for competition: when PhD candidates experience a lot of competition on the work floor, they will also have a higher score on structural issues (β=0,17). PhD candidates that indicated to have a low level of passion for their research score higher on structural issues than those with an intermediate level of passion for their research (β=0,09). This model explains 10,4% of the variance.

We took a deeper look into the bivariate relationship between structural issues and significant background characteristics (see appendix 27). The average score on structural issues is 2,5. The non-European PhD candidates have the lowest score on structural issues (2,0/10) and vary significantly from the Belgian and other European respondents (both 2,8/10). The PhD candidates without a research plan have a score of 3,5/10 on structural issues, which is significantly higher than those with an extended (2,2/10) and limited (2,5/10) research plan. As discussed above, a higher score on time pressure leads to more structural issues and the same is true for the perceived competition in the work environment. Respondents who indicate to have a high level of passion for their research experience less structural issues (2,2/10) than those with an intermediate level of passion (3,0/10) and a low level of passion for the research (3,6/10).

3.2 Satisfaction with supervisor

The satisfaction with the supervisor is another aspect that determines the overall job satisfaction. Nine items to measure this element were included in the survey. Figure 11 presents the scores on each of these items. The item the PhD candidates are most satisfied with is the freedom they get from their supervisor to develop ideas (83,7%). Also the expertise of the supervisor on the research subject (79,1%), their involvement (78,7%) and the quality of the meetings (77,4%) are much appreciated. The aspect the PhD candidates are the least satisfied with is the introduction to other prominent researchers in the field of interest (19,0% is dissatisfied) and the frequency of the meetings (13,8% is dissatisfied).

Figure 11: Scores (in %) on different items of satisfaction with the supervisor (n=680)



A principal component analysis was performed on the nine items and resulted in two new variables: the satisfaction with the **support (S)** of the supervisor and the satisfaction with the **freedom (F)** they get from the supervisor (appendix table 28). These two aggregated variables show a correlation of 0,43.

3.2.1 Satisfaction with the support of the supervisor

In this part we will discuss the satisfaction with the support of the supervisor. We tested this variable against the background characteristics using a multiple regression analysis (see appendix table 29).

The final model of this analysis shows that female PhD candidates are less satisfied with the support of their supervisor compared to the male colleagues (β= -0,07). Moreover, respondents without a research plan (β= -0,18) and respondents with a limited research plan (β= -0,08) feel less supported by their supervisor than those with an extended research plan.

Time pressure and competition also show significant effects. The more time pressure a PhD candidates experiences, the less supported they feel by their supervisor (β= -0,11). The same effect is true for the level of competition: more competition leads to a lower sense of support by the supervisor (β= -0,19). Those how do not expect to have an academic career after graduating also have a lower score on support by the supervisor compared to those who somewhat expect this (β= -0,12). The experience of indirect victimization leads to a lower score on support by the supervisor (β= -0,09).

Respondents who indicate a high level of passion for their research report to feel more supported by their supervisor than those with an intermediate level of passion (β=0,12). Also the level of job engagement shows a positive effect on the support by the supervisor (β= 0,15). The final model explains 32,6% of the variance in support.

An overview of the bivariate effects between the background characteristics and the support of the supervisor can be found in appendix table 30, with an average score of 7,3. Expecting to work in academia after graduating has no significant bivariate effect. Female PhD candidates feel less supported by their supervisor (7,1/10) than their male colleagues (7,5/10). Respondents without a research plan only score 5,8/10 on the support of their supervisor, compared to 7,7/10 by those with an extended research plan and 7,2/10 by those with a limited research plan.

As discussed above, a higher score on time pressure and perceived competition leads to a lower score on support by the supervisor. On the other hand, a higher score on passion for the research and job engagement

leads to a higher sense of being supported by the supervisor. PhD candidates who experienced indirect victimization by colleagues at least once score lower on the support of the supervisor (6,5/10) than those who have never experiences this (7,5/10).

3.2.2 Satisfaction with the freedom of the supervisor

In this part, we will discuss the satisfaction of the PhD candidates with the freedom they get from their supervisor.

The multiple regression analysis shows us that European PhD candidates are more satisfied with the freedom they receive from their supervisor than the Belgian ones (β=0,09) (see appendix table 31). Self-efficacy (β=0,18) and work-family balance (β=0,20) have a positive effect on the perceived freedom of the supervisor. A higher score on these variables leads to more satisfaction about the freedom they get. The more competition is experienced among colleagues on the other hand, the less satisfied respondents are with the received freedom from their supervisor (β= -0,11). Also the type of contract has a negative influence. Respondents without a contract are less satisfied with the freedom they get from their supervisor compared to those with a personal mandate (β= -0,11).

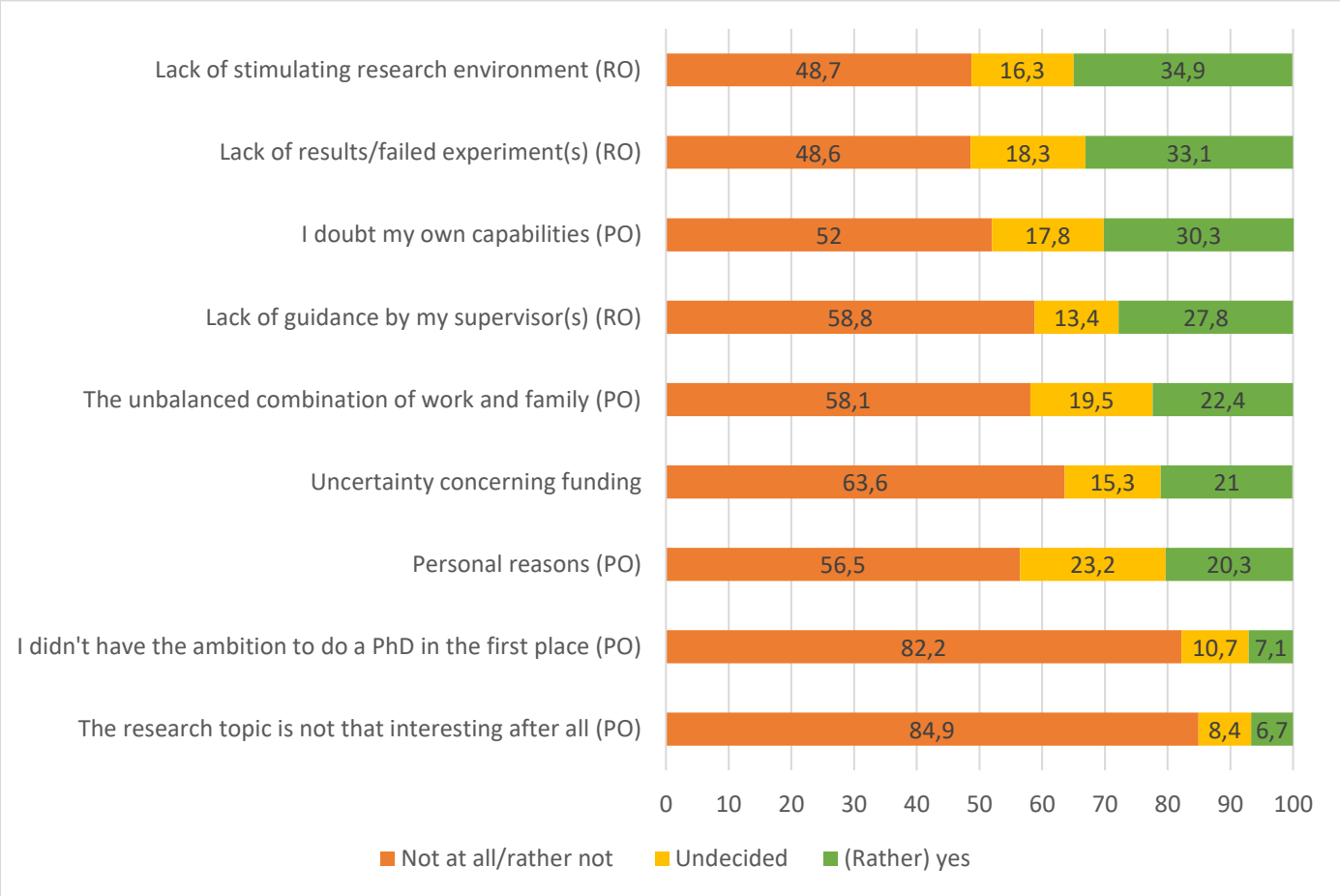
Lastly, the level of indirect victimization has a significant influence on the experienced freedom: PhD candidates who do experience indirect victimization on the work floor are less satisfied with the freedom by their supervisor (β= -0,14). 16,9% of the variance in the satisfaction with the freedom gets explained by these variables.

An overview of the bivariate effects between the freedom by the supervisor and background characteristics can be found in appendix 32. The average score on freedom is 7,8/10. Respondents with a personal mandate score the highest on this variable (8,1/10), and this is significantly higher than those with project funding who are also involved in other projects (7,3/10). The higher the score on self-efficacy and satisfaction with the work-family balance, the higher the freedom is rated. Respondents who score low on the level of competition score significantly higher on the satisfaction with the freedom (8,4/10) compared to those who score intermediately (7,6/10) or high (7,3/10) on competition. PhD candidates who experience indirect victimization by colleagues at least once are significantly less satisfied with the freedom by the supervisor (7,1/10) than those who never had this experience (8,0/10).

3.3 Perceived obstacles

Obtaining a PhD is a long process during which some obstacles need to be overcome. In this section, the experience of these obstacles will be discussed. As shown in figure 12, the lack of a stimulating research environment (34,9%), the lack of results or failed experiments (33,1%) and doubting their own capabilities (30,3%) are the main obstacles PhD candidates encounter. Not having the ambition to do a PhD (7,1%) or the research topic not being that interesting (6,7%) are the least often indicated as resisting factors to successfully complete the PhD trajectory.

Figure 12: Scores (in %) on different items of perceived obstacles (n=704)



After doing a principal component analyses (appendix table 33), two different variables were distinguished: **research related obstacles (RO)** and **personal obstacles (PO)**. The item on funding did not load strongly enough on either of the variables, so this was excluded for the analysis. These two new variables show a negative correlation of -0,36.

3.3.1 Personal obstacles

In this part, we take a closer look at the personal doubt PhD candidates experience and examine how these are related to the several background characteristics.

According to the multiple regression analysis (see appendix table 34), PhD candidates in the DSh score higher on personal obstacles than those in the doctoral school of NSE (β=0,08). Respondents with project funding whose only project is their PhD experience more personal obstacles than those with a personal mandate (β=0,12). Competition (β=0,08) and time pressure (β=0,18) are also significant factors. The more PhD candidates experience these, the more personal obstacles they have. Also being in the starting phase of the PhD research leads to more personal obstacles than being in the executing phase (β=0,08). A higher score on self-efficacy on the other hand, leads to less personal obstacles (β= -0,31). Lastly, PhD candidates who indicate to have a high amount of passion for their research report fewer personal obstacles than those who score averagely on the level of passion (β= -0,19). This model explains 30,4% of the variance of personal obstacles.

The bivariate effects between personal obstacles and the background characteristics can be found in appendix table 35. The average score on personal obstacles is 2,9/10. PhD candidates in the DSh score significantly higher on personal obstacles (3,2/10) than the respondents in the doctoral school of NSE (2,7/10). As discussed above, the higher the score on self-efficacy and passion for the research, the less personal obstacles are experienced. The opposite effect is true for time pressure and the experienced competition on the work floor.

3.3.2 Research related obstacles

After discussing the personal obstacles PhD candidates may have, it is also interesting to look deeper into the obstacles that originate from the research itself (e.g., a lack of results or failed experiments, the research topic that turns out not to be that interesting after all etc.).

We see that female PhD candidates experience more research related obstacles than male respondents (β=0,07) (see appendix table 36). Time pressure (β=0,13) and the amount of competition in the work environment (β=0,15) also show positive effects: a higher score on these variables is related to more research related obstacles. The amount of passion one has for their research is of importance. PhD candidates with a low level of passion have more research related obstacles (β=0,10) than those with an intermediate level of passion. Respondents who report a high level of passion on the other hand show lower rates research related obstacles (β= -0,10) than those with an intermediate level of passion. Lastly, the more PhD candidates feel

like they can contribute something with their work, the less research related obstacles they report (β= -0,13). The final model explains 14,2% of the variance.

The average score on research related obstacles is 4,0/10. On average, female PhD candidates score higher than this: 4,4/10. This is significantly higher than the male respondents 3,8/10. PhD candidates who score low on competition have significantly less research related obstacles (3,3/10) than those with an intermediate score on competition (4,2/10) or a high score (4,6/10). When PhD candidates report to have a high amount of passion for their research, they score significantly lower on research related obstacles (3,6/10) than those with an intermediate (4,7/10) or low (5,6/10) amount of passion. The more time pressure PhD candidates experience, the more research related obstacles they report. An overview of these bivariate effect can be found in appendix table 37.

3.4 PhD on the right track

The majority of the PhD candidates says to be on the right track with their PhD research (70,4%). 13,2% thinks the opposite. 16,3% is undecided.

Using a multiple regression analysis, we look deeper into how this feeling of being on the right track varies between the different groups in population (see appendix table 38). PhD candidates who are doing an interdisciplinary PhD feel more on the right track with their research than those in the doctoral school of NSE (β=0,10). PhD candidates who report a low amount of passion for their research feel less on the right track than those with an intermediate amount of passion (β= -0,15). A high amount of passion on the other hand, leads to a greater feeling of being on the right track (β=0,15). The more self-efficacy a PhD candidates report, the more they feel like being on the right track (β=0,17). Next to the people in the finalizing phase feeling more on the right track with their research (β=0,16), we see that people in the starting phase feel less on the right track than respondents in the executing phase (β= -0,07). PhD candidates who do not expect an academic career after graduating also feel less on the right track, compared to those who somewhat expect an academic career (β= -0,10). The more time pressure PhD candidates experience, the less they feel on the right track with their research (β= -0,20). Moreover, respondents with a limited research plan (β= -0,13) or no research plan at all (β= -0,25) feel less on the right track than those with an extended research plan. When PhD candidates report to have experienced indirect victimization, they feel less on the right track with their PhD (β= -0,09). 27,1% of the variance of being on the right track gets explained.

On average, PhD candidates give a score of 3,7/5 when asked whether or not they are on the right track with their PhD research. Respondents in the finalizing phase score significantly higher (3,7/5) than respondents in

the executing (3,6/5) or starting phase (3,5/5). When PhD candidates don't have a research plan, they feel significantly less on the right track (3,1/5) than those with a limited (3,6/5) or extended research plan (3,8/5). As mentioned above, the more self-efficacy and passion they have, the more PhD candidates feel like being on the right track in their PhD process. The opposite effect is true for time pressure. PhD candidates who don't expect to work in academia after finalizing their PhD feel significantly less on the right track (3,3/5) than those who somewhat (3,7/5) or totally expect an academic career (3,9/5). Finally, when respondents have never experienced indirect victimization in the work environment, they feel significantly more on the right track (3,7/5) than those who experienced it at least once (3,4/5). An overview of these bivariate effects can be found in appendix 39.

3.5 Submitting PhD successfully

The PhD candidates were asked to indicate to what extent they think they will submit their PhD successfully on a scale from 0 to 10. The majority thinks these chances are high and gives a score of 8 or higher. One in three (33,8%) give a more average score: between 5 and 7. A small percentage of 3,1% estimates their chances low.

We tested the score on submitting the PhD successfully against the background characteristics using a multiple regression analysis (see appendix table 40). Not having a research plan leads to a lower expectation to submit the PhD successfully (β= -0,11), compared to those with an extended research plan. Also not having a contract has a negative influence on the estimated chance to submit the PhD successfully (β= -0,10). The higher PhD candidates score on time pressure, the lower they estimate their chances to submit the PhD successfully (β= -0,14). Moreover, PhD candidates with a low level of passion for their research score lower on their estimated chance to submit successfully compared to those with an intermediate amount of passion (β= -0,18). The opposite effect is true for those with a high level of passion for their research (β=0,09).

PhD candidates that don't have the Belgian nationality estimate their chances to submit successfully higher than the Belgian respondents. This effect is slightly stronger for the non-European PhD candidates (β=0,09) than for the European ones (β=0,08). Respondents in the finalizing stage of their PhD also estimate the chance to eventually submit successfully higher than those who are still in the executing phase (β=0,18), which is a logical finding since they already progressed further in the trajectory. Lastly, the higher respondents score on self-efficacy, the higher they estimate their chances to finish the PhD trajectory in a successful manner (β=0,35). This model explains 32,5% of the variance in submitting the PhD successfully.

On average, PhD candidates give a score of 7,9 out of 10 when asked how high they estimate their chance to submit the PhD successfully. Non-European PhD candidates give the highest score (8,2/10), significantly higher than the Belgian ones (7,6/10). Respondents in the final phase of their research give a score of 8,3/10 and score significantly higher than those in the starting phase (7,7/10) and the executing phase (7,8/10). An extended research plan also leads to a higher estimation of submitting successfully (8,1/10), compared to those with only a limited research plan (7,8/10) or no research plan at all (7,0/10). The higher the level of self-efficacy and passion for the research, the higher the chances to submit successfully are estimated. Time pressure on the other hand has a negative effect. An overview of these bivariate effects can be found in appendix 41.

4. Integrated approach: Latent class analysis

4.1 Cluster determination

A latent class analysis (LCA) was performed on the nine constituent variables of job satisfaction that were discussed in chapter three. The goal of this analysis is to divide the respondents in clusters with similar opinions on job satisfaction. It is important to note that only the respondents with a physical working space at the VUB are included in the analysis, excluding 112 respondents. An overview of the results of this analysis can be found below in table 5 (appendix table 42).Three separate clusters were distinguished:

Cluster 1: moderate cluster (n=271, 47,8%)

In this cluster, the PhD candidates have a rather moderate opinion on the different aspects that contribute to the overall job satisfaction. They don't encounter an unusually high or low number of obstacles during their research. Moreover, they are relatively neutral about the support and freedom they receive from their supervisor. The same neutral opinion is reflected in their satisfaction about the warmth of their work environment. The structural issues they encounter in their workspace are somewhat high, and they are also relatively negative about their labour conditions. However, the big majority of this cluster feels like being on the right track with their PhD research and expects to submit their PhD successfully.

Cluster 2: doubtful, unsatisfied cluster (n=160, 28,3%)

This cluster is rather negative about the PhD trajectory. They experience a high number of obstacles, both personal and research related. They are not satisfied with the support they received from their supervisor. The majority also give a low score on the freedom they get from their supervisor, although this is rated slightly higher than the support. The majority of the people in this cluster is not satisfied with the warmth of the work environment. Moreover, they score relatively high on the structural issues they encounter at the workplace and rather low on the satisfaction with the labour conditions. Only a small percentage feels like they are on the right track with their research and the majority does not estimate their chances to submit the PhD successfully as high.

Cluster 3: satisfied, confident cluster (n=135, 23,9%)

Respondents in this cluster are optimistic about their PhD trajectory. They don't experience many obstacles and are satisfied with the support and freedom they receive from their supervisor. They are satisfied with the warmth of their working environment and their labour conditions. Moreover, they don't experience a lot of structural issues. These PhD candidates also feel like they are on the right track with their research and think they will submit the PhD successfully.

Table 5: Latent class analysis

		Moderate N=271	Doubtful, unsatisfied N=160	Confident & satisfied N=135	R^2
Research related obstacles					0,25
	Low	0,3205	0,0924	0,6684	
	Medium	0,3786	0,2909	0,2623	
	High	0,3010	0,6167	0,0693	
	Mean	2,0195	1,4757	2,5991	
Personal obstacles					0,17
	Low	0,2891	0,1473	0,6331	
	Medium	0,3738	0,3317	0,2803	
	High	0,3371	0,5211	0,0866	
	Mean	2,0479	2,3738	1,4536	
Satisfaction with support supervisor					0,39
	Low	0,2764	0,6737	0,0185	
	Medium	0,4345	0,2778	0,1866	
	High	0,2891	0,0485	0,7949	
	Mean	2,0127	1,3748	2,7763	
Satisfaction with freedom received from supervisor					0,28
	Low	0,3092	0,5255	0,0259	
	Medium	0,4197	0,3583	0,2047	
	High	0,2711	0,1162	0,7694	
	Mean	1,9620	1,5908	2,7435	
Satisfaction warmth working environment					0,27
	Low	0,3528	0,5445	0,0359	
	Medium	0,3957	0,3372	0,2176	
	High	0,2514	0,1183	0,7465	
	Mean	1,8986	1,5738	2,7106	
Structural issues					0,20
	Low	0,2489	0,2177	0,6322	
	Medium	0,3571	0,3499	0,2755	
	High	0,3940	0,4324	0,0923	
	Mean	1,8549	1,7853	2,5399	
Labour conditions					0,14
	Low	0,4137	0,4413	0,0588	
	Medium	0,3630	0,3566	0,2421	
	High	0,2234	0,2021	0,6992	
	Mean	1,8097	1,7609	2,6404	
Being on the right track					0,42
	Not at all/rather not	0,0177	0,4253	0,0125	
	Undecided	0,1249	0,3282	0,1063	
	Rather/totally	0,8574	0,2466	0,8812	
	Mean	2,8397	1,8213	2,8687	
Successfully submitting PhD					0,28
	Low	0,0039	0,0948	0,0017	
	Medium	0,2406	0,6664	0,1674	
	High	0,7555	0,2389	0,8309	
	Mean	2,7515	2,1441	2,8292	

4.2 Cluster identification

In this section, we look deeper into how cluster membership is linked to the several background variables. To do so, a logistic regression was performed. We did four logistic regressions on each cluster. In the first model, the basic background variables were included: gender, nationality, doctoral school, the phase in the PhD trajectory, previous work experience, the type of contract and having a research plan. In the second model, the following variables were added: self-efficacy, time pressure, competition, the passion for the research, the expectation to work in academia after graduating and the amount of passion for the research. In the third model, job engagement, job contribution, direct and indirect victimization were added. The fourth and last model only takes into account the variables that showed a significant effect in the previous models.

4.2.1 The moderate cluster

In appendix table 43, the results of the four logistics regression analyses between the moderate cluster and the background characteristics can be found. The final model explains 14,4% of the variance in the moderate cluster. This relatively low percentage is due to the fact that the moderate cluster a rather broad cluster that includes almost half of the PhD candidates. Because of this, this cluster is not characterized by a very specific type of PhD candidate but rather comprises all the respondents that do not belong to the positive or negative extreme. PhD candidates with a high amount of passion for their research are more likely to belong to this cluster (OR=2,23). Also, respondents that are part of the doctoral school of LSM (OR=2,09) or the doctoral school of DSh (OR=1,59) have a higher chance to be part of the moderate cluster compared to those in the doctoral school of NSE. PhD candidates in the finalizing phase of their research (OR=2,00) and those who had work experience prior to their doctoral research (OR=1,62) also have a higher chance to belong to the moderate cluster. Respondents that expect an academic career after graduating (OR=0,57) or those with an “other” type of contract (OR=0,42) or less likely to be part of this cluster.

4.2.2 The doubtful and unsatisfied cluster

28,3% of the PhD candidates belong to the cluster that is characterized by a lot of doubts, obstacles and dissatisfaction. The final model of the logistic regression analysis explains 44,6% of the variance in the doubtful and unsatisfied cluster (appendix table 44). Not having a research plan (OR=2,32) or having a limited research plan (OR=1,70) is strongly linked to membership of this cluster (OR=3,80). Also PhD candidates that don’t expect an academic career (OR=2,32) and experience a lot of time pressure (OR=2,10) or competition (OR=1,49) have a higher chance to be part of this unsatisfied cluster. The more self-efficacy (OR=0,60) or

passion for their research (OR=0,30) one has, the less likely they are to belong to this cluster. Also, PhD candidates that are in the final phase of their research have a lower chance to belong to this cluster (OR=0,29).

4.2.3 The satisfied and confident cluster

The satisfied and confident cluster comprises 23,9% of the PhD candidates. Non-European respondents are more likely to be part of this cluster than Belgian candidates (OR=1,90) (appendix table 45). Job engagement appears as a significant factor: the more job engagement PhD candidates have, the more likely they are to belong to the positive cluster (OR=1,73). Also the level of self-efficacy shows to be an important factor in the membership of the optimistic cluster. The higher PhD candidates score on this, the more likely they are to be part of this cluster (OR=1,57). When PhD candidates experience a lot of time pressure, they have a lower chance to be part of the optimistic cluster (OR=0,58). The same is true for the level of competition that is experience in the work environment (OR=0,58). This model explains 34,8% of the variance in the satisfied cluster.

4.2.4 Bivariate relationships between clusters and background variables

When we look at the bivariate relationships between the background variables and the clusters (appendix table 46) we see that the satisfied cluster score significantly higher on self-efficacy (7,4/10) than the moderate cluster (6,4/10) and the doubtful cluster (5,4/10). We see the same tendency for the work engagement and the work contribution. When it comes to the level of passion, the satisfied cluster has an average score of 8,8/10. The moderate cluster scores 8,0/10 and the doubtful cluster 6,7/10, on average. Moreover, the satisfied cluster has the highest average for the satisfaction with the work-family balance (7,9/10). The doubtful cluster has the lowest score, 7,1/10.

For time pressure, there is an opposite effect. The doubtful cluster has the highest average (5,2/10), whereas the satisfied cluster has the lowest (3,0/10). The average of the moderate cluster is located between these two (4,1/10). We see the same pattern for the level of competition in the work environment. Also for indirect victimization the doubtful cluster has the highest score (0,7/10). The moderate cluster has as average of 3,0/10 and the satisfied cluster scores the lowest with 0,1/10 on average.

When it comes to nationality, the majority of PhD candidates in the doubtful cluster is Belgian (56,3%) (appendix table 47). The highest percentage of respondents in the satisfied cluster is non-European (49,6%). In terms of doctoral schools, the PhD candidates in the moderate cluster are rather evenly distributed over the different doctoral schools. In the doubtful cluster, the DSh is overrepresented. In the satisfied cluster, 56,3% comes from the doctoral school of NSE.

One in three respondents in the moderate cluster expects to work in academia after graduating (33,3%). In the satisfied cluster, this is 55,2%. Almost half of the PhD candidates in the doubtful cluster (49,4%) does not expect a career in academia. On average, 47,5% of all PhD candidates has an extended research plan. In the moderate cluster, 50,9% has one and in the satisfied cluster, 58,5% has an extended plan. In both these clusters, respondents with an extended research plan are thus overrepresented. In the doubtful cluster however, less than one in three (32,5%) has an extended plan. The biggest portion (48,1%) has only a limited research plan and 19,4% does not have a research plan at all.

5. Qualitative results: Doctoral training offer, infrastructure and administrative support

The PhD Survey contains several open-ended questions. These allow respondents to clarify some of their answers, but also to offer feedback on this survey and concomitant processes itself which will be taken into account for future editions of the Survey.

Most interesting from a wider policy standpoint are the open-ended questions on infrastructure, administrative support, and the doctoral training offer. Respondents indicated several issues and offered suggestions on how to improve these. Whilst it is not feasible to delve into each response, the most common recurring themes will be addressed in this chapter.

5.1. Infrastructure

Research requires a lot of infrastructure and specialized tools, which may vary greatly between and even within disciplines.

A **library** is the most basic requirement, both as a place of study as a place where PhD candidates can find research materials. Complaints focus mostly on a lack of digital access to certain online journals in their respective fields. This forces PhD candidates to find a work-around by contacting colleagues from other (Flemish) universities that do have these journals in the catalogue, or leads them to make use of more illicit channels. This may be a time-intensive process however, especially for beginning researchers who lack these contacts.

Several also expressed discontent with the physical offer of the library, which was lacking essential books, or from an out-of-date catalogue system that suggested books were present when they had been known to be lost for years, without them being replaced. A poignant example was offered by one respondent, who claimed that *"The library of the VUB is not great for material. As such, I need to get my books from other institutions and have even moved back to The Netherlands to write up my PhD, since all the material on Belgian history (!) is available here but not at the VUB."*

Offices are another essential pillar of research infrastructure. Though some may prefer to work from home during certain stages of their doctoral journey, offices are still the place where most writing and thinking takes place. They also serve as a meeting place, and are thus essential for the coherency and atmosphere in research groups. Ideally, offices provide both a welcoming atmosphere and space for interpersonal contacts, as well as

a comfortable working environment free of distractions. Unfortunately, not everyone is satisfied with their office arrangements.

For starters, some may not even have access to an office and office materials, such as a computer. These are usually PhD Candidates working as a voluntary fellow[5]. Of those that do have an office, commonly signaled issues are a lack of space, office materials, or even a lack of basic comforts as this quote indicates *"[…] we have no windows, no heating system, no cooling system, and no ventilation. […] After 6 months of no natural light (with tl-lightning all the time), most of the people in my office feel tired and maybe a bit depressed and have headaches at the end of the day. We all know this is due to the lack of natural light and fresh air."*

Some forms of research require more specialized tools, equipment and environments, usually in the form of **laboratories**. PhD candidates indicate that they lack the required research equipment to perform their research, or that the material they have is outdated or is in constant need of repair, impeding their research progress.

Even more concerning is the condition of some of the labs. This may interfere with the quality of research, as it is not possible to hold certain environmental conditions constant, thus impacting research results. This holds for both animal research and others. In some extreme cases, outdated or deteriorating lab conditions may even endanger the staff working there, and several respondents expressed concern about their working environment being a potential health hazard.

5.2 Administrative support

PhD candidates also suggested which aspects of the general administrative support could be implemented or improved. Some questions call for initiatives and information that are already in place, which implies that these are not always as easy to find. Communication on these is always about striking a balance between active communication by the responsible services, and not overloading PhD candidates with information, which may not be of use to everyone.

One of the most commonly expressed needs is access to easily understandable information about the **rights and duties of PhD candidates**, both with regards to internal university policy, and in the context of broader contractual and social legislation. This is a complicated issue, due to the myriad different forms of contracts

[5] « onbezoldigd medewerkers »

through which doctoral research is performed, especially considering many PhD candidates are not entirely certain on which type of contract they are employed.

However, some groups may warrant some additional attention. Most prominent and necessary is additional support and info for international PhD candidates, both from EU and non-EU countries. Several express the need for more information about Belgian culture in general, and more specifically about administrative requirements, as the following quote indicates *"As a non-EU citizen, I don't think I received all the necessary information related with administrative procedures (commune registration) or work-related (such as taxes, health insurance, how the health system works, what are my rights and obligations as an employee and resident, do I have a pension fund or I have to do that myself etc). To some of this questions, 6 months in, I still don't know/have the answer."*

Other categories of PhD candidates in specific situations ask for more easily accessible information, perhaps through infosessions, or through peer-support networks. These include sandwich PhD's[6], Joint PhD's, researchers that combine (clinical) work and research and are rarely present at the VUB, and those employed on outside funding, such as the FWO.

Several PhD candidates also asked for **more support in the area of mental health**, both in the form of personal support, workshops and activities aimed at research groups as a whole. The university is also expected to organize more social activities for PhD's, with opportunities to present their work and find likeminded souls to connect and conduct (interdisciplinary) research with.

5.3 Doctoral training offer

The **doctoral training offer** was also an aspect PhD candidates weighted in on, mostly suggesting courses the VUB lacks, or needs more of. It is important to note that interest in participating in the doctoral training offer increased dramatically during the lockdown, something which is noticed in universities across Flanders. This effect may have been larger even at our university, due to the implementation of compulsory doctoral education at the start of the academic year, and rather slow uptake of familiarity with the new training platform, TEO's VUB LRN module.

[6] PhD candidates that perform a large part of their research at another institution than their home university

One of the most recurring questions was the request for **more workshops being organized online**, mostly from PhD candidates for whom it is impossible or inconvenient to make it to the Etterbeek campus, where the majority of trainings take place.

With regard to the **content of the training offer**, some made additional suggestions. These include English language pedagogical courses and additional courses focused on wellbeing. There is also a need for more courses on Academic English, for which there is a great demand every year.

There is also a demand for **more research focused courses**. Predominantly these are requests for more methodological courses, especially statistical courses. Related to these methodological courses are trainings centered on the use of software for data-analysis, both paid and open-source software. Lastly, several candidates requested courses on theory and critical-thinking.

6. Longitudinal analysis: Changes over time

As this is the fourth edition of the PhD survey, a longitudinal analysis was performed on the data we gathered over the several years to investigate how the satisfaction of the PhD candidates changes over time. In this analysis, the data of 2018, 2019 and 2020 were included. The data of 2017 were left out, since the pilot study only included respondents of three faculties.

The three measurement occasions (2018, 2019 and 2020) allow us to analyze changes in several aspects of job satisfaction over time. These multiple measurements are taken from mostly the same individuals. Methodologically, this implies that we need to take into account that the observations are not stochastic independent of each other, yet it also allows for an analysis and decomposition of different types of change over time. Looking at how satisfaction changes between different surveys is interesting, yet these changes over time can be determined by multiple aspects or levels. On the one hand, they can be a result of external factors (e.g., changes in the policy, different socio-economic composition of the population…). On the other hand, the changes in satisfaction can also be due to changes within the respondents themselves over the years, as they proceed through the PhD trajectory. In our models, we take into account these different kinds of change.

6.1 Method

Multilevel modelling

First, the issue of the correlation of individual's measurements over time is addressed by using a multilevel approach, in which we specify the different measurement points as the first level observations (level 1). These are nested within PhD candidates which are the cases we specify at the grouping level (level 2). This is the typical multilevel model specification for longitudinal analyses in which individuals' responses are included multiple times.

Secondly, inspired by more advanced growth modelling which focusses on within-individuals change over time, we specify different types of time variables. These allow us to separate change occurring within individuals (e.g., because they progress further in their trajectory) from change over time (calendar years) which might be due to changing circumstances (e.g., COVID-19 crisis) or policy changes.

In total, we specify three forms of time in this chapter:

1) Year of measurement. This is a categorical variable. The reference category is 2018. Two dummies are included: 2019 and 2020. Because we control for individual change over time (see below), effects

captured by these time variables, are indicative of real change over time (trends, in as far as the change seems to be linear over time).

2) Years passed: Candidate. This variable measures the number of years that the PhD candidate has been in the program at the time they first participated in the survey. This variable is included because there is a relatively large variation in the number of years a candidate has been in the program. It is only used to purify the effect of changes over time (see specification 3). The results of this time specification will not be discussed further in the discussion.
3) Years passed: Measurement. This variable calculates the number of years a PhD candidate has been in the PhD trajectory since the first time they participated in the survey as measured in *Years Passed: Candidate* (see point 2) and is an indicator of the pure change over time, within the PhD trajectory of respondent. Together with the year of measurement, this variable forms the core of the analyses presented in this chapter.

These two core time variables allow us to disentangle 1) time trends or effects of period changes (between-individual differences), and 2) experience or aging effects (within-individual differences). Table 6 below shows the number of observations for each combination of the three measurement occasions and the years of progress in the PhD trajectory (with the first survey year as starting point, i.e., value 0).

Table 6: Number of observations by year of survey and the number of years passed in study

	Number of years passed (since first survey)		
Year of survey	0	1	2
2018	758	0	0
2019	320	375	0
2020	292	140	267

Variables

The analysis was performed for five dependent variables:

- Being on the right track with the doctoral research (1 to 5 scale)
- Satisfaction with the support of the supervisor (0 to 10 scale)
- Satisfaction with the freedom of the supervisor (0 to 10 scale)
- Satisfaction with the labour conditions (0 to 10 scale)
- Personal obstacles (0 to 10 scale)

These five variables were selected from the nine variables that contribute to job satisfaction (as discussed in chapter 3) because it was expected that they would change the most over time and/or because they have the biggest influence on the general job satisfaction.

The following background variables were used as independent variables:

- Gender (female, male*)
- Doctoral school (DSh, NSE*, LSM, interdisciplinary PhD)
- Type of contract (personal mandate*, teaching assistant, project funding, no contract, other type of contract)
- Previous work experience (no*, yes, still having another job next to PhD research)

Note: * indicates the reference categories in the analyses.

Modelling strategy

In these models, we examine whether there has been a change over time and whether the change differs between subgroups of PhD candidates. For each of the dependent variables, we report a first model which includes the main effects of the change over the different measurements, the change within the PhD trajectory as well as the background variables (**main effects**).

In a second model, the **interaction effects** between the background variables and the time variables are added to study whether the observed changes over time vary between different groups in the population. Including the interaction terms also changes the reference levels of the analyses, so the effects of the background characteristics can be interpreted as the individual differences at the first survey and/or first survey participation (what we can call "starting levels") whereas the interaction terms point to differences in the amount of change over time (which adds to the starting level differences) according to the background characteristics.

6.2 Results

In this section, we will discuss how each dependent variable changes over time. To do this, we use the two models explained above. We present here the B's (and not the standardised β's, as before). An increase of 1 here means an effective increase of 1 on the measured scale. For example, "being on the right track" is measured using a scale of 1 to 5. A B=1 means an increase of 1 on the scale up to 5.

6.2.1 Being on the right track

Model 1 in table 7 below (appendix table 48) shows no effects of the year of the survey or the progression throughout the PhD trajectory. Some background characteristics do affect the feeling of being on the right track. There is a significant effect of gender on being on the right track: female PhD candidates feel less on the right track than their male colleagues (B= -0,12). PhD candidates with a teaching assistant contract also feel less on track compared to those with a personal mandate (B= -0,17). PhD candidates who had another job before they started their PhD feel more on the right track (B=0,11) than PhD candidates without any prior work experience.

In model 2, we add interaction effects between the background variables and change over time. Change over time does seem to occur, not in general, but in particular among the people without a formal VUB-employment contract. For these respondents, the time trend is negative. The comparison with 2018 is statistically significant for 2019 (B= -0,37). Combined with the level in 2018 (B=0,18), this group is not more negative about being on track than PhD candidates with a personal mandate, but in later years this group is more negative about it (B=0,178 - 0,370). No further significant differences over time were found regarding being on the right track.

Table 7: multilevel analysis between being on the right track, time and background variables

	Model 1		Model 2	
Constant	3.824	***	3.820	***
Time specifications				
Year of measurement (ref.: 2018)				
2019	.046	n.s.	.090	n.s.
2020	-.076	n.s.	-.103	n.s.
Years passed: Candidate	-.002	n.s.	-.003	n.s.
Years passed: measurement	-.017	n.s.	-.053	n.s.
Background				
Gender (ref.: male)				
Female	-.123	*	-.153	*
Doctoral school (ref.: NSE)				
DSh	-.075	n.s.	-.098	n.s.
LSM	.001	n.s.	-.051	n.s.
Interdisciplinary	.245	n.s.	.127	n.s.
Type of contract (ref.: Personal mandate)				
Research/Teaching Assistant	-.166	*	-.211	*
Project funding	-.040	n.s.	.058	n.s.
No contract, self-financed	-.025	n.s.	.178	n.s.
Other	-.085	n.s.	-.190	n.s.
Missing	-.023	n.s.	.105	n.s.
Previous work experience (ref.: no)				
Yes	.107	*	.078	n.s.
Still have another job	.087	n.s.	.077	n.s.
Interactions Years passed: Measurement				
Time*Female			.135	n.s.
Time*DSh			-.060	n.s.
Time*LSM			-.016	n.s.
Time*interdisciplinary			.311	n.s.
Time*Research/Teaching assistant			-.007	n.s.
Time*Project funding			-.107	n.s.
Time*No contract			.065	n.s.
Time*Other			-.092	n.s.

Time*Missing		-.116	n.s.
Time*Yes		.087	n.s.
Time*Still have another job		0.000	n.s.
Interactions year of measurement			
2019*Female		.025	n.s.
2020*Female		-.075	n.s.
2019*DSh		-.047	n.s.
2020*DSh		.193	n.s.
2019*LSM		.004	n.s.
2020*LSM		.183	n.s.
2019*Interdisciplinary		-.142	n.s.
2020*Interdisciplinary		.183	n.s.
2019*Research/Teaching assistant		.116	n.s.
2020*Research/Teaching assistant		.112	n.s.
2019*Project funding		-.117	n.s.
2020*Project funding		-.021	n.s.
2019*No contract/self-financed		-.369	*
2020*No contract/self-financed		-.320	n.s.
2019*Other contract		.222	n.s.
2020*Other contract		.217	n.s.
2019*Contract missing		-.215	n.s.
2020*Contract missing		-.016	n.s.
2019*Previous work experience		.049	n.s.
2020*Previous work experience		-.070	n.s.
2019*Still have another job		.063	n.s.
2020*Still have another job		-.047	n.s.
-2LL	-2,770.472	-2,791.855	
AIC	5,576.943	5,685.711	
BIC	5,678.655	5,973.894	
N observations	2,102	2,102	

6.2.2 Support and freedom of the supervisor

The overall satisfaction with the **support** by the supervisor increases over the years (B= 0,33 in 2019 and 0,48 in 2020 compared to 2018, respectively) yet decreases as a PhD candidate moves through the PhD process, as shown in table 8 below (appendix table 49). Model 1 shows that for every year that a candidate progresses further in the PhD program, satisfaction with the support received from the supervisor decreases by B=-0,40 (on a 0 to 10 scale). Besides this, and confirming earlier findings (see 3.2.1), female PhD candidates are less satisfied with the support of their supervisor than male PhD candidates (B= -0,35). In model 2, in which interaction terms are included, no significant variation in the changes over time is observed: The effects of time (both the trends over time as the changes throughout the PhD trajectory) remain and do not differ significantly according to the background of PhD candidates.

Table 8: multilevel analysis between support of the supervisor, time and background variables

	Model 1		Model 2	
Constant	7.462	***	7.395	***
Time specifications				
Year of measurement (ref.: 2018)				
2019	.333	**	.222	n.s.
2020	.480	**	.836	*
Years passed: Candidate	-.139	***	-.134	***
Years passed: measurement	-.400	***	-.520	**
Background				
Gender (ref.: male)				
Female	-.349	**	-.392	*
Doctoral school (ref.: NSE)				
DSh	-.094	n.s.	.010	n.s.
LSM	-.048	n.s.	-.118	n.s.
Interdisciplinary	-.310	n.s.	.649	n.s.
Type of contract (ref.: Personal mandate)				
Research/Teaching Assistant	-.282	n.s.	-.289	n.s.
Project funding	.042	n.s.	.113	n.s.
No contract, self-financed	-0.000	n.s.	-.046	n.s.
Other	.114	n.s.	-.050	n.s.
Missing	.144	n.s.	.298	n.s.
Previous work experience (ref.: no)				
Yes	.156	n.s.	.209	n.s.
Still have another job	.330	n.s.	.529	*
Interactions Years passed: Measurement				
Time*Female			.048	n.s.
Time*DSh			.186	n.s.
Time*LSM			.071	n.s.
Time*interdisciplinary			.638	n.s.
Time*Research/Teaching assistant			-.145	n.s.
Time*Project funding			-.041	n.s.
Time*No contract			-.057	n.s.
Time*Other			-.055	n.s.
Time*Missing			-.478	n.s.
Time*Yes			.119	n.s.
Time*Still have another job			.133	n.s.
Interactions year of measurement				
2019*Female			.168	n.s.
2020*Female			-.064	n.s.
2019*DSh			-.196	n.s.
2020*DSh			-.354	n.s.
2019*LSM			.136	n.s.
2020*LSM			.069	n.s.
2019*Interdisciplinary			-1.489	n.s.
2020*Interdisciplinary			-1.929	n.s.
2019*Research/Teaching assistant			.154	n.s.
2020*Research/Teaching assistant			.210	n.s.
2019*Project funding			.078	n.s.
2020*Project funding			-.178	n.s.
2019*No contract/self-financed			.294	n.s.
2020*No contract/self-financed			.037	n.s.
2019*Other contract			.350	n.s.
2020*Other contract			.338	n.s.
2019*Contract missing			.063	n.s.
2020*Contract missing			.181	n.s.
2019*Previous work experience			-.047	n.s.
2020*Previous work experience			-.349	n.s.
2019*Still have another job			-.108	n.s.
2020*Still have another job			-.718	n.s.
-2LL	-4,273.397		-4,278.285	
AIC	8,582.793		8,658.569	
BIC	8,684.220		8,945.945	
N observations	2,069		2,069	

Model 1 in table 9 below (appendix table 50) shows that the satisfaction with the **freedom** one experiences decreases substantially as one proceeds in its PhD trajectory (B= -0,17). The satisfaction with the freedom turns out to be lower in 2019 compared to 2018 (B= -0,27), while satisfaction is higher in 2020 (B= 0,34). We see no explanation here. Teaching assistants (B= -0,38) and respondents without a contract (B= -0,47) are less satisfied with the freedom they get from their supervisor compared to those with a personal mandate. The same is true for the PhD candidates who have project funding (B= -0,27). When respondents had another job prior to starting their PhD, they score higher on the satisfaction with freedom (B= 0,22). These results were also presented earlier specifically for the PhD survey of 2020.

In addition, these differences appear to be consistently observed over time, as interaction terms between the two time change variables with background characteristics are not significant (although the candidates from the interdisciplinary DS do show a large negative trend, probably due to the very small numbers which makes results sensitive to outliers).

Table 9: multilevel analysis between freedom of the supervisor, time and background variables

	Model 1		Model 2	
Constant	7.896	***	7.874	***
Time specifications				
Year of measurement (ref.: 2018)				
2019	-.272	**	-.411	n.s.
2020	.341	*	.383	n.s.
Years passed: Candidate	-.030	n.s.	-.026	n.s.
Years passed: measurement	-.172	*	-.117	n.s.
Background				
Gender (ref.: male)				
Female	-.174	n.s.	-.290	n.s.
Doctoral school (ref.: NSE)				
DSh	.122	n.s.	.116	n.s.
LSM	-.261	n.s.	-.310	n.s.
Interdisciplinary	.153	n.s.	.774	n.s.
Type of contract (ref.: Personal mandate)				
Research/Teaching Assistant	-.377	*	-.411	*
Project funding	-.266	*	-.208	n.s.
No contract, self-financed	-.471	**	-.609	**
Other	-.329	n.s.	-.428	n.s.
Missing	-.327	n.s.	-.023	n.s.
Previous work experience (ref.: no)				
Yes	.224	*	.384	**
Still have another job	.058	n.s.	.399	n.s.
Interactions Years passed: Measurement				
Time*Female			-.085	n.s.
Time*DSh			.061	n.s.
Time*LSM			.075	n.s.
Time*interdisciplinary			.933	n.s.
Time*Research/Teaching assistant			-.179	n.s.
Time*Project funding			-.283	n.s.
Time*No contract			-.230	n.s.
Time*Other			-.236	n.s.
Time*Missing			-.097	n.s.
Time*Yes			.239	n.s.

Time*Still have another job	.214	n.s.
Interactions year of measurement		
2019*Female	.250	n.s.
2020*Female	.218	n.s.
2019*DSh	.049	n.s.
2020*DSh	-.096	n.s.
2019*LSM	.059	n.s.
2020*LSM	.029	n.s.
2019*Interdisciplinary	-.720	n.s.
2020*Interdisciplinary	-1.823	n.s.
2019*Research/Teaching assistant	.247	n.s.
2020*Research/Teaching assistant	.257	n.s.
2019*Project funding	.171	n.s.
2020*Project funding	.072	n.s.
2019*No contract/self-financed	.539	n.s.
2020*No contract/self-financed	.255	n.s.
2019*Other contract	.248	n.s.
2020*Other contract	.443	n.s.
2019*Contract missing	-.301	n.s.
2020*Contract missing	-.500	n.s.
2019*Previous work experience	-.413	n.s.
2020*Previous work experience	-.423	n.s.
2019*Still have another job	-.463	n.s.
2020*Still have another job	-.867	n.s.
-2LL	-4,226.637	-4,230.020
AIC	8,489.273	8,562.040
BIC	8,590.700	8,849.416
N observations	2,069	2,069

6.2.3 Labour conditions

Overall, the satisfaction with the labour conditions decreases over the years. Model 1 shows that in 2019, PhD candidates were significantly less satisfied with the labour condition than in 2018 (B= -0,73) (appendix table 51). In 2020 however, candidates seem to be more satisfied with the labour conditions than in 2019, as a result of which the 2020 parameter no longer deviates significantly from that of 2018. Throughout the years of the PhD process itself, the satisfaction with the labour conditions of a PhD candidate does not change significantly.

Respondents in the DSh are significantly less satisfied with the labour conditions than those in the doctoral school of NSE (B= -0,42). The same is true for the respondents in the doctoral school of LSM (B= -0,54). Candidates without any employment contract score quite fundamentally lower on the satisfaction with the labour conditions than candidates on a personal mandate (B= -1,21). PhD candidates with an "other" contract also score lower (B= -0,45). Model 2 shows, in addition, that as a PhD candidate with an “other” contract progresses in their trajectory, the evaluation of the labour conditions changes. For every year that one is active, satisfaction among this group decreases more (B= -0,65) than among the PhD candidates with a personal mandate. So, as PhD candidates continue in their PhD trajectory, the gap in satisfaction with the labour conditions grows.

Table 10: multilevel analysis between labour conditions, time and background variables

	Model 1		Model 2	
Constant	7.774	***	7.907	***
Time specifications				
Year of measurement (ref.: 2018)				
2019	-.733	***	-.980	***
2020	-.247	n.s.	-.481	n.s.
Years passed: Candidate	-.032	n.s.	-.030	n.s.
Years passed: measurement	.081	n.s.	.132	n.s.
Background				
Gender (ref.: male)				
Female	-.002	n.s.	-.050	n.s.
Doctoral school (ref.: NSE)				
DSh	-.422	***	-.511	**
LSM	-.536	***	-.825	***
Interdisciplinary	-.266	n.s.	1.257	n.s.
Type of contract (ref.: Personal mandate)				
Research/Teaching Assistant	-.014	n.s.	-.001	n.s.
Project funding	.141	n.s.	.207	n.s.
No contract, self-financed	-1.210	***	-1.474	***
Other	-.445	**	-.556	n.s.
Missing	-.128	n.s.	-.419	n.s.
Previous work experience (ref.: no)				
Yes	-.070	n.s.	-.041	n.s.
Still have another job	-.201	n.s.	-.813	*
Interactions Years passed: Measurement				
Time*Female			.097	n.s.
Time*DSh			-.184	n.s.
Time*LSM			.123	n.s.
Time*interdisciplinary			-.500	n.s.
Time*Research/Teaching assistant			-.140	n.s.
Time*Project funding			-.036	n.s.
Time*No contract			.466	n.s.
Time*Other			-.646	*
Time*Missing			.058	n.s.
Time*Yes			-.094	n.s.
Time*Still have another job			.029	n.s.
Interactions year of measurement				
2019*Female			.060	n.s.
2020*Female			-.017	n.s.
2019*DSh			.201	n.s.
2020*DSh			.287	n.s.
2019*LSM			.311	n.s.
2020*LSM			.377	n.s.
2019*Interdisciplinary			-.711	n.s.
2020*Interdisciplinary			-2.411	n.s.
2019*Research/Teaching assistant			.109	n.s.
2020*Research/Teaching assistant			.023	n.s.
2019*Project funding			-.092	n.s.
2020*Project funding			-.060	n.s.
2019*No contract/self-financed			.137	n.s.
2020*No contract/self-financed			-.105	n.s.
2019*Other contract			.463	n.s.
2020*Other contract			1.019	n.s.
2019*Contract missing			.049	n.s.
2020*Contract missing			.748	n.s.
2019*Previous work experience			.058	n.s.
2020*Previous work experience			-.016	n.s.
2019*Still have another job			.757	n.s.
2020*Still have another job			.596	n.s.
-2LL	-3,209.604		-3,201.435	
AIC	6,455.207		6,504.870	
BIC	6,552.917		6,781.715	
N observations	1,683		1,683	

6.2.4 Personal obstacles

In 2019, PhD candidates experienced significantly more personal obstacles than in 2018 (B=0,22), as shown in table 11 below (appendix table 52). However, there is no significant increasing trend of personal obstacles over the years. This can be regarded as remarkable, because the expectation was that more obstacles would be experienced in 2020 due to the burgeoning COVID crisis (the survey was conducted during the first lockdown, April-May 2020).

In general, female PhD candidates experience more personal obstacles than their male colleagues (B=0,62). This effect was substantially weaker in 2019 (B= -0,71) and in 2020 (B= -0,79) than it was in 2018. Furthermore, PhD candidates in the DSh also score higher on personal obstacles than those in the doctoral school of NSE (B=0,45). Also teaching assistants experience more personal obstacles than those with a personal mandate (B=0,37). PhD candidates with an "other" type of contract also experience more doubts the further they progress in the trajectory (B=0,78).

Table 11: multilevel analysis between personal obstacles, time and background variables

	Model 1		Model 2	
Constant	2.187	***	2.028	***
Time specifications				
Year of measurement (ref.: 2018)				
2019	.223	*	.771	**
2020	.201	n.s.	.629	n.s.
Years passed: Candidate	.051	n.s.	.053	n.s.
Years passed: measurement	-.032	n.s.	-.401	*
Background				
Gender (ref.: male)				
Female	.615	***	.988	***
Doctoral school (ref.: NSE)				
DSh	.448	***	.609	**
LSM	.057	n.s.	-.004	n.s.
Interdisciplinary	.866	n.s.	-.533	n.s.
Type of contract (ref.: Personal mandate)				
Research/Teaching Assistant	.373	*	.346	n.s.
Project funding	.198	n.s.	.078	n.s.
No contract, self-financed	.047	n.s.	-.020	n.s.
Other	.105	n.s.	-.076	n.s.
Missing	-.135	n.s.	-.071	n.s.
Previous work experience (ref.: no)				
Yes	.005	n.s.	-.107	n.s.
Still have another job	-.110	n.s.	.223	n.s.
Interactions Years passed: Measurement				
Time*Female			.295	n.s.
Time*DSh			.272	n.s.
Time*LSM			-.074	n.s.
Time*interdisciplinary			-.243	n.s.
Time*Research/Teaching assistant			-.134	n.s.
Time*Project funding			.247	n.s.
Time*No contract			.081	n.s.
Time*Other			.784	**
Time*Missing			.268	n.s.
Time*Yes			.035	n.s.

Time*Still have another job		-.227	n.s.
Interactions year of measurement			
2019*Female		-.714	***
2020*Female		-.786	**
2019*DSh		-.475	n.s.
2020*DSh		-.401	n.s.
2019*LSM		.045	n.s.
2020*LSM		.183	n.s.
2019*Interdisciplinary		1.693	n.s.
2020*Interdisciplinary		2.453	n.s.
2019*Research/Teaching assistant		-.049	n.s.
2020*Research/Teaching assistant		.267	n.s.
2019*Project funding		-.207	n.s.
2020*Project funding		.263	n.s.
2019*No contract/self-financed		-.053	n.s.
2020*No contract/self-financed		.186	n.s.
2019*Other contract		-.069	n.s.
2020*Other contract		-.695	n.s.
2019*Contract missing		-.486	n.s.
2020*Contract missing		-.020	n.s.
2019*Previous work experience		.259	n.s.
2020*Previous work experience		.065	n.s.
2019*Still have another job		-.109	n.s.
2020*Still have another job		-.286	n.s.
-2LL	-4,375.371	-4,361.124	
AIC	8,786.742	8,824.249	
BIC	8,888.403	9,112.286	
N observations	2,096	2,096	

7. Conclusion

This report aimed at getter a deeper insight into the level of job satisfaction among the PhD candidates at the VUB. To get a thorough understanding of this, the analysis and report were built on consecutive parts. First, the background characteristics of the PhD candidates were discussed. Then, the aspects that contribute to job satisfaction were operationalized and tested against the different background variables.

The core of this report analysed in depth the relationship between different aspects of job satisfaction in a cluster analysis. The PhD candidates were divided into three clusters, each characterized by a certain level of job satisfaction, and we further investigated what characteristics influence cluster membership.

A new aspect compared to earlier years is an explorative longitudinal study of how a selection of the aspects related to job satisfaction changed over the years (in which the survey was performed) and how they change within a PhD candidate as they progress in the trajectory. This will be addressed in the second part of the conclusion.

Just like last year, three clusters were identified. Most people belong to the moderate cluster, with PhD candidates that have a rather neutral opinion on their job conditions yet feel like they are on the right track with their PhD research and will submit it successfully. 48% of the PhD candidates belong to this cluster. In addition, there is a group of 28% of candidates belonging to the uncertain and dissatisfied cluster, which includes PhD candidates that experience a lot of doubts and dissatisfaction about their work environment. The final 24% of the PhD candidates belong to the satisfied and confident cluster with a very positive outlook on their PhD trajectory.

What follows is an overview of the background variables that are the most closely linked to cluster membership.

Phase of the PhD

The phase of the PhD plays an important role in the job satisfaction of the PhD candidates. PhD candidates in the finalizing phase of their research have a higher chance to be part of the moderate cluster and are less likely part of the doubtful, unsatisfied cluster. This can be due to the fact that PhD candidates in a later stage feel more on the right track with their research and estimate their chance to submit the PhD successfully higher than those in earlier stages of the trajectory, or because those part of the doubtful and unsatisfied

cluster are more likely to have dropped out before they reach the finalizing stage. Moreover, PhD candidates that are still in the starting phase of their research have more personal doubts and feel less on the right track.

Passion for the PhD research

PhD candidates with a high level of passion for their research are more likely to be part of the moderate cluster and have a lower chance to be part of the doubtful, unsatisfied cluster. This is because having a lot of passion for the research is linked to feeling supported by the supervisor and experiencing a low number of obstacles, personally as well as research related. As a result, PhD candidates that are passionate about their research also feel like they are on the right track and will submit the PhD successfully. Having a low level of passion for the research on the other hand, is closely linked to experiencing a lot of research related obstacles and structural issues in the work environment. Also, the warmth of the work environment is rated poorly by this group of PhD candidates. As a result, they don't feel on the right track with their research and doubt their ability to submit successfully.

Expecting to work in academia after graduating

PhD candidates that don't expect an academic career after graduation are more likely to be found in the doubtful, unsatisfied cluster. This can be explained by the fact that there is a significant relationship between not expecting an academic career and not feeling supported by the supervisor. Also, respondents that don't expect an academic career feel less on track with their research than the ones who do (somewhat) expect an academic career. These aspects add to a higher chance of membership of the doubtful cluster.

Self-efficacy

A high level of self-efficacy is related to more satisfaction with the labour conditions and received freedom of the supervisor. Moreover, PhD candidates with a high level of self-efficacy feel more on the right track with their research and expect to submit the PhD successfully at the end of the trajectory. Because of this, the higher a PhD candidate scores on self-efficacy, the higher the chance to be part of the satisfied, confident cluster. Candidates with a lower level of self-efficacy on the other hand, are more likely to be part of the doubtful, unsatisfied cluster.

Time pressure

PhD candidates who experience a lot of time pressure in their work are more likely to belong to the doubtful cluster and less likely to be part of the satisfied cluster. This is because there is a significant relationship between experiencing time pressure and being unsatisfied about the warmth of the work environment and the labour conditions. Experiencing a lot of time pressure is also linked to a lack of support by the supervisor

and experiencing a lot of personal and research related obstacles. As a result, PhD candidates with a lot of time pressure don't feel like they are on the right track with their research and estimate their chances to submit successfully as rather low.

Competition on the work floor

Experiencing a lot of competition in the research group has quite a few negative consequences. PhD candidates who perceive the working environment as highly competitive are not satisfied with the warmth of their work environment or their labour conditions and experience a lot of structural issues in their workspace (e.g., insufficient space in the office, problems with the infrastructure…). There is also a relationship between experiencing a lot of competition and a lack of support and freedom received from the supervisor. This is why PhD candidates that experience a lot of competition in their research group are more likely to be part of the doubtful cluster and less likely to belong to the satisfied, confident cluster.

Longitudinal analysis

To examine the change in the level of satisfaction over the years, we performed a multilevel analysis on five of the variables that contribute to job satisfaction. These analyses are a first attempt at longitudinal analyses of changes over time in PhD candidates' job satisfaction.

We will only be able to estimate true growth models (incorporating the time dependency between measurement occasions methodologically more fully) when we will have four repeated measurements next year. However, the results from these models are promising in two ways, underscoring the usefulness of developing these kinds of analyses further: results seem a) consistent with many of the more descriptive results reported earlier, and, b) seem to point to a number of changes over time, offering new avenues for improving support for PhD candidates.

The aspect that shows the most significant changes over time is the satisfaction with the support and the freedom received from the supervisor. The level of satisfaction with the support of the supervisor has increased over the years, yet as PhD candidates progress through the trajectory, they become less satisfied with this support.

For the satisfaction with the freedom, we don't see a linear trend over time: in 2019, PhD candidates were less satisfied with the freedom they got from their supervisor compared to 2018, but in 2020 the satisfaction was higher. However, the satisfaction with the freedom from the supervisor also decreases as the PhD candidates progress further in the trajectory. From this we can conclude that is important for supervisors to

stay involved and supportive towards their PhD candidate throughout the whole process, including in the later stages. Given the importance of these variables for the latent class analysis presented in chapter 4, changes over time for these aspects should continue to be analysed in more detail in the coming years.

When it comes to the satisfaction with the labour conditions and the personal obstacles PhD candidates encountered, 2019 appears to be the most “negative” year. In 2019, PhD candidates were significantly less satisfied with the labour conditions than in 2018 and experienced more personal obstacles. A next PhD survey will show whether this "non-linearity" has to do with a (temporal) corona effect or rather points to a real trend change.

Moreover, PhD candidates with an “other” type of contract tend to become less satisfied with the labour conditions and to experience more personal obstacles as they progress through the PhD trajectory. This group therefore does not only differ from others according to their contract, but also according to their job satisfaction as a consequence. The mechanisms behind the “other” category should be specifically examined further. This may concern candidates who are outside the usual forms of contract, temporarily or otherwise. The results presented here suggest that this should, as far as possible, be avoided or followed up, given the negative consequences for job satisfaction.

Overall, there is no significant change over time when it comes to the feeling of being on the right track with the PhD. PhD candidates don’t feel more or less on the right track in 2020 than they did in 2019 or 2018 (although the no contract PhD's do report lower values on this in 2019 compared to 2018). This feeling also doesn’t change over the course of the PhD trajectory itself.

General conclusion

In general, the biggest part of the PhD candidates feel that they are on the right track with their research and expect to end the PhD trajectory successfully. However, almost 1 in 3 (28,3%) does experience some serious problems in their trajectory. An important factor in this dissatisfaction is the lack of support and freedom these candidates get from their supervisor. The most problematic aspects with the involvement of the supervisor for this group are the lack of introduction to other prominent researchers in their field of interest (40,7% is dissatisfied), the frequency of the meetings with the supervisor (27,8% is dissatisfied) and the lack of stimulation and inspiration by the supervisor to solve research problems (26,6% is dissatisfied).

The warmth of the work environment also plays an important role in the job satisfaction. The respondents in the doubtful cluster are especially dissatisfied with the overall support within the university to develop their research (22,7% is dissatisfied) and the introduction to the research group/department (21,2% is dissatisfied).

The job satisfaction is also determined by the amount of research related obstacles PhD candidates experience. PhD candidates in the doubtful cluster indicate the lack of a stimulating research environment (56,9%) and the lack of results or failed experiments (51,7%) as the most important research related obstacles they encounter. Finally, not having a research plan or only having a limited research plan is also an important element in being part of this doubtful cluster.

8. Policy recommendations

8.1. The PhD – supervisor relationship: towards a working alliance

The results of the survey strongly indicate the importance of the work environment, and the relationship between the PhD candidate and the supervisor. These two are strongly intertwined, and places unique and sometimes conflicting demands on the supervisor, who is expected to juggle the difficult task of combining the role of expert mentor, coach, judge, leader, employer and manager in addition to the classical roles of educator and researcher.

The idea of the lone scholar plugging away at mountains of data to find a pure nugget of Truth has always been a myth, in some fields more so than others, but it has become even more so in recent decades. Research increasingly depends on cooperation, especially now that the research groups and budgets have increased in size. To complicate matters, (inter)national and institutional policy has asked academics to adapt a capitalist mindset, focused on maximizing production, whether it is of successful grant applications, PhD degrees or publications (Slaughter & Rhoades, 2004). Junior researchers are also asked to consider their future career paths, which more often than not lead them outside of academia, as governments wish to establish a knowledge economy built by a highly educated workforce.

Against this background, it is important to not lose track of the dynamics that take place at the micro level, in the research group, between PhD candidates and their supervisor(s). A good supervisor balances support and freedom – he/she makes time for the individual projects of his PhD candidates, stimulates and gives feedback where needed, let PhD candidates grow in their field of research, and makes this possible in an environment where cooperation and exchange are stimulated. While good supervision can give PhD candidates the necessary boost to keep going, bad supervision can remove all satisfaction in doing research. These relationships are not easy or self-evident, owing to the many different personalities, work contexts, roles and expectations at play. Though there is no single simple model on how to be a good supervisor or PhD candidate, this and other research and experiences make clear that there are definitely useful guidelines and lessons to be learned.

The survey shows that whilst many PhD candidates report being on a good track and have a good or satisfactory relationship with their supervisor, this is not the case for a sizeable proportion of them. Often voiced concerns are a lack of support and regular meetings and a lack of follow-up on research plans. This indicates that some research groups or relations are characterized by laissez-faire leadership style, where a group expects a leader to act and chart the course, but does not take up that role. Whilst this may work at

times, it also risks becoming problematic when issues occur without being addressed, and this style is related to worse outcomes, including with regards to mental health (Levecque & al, 2017).

The way forward out of this impasse may be guided by the concept of a 'working alliance' between PhD candidate and supervisor. According to Frisscher & Larsson (2000) *The working alliance implies a contract for work, stating its goals, the tasks to reach these goals, and the interpersonal bonding which is needed to give force and endurance to the endeavour. The constant scrutiny of this contract, the mutual concern with the working alliance, by itself, contributes to its strength.*

This definition points to the need of:

- A regular rhythm of meetings. We recommend agreeing on a fixed moment for this, rather than this being decided ad-hoc. We are all creatures of habit. It is better and easier to have a regular system and cancel ad-hoc when urgent things do come up, than not having a system in place and trying to work something out on an ad-hoc basis.
- A proper, specific and continually revised research plan should not be disregarded. It helps keep one on track and helps keep both sides motivated and confident. Setbacks, whatever they may be, are a natural part of both research and life. But how they are dealt with makes all the difference, and is related to how success is framed. A management style that is focused on failing forwards, focusing on personal effort, learning, experimentation and constructively dealing with failure reduces chances of burnout, in contrast with management styles that focus on outward demonstrations of performance and achievements, interpersonal competition and outperforming others (Sijbom et al, 2016).
- These meetings should not only focus on the research being produced, but also on the other tasks, goals and interests of the two parties, including those beyond the duration of the PhD. As awkward it may sometimes be, the general experience and mood with the process should not be swept under the rug. A simple "How are you… no, really?" can make a world of difference.
- The discussion should include reflection on the working relationship itself, and how to tailor that to both interests. What is working out well, and what could be improved? Are there any misgivings or disappointments, and what's a way forward both sides can agree upon?
- This is a constant reiterative process and is open to revision. Reflection and discussion on this ideally commences during the hiring process, in order to manage expectations from both sides. That being said – it's never too late to get started.

The institutionally mandated annual progress report can be the starting point for this process, but it should not and cannot be the endpoint. Whilst it may sometimes be seen as an administrative burden, it can also be

a useful tool that can be used to leverage these principles into the daily working practice. When practiced regularly, this annual report will not have to be started from scratch, but builds upon prior meetings and research plans and functions as a useful yearly recap of lessons learned.

Whilst we are aware that these recommendations place a lot of pressure on the shoulder of supervisors, this is not a burden they should shoulder alone, but one that can be shared within the research group. In fact, it may be better to start by focusing time and energy on creating an open, inclusive and collaborative working environment rather than forcing reliance on a single person. Regular group meetings where group members can present and offer feedback on each other's work, but are also asked to openly reflect on the dynamics in the group are useful tools for establishing such a welcoming and warm group culture. Furthermore, actively involving a second supervisor at the steering wheel, definitely in case the main supervisor has many PhD candidates, is highly recommended. The advisory commission can also play an important part in guiding the PhD candidate, if good arrangements are being made from the start.

Steering (a group of) researchers requires good leadership skills, but functioning within one is not easy either. Any group may benefit from improving skills such as teamwork, communication, conflict resolution, negotiation and other social skills. The general training offer for researchers is broader than it has ever been, and is continuously being expanded and revised. A week of research professionalisation – comparable to its counterpart of educational professionalisation - is being prepared in 2021 based on a needs assessment of professors and postdoctoral researchers. Furthermore, a specific training track for supervisors not only includes insight into literature on how to work with different types of PhD candidates, how to manage expectations and avoid conflicts, but also offers the possibility to share experiences and help supervisors to grow in this role.

8.2. Infrastructure, administrative support & doctoral training offer

Though **infrastructure** is costly, and keeping it up-to-date is a process that is never finished, it is also an investment in the health, happiness and productivity of staff. While some respondents expressed being unsatisfied by the state of their (local) infrastructure, several indicated that works were actually ongoing or had been planned, if momentarily postponed due to COVID-19 restrictions. Current renovation and expansion projects should thus continue apace, with priority given to those that lack basic office comforts and safe and reliable research environments. Complaints concerning the inadequate availability of (digital) books and journals should be further discussed at the level of the library commission.

It is also clear that PhD candidates feel the need for **comprehensive and easily searchable digital databases and websites** to find the information they are looking for. The transition to several Sharepoint websites (including staff.vub.be to replace the old intranet pages) and knowledge articles of VUB Service-Now are promising in that regard but will require additional efforts to expand and keep these up to date, and to make sure that everyone is able to find their way to these sources when they need it.

One of the most highlighted needs concerns **information on the rights and duties of PhD candidates**. Fortunately, over the past few months, inroads have been made into this area by the People & Organization (P&O), in the form of digestible one-pagers that are available on VUB Service-Now.

A centralised system or service helping international PhD candidates with all their queries is also lacking at the moment. International PhD candidates don't have a single point of contact, and depending on their specific questions, have to contact several services themselves in order to find the right answer. Cooperation of several services (International Office, R&D and P&O) is necessary in order to offer a better service.

Initiatives to support mental health have been a priority for RTDO and the wider VUB for some time, and have become even more so during the Corona pandemic. However, support initiatives were somewhat scattered and not always as easily findable. This is especially an issue for PhD candidates in urgent need of someone to talk to, and who might struggle with finding the right help. Fortunately, over the past few months, improvements have already been made in this area by increased collaboration between RTDO, student psychologists, P&O, Huis van de Veerkracht and BRUCC, with P&O serving as a central point of contact and referral, with a low-threshold for access.

PhD candidates also expressed a need for **more social (research) events**. We can expect that this need will be even more urgent when the lockdown ends. However, there is already a rather expansive offer which may need to be better communicated. RTDO organizes the PhD Day every two years, and the Doctoral Schools also organise discipline-specific PhD days (LSM for example every year in March). In addition, there are also the PhD Networks associated to each of the Doctoral Schools. These organize events for their peers, and whilst we greatly appreciate the efforts of all PhD candidates involved in them, not all of these are as active as the others and may require closer follow-up.

With regards to the doctoral training offer, **more online courses** were requested. Before COVID-19, workshops were delivered online only extremely rarely. This has changed during the last year and the experience and expertise developed will have an impact on how workshops will be delivered in the future. The advantages

and disadvantages of both online and physical workshops will need to be evaluated when returning to campus is possible, in order to offer a healthy mix of both.

Several respondents offered suggested for how to **expand the content of the doctoral training offer**. English language pedagogical courses and additional courses focused on wellbeing have already taken place or are planned to take place. For Academic English there are no additional courses planned as of yet, as RTDO expects the lack of sufficient seats to be a temporary issue, but the situation will be monitored further next year.

With regards to **research-focused courses** on both methodology and software for data analysis, there is already a large offer organized both by RTDO and the Doctoral Schools (e.g. FLAMES). However, these tend to fill up quite easily and may need to be scaled up in the future. PhD candidates can also register for one of the many courses aimed at bachelor and master students, but this may need more communication in order to ensure all PhD candidates are aware of this possibility. With regards to data analysis software, several inroads have been made since the Survey took place, both through training offered with Datacamp, additional courses in R and a selected number of software centrally available for free and with the necessary support from VUB IT services. Lastly, several candidates requested courses on theory and critical-thinking. Considering how central these are to scientific research, it would indeed be useful to organize courses that address these head-on, rather than being present implicitly in other courses, and it is something RTDO is looking into. VUB is of course not the only place to follow training; PhD candidates can follow courses (both organised by the Doctoral Schools and on Bachelor and Master level) at other Flemish universities and ULB for free, and are strongly encouraged to follow international summer schools. The latter is being supported by the Doctoral Schools via travel grants.

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